Abstracts Presented at the Fiftieth Annual Virtual Meeting International Neuropsychological Society

February 1-4, 2022

CE Workshop 01: Understanding, Assessing, and Treating Sleep as a Transdiagnostic Process Underlying Subclinical Neurocognitive and Affective Issues and Mental Disorders

Presenter: Esther Yuet Ying Lau

9:00am - 12:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
Accumulating evidence converges to underline the contribution of sleep and sleep disorders to the neuropsychological functioning of individuals with and without mental illnesses. The pervasive influence of sleep on human neural systems underlying emotions and cognitions in both health and disease processes is being uncovered by researchers across disciplines, supporting the transdiagnostic role of sleep in various mental disorders. This workshop will first broadly address the sleep-related cognitive and affective processes that are critical and central to the understanding and promotion of neuropsychological health across the life span and cultures, with evidence from both experimental and longitudinal studies of our laboratory and others. Upon this scientific basis, this workshop will equip health practitioners and researchers with foundational knowledge regarding the psychopathology, assessment and interventions of sleep-wake dysfunctions. This half-day workshop will provide an overview of (1) basic sleep science including the neurocognitive-affective impact of sleep; (2) diagnoses, features and psychopathology of common sleep-wake disorders; and (3) assessment tools and treatment protocols of sleep disturbances with a focus on cognitive-behavioral therapy for insomnia (CBT-I).

Upon conclusion of this course, learners will be able to:
- Educate patients, the public, and fellow health care professionals on scientific knowledge of sleep
- Identify and conceptualize common sleep-wake disorders
- Apply assessment tools for sleep disturbances and CBT-I strategies upon further training

CE Workshop 02: Cognitive Impairment after Critical Illness and the Contributions of Delirium: A Serious Public Health Concern

Presenters: E. Wesley Ely & James C. Jackson

9:00am - 12:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
Every year in North America, millions of individuals are treated in intensive care units for serious and life-threatening medical conditions. Among survivors, as many as a third experience sustained cognitive impairment of a severity that impacts their functioning and impedes key areas of their life, while imperiling their quality of life. Risk factors for the development of this impairment are numerous and delirium - occurring in the ICU - appears to play a prominent role. In this workshop we will review the problem of cognitive impairment after critical illness, characterize it clinically, explore the contributions of conditions such as delirium, and highlight developments in treatment and rehabilitation.

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Upon conclusion of this course, learners will be able to:
- Summarize contemporary thinking and understanding of the relationship between delirium and the development of cognitive impairment after critical illness
- Recognize the nature and characteristics of the cognitive impairment so prevalent in survivors of critical illness
- Apply insights about Post Intensive Care Syndrome to the care and understanding of patients

CE Workshop 03: Impaired Self-Awareness After Brain Injury: Applying Guidelines for Assessment and Management

Presenter: Tamara Ownsworth

9:00am - 12:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
Self-awareness, or understanding your own strengths and weaknesses and noticing your thoughts and actions in the moment, is believed to contribute to better mental health, occupational performance and social functioning. After brain injury, self-awareness refers to the ability to accurately recognise changes in one's functioning and understand how these will affect everyday life and the future. In this context, poor self-awareness may pose a liability for successful recovery or, alternatively, protect individuals from psychological distress. This workshop will initially provide an overview of theoretical models of self-awareness and then consider the relevance of self-awareness to clinical practice in brain injury rehabilitation. Evidence of awareness 'typologies' and research on the impact of self-awareness on functional and psychosocial outcomes will be presented. Approaches to assessing self-awareness will be outlined, followed by a review of interventions, evidence of efficacy and practice standards. Overall, the workshop will highlight how self-awareness of post-injury changes supports individuals to develop a realistic and adaptive sense of self. Yet, there may be circumstances in which targeting the development of self-awareness is neither necessary nor beneficial. Guidelines for managing impaired self-awareness and future research directions will be discussed.

Upon conclusion of this course, learners will be able to:
- Explain the theoretical basis for impaired self-awareness after brain injury
- Describe different approaches for assessing and managing impaired self-awareness
- Explain the relationship between self-awareness and functional and psychosocial outcomes
- Summarize the evidence on the effectiveness of interventions for improving self-awareness
- Apply guidelines to select appropriate approaches for managing impaired self-awareness in practice or other professional contexts

CE Workshop 04: Machine Learning Applications for Neuropsychology: Rationale, Risk, and Best Practices

Presenter: Robert Paul

1:00 - 4:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
Machine learning (ML) applications in patient care research have boomed over the past decade. ML offers some advantages over traditional analytic approaches (e.g., need for a priori hypotheses, multiple comparisons) that are designed for hypothesis confirmation rather than scientific discovery. Studies conducted in the fields of oncology, cardiology and other select disciplines provide empirical support that ML methods can facilitate discovery of novel disease mechanisms, new targets for therapeutic interventions, and the development of predictive models for patient care outcomes. Less is known about the utility of ML to achieve similar outcomes in neuropsychology. ML can be applied to interrogate the complex interplay between biological, psychosocial and cultural factors that underlie the development and expression of cognitive phenotypes, but the relative value of the outcomes will be determined by the specific methodology

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employed. This workshop will explain the rationale and potential clinical relevance of ML in neuropsychology, as well as key challenges and risks (e.g., introduction of bias, overfitting, ethics), and recommendations for best practices (guidelines and specific methods). Outcomes from studies using ensemble machine learning will be emphasized.

Upon conclusion of this course, learners will be able to:
- Explain the advantages and disadvantages of ML applications for neuropsychology
- Identify the differences between specific ensemble machine learning, support vector machines, and convolutional neural networks and describe the relevance to neuropsychological research
- Synthesize and evaluate the results from neuropsychological studies that employed ML

CE Workshop 05: Neuroethics in Neuropsychology: Foundations and New Horizons

Presenter: Laura Y. Cabrera

1:00 - 4:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
This workshop addresses neuroethics in neuropsychology in today's world. Knowing when you have crossed the line from an ethical to an unethical situation can at times be difficult to discern. Similarly, it is also challenging to know how to best handle ethical situations. The issues become more salient when we are discussing advances or interventions that deal with the human brain and human behavior. The workshop will introduce neuroethics, and the role it has for scientific disciplines which contribute to the understanding of brain-behavior relationships. This workshop will provide guidance on understanding and identifying the neuroethical issues you face in our practice. The workshop will also discuss a common set of principles and standards upon which neuropsychologists, and others involved in related fields, can draw as part of their professional work and clinical practice, including issues of diversity, equity and inclusion. The second part of the workshop will be more hands-on with discussion of ethics cases in real real-life scenarios and utilize the tools and frameworks discussed in the first part to help you both identify ethical issues and come up with solutions and ways to mitigate these issues in the future.

Upon conclusion of this course, learners will be able to:
- Recognize what neuroethics is, the issues it deals with, and its role in fields related to human brain and behavior
- Describe key steps in the decision-making process to address neuroethical issues
- Apply principles and frameworks in neuroethical issues encountered in neuropsychology

CE Workshop 06: Metabolomics and Lipidomics: Understanding the Technology and How they Translate to Meaningful Clinical Findings

Presenter: Stewart Graham

1:00 - 4:00pm
Tuesday, February 1, 2022

Abstract & Learning Objectives:
Metabolomics and lipidomics are the last rung of the systems biology cascade and the -omics platforms and provide the greatest insight into any given phenotype. Importantly, metabolites and lipids are the end products of cellular regulatory processes, and their respective levels are regarded as the ultimate response of biological systems to genetic or environmental changes. During this seminar we will cover the basics of metabolomics and lipidomics to include: definitions, origins, technological requirements, the importance of the design of the experiment, pros and cons of these platforms as compared to other -omics techniques and ultimately, data interpretation and how they can be translated into meaningful clinical findings. We will concentrate on deciphering the "soup" of information which we get from such studies and how they relate to cognition and common neurodegenerative/neurological disorders. Examples of where these techniques have been

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successfully applied will be presented to cover both biomarker and pathophysiology-based research.

Upon conclusion of this course, learners will be able to:
- Demonstrate competency to discuss metabolomics and lipidomics and how these platforms can be incorporated into your research
- Describe how they can be used as potential biomarkers for the early diagnosis/prediction of disease, with examples
- Explain how these techniques can be used to decipher the etiology and pathophysiology of disease

Poster Session 01: Aging

7:30 - 8:30am
Wednesday, February 2, 2022

1 Neuropsychological Treatment Recommendations Utilizing the MCLHB-DRR Scale for Dementia Prevention

Angelina E Witbeck
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Objective: This is the first study to our knowledge that uses the MCLHB-DRR scale in the United States. The purpose of this study is to determine the motivation to change health and lifestyle factors to reduce the risk of developing dementia within the older adult population. This study aims to create a better understanding for neuropsychologists and other healthcare providers to create an individualistic treatment plan to reduce the risk of developing dementia for high risk patients.
Participants and Methods: Participants in this study were over the age of 18. 543 participants began the scale, and 66 were excluded for not completing the scale in its entirety, yielding 477 participants for the study. Participants completed the MCLHB-DRR scale as well as a demographic questionnaire.
Results: Of the sample population, 37.4% of participants reported a family history of dementia, while 27.0% of the participants served as caregivers for an individual with a dementia diagnosis. In addition, 32.0% of participants reported memory concerns, and 46.4% believe to be at risk for developing dementia. The majority of the participants reported that they would be willing to know their own risk for developing dementia (91.2%). The Cronbach's a across subscales of the MCLHB-DRR scale ranged from 0.67-0.87. Males reported greater perceived susceptibility for developing dementia than females ($p<.0001$). Females perceive more significant barriers to change lifestyles and health behaviors than males ($p<.03$). Older adults perceive greater susceptibility to developing dementia ($p<.0001$), and those over the age of 40 have a significantly higher perceived susceptibility. Middle-aged adults ($\geq$ 40 years old) perceived higher severity of developing dementia than younger adults ($p<0.3$). Older adults ($\geq$ 60 years old) perceived lower barriers to making lifestyle changes than any other age group ($p<.0001$). Younger adults had lower motivation as compared to middle-aged adults (40-59 years old) ($p<.03$). Those with a family history of dementia had higher perceived susceptibility of developing dementia ($p<.0001$), perceived severity ($p<.03$) and higher levels of cues to action ($p<.01$). Those with experience as a caregiver for someone with dementia had higher perceived susceptibility ($p<.0001$) and cues to action ($p<.002$) but did not show the significance for perceived severity, benefits, barriers, general health motivation, or self-efficacy.
Conclusions: Treatment recommendations are often individualized to each patient and the same must be considered for early dementia prevention for those that are at a high risk of developing dementia. This study provides evidence for areas of psychoeducation that are important to address with patients following a neuropsychological evaluation.
Keywords: aging (normal), memory complaints, treatment outcome

2 Practice Effects and Intra-Individual Variability: Shared Mechanisms in Predicting Cognitive Status

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Objective: Practice effects (PEs), or improvements in performance on repeat test administrations, have been shown to be comprised of two components: (a) a recovery from an initial suppression of performance caused by reaction to task novelty, and (b) an improvement in performance due to subsequent learning. Both aspects of PE have been found to be affected by cognitive decline such that (a) recovery from novelty increases temporarily during early cognitive decline due to greater initial suppression of performance (resulting in temporarily larger PEs), whereas (b) the ability to learn decreases (resulting in smaller PEs). Since PEs for different tests have been shown to be differentially dependent on these two PE mechanisms, the magnitude of the PE is dependent on both an individual's degree of cognitive decline and on specific task demands. A separate line of research has shown that increases in intra-individual variability (IIV) in task performance are also associated with cognitive decline, although the mechanism driving this association is not fully understood. Since IIV could, in part, reflect within-task PEs, and since both IIV and PEs are predictive of cognitive decline, the goal of the present study was to examine whether IIV is related to one or both PE components, and, if so, whether IIV's association with cognitive decline can be explained by either of the two PE components.
Participants and Methods: A total of 63 community-dwelling older adults (M_{age}=74.5, $M_{education}$=15.4 years, 58% female) completed the Dementia Rating Scale, 2nd Edition (DRS-2) to assess cognitive status, and the Push-Turn-Taptap task to assess IIV. Participants were also administered two repetitions of the *Weschler Adult Intelligence Scale, 4th Edition* Coding and Symbol Search subtests, assessing PE separately for each test. In a prior study with this sample, PEs on Coding (PE_{Coding}) and on Symbol Search (PE_{Symbol}) were associated with the DRS-2 (linear and quadratic association, respectively), and with memory and novelty, respectively.
Results: IIV showed negative linear correlation with PE_{Coding} (r= -.40), suggesting that those with higher IIV also did not adequately benefit from prior learning. There was no association between IIV and PE_{Symbol} (linear or quadratic). IIV was also significantly negatively correlated with DRS-2 scores. In a series of hierarchical linear regressions, IIV predicted DRS-2 score beyond PE_{Coding} [B=-23.29, $t(62)$=-6.46, p<.001] and PE_{Symbol} [B=-23.30, $t(62)$=-7.08, p<.001] whereas neither PE predicted DRS-2 beyond IIV.
Conclusions: The present results suggest that IIV has shared underlying mechanisms with PE for some but not all cognitive processes (i.e., those related to memory/learning but not task novelty). In other words, IIV does not seem to reflect within-task practice but is more likely representative of impaired learning/memory processes, such as periodic "forgetting" of the task or task rules. Additionally, IIV was a better predictor of cognitive status than both forms of PE. This may be because IIV captures a greater range of underlying mechanisms than PE and is thus more sensitive to cognitive dysfunction. These findings add support to existing literature positioning IIV as a promising novel marker of cognitive decline.
Keywords: aging (normal), mild cognitive impairment, assessment

3 Investigating the Impact of LGG Probiotic Supplementation on Cognitive Function in Physically Active Older Adults

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Objective: The prevalence of neurodegenerative conditions is projected to increase, and preventive strategies are critically needed. Two promising interventions for promoting brain health are physical activity (PA) and probiotic supplementation. Initial research suggests that the combination of PA and probiotics may be especially beneficial for cognitive outcomes. The present study examined whether supplementation with the

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probiotic *Lactobacillus rhamnosus* GG (LGG) improves cognitive performance in physically active older adults.
Participants and Methods: We conducted a three-month, double-blind, placebo controlled randomized clinical trial with a 1:1 allocation ratio in a sample of healthy middle-aged and older adults (n=200, Mage=64.3, SD+/-5.56 yrs.). Exclusion criteria included self-reported history of severe psychiatric disorder, neurological disorder, severe gastrointestinal symptoms or surgery, substance abuse, and recent probiotic, prebiotic, antibiotic, or acid-blocker use. Participants were asked to consume two capsules (i.e., LGG or placebo) daily over approximately 90 days and complete four on-site visits (i.e., baseline, two adherence visits, and follow up). At baseline and follow-up, cognitive function was assessed using the NIH Toolbox Cognition Battery, dietary information was obtained through the EPIC-Norfolk Food Frequency Questionnaire (EPIC-FFQ), and PA levels were obtained through the International Physical Activity Questionnaire (IPAQ). Primary outcome was change in Total Cognition Score (i.e., composite score) and subtest scores from baseline to follow-up. Only participants who reported meeting weekly PA guidelines (i.e., 150 minutes moderate exercise or 75 minutes vigorous exercise) and did not show significant changes in PA levels over time were included.
Results: A total of 127 participants were included in primary analyses. Probiotic (n=70) and placebo (n=57) groups were generally similar in demographic, medical, and cognitive test performance. Overall, the sample showed intact cognitive performance at baseline (Total Composite Score M= 48.3, SD=9.7; subtest average *t* scores ranged 43 to 57). Contrary to expectations, repeated measures ANOVA showed no significant change in cognitive function from baseline to follow-up as an effect of LGG on either Total Composite Score [$F(1,118)=0.30$, $\eta_p^2 = 0.00$, $p=0.59$] or subtests (all $p>.05$, range 0.20 – 0.74).
Conclusions: LGG probiotic supplementation was not found to improve cognitive function in this sample of physically active older adults. Limited findings may be due to inclusion of an extremely healthy sample with intact gut microbiome or may indicate that probiotics confer less cognitive benefit in those already physically active. Future research should examine the use of probiotics in persons with greater disease burden and more sedentary lifestyle to further elucidate potential cognitive benefits of probiotic supplementation.
Keywords: aging (normal), cognitive functioning

4 Assessment of Somatic, Cognitive, and Overall Anxiety as Predictors of Cognitive Decline in Community-Dwelling Older Adults

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Objective: Late-life anxiety is prevalent in older adults and is associated with negative outcomes, including poorer cognitive performance. There is mixed evidence as to whether anxiety predicts longitudinal cognitive decline. When anxiety is measured as distinct domains of somatic and cognitive anxiety, research has demonstrated cross-sectional differential associations of somatic and cognitive anxiety with cognitive performance. No study to date has examined the longitudinal associations of somatic and cognitive anxiety with cognitive performance. Thus, this study was designed to examine whether baseline somatic, cognitive, and overall anxiety predicted cognitive decline in community-dwelling older adults.
Participants and Methods: Participants were relatively healthy community-dwelling older adults ($N = 522$; M age = 75.96, $SD \pm 6.46$ years; 55.4% female). Somatic, cognitive, and overall anxiety were measured at baseline using the Beck Anxiety Inventory. Neuropsychological test performance measured via composite scores in three cognitive domains (attention/executive functions, verbal memory, and global cognition) was examined annually up to eight years. The attention/executive functions composite consisted of the Digit Symbol Substitution Test, the Trail Making Test Parts A and B, and the Controlled Oral Word Association Test. The verbal memory composite consisted of the List Learning, Story Memory, List Recall, List

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Recognition, and Story Recall subtests from the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). The global cognition composite consisted of all the RBANS subtests. Linear mixed effects models assessed whether somatic, cognitive, and overall anxiety predicted decline in performance over time in the three cognitive domains.
Results: Somatic anxiety (M = 2.22, SD ± 3.26), cognitive anxiety (M = 2.28, SD ± 2.83), and overall anxiety (M = 4.50, SD ± 5.43) were in the minimal range. Linear mixed effects models adjusted for age, sex, years of education, depression, and health comorbidities found that no types of anxiety predicted decline in cognitive performance over time. Baseline somatic anxiety was not associated with decline in attention/executive functions (estimate = -0.004, p = .755), verbal memory (estimate = -0.015, p = .310), nor global cognition (estimate = -0.011, p = .257). Baseline cognitive anxiety was not associated with decline in attention/executive functions (estimate = 0.005, p = .677), verbal memory (estimate = -0.003, p = .849), nor global cognition (estimate = 0.004, p = .674). Baseline overall anxiety was not associated with decline in attention/executive functions (estimate = -0.003, p = .794), verbal memory (estimate = -0.006, p = .668), nor global cognition (estimate = -0.002, p = .833).
Conclusions: Somatic, cognitive, and overall anxiety did not predict cognitive decline in relatively healthy community-dwelling older adults. The present study adds to mixed evidence in the literature as to whether anxiety predicts cognitive decline, and suggests that prior findings demonstrating cross-sectional differential associations of somatic and cognitive anxiety with cognitive performance did not extend to a longitudinal design. Although cognition was comprehensively assessed as separate domains and robust analyses were used, low anxiety scores may have reduced the power required to demonstrate significant associations between somatic, cognitive, and overall anxiety and cognitive decline.
Keywords: aging (normal), anxiety, cognitive functioning
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5 The Examination of Multiple Modifiable Fitness Variables and Cognition in Healthy Older Adults

Kelly J. Hiersche, Jessica Stark, Alexander N. Hasselbach, Scott M. Hayes
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Objective: The current study examines the relative contributions of different domains of modifiable fitness variables (gait speed, forced expiratory flow, grip strength, and body mass index; BMI) to cognitive performance (executive function, processing speed, episodic memory, and fluid reasoning) in healthy older adults recruited through the Health and Retirement Study (HRS).
Participants and Methods: Older adults without dementia (n = 619; 343 females; ages 64-98 years, mean = 74.9, sd = 6.9; education: mean = 13.4 years, sd = 2.6; MMSE score: mean = 28.0, sd = 1.6) who completed the fitness assessments in the HRS 2016 core appointment and the 2016 Harmonized Cognitive Assessment Protocol were included in the analysis. Four hierarchical regressions were run with executive function, processing speed, episodic memory, and fluid reasoning as the dependent variables of interest. Control variables (age, sex, education, time between appointments, and a chronic disease score) were included in step one of the models. Modifiable fitness variables (gait speed, forced expiratory flow, grip strength, and BMI) were added in step two of the models.
Results: Modifiable fitness variables accounted for significant variance within each cognitive domain. The strongest relationship was observed in the executive function model, with the modifiable fitness variables accounting for 9.7% of variance in a composite score of executive function (model R^2 = 0.348, F(585) = 34.76, p <0.001). Modifiable fitness variables explained an additional 6.3% of the variance in fluid reasoning (model R^2 = 0.242, F(600) = 21.28, p <0.001), 6.0% in the processing speed (model R^2 = 0.258, F(597) = 23.03, p <0.001), and 3.7% in episodic memory (model R^2 = 0.237, F(609) = 21.04, p <0.001). Of the

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modifiable fitness variables, normal walking speed and forced expiratory flow (a metric of pulmonary function) were significant contributors within each cognitive domain.
Conclusions: Our findings suggest that modifiable fitness variables account for unique variance in multiple domains of cognition, even after accounting for age, sex, education, and chronic disease, in a large sample of healthy older adults. Modifiable fitness variables explained the most variance in executive function. These findings support previous studies examining the relationship among modifiable fitness variables and cognition and extend the literature by demonstrating that metrics of physical performance are more strongly associated with cognition compared to BMI.
Keywords: aging (normal)**,** cognitive functioning**,** executive functions
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6 Fatigue across the lifespan in men and women: state vs. trait

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Objective: Because aging is associated with decline in numerous domains, a common assumption is that fatigue worsens with age. However, the literature is mixed: some studies show that older individuals experience more fatigue, while others have suggested the opposite effect. Some of the inconsistencies in the literature may be related to gender differences in fatigue. Conflicting findings may also be due to differences in the instruments used to study fatigue inasmuch as the correlation between state and trait measures of fatigue has been shown to be weak. Thus, the purpose of the current study was to examine both state and trait fatigue across age and gender using a combination of neuroimaging and self-report data.
Participants and Methods: Here, we investigated the effects of age and gender in 64 healthy individuals on self-reported fatigue using two measures: the multi-factor fatigue scale (MFIS), a measure of trait fatigue, and the visual analog scale of fatigue (VAS-F), a measure of state fatigue.
Results: We found age to be positively correlated with trait fatigue ($r=0.336$, $p=0.007$): increasing age was associated with more trait fatigue. However, for state fatigue increasing age was associated with less fatigue ($F(1,35)=9.19$, $p < 0.01$, coefficient = -0.4). In the neuroimaging data, age interacted with VAS-F in the middle frontal gyrus. In younger individuals (20-32), the relationship between age and brain activation was negative (more activation was associated with less fatigue), for middle-aged individuals (33-48), the relationship was flat, and for older individuals (55+) the relationship was positive (more activation was associated with more fatigue). Gender also interacted with VAS-F in several areas including the orbital, middle and inferior frontal gyri. For women, the relationship between fatigue and brain activation was negative (more activation was associated with less fatigue) while for men, it was positive (more activation was associated with more fatigue).
Conclusions: Taken together, these results show that older individuals may believe themselves to be more prone to fatigue (trait measures), but they actually report less fatigue during task performance (state measures). The neuroimaging data indicate that the role of middle frontal areas change across age: younger individuals may use these areas (which are also associated with cognitive control) to combat fatigue, but this is not the case with older individuals. Moreover, the association between patterns of response in fatigue-related brain areas and VAS-F may suggest greater resilience in females than males when faced with a fatiguing task.
Keywords: fatigue**,** aging (normal)**,** neuroimaging: functional
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7 Stability of Cognitive Abilities over Different Stages of Life

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Objective: Factors in early life are increasingly considered when investigating adult health and development. For example, better cognitive abilities in adolescence and early adulthood have been described to predict better cognitive abilities in later life. To date, however, little is known about whether cognitive abilities before entering formal education – in infancy and at preschool age - are predictive of cognitive abilities in later life. Therefore, we examined the stability of cognitive abilities in the same individuals between infancy, preschool age, childhood, adolescence, and mid-adulthood.
Participants and Methods: The data originate from the Zurich Longitudinal Study (ZLS), a cohort study initiated in Switzerland in 1954. A total of 445 individuals were enrolled at birth. Cognitive abilities were repeatedly assessed in 384 of them between infancy and mid-adulthood. Cognitive abilities were measured with age-appropriate standardized tests, namely, the Brunet Lézine Test at age 6, 9, 12 and 18 months, and at 2 years, the Stanford-Binet Tests of Intelligence at age 3, 5, 8, and 11 years, the Block Design of the Wechsler Intelligence Scale for Children at age 7 years, the Coloured Progressive Matrices Test at age 9 years, the AH4 Group Test of General Intelligence at age 14 years, and selected subtests of the Wechsler Intelligence Scale for Children – Revised at ages 39 to 50 years. Stability was tested with a latent variable modeling technique: Test scores assessed during five developmental periods served as indicators of the respective latent factors (infancy (0.5 – 2 years), preschool age (3 – 5 years), childhood (7 – 11 years), adolescence (14 years) and mid-adulthood (39 – 50 years).
Results: The model fit indices of the five-factor Structural Equation Model were inconsistent: The chi-square test was statistically significant ($\chi^2(160) = 439.4$, $p < .001$); whereas the ratio of χ^2 and degrees of freedom ($\chi^2/df = 2.7$) indicated an acceptable fit, CFI (0.85) and TLI (0.82) indicated a poor fit and the RMSEA (0.07) indicated an acceptable fit. Correlations between the cognitive ability factors at different developmental periods ranged from weak (r = 0.22 between infancy and adolescence) to strong (r = 0.87 between preschool age and childhood, and childhood and mid-adulthood). Mid-adulthood cognitive abilities were correlated moderately with cognitive abilities in infancy (r = 0.34) and strongly with cognitive abilities in preschool age (r = 0.77), in childhood (r = 0.87), and in adolescence (r = 0.77). Cognitive abilities before entering formal education explained a substantial proportion of the variance in mid-adulthood cognitive abilities (infancy: 12%; preschool age: 59%).
Conclusions: Better cognitive abilities in early live predict better cognitive abilities in mid-adulthood. The stability of cognitive abilities is particularly high from preschool age onward. Therefore, the foundation of healthy aging in terms of good cognitive abilities as a potential protective factor against age-related decline of health may already develop early in life.
Keywords: intelligence**,** aging (normal)**,** child development (normal)
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8 Trait Mindfulness Mediates the Relationship Between Perceived Stress and Inhibitory Control

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Objective: Trait mindfulness is associated with a variety of health benefits, as well as reduced negative affect and stress. Trait mindfulness is also associated with better executive function, which may play a role in the relationship between perceived stress and worse cognitive outcomes. This study aimed to determine if trait mindfulness mediated the relationship between perceived stress and inhibitory control in older adults.
Participants and Methods: 121 older adults recruited through the Maine Aging Behavior Learning Enrichment Study were included in this study. The National Institute of Health Toolbox Flanker Inhibitory Control and Attention Test measured inhibitory control. The Mindfulness Awareness Scale measured trait mindfulness and the Perceived Stress Scale measured stress. Mediation analyses used Hayes' PROCESS macro for SPSS.
Results: Correlational analyses found that trait mindfulness is significantly associated with less perceived stress and better inhibitory control, while greater perceived stress is associated with worse inhibitory control. However, mediation analyses revealed that the effect of perceived stress was not significantly associated with low inhibitory control when the mediating influence of trait mindfulness was present in the model.
Conclusions: Results indicated that mindfulness may reduce the harmful effects of stress on executive function, specifically inhibitory control in older adults. Implications for such findings could include the incorporation of trait mindfulness enhancing practices in older adults that potentially might have beneficial effects on cognitive function.
Keywords: executive functions**,** aging (normal)**,** cognitive functioning

9 Gender Differences in Resting Brain Activity and Connectivity in the Cognitively Normal Oldest Old from the McKnight Brain Aging Registry

Che Liu[1], Noam Alperin[1], Lee Sang[1], Bonnie Levin[1], Marti Flothmann[1], Sara Sims[2], Ted Trouard[3], Ronald Cohen[4], Gene Alexander[3], Kristina Visscher[2], Rundek Tatjana[1]

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Objective: The blood-oxygen-level-dependent signal obtained by fMRI during rest is widely used to identify brain regions that exhibit similar fluctuations and are therefore considered functionally connected. Recent studies demonstrated gender-related differences in the patterns of resting-state brain activity and functional connectivity (FC), primarily in the default mode network (DMN), visual network, and sensorimotor network. Yet, gender differences in the resting-state brain activity patterns have not yet been studied in cognitively normal oldest-old (age 85+) adults. In this study, we compared resting-state brain activity across the whole brain between oldest-old females and males. Multi-method analyses were used to obtain comprehensive characteristics of the activity patterns.
Participants and Methods: Participants were part of the McKnight Brain Aging Registry study conducted at these four institutes: The Universities of Alabama, Arizona, Florida and Miami. Data from seventy-five cognitively normal participants (45 females, age 85-97 and 30 males, age 85-95) was included. Participants underwent neuropsychological tests to determine their cognitive status, and structural and resting-state fMRI scans to generate the brain activity maps. We applied 3 distinct analysis methods revealing complementary information using the CONN toolbox (v.18a) in MATLAB. Voxel-based resting brain activity was measured as fractional amplitude of low-frequency fluctuation (fALFF), which is the ratio of the averaged square root of power-spectrum across a low-frequency range (0.008 to 0.09 Hz) over the entire frequency range. The fALFF method provides a measure of functional activity level. Region-to-region FC following Harvard-Oxford atlas was calculated as a correlation coefficient between distinct brain regions. Graph measures (clustering coefficient, efficiency, transitivity, and modularity) were used to assess local connectivity between one brain region and the rest of the brain, and the global organization of the whole brain network. Graph-based analysis characterizes the local and global

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topological organization of the complex brain network.
Results: Males had higher fALFF in the right occipital pole (diff=0.91, p-FDR=0.015). Other significant differences were found in FC of multiple pairs of brain regions, including DMN, visual, sensorimotor and frontoparietal regions. Females had stronger FC in 6 pairs of regions (0.14 to 0.21, p-FDR=0.020 to 0.046), while males had stronger FC in 17 pairs of regions (0.13 to 0.19, p-FDR=0.009 to 0.049). Females had higher global modularity at several graph densities (0.014 to 0.015, p-FDR range: 0.015 to 0.048). Females showed larger degree (number of connections to a certain ROI) to the left angular gyrus, left thalamus, and bilateral caudate (diff range: 4.989 to 8.778, p-FDR≤0.002), higher global efficiency of the bilateral caudate (diff=0.06, p-FDR≤0.001), higher local efficiency and larger clustering coefficient of the right middle frontal gyrus (diff=0.092 and 0.060, p-FDR<0.001), while males showed the larger degree to the bilateral central opercular cortices (diff=6.389 and 6.667, p-FDR≤0.002) and higher global efficiency of the right central opercular cortex (diff=0.037, p-FDR<0.001).
Conclusions: Clear gender-related differences in functional topological organization and laterality exist in the oldest-old. Male had higher activity within the visual network. Females had stronger FC within the DMN and in several frontoparietal regions, whereas males had stronger FC in sensorimotor and visual regions. Females had greater segregation between networks than males.
Keywords: aging (normal)**,** neuroimaging: functional**,** brain function

10 Influence of Age and Apolipoprotein E ε4 status on Regional White Matter Hyperintensity Volume and Cognition in Healthy Aging

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Objective: Vascular health factors, including elevated white matter hyperintensity (WMH) volumes, during midlife and young-older age may increase vulnerability to cognitive aging and Alzheimer's disease (AD) risk. In addition, having an apolipoprotein E (APOE) ε4 genotype has been associated with greater WMH volumes and cognitive decline in aging. We sought to examine whether regional WMH volume mediates the relationship between APOE ε4 status and cognition in healthy aging and if this association is moderated by age group differences.
Participants and Methods: A cohort of 187 cognitively healthy adults (mean±sd age = 70.6±10.1, APOE ε4 status (yes/no) = 56/131), ages 50 to 89 were assessed with tests of memory, executive function, and processing speed. Hemispheric regional WMH volumes within the four cerebral lobes were measured using T1 and T2 FLAIR 3T MRI scans and the lesion segmentation toolbox (Schmidt et al., 2012) with SPM12. ANCOVA's were performed, followed by mediation analyses using SPSS PROCESS macro software (Hayes, 2012) that included percentile bootstrap resampling with 10,000 iterations to produce 95% confidence intervals.
Results: After we controlled for sex, body mass index, years smoking, and hypertension, cholesterol, and statin medication status, analyses revealed significant main effects of age group (young-old = 50-69 years; old-old = 70-89 years), with the old-old group having greater WMH volumes within left and right frontal, temporal, and parietal WMH volumes (*p*'s <.001) than the young-old group. There were no main effects of APOE ε4 status. Significant age by APOE ε4 group interactions were observed for right parietal (*p* = .012) and left temporal WMH volumes (*p* = .005). Within the young-old group, APOE ε4 carriers had greater right parietal (*p* = .022) and left temporal (*p* = .006) WMH volumes than non-carriers. In the old-old, right parietal and left temporal WMH volumes were comparable across APOE ε4 groups. Follow-up moderated mediation analyses revealed that the relations between APOE ε4 status and cognitive performance on Selective Reminding Test sum recall (3.21 (SE=1.77), 95% CI, [.412, 7.34]), consistent long-term retrieval (5.98 (SE=3.29), 95% CI, [.794, 13.37]), and delayed recall (.429

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(SE=.257), 95% CI, [.020, 1.01]), as well as Trail Making Test part B (-6.94 (SE=3.59), 95% CI, [-15.09, -1.24]) and Stroop Word-Color Interference (2.03 (SE=.962), 95% CI, [.448, 4.16]) were each mediated by left temporal WMH volume and moderated by age group. In the young-old group, but not the old-old group, there were significant indirect effects of APOE ε4 status on cognition through left temporal WMH volume. Right parietal WMH volume did not show significant moderated mediation effects for any cognitive measure.
Conclusions: In our sample of healthy older adults, APOE ε4 carriers had greater WMH burden in the left temporal lobes than APOE e4 non-carriers, but only in the young-old group, which, in turn, related to poorer memory and executive cognitive functions. These findings suggest that, among healthy young-old adults, having increased left temporal WMH volume in the context of APOE e4, may represent an early marker of cognitive aging, potentially placing these individuals at greater risk for AD.
Keywords: apolipoprotein E**,** cognitive functioning**,** aging (normal)

11 Can Video Telematics Provide Ecologically Valid Assessments of Age-Related Driving Changes? A Risky Driving Example

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Objective: Driving is an everyday task that requires simple and complex cognitive functions. It is well-documented that older adults are at increased risk of poor driving due to age-related cognitive decline. Existing clinical tools to assess driving ability (e.g., cognitive tests, questionnaires, on-road driving tests) have limited ecological validity, accuracy, and sensitivity. Thus, there is a need for novel tools to facilitate early detection of at-risk driving and to improve driver safety. Video telematics platforms provide opportunities to directly measure naturalistic driving, including not only collisions but also unsafe behaviors and subtle errors which may provide novel metrics for at-risk driving. This study aims to use video telematics to examine age-related changes in naturalistic driving behaviors.
Participants and Methods: The present study enrolled four healthy drivers (minimum of 2 days/week) using a matched case-control design.Participants were two older adult drivers (60-year-old woman, 61-year-old man) matched with two adult drivers (34-year-old woman, 31-year-old man) based on gender, race, ethnicity, education, handedness, employment status, and reported driving frequency (+/-1 day per week). Participants completed 28 days of naturalistic driving with the Lytx video telematics platform installed in their vehicle. Driving events were detected automatically using accelerometer, GPS, and video data. Driving behaviors during events were coded by driving risk analysts. Behaviors were assigned risk scores from 0 (no risk) to 10 (high risk) based on their risk of leading to a collision. For each participant, the total number of unsafe driving events, the number of unsafe events per hour driven, and the risk score per hour driven were calculated.
Results: The mean number of unsafe driving events per participant was 1.8 per hour driven (SD=2.4) among the older adult drivers versus 0.8 per hour driven (SD=0.3) among the adult drivers. The mean observed risk score was 8.3 per hour driven (SD=11.5) among the older adult drivers versus 3.5 per hour driven (SD=1.9) among the adult drivers. There was marked variability among the older adult drivers (total unsafe driving events: 1 and 71; unsafe driving events per hour: 0.2 and 16.5; risk score per hour: 0.1 and 3.5). In the older adult driver with riskier driving, the most common behaviors were speeding, rolling stop, and unsafe following distance. By comparison, there was more consistency among the adult drivers (total unsafe driving events: 13 and 25; unsafe driving events per hour: 0.6 and 1.1; risk score per hour: 2.2 and 4.8). No participants had collisions.
Conclusions: Video telematics are a novel tool that can offer new measures of unsafe driving behaviors among older adults that may be more sensitive and ecologically valid than existing tools. Our findings indicate that the older adult drivers demonstrated greater variability in unsafe driving behaviors. These results may

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have important implications for early detection, intervention, and recommendations for older adult drivers. Results are preliminary given the small sample size, and further investigation is warranted to determine whether findings generalize to larger samples.
Keywords: driving**,** ecological validity**,** aging (normal)

12 Visit-To-Visit Blood Pressure Variability Predicts Longitudinal Tau Accumulation in Older Adults

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Objective: There is a well-established link between average blood pressure levels and Alzheimer's disease pathology, including tau. However, less is known about relationships with blood pressure variability, an emerging risk factor for stroke, cognitive impairment, and dementia, independent of average blood pressure levels. Additionally, recent tau-PET imaging studies suggest tau accumulates in brain regions vulnerable to Alzheimer's disease, but it remains unclear whether blood pressure variability may be related to tau burden over time.
Participants and Methods: 344 Alzheimer's Disease Neuroimaging Initiative participants without history of dementia or stroke underwent 3-4 blood pressure measurements over 12 months and ≥ 1 tau-PET (AV-1451 tracer) thereafter. Blood pressure variability over 12 months was calculated as variability independent of mean, a commonly used index of blood pressure variability uncorrelated with average blood pressure levels. For each tau-PET collected after the final blood pressure measurement, tau burden (standardized uptake value ratio [partial-volume corrected, normalized to cerebellum]) was determined for several *a priori* brain regions of interest linked with Alzheimer's disease. To investigate potential links in populations at increased genetic risk for AD, apolipoprotein ϵ4 carrier status was defined as at least one ϵ4 allele. Bayesian linear growth modelling examined the role of BPV, apolipoprotein ϵ4 carrier status, and the passage of time on tau accumulation in hippocampus, entorhinal cortex, inferior parietal cortex, and inferior temporal cortex. All models controlled for age at tau-PET, sex, apolipoprotein ϵ4 carrier status (for main effect models), baseline Mini Mental State Exam score, average blood pressure, baseline hypertension, vascular risk, and antihypertensive medication use.
Results: Analyses revealed a significant interaction of blood pressure variability by time on tau burden in the entorhinal cortex (systolic: ß: 1.03 [95% credible interval .81, 1.25]; diastolic ß: 2.68 [95% credible interval 2.55, 2.79]), indicating that participants with elevated blood pressure variability were observed to have the fastest tau accumulation in the entorhinal cortex at follow-up. There was also a significant three-way interaction of blood pressure variability by apolipoprotein ϵ4 carrier status by time on entorhinal cortex tau burden (systolic: ß: 2.12 [95% CI .45, 3.85; diastolic: ß: 4.27 [95% CI 2.20, 6.17]), suggesting that entorhinal cortex tau burden at follow-up increased the fastest for apolipoprotein ϵ4 carriers with elevated blood pressure variability. Associations with tau accumulation in inferior parietal cortex and inferior temporal cortex were less consistent, and no associations were observed with hippocampal tau accumulation.
Conclusions: Findings suggest that elevated blood pressure variability is related to later tau accumulation in brain regions known to be initial sites of tau pathology in AD. Elevated blood pressure variability was particularly predictive of tau accumulation in apolipoprotein ϵ4 carriers relative to non-carriers. Blood pressure variability may represent a marker of vascular dysfunction related to early-stage tau pathology contributing to AD.
Keywords: aging (normal)**,** positron emission tomography**,** apolipoprotein E

13 From Graceful Degradation to Catastrophic Failure: A Neuropsychological Model to Guide the Interpretation of In-Vivo Digital Data to

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Identify Cognitive Decline in Older Adults

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Objective: Current approaches to the assessment of age-related neurodegenerative decline possess many drawbacks that are increasingly being addressed by emerging digital tools that span a multitude of devices and contexts. However, lack of theoretical frameworks from which to design and interpret studies using novel data sources presents a major gap in this burgeoning field. The digital phenotyping approach will be presented as one key example of an emerging methodology that generates large datasets of continuously collected information from sensors embedded in the natural context. Next, a new model based in the neuropsychological literature will be described that generates testable hypotheses and facilitates the interpretation of data obtained from digital sensors.
Participants and Methods: Existing approaches to detection of pathological change and the role of digital tools to address known drawbacks were first reviewed. Established age-related trends in cognitive and functional decline over time were outlined, drawing from studies and theories across the fields of neuropsychology, cognitive neuroscience, neurology, and computer science. Data from relevant studies were reviewed and synthesized to inform a novel conceptual framework as well as testable hypotheses grounded in theory to inform the design and interpretation of future studies.
Results: Identified drawbacks of existing methods to assess age-related disease and decline involve cost effectiveness, accessibility, invasiveness, clinical relevance, ecological validity, reliability, and efficiency. Preliminary studies suggest that smartphone-based digital phenotyping may address many of these drawbacks by yielding continuous large-scale data in real life with minimal interference, providing a naturalistic and increasingly sensitive measure of everyday functioning, though existing studies have been exploratory in nature and lack a priori hypotheses informed by theory. Known trends observed across the cognitive aging spectrum include changes in mean performance level on validated cognitive and functional measures, but also consistent patterns of variability and inefficiency across a variety of measures and outcomes. Taken together, we propose that specific patterns of activity level and intraindividual variability will be observed when using passive digital technologies to assess everyday cognition in older adults across the cognitive aging spectrum. The digital phenotyping approach can capture these predicted trends in everyday life across a greater range of personally-relevant behaviors, with a particular focus on variability as a sensitive metric for both group differences and intraindividual change over time.
Conclusions: The use of emerging digital tools such as smartphone-based digital phenotyping requires a conceptual framework from which to design studies and interpret large scale, unconstrained datasets from everyday life, particularly as technologies continue to evolve. Considering established trends in variability and activity levels yields a theoretical model that may be empirically evaluated in future studies.
Keywords: assessment**,** technology**,** everyday functioning
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14 Utilizing a Residual Measure of Cognitive Reserve in Older Adults to Examine Neural Efficiency During Active Walking

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Objective: Cognitive reserve is a measure of resilience against cognitive decline in aging. Dual-task walking, an attention-demanding task requiring the combination of walking and

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performing a cognitive task, is a robust predictor of health outcomes in aging. Poor structural integrity of the brain has been associated with high and inefficient increases in functional Near-Infrared Spectroscopy (fNIRS)-derived oxygenated hemoglobin (HbO_2) in the prefrontal cortex from single task conditions to dual-task walking. Cognitive reserve has been described as an efficiency of cognitive processes to adapt to age-related changes. However, whether cognitive reserve influences the efficiency of cortical control of gait has not been reported. Herein, we examined the moderating role of cognitive reserve on the increase in prefrontal cortex HbO_2 from single-task to dual-task walking conditions. We predicted that higher cognitive reserve would be associated with attenuated (i.e., more efficient) increases in fNIRS-derived HbO_2 from single task conditions to dual-task walking, taking into account cognitive and gait performance.
Participants and Methods: Participants were community-residing older adults enrolled in a cohort study, "Central Control of Mobility in Aging." A total of 55 right-handed adults age 65 and older without dementia were included in the analyses (mean age = 74.84 $\pm$4.97; %female = 49.1). Our established dual-task walking paradigm included three tasks: single-task-walk (STW), single-task-alpha (STA – cognitive task), and dual-task-walk (DTW). Multimodal neuroimaging included measurement of fNIRS-derived HbO_2 in the prefrontal cortex, assessed during the three task conditions, and structural brain integrity via MRI in a 3T Philips scanner. Cognitive reserve was operationalized using a residual approach; we removed the variance on a measure of reading (Wide Range Achievement Test, 3rd edition; WRAT-3) accounted for by sociodemographic variables (sex, ethnicity, and education), current cognitive functioning (Composite: Digit Symbol Modalities Test, Free and Cued Selective Reminding Test, Letter Fluency-FAS), and structural brain integrity (left rostral middle frontal volume).
Results: The linear regression model used to operationalize a residual cognitive reserve measure was statistically significant ($R = .80$, $R^2 = .64$, $p < .001$). Linear mixed effects models revealed that cognitive reserve moderated the change in HbO_2 from single tasks to DTW. Specifically, higher cognitive reserve was associated with smaller increases in HbO_2 levels from STW to DTW (interaction ß = .19, $p < .001$) and from STA to DTW (interaction ß = .23, $p < .001$). This moderation effect remained significant in follow up models that included adjustment for demographics variables, dual-task walking and cognitive performance, and concurrent moderation effects of current cognitive functioning and gray and white matter integrity.
Conclusions: The current study is the first to provide evidence that higher cognitive reserve was associated with more efficient neural activation of active walking in older adults. These findings may have implications for future planning of interventions to enhance brain control of locomotion.
Keywords: cognitive reserve**,** movement**,** neuroimaging: functional
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15 Temporal Patterns of Detail Use in Episodic Autobiographical Memory Elaboration Across the Adult Lifespan

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Objective: Remembering episodic autobiographical memories (EAMs) involves the accumulation of memory details across time in the mind's eye. Evidence for this temporal unfolding has been partly captured in dynamic changes of neural networks during elaboration. Along with changes in brain activity, cognitive theory suggests variations in details at different points in EAM elaboration. Investigating cognitive temporal dynamics can provide new insights into how memories unfold and may also identify age-specific patterns underlying episodic detail reductions in cognitively healthy older adults.
Participants and Methods: From seven studies of autobiographical memory using adaptations of the Autobiographical Interview (Levine et al.,

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2002), we gathered a sample of 198 healthy young, middle-aged, and older adults who silently recalled three to six EAMs from different lifetime periods and described each memory aloud during an elaboration phase. Each memory was transcribed and segmented into five timepoints based on word count, with episodic and semantic details summed in each timepoint. Episodic details were additionally separated into two categories, namely event-based and scene-based, to explore their temporal use patterns. Two and three level multilevel models were conducted to track the use of episodic and semantic details across EAM elaboration within the entire sample and to examine how these temporal trajectories change with participant age.
Results: For the entire sample, EAM elaboration was characterized by episodic and event-based details peaking in the middle of memories, whereas scene-based and semantic details appeared to be highest at the beginning. Number of initial semantic details impacted temporal episodic detail patterns such that having average or fewer than average semantic details predicted a more variable trajectory. Participant age interacted significantly with memory timepoint to predict only scene-based details, suggesting that younger age related to higher initial details with a steeper decrease of these details across elaboration. Furthermore, memories from younger adults that contained higher initial semantic details also had more total episodic details, whereas memories from middle-aged and older adults did not show the same benefit. In fact, memories from older adults with more initial semantic details also contained fewer episodic details overall.
Conclusions: These findings identify general patterns of detail use across EAM elaboration and provide support for the importance of contextual information such as semantic and scene-based details at the outset of elaboration to provide a scaffold for event details. Given the general stability of most temporal patterns across the lifespan, typical age-related differences in episodic detail generation could be due to narrative style processes. Lastly, semantic details initially populating an elaboration may play differential roles in recollection across the adult lifespan.
Keywords: memory: normal**,** aging (normal)

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16 Omega-3 Fatty Acids, Cognition, and Brain Volume in Healthy Elderly Adults

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Objective: As the elderly population grows at increasing rates in the US, so does the disease burden and cost of care associated with aging and cognitive decline. Research has identified factors like diet and exercise that may prevent or delay the onset of cognitive decline. Due to their mechanistic roles in nerve signaling, synaptic plasticity, myelination, neurogenesis, and reducing neuroinflammation, omega-3 fatty acids have been explored for their potential neuroprotective effects. The aim of this study is to examine associations between omega-3 fatty acids, cognitive function, and neuroanatomical markers in a healthy aging population.
Participants and Methods: Adults aged 65 and older (*n*=40, 48.9% Female) were recruited for the Loma Linda University Adventist Health Study-2 Cognitive and Neuroimaging Substudy. Participants had a mean age of 76.25 years (*SD*=8.29), 16.77 years of education (*SD*=2.53), and were majority of Caucasian race (85.0%). Participants underwent a two-hour neurocognitive battery, including measures of semantic fluency (Animals) and memory (Rey Auditory Verbal Learning Test, RAVLT; WMS-IV Logical Memory, LM; Rey Complex Figure Test 3-minute delayed recall, ReyODR). Composite scores were created for (a) immediate memory - using the RAVLT Immediate Recall and the LM Immediate Recall; (b) delayed memory using the RAVLT Long Delay, LM Delayed Recall, and ReyODR. Participants underwent brain imaging on a 3T Siemens MRI, including a 3D T1-weighted MPRAGE sequence. Cortical reconstruction and volumetric segmentation were performed using the Freesurfer image analysis suite. Blood samples were collected for

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fatty acid analysis; an omega-3 index was constructed as the sum of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Correlational analyses, controlling for age, sex, and education, investigated relationships between omega-3 and cognitive function (semantic fluency, immediate memory, delayed memory), and between omega-3 and gray and white matter volumes.
Results: The omega-3 index was significantly positively correlated with Animals (*r*=.46, *p*=.004) and delayed memory (*r*=.36, *p*=.03), but not with immediate memory (*r*=.13, *p*=.45). The omega-3 index was also significantly positively correlated with white matter volume (left hemisphere: *r*=.36, *p*=.03; right hemisphere: *r*=.36, *p*=.03; total white matter volume: *r*=.36, *p*=.03), but not with total gray matter volume (*r*=.21, *p*=.22).
Conclusions: Higher blood levels of omega-3 were positively correlated with measures of semantic fluency and delayed memory, both of which are impacted by aging and Alzheimer's disease. Omega-3 levels were also associated with white matter volume, but not gray matter volume. Omega-3 fatty acids play essential roles in myelin development which improves signal transduction and growth of white matter regions of the brain. These results may suggest that omega-3 fatty acids have a greater effect on white matter compared to gray matter. With the rise in healthcare costs associated with aging, prevention strategies are being sought to prevent or delay cognitive decline. These results are promising and introduce the possibility that increasing omega-3 consumption may be one low-cost, efficacious strategy that merits further exploration in efforts to slow cognitive decline. Additional research should investigate the mechanistic pathways between omega-3 fatty acids, brain volume, and cognition.
Keywords: aging (normal)**,** cognitive functioning**,** neuroimaging: structural
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17 The Association of Occupational Complexity with Ten-Year Cognitive Change in ACTIVE

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Objective: The current project evaluated whether the occupational complexity (OC) of older adults' longest-held job was associated with subsequent ten-year longitudinal change in cognition. Past research has suggested that individuals who enter late life having held more intellectually demanding jobs perform at a higher cognitive level, but the effects on subsequent cognitive decline have been less consistently reported. This study examined the relationship between four dimensions of OC and ten-year change in reasoning, memory, and processing speed.
Participants and Methods: Participants at baseline were 2,371 adults (mean age = 74 years, mean education = 14 years, 77% female, 25% African American) from the ACTIVE (Advanced Cognitive Training for Independent and Vital Elderly) study. Participants described their longest held job, which was subsequently coded by two raters using the Dictionary of Occupational Titles (DOT). The current project examined four higher order dimensions of OC: cognitive demand, fine motor skills, physical demand, and color vision as predictors of cognition. In all cases, higher scores indicate that participants reported holding jobs that were more demanding of that dimension. Using latent growth models, the intercept and ten-year linear and quadratic slopes of three cognitive composites (Reasoning, Memory, Speed) served as the dependent variables, four occupational complexity factors were the independent variables, and whether or not training was received, age, sex, education, and Black/ White race were covariates.
Results: All effects shown are p< .05, and regression weights are standardized. Controlling for age, sex, race and education, holding jobs higher in *cognitive demands* was positively associated with baseline memory *(b*= 0.082*)* and reasoning *(b*= 0.097*)*. Holding jobs higher in *fine motor skills* was positively associated with the baseline level of all three cognitive domains *(Memory: b= 0.064; Reasoning: b= 0.087; Speed: b= 0.049)*. Having held more *physically demanding jobs* was negatively

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associated with baseline reasoning *(b*= -0.050*)*; having held jobs demanding more *color vision* was negatively associated with baseline memory *(b*= -0.084*)*.
Regarding cognitive change, having held jobs higher in *fine motor skills (b*= 0.092*)* was associated with less cognitive decline in memory. Having held jobs requiring more *physical demands (b*= -0.174*)* and more *color vision (b*= -0.129*)* was associated with greater cognitive decline in processing speed. No occupational complexity variables were associated with cognitive change in reasoning.
Conclusions: After adjusting for age, sex, race, and education, having held jobs higher in cognitive demands and fine motor skills was positively associated, while having held jobs higher in physical demands and color vision was negatively associated with baseline cognition. Having worked jobs demanding more fine motor skills was associated with shallower memory decline, while having held jobs with greater physical and color vision demands was associated with steeper processing speed decline. Limitations of the current study included a positively selected sample and focus on a single job for each participant. Strengths of the current study included a large, diverse sample and ten years of follow-up data. Overall, this provides supporting evidence that past occupational complexity is uniquely associated with cognitive change in later adulthood.
Keywords: cognitive course**,** aging (normal)

18 Inhibitory Deficits May Explain Higher Levels of Off-Topic Verbosity Among Older Adults

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Objective: Off-topic verbosity (OTV) refers to prolonged speech lacking in focus and coherence. Previous research indicates that older adults demonstrate greater OTV than young adults. The inhibitory deficit hypothesis attributes age-related increases in OTV to diminished inhibitory processes. In this study, we investigated relationships between inhibition of overlearned responses on a Stroop test and OTV among young and older adults. We hypothesized that poorer performance on the Stroop test would be associated with greater OTV, particularly among older adults.
Participants and Methods: Young adults (*n* = 61) and older adults (*n* = 75) completed the Delis-Kaplan Executive Function Systems Color-Word Interference Test (a Stroop test) and provided a verbal sample that was transcribed and rated for quantity of speech, tangentiality, and egocentrism by three independent judges.
Results: Among young adults, slower speed and more errors on the Stroop test were associated with lower tangentiality and lower quantity of speech. Among older adults, slower speed on the Stroop test was associated with greater tangentiality of speech, and more errors on the Stroop test were associated with lower quantity of speech.
Conclusions: Young adults with lower Stroop test performance may produce a lower quantity of speech that is relatively focused on the topic at hand (i.e., lower in tangentiality). Older adults with lower Stroop test performance also demonstrate a lower quantity of speech but, in contrast, this speech is more tangential. Consistent with the inhibitory deficit hypothesis, neurocognitive changes in the inhibition of overlearned responses may play a role in age effects for OTV.
Keywords: language**,** verbal abilities**,** aging (normal)
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19 Episodic Memory and Executive Function Are Differentially Affected by Retests but Similarly Affected by Age in a Longitudinal Study of Normally-Aging Older Adults

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Objective: Episodic memory and executive function are two cognitive domains that have been studied extensively in older adults and have been shown to decline in normally-aging older individuals. However, one of the problems with characterizing cognitive changes in longitudinal studies has been separating effects attributable to normal aging from effects created by repeated testing or practice.
Participants and Methods: In the present study, 169 people aged 65 and older were enrolled over several years and tested at least 3 times at variable intervals (M=3.1 yrs). The cognitive measures were composite scores representing memory function associated primarily with medial temporal brain regions, and executive function dependent on prefrontal brain regions. Each composite was made up of five neuropsychological tests, previously identified through factor analysis. For one pair of composite scores, variance attributable to age was removed from each subtest through regression analyses before z-scores were computed, creating two age-corrected composites. A second pair of composites were not age-corrected but instead were practice-corrected. Using mixed-effects models, we first explored retest effects for each cognitive domain, independent of age, using the age-corrected composites. We then modeled aging effects using the age-uncorrected composites after subtracting out retest effects.
Results: Results indicated significant retest effects for memory but not for executive function, such that memory performance improved with repeat testing. When these practice effects were removed from the age-uncorrected data, effects of aging were evident for both executive and memory function with significant declines with aging. We also explored several individual difference variables including sex, IQ, and age at the initial testing session and across time. Although all three variables affected performance on both cognitive factors at the initial test, only age at initial testing session moderated the memory practice effects, with older age associated with weaker practice effects. In regard to aging effects, younger-older adults showed less age-related decline over time on both cognitive factors, and people with higher IQs showed slower age-related decline in memory, but no advantages for executive function.
Conclusions: These findings suggest that a) aging affects both memory and executive function similarly, b) that higher IQ, possibly reflecting cognitive reserve, may slow age-related declines in memory, and c) that practice through repeated testing enhances performance, particularly in memory, and may therefore mask aging effects if not taken into account.
Keywords: aging (normal), memory: normal, everyday functioning
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20 Homocysteine-Related Network Covariance Pattern of Subcortical Gray Matter Volumes in Healthy Aging

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Objective: Elevated homocysteine (Hcy) levels have been recognized as a vascular health factor associated with an increased risk of cognitive impairment, cerebrovascular disease (CVD), and Alzheimer's disease (AD). Using multivariate network analysis with the Scaled Subprofile Model (SSM), we sought to identify a structural magnetic resonance imaging (MRI) covariance pattern that reflects the regionally distributed effects of Hcy on subcortical gray matter (SGM) volumes and its relation to other health risk factors, white matter hyperintensity (WMH) volume, and cognition in healthy aging.
Participants and Methods: T2 FLAIR and T1-weighted volumetric MRI scans were acquired in 160 healthy older adults aged 50-89 years (mean ± sd age = 69.66 ± 9.95, 53.8% women). We obtained total WMH volume by performing the automated segmentation of WMH lesions using SPM12's Lesion Segmentation Toolbox. Bilateral SGM volumes were extracted through the automated subcortical segmentation from T1-weighted images with Freesurfer. A multivariate SSM analysis was performed on the SGM volumes in relation to fasting total plasma Hcy levels to provide a Hcy-related SGM network covariance pattern. Multiple regression analysis was followed by mediation analyses to evaluate how the Hcy-related regional network SGM covariance pattern was associated with vascular and AD-related health risk factors, WMH volume, and cognitive performance.
Results: The Hcy-related SGM network pattern was characterized by volume reductions in bilateral hippocampus and nucleus accumbens with relative increases in volumes of bilateral caudate, pallidum, and putamen. Multiple regression analysis revealed that greater expression of the Hcy-SGM pattern was associated with older age, greater WMH volume, and male sex, with other vascular and AD-related risk factors not significantly associated with the Hcy-SGM pattern. Mediation analyses showed that the relationship between age and processing speed was mediated sequentially through WMH load and the Hcy-SGM pattern (Effect = .027, *SE* = .018, 95% CI .001 to .069).
Conclusions: Using multivariate network analysis with the SSM, we identified a Hcy-related regional network SGM covariance pattern mainly characterized by volume reductions in the bilateral hippocampus and nucleus accumbens, brain regions often affected in both CVD and AD. We found that greater expression of the SSM Hcy-related SGM pattern was related to older age, greater WMH load, and male sex. Mediation analyses indicated that age predicted WMH burden, which predicted the Hcy-related SGM pattern, which was, in turn, associated with poorer processing speed performance. Given that CVD and AD have been associated with hippocampal and nucleus accumbens volume loss, these findings suggest that this Hcy-related network pattern of brain atrophy may provide a novel neuroimaging biomarker linking peripheral vascular health to cognitive impairment, CVD, and preclinical AD risk.
Keywords: aging (normal)**,** neuroimaging: structural**,** cognitive functioning
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21 Association of Age with Gray to White Matter Contrast Differences is Mediated by White Matter Integrity in Healthy Older Adults

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Objective: Gray to white matter contrast (GWC) measured by structural T1 magnetic resonance imaging (MRI) has shown age-related differences associated with healthy and pathological aging in older adults, with frontal and temporal regions preferentially affected. These contrast effects are thought to reflect MR white matter signal differences, but the underlying neurobiological mechanisms remain unclear. We sought to examine if measures of global white matter integrity assessed by diffusion tensor imaging (DTI) have a role in mediating the relationship between age and regional lobar GWC in healthy aging.
Participants and Methods: A cohort of 163 healthy adults ages 50 to 89 (mean±sd age =

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69.7±10.4, 81F/82M, mean±sd Mini-Mental State Exam = 29±1.2) were included. Volumetric T1 and diffusion-weighted 3T MRI scans were processed using Freesurfer (v5.3) and TRACULA (Tracts Constrained by Underlying Anatomy; Yendiki et al., 2011) to compute average global whole brain estimates of fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD), and axial diffusivity (AD) from 18 major white matter tracts. GWC was computed using FreeSurfer for 68 regions of interest for each participant, which were averaged to create frontal, temporal, parietal, and occipital lobe values. Lobar white matter hyperintensity (WMH) volumes were obtained with T1 and T2 FLAIR scans using the lesion segmentation toolbox (Schmidt et al., 2012) with SPM12. Mediation analyses were conducted with SPSS PROCESS macro software (Hayes, 2012), including percentile bootstrap resampling with 10,000 iterations to provide 95% confidence intervals.
Results: After controlling for sex, hypertension status, and corresponding lobar WMH volume, analyses showed significant direct effects of age with greater age associated with decreased GWC in frontal, parietal, temporal (*p's* <.001), and occipital ($p < .05$) lobes. Further, global MD (-.01 (SE=.006), 95% CI, [-.03, -.001]) and RD (-.01 (SE=.006), 95% CI, [-.02, -.002]), but not AD, partially mediated the age effects on GWC with older age associated with greater MD and RD, which in turn was associated with only lower frontal GWC. Including the same covariates, FA (-.01 (SE=.04), 95% CI, [-.02, -.001]) partially mediated the effect of age only on temporal GWC, such that older age was associated with lower FA, which in turn was associated with lower temporal GWC.
Conclusions: In a sample of healthy older adults, we found that increasing age was associated with less GWC in frontal, temporal, parietal and occipital lobes. Global DTI white matter integrity metrics partially mediated the relation of age to lobar GWC, but only in the frontal and temporal lobes, after we controlled for vascular risk factors of hypertension and WMH volume. Together, our findings suggest that age-related degradation of myelin and reductions in directional white matter integrity may reflect underlying factors contributing to differences in GWC with increasing age for regions preferentially vulnerable to brain aging, such as the frontal and temporal lobes. Future work is needed to further evaluate how regional GWC differences influence the progression toward healthy versus pathological aging.
Keywords: aging (normal), neuroimaging: structural, frontal lobes

22 Executive Functioning Impacts Nature of Subjective Memory Complaint Endorsement Indicating Broader Cognitive Concerns in Older Adults

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Objective: Subjective memory complaints (SMCs) may be able to index impending cognitive decline; however, findings examining the relationship between subjective and objective memory are inconsistent. Moreover, it is unclear to what extent SMC endorsement specifically reflects memory impairment or whether it might better represent difficulty in other cognitive domains, such as executive functioning. Indeed, subtle executive dysfunction may contribute to perceived memory problems as executive function is required for memory processes. Thus, SMC endorsement may tap more general cognitive dysfunction than memory disturbance. Understanding the nature of SMC endorsement may be crucial to achieving early identification, intervention and prevention of future cognitive impairment. The present study therefore examined the relationship between SMCs and objective memory performance and the role of executive functioning in this relationship. We hypothesized that executive functioning would moderate the relationship between subjective and objective memory, with individuals exhibiting poor executive functioning endorsing more accurate SMCs.
Participants and Methods: Forty-eight older adults (M_{age}=77.52, range=70-86) completed the Memory Functioning Questionnaire (MFQ) Frequency of Forgetting subscale (FoF) to measure SMCs, the Rey Auditory Verbal Learning Test delayed recall (RAVLT-DR) to

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measure objective memory performance, and the Trail-making Tests part B (TMTB) to measure executive functioning. We tested whether executive functioning moderated the relationship between SMCs and objective memory; age, depression, and anxiety were covariates in the model.
Results: The moderation model was significant (R^2=.42; p=0.001), with TMTB performance (ß=-0.70, t(48)=-3.20; p=.003) and the RAVLT DR X TMTB interaction (ß=.078, t(48)=2.90; p=.01) significantly predicting MFQ FoF score. Results showed that TMTB moderated the effect of objective memory (RAVLT DR) on SMC endorsement, with objective memory more strongly related to SMC endorsement in individuals who also demonstrated poorer TMTB performance. Results suggest that SMCs may tap broader cognitive concerns than memory.
Conclusions: Individuals who had poorer executive functioning were more accurate in assessing their own memory abilities than those with good executive functioning. Thus, early changes in executive functioning may impact both memory and SMC endorsement. Importantly, SMC endorsement may reflect broader cognitive dysfunction than memory impairment. These findings highlight the importance of assessing other cognitive domains alongside memory, such as executive functioning, despite individuals presenting with primary concerns of memory decline.
Keywords: memory complaints**,** executive functions**,** neuropsychological assessment

23 The Mediating Role of SES on the Relationship between Pregnancy History and Later Life Cognition

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Objective: The association of pregnancy with later-life cognition is not well understood. Additionally, there is little literature that addresses the potential confounding role of socioeconomic factors on this relationship. We examined whether pregnancy was associated with cognitive function later in life in a large, population-based sample of postmenopausal women. Based on the existing literature on this subject, we hypothesized that a greater number of pregnancies would be associated with low cognitive function and a greater number of incomplete pregnancies would be associated with higher cognitive functioning. We also examined the potential mediating effects of education level and federal income-to-poverty ratio (PIR) on this relationship.
Participants and Methods: Participants were 1,016 women from the cross-sectional, population-based National Health and Nutrition Examination Survey (NHANES). Mean age at assessment was 67.31 years (SD = 5.36), and 32% of the sample reported some college education. We used data available from two study waves corresponding to the years 2011-2014. Cognitive functioning was evaluated by Digit Symbol Substitution Test (DSST), Animal Fluency, and Consortium to Establish a Registry for Alzheimer's Disease (CERAD) word-learning task (CERAD-WL), and CERAD delayed recall task (CERAD-DR). Socioeconomic status was evaluated using education level and federal income-to-poverty ratio (PIR) (calculated as the proportion of total family income to poverty level). Multiple linear regression models adjusted for relevant covariates (age at screening, race, length of reproductive span, BMI, smoking status, medical conditions, depression symptoms, education level, and PIR) to examine the relationship between the number of term and incomplete pregnancies and cognitive performance.
Results: Women with a higher number of term pregnancies showed significantly worse cognitive performance on the DSST (β =-0.09, 95% confidence interval [CI] -0.12 to -0.06), CERAD-DR (β = -0.04, 95% CI -0.08 to -0.01) and AF (β = -0.03, 95% CI -0.07 to 0.00). A slight positive relationship was found between the number of incomplete pregnancies and AF (β = 0.06, 95% CI 0.00 to 0.12) and CERAD-DR scores (β = 0.07, 95% CI 0.01 to 0.13) however all significant relationships were attenuated when adding education and PIR into our models. Significant associations between term/incomplete pregnancies and cognitive

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scores were significantly mediated by PIR but not education level. PIR accounted for 28-56% of the effect on cognitive scores.
Conclusions: Higher parity was associated with worse performance on DSST, AF, and CERAD-DR tasks; these differences were significantly mediated by SES. Conversely, we found a positive relationship between the number of incomplete pregnancies, AF, and CERAD-DR scores, however, this relationship was also mediated by SES. Our results indicate reproductive history plays a significant role in later life cognition however further research is needed to evaluate the mediating role of SES on the relationship between pregnancy history and later-life cognition.
Keywords: aging (normal)**,** cognitive functioning**,** hormones
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24 Recent Cannabis Use is Associated with Auditory Attention and Verbal Memory Process Scores in Older Adults

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Objective: Few studies have investigated neuropsychological effects of cannabis use in older adults, despite recreational and medical cannabis use becoming more common. Deleterious effects of cannabis have been reported for a range of cognitive functions (e.g., verbal learning and memory, executive function), but existing studies have largely focused on young adults. This pilot study aims to examine relationships between neuropsychological functioning and cannabis use in adults at least 60 years old to better inform patients and providers.
Participants and Methods: Two small pilot samples (n=7 in-person cognitive test data collection; n=5 telehealth data collection) of adults aged 60 years and older with history of primarily recreational cannabis use were compiled for the current analyses. Participants completed online questionnaires and neuropsychological tests (WAIS-IV Digit Span, PASAT, phonemic fluency, CVLT-II). Primary measures of interest were long-term and recent (past 3 months) cannabis use [estimated years of regular use (at least once per week), recent frequency and quantity of use, estimated typical THC concentration]. Partial correlations were used to explore possible relationships between cannabis use measures and cognitive test scores while controlling for alcohol consumption.
Results: Participants identified as 3 women and 9 men with homogeneous racial/ethnic background (n=10 White not Hispanic/Latino), mean age 68.33 years (SD=5.77), and 14.92 years of education (SD=1.88, range 12-18 years). Reported mean age of first cannabis use was 19.5 years old (SD=4.01; range 15-27 years old) and mean years of regular use was 35.92 years (SD=18.92). On average, participants reported consuming about 0.25 g of cannabis per use day and using between 4 and 5 days each week over the last 3 months (with n=5 daily users). Only n=8 participants were able to report a typical THC concentration of 21.21% on average (SD=5.41), with n=4 reporting being given their product and having no knowledge of content. Mean AUDIT-C score was 3.50 (SD=1.98) with n=8 participants meeting positive cutoffs, and alcohol consumption was therefore included as a covariate. Partial correlations between cannabis use and normed test scores, uncorrected for multiple comparisons, are reported. Estimated years of use was negatively associated with CVLT-II Total Intrusions (r_p=-.64, $p \leq .05$). Recent frequency of use was negatively associated with CVLT-II Total Learning Slope (r_p=-.63, $p \leq .05$), and both frequency and quantity of use were positively associated with CVLT-II Retroactive Interference (r_p=.78 and .77 respectively, $p < .01$). Finally, estimated THC concentration (n=8) was positively associated with WAIS-IV Digit Span Sequencing (r_p=.89, $p \leq .05$) and Total (r_p=.82, $p \leq .05$).
Conclusions: These preliminary findings suggest several promising

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directions for future research on cannabis use in older adults. Specifically, process scores on the CVLT-II should be closely examined, as indicated by the associations between frequent and/or heavy cannabis use and retroactive interference and reduced learning slope. Additionally, observed positive associations between digit span and higher estimated THC concentration suggest a contributing role of putative stimulant properties of high-potency cannabis. Overall, measures of recent cannabis use (i.e., frequency, amount, and potency) appear most relevant for potential impact of cannabis on neuropsychological functioning.
Keywords: aging (normal), cannabis

25 Longitudinal Trajectories of Executive Function and Processing Speed/Attention in Older Adults in Relation to Vascular Risk Factors

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Objective: Executive functions and processing speed/attention are cognitive abilities commonly thought to decline with increasing exposure to vascular risk factors or greater vascular burden. However, it remains unclear whether different patterns or rates of decline in these domains are observed in relation to specific vascular risk factors. Thus, we aimed to identify longitudinal trajectories of cognitive change in older adults and determine whether differing trajectories are associated with specific vascular risk factors or an overall vascular burden score.
Participants and Methods: 199 older adult (65+) participants (M age=74.27, SD=6.33; 33.7% women; 81.9% White) were recruited as medically stable controls (i.e., no surgery) with mild-to-moderate aortic stenosis for a parent study on post-operative cognitive change following surgical aortic valve replacement (SAVR). Latent growth mixture modeling was performed on executive function (Trail Making Test B), processing speed/attention (Digit Span Forward), and memory (HVLT-R Delayed Recall) trajectories over a 1-year period. Classes from the best fitting model for each cognitive domain were compared on vascular burden scores (sum of vascular risk factors and vascular disease; range = 0-7) and the presence of other vascular risk factors over a 1-year follow-up period.
Results: Three executive function trajectories (slow/declining, fast/stable, average/stable); and two processing speed/attention trajectories (high /stable, average/stable) emerged. The two processing speed/attention trajectory groups significantly differed on history of smoking ($\chi^2(2) = 7.66$, $p<.05$) and vascular burden scores, such that individuals in the average/stable group had significantly greater vascular burden (M=3.32, SD=1.19) than those in the high/stable group (M=2.88, SD=1.25), $t(193)=-2.11$, $p<.05$. The three executive function trajectory groups significantly differed on vascular burden scores, such that the fast/stable group had significantly less vascular burden (M=3.05, SD=1.16) compared to the average/stable group (M=4.00, SD=1.09, $p<.001$), $F(2, 194) = 7.92$, $p<.001$. These groups also differed on other vascular risk factors including carotid disease ($\chi^2(2) = 6.51$, $p<.05$), congestive heart failure ($\chi^2(2) = 6.22$, $p<.05$), diabetes ($\chi^2(2) = 15.67$, $p<.001$), peripheral vascular disease ($\chi^2(2) = 13.57$, $p<.01$), and cerebrovascular disease (i.e., sum of past TIA, past stroke, and carotid disease; $\chi^2(2) = 5.98$, $p=.05$). The memory domain revealed only one trajectory group, so no further analyses were conducted.
Conclusions: Change in cognitive test scores, including executive function or processing speed scores, even over a short-time period may be indicative of underlying neurodegenerative processes, specifically of vascular pathology. The TMT-B test appears to be particularly sensitive to declines in executive function related to vascular pathology. However, these findings demonstrate that different cognitive abilities are associated with different rates and patterns of decline, with no evidence of differing memory trajectories in the one-year follow-up period. Future research should examine cognitive trajectories over a longer follow-up period to elucidate long-term cognitive consequences of vascular risk factors.

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Keywords: executive functions**,** attention**,** vascular cognitive impairment

26 White matter microstructure is associated with serum clusterin and everyday functioning in a sample of older adults without dementia

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Objective: Although clusterin--a protein involved in lipid transport, amyloid beta clearance, and myelination--has been linked to gray matter atrophy within samples of older adults at risk for Alzheimer's disease, research exploring associations with white matter (WM) micro- and macro- structural markers are largely limited. The current study (1) explored associations between serum clusterin protein levels and WM micro- and macro- structural markers, as well as (2) clarified whether variations in WM fractional anisotropy (FA) were associated with functional abilities within a sample of older adults free of dementia
Participants and Methods: Participants underwent magnetic resonance imaging (MRI) brain exams and a blood draw and completed a performance-based measure of everyday functioning (Independent Living Scale [ILS]). Multiple linear regression adjusting for age, sex, apolipoprotein E (APOE) e4 positivity, and vascular risk factors were used to explore serum clusterin associations with WM metrics, as well clarify potential links between WM microstructure and everyday functioning.
Results: Higher serum clusterin was associated with lower FA in several thalamocortical (anterior and posterior internal capsule, posterior thalamic radiation; ßs = -.32 to -.37, ps = .01 to .02) and association fiber tracts (external capsule, superior longitudinal fasciculus; ßs = -.32 to -.40, ps = .02). There was no significant association between serum clusterin and white matter hyperintensity (WMH) volume (ß = .175, p = .19), but higher FA of several WM tracts was associated with better performance on the ILS (ßs = .37 to .53, ps = .006 to .03).
Conclusions: Serum clusterin is differentially associated with WM metrics, and WM microstructure is associated with everyday functioning in a sample of older adults without dementia.
Keywords: aging (normal)**,** activities of daily living**,** neuroimaging: structural

27 Waist-to-Height Ratio: A Better Obesity Measurement to Predict Cognition in Older Adults?

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Objective: Abdominal obesity is associated with cardiometabolic disorders, which have been inconsistently associated with cognition in older adults. Body mass index (BMI) has traditionally been used as a measure of overall obesity, but it does not account for body fat distribution. Alternatively, measures of abdominal obesity, such as waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), may better account for age-related changes in body fat distribution. WHtR has been found to be more strongly associated with cardiometabolic risk factors than WC and BMI, but it has not often been explored in relation to cognitive functioning. This study investigated the relationship between abdominal obesity measurements, cardiometabolic risk factors, and cognition in older adults.
Participants and Methods: Participants included 5,561 1957 high school graduates (M_{age}=71.2 years, *SD*=0.9 years) from the Wisconsin Longitudinal Study, a publicly available database that includes graduates followed longitudinally until 2011. Cognitive, demographic, and health variables from the 2011 wave were used. Cognitive assessment included Letter Fluency, Category Fluency, Digit Ordering, Similarities, and Immediate and Delayed Recall of a 10-word list. Bayesian correlations investigated associations between abdominal obesity measurements (WC, WHR, WHtR), cardiometabolic risk factors, and cognition. Bayesian regressions examined

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cross-sectional effects of abdominal obesity measurements on cognitive scores, adjusted for sex and education. Cognitive scores were also corrected for the presence or absence of metabolic syndrome factors that are comorbidities of obesity, including hypertension, high cholesterol, and high blood sugar.
Results: Bayesian correlations between abdominal obesity measurements and cardiometabolic risk factors demonstrated WC, WHR, and WHtR were all correlated with history of hypertension, heart attack, stroke, high cholesterol, and high blood sugar (all BF_{10}>3). Bayesian correlations between abdominal obesity measurements and cognition showed higher WC, WHR, and WHtR were associated with worse Letter Fluency and Similarities. Higher WC and WHR were associated with worse Category Fluency, Immediate and Delayed Recall. Higher WHR was associated with worse Digit Ordering. The Bayesian regression null model included sex, education, and presence of hypertension, high cholesterol, and high blood sugar. Compared to the null model, the strongest evidence in favor of the alternate hypothesis was associated with addition of WHtR to the null model (BF_{10}=58.7, ΔR^2=.002) when predicting Letter Fluency. Likewise, the addition of WC to the null model provided evidence in favor of the alternate hypothesis when predicting Letter Fluency (BF_{10}=3.7, ΔR^2=.001), although the evidence is more modest. WHR did not predict cognition beyond the null model. The null model accounted for approximately 4% to 15% of the variance across all models.
Conclusions: All abdominal obesity measurements were associated with cardiometabolic risk factors. WHR and WC were correlated with memory and executive functioning performance. WHtR was correlated with only executive functioning performance. After adjusting for sex, education, and the presence of hypertension, high cholesterol, and high blood sugar, worse letter fluency was predicted by WHtR and WC, although effect sizes were generally quite small. Our findings suggest WHtR may provide some insight to executive functioning performance in older adults, but it is not superior to other abdominal obesity measurements.

Keywords: aging (normal)**,** cognitive functioning**,** cardiovascular disease
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28 Associations Between Cardiovascular Risk, White Matter, and Medication Predictors on Longitudinal Cognitive Change in the National Alzheimer's Coordinating Center Cohort

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Objective: Drawing on the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS), this study investigated the associations between baseline vascular risk factors/ cardiovascular disease (CVD) and white matter hyperintensity (WMH) burden on level and rate of change in cognition over a 6-year period. In addition, we evaluated whether pharmacological management of CVD (medication) attenuated the effect of CVD on overall cognitive performance and change over time and/or if WMH volume mediated the relationship between CVD burden on cognition over time.
Participants and Methods: Participants were 1,049 cognitively diverse older adults drawn from a larger NACC data repository of 22,684 participants whose data was frozen as of December 2019. The subsample included only participants who were aged 60-97 (56.7% women) who completed at least one post-baseline neuropsychological evaluation, had medication data, and both T1 and FLAIR neuroimaging scans. Cognitive composites of Memory, Attention, Executive Function, and Language were derived factor analytically using harmonized data across UDS versions 1 through 3, which were different form sets used over three different periods with some non-overlapping instruments. Baseline WMH volume was quantified using UBO Detector, a semi-automated processing pipeline. Baseline health screening and medication data was used to determine overall CVD burden and total medication use. Longitudinal latent growth curve models were estimated adjusting for age,

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education, sex, race, and Hispanic ethnicity. Four separate models were run estimating intercept and 6-year linear slope for the four cognitive composites.
Results: Higher baseline total CVD medications were associated with greater CVD burden (p < .001); however no direct effects of CVD medication were found on level or rate of change across cognitive constructs or WMH volume. While no direct effects of CVD burden on level or rate of change in cognition were observed, instead we found evidence supporting that CVD had small, but significant, *indirect* effects on overall level of Memory, Attention, Executive Functioning and Language (all *p's* < .01). Whole brain WMH volume served as the mediator of this relationship, as it did for an indirect effect of baseline CVD on 6-year rate of decline in Memory and Executive Function.
Conclusions: Findings from this study were generally consistent with previous literature and extend extant knowledge regarding the direct and indirect associations between CVD burden, pharmacological treatment, and neuropathology of presumed vascular origin on cognitive decline trajectories in an older adult sample. Results reveal the subtle importance of CVD risk factors on late life cognition even after accounting for treatment and WMH volume and highlight the need for additional research to determine sensitive windows of opportunity for intervention.
Keywords: cardiovascular disease**,** aging disorders**,** neuroimaging: structural

29 Cortical Thickness in Older Adults: Sex Differences and Behavioral Consequences

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Objective: Previous research has established that males and females exhibit differences in brain volumetry and cognition. We also know that cortical thickness declines with age. However, it is uncertain whether age-related cortical thinning differs between males and females. The present study sought to characterize sex differences in regional cortical thickness in a sample of healthy older adults. We also investigated the ability of cortical thickness to predict cognitive and motor outcomes.
Participants and Methods: 29 male and 52 female older adult participants (65-87 years old, M_{age} = 70.4 ± 5.02) completed a battery of behavioral tasks (NIH Toolbox Cognition Battery, Rivermead Behavioral Memory Story Test, NIH 2-minute Endurance Walk, NIH Grip Strength Test, and a Cortical Metrics vibrotactile somatosensory task) and a high-resolution structural MRI scan. Estimates of regional cortical thickness were calculated using FreeSurfer. Exploratory factor analysis (EFA) on the cognitive and sensorimotor measures identified latent factors associated with fluid and crystallized cognition, memory, processing speed, gross motor, fine motor, and tactile ability. EFA on the regional cortical thickness measures identified three latent factors in both the left (dorsolateral frontal, cingulate temporal, and posterior cortex) and right hemispheres (lateral frontal, medial occipital, and posterior cortex). Multiple regression was used to examine age and sex effects and age x sex interactions on the cortical thickness factors as well as the relationship between cortical thickness and behavior.
Results: The left hemisphere (LH) dorsolateral frontal factor and right hemisphere (RH) lateral frontal factor showed significant declines with age (B's ≤ -0.05, p's ≤ 0.002) within older adults both before and after controlling for sex, years of education, and estimated total intracranial volume (ETIV). However, there were no significant interactions between age and sex on cortical thickness. The LH dorsolateral frontal cortical thickness scores were larger in older females than older males (B's ≥ 0.49, p's ≤ 0.02) both before and after controlling for age, education, and ETIV. For the behavioral outcomes, after controlling for age, sex, education, and ETIV, both LH and RH frontal and posterior cortical thickness factors were positively associated with gross motor function (B's ≥ 0.15, p's ≤ 0.04). LH and RH posterior factors were also positively associated with crystallized cognition (B's ≥ 0.24, p's ≤ 0.04).
Conclusions: Thicker dorsolateral frontal cortex in females suggests that males are more vulnerable to atrophy and/or that older females

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are more protected against cortical thinning in this region. However, the lack of an age x sex interaction suggests that the rate of cortical atrophy does not substantially differ between older males and females. The results also confirm the hypothesis that individual differences in cortical thickness among older adults are associated with individual differences in behavior. Understanding sex differences in cortical thickness among older adults and the relationship between cortical thickness and behavior could help identify factors that protect late-life cognitive function and reduce sex-related brain health disparities among older adults.

Keywords: aging (normal)**,** neuroimaging: structural**,** motor function

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30 The Association Between Head Motion During Functional Magnetic Resonance Imaging and Executive Functioning in Older Adults

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Objective: Minimizing motion during functional magnetic resonance imaging (fMRI) is important for maintaining the integrity of neuroimaging data. In-scanner head motion tends to increase with age. However, the cognitive profile of "high-movers" in older adults has yet to be explored. Cognitively, older adults experience declines in cognitive control domains. Less cognitive control may influence the ability to implement a verbal instruction (e.g., "remain still during the scan"), to consistently monitor head motion, and to suppress distractions from the novel scanning environment (e.g., loud noises). This study aimed to explore the association between in-scanner head motion and cognitive functioning in a sample of older adults.

Participants and Methods: 282 older adults (mean age = 71.6 ± 5.1) underwent resting-state fMRI (rs-fMRI) and completed neuropsychological measures in executive functioning (set-shifting = Trail Making Test Part B, inhibition = Stroop Color-Word trial, and working memory = Digit Span Backwards and Letter Number Sequencing), processing speed (Coding), and verbal memory (Hopkins Verbal Learning Test – Revised [HVLT]). Head motion parameters (i.e., invalid scans) were extracted from a 6-minute rs-fMRI scan collected on two 3T scanners. Using the intermediate settings on the Artifact Detection Toolbox, "invalid scans" were flagged as outliers due to motion with global blood oxygen level dependent signal changes beyond 5 standard deviations and framewise displacement greater than 0.9mm. Prior to analyses, scanner type was regressed from the total number of invalid scans, and age and education were regressed from all neuropsychological measures. Due to data non-normality, Spearman's Rank-Order correlations were calculated between 1) the neuropsychological residuals and total number of invalid scan residuals and 2) demographic variables and total number of invalid scan residuals.

Results: Number of invalid scans was significantly associated with performance on set-shifting (TMT-B) and inhibition (Stroop Color-Word) tasks. Specifically, higher number of invalid scans was related to greater amount of time to complete TMT-B ($\rho = 0.20$, $p = 0.001$; i.e., worse performance) and fewer total number of correct responses on the Stroop Color-Word trial ($\rho = -0.16$, $p = 0.009$). Performance on measures of working memory – Letter Number Sequencing and Digit Span Backwards ($\rho = -0.07$, $p = 0.28$; $\rho = -0.06$, $p = 0.34$, respectively), episodic memory – HVLT delay recall ($\rho = -.08$, $p = .20$), and processing speed – Coding ($\rho = -0.06$, $p = 0.33$) was not significantly related to number of invalid scans. Higher number of invalid scans was also associated with older age ($\rho = 0.17$, $p = 0.003$).

Conclusions: This is the first study to investigate a cognitive profile of high-movers

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during fMRI in a sample of healthy older adults. In our sample, poorer performance on inhibition and set-shifting tasks related to a higher number of invalid scans due to motion. Since performance in these domains tend to decline in non-pathological aging, these findings raise concerns regarding potential systematic exclusion due to motion of older adults with lower executive functioning in neuroimaging samples. Future research should continue to explore prospective motion correction techniques to better ensure the collection of quality neuroimaging data without excluding potentially informative participants from the sample.
Keywords: aging (normal), executive functions, neuroimaging: functional

31 Does Neurocognition Contribute to Age-Related Deficits in Navigating Electronic Patient Health Portals?

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Objective: The Internet serves an increasingly critical role in managing health-related activities. Electronic patient portals, for example, provide a centralized platform where individuals can access lab results, manage prescriptions and appointments, and communicate with healthcare providers. This study examined whether neurocognition mediates the effect of older age on electronic patient portal navigation.
Participants and Methods: Fifty-two younger (age 18 to 35 years) and forty-five older adults (age 50 and older) completed a neuropsychological battery, self-report questionnaires, and measures of health literacy and functional capacity. Participants also completed the Test of Online Health Records Navigation (TOHRN)- an experimenter-controlled website on which participants are asked to log-in, review laboratory results, read provider messages, and schedule an appointment.
Results: Mediation analyses revealed a significant indirect effect of age on TOHRN accuracy, which was fully mediated by composite Z-scores of global neurocognition and individual cognitive domains including executive functioning, memory, and processing speed, but not attention. Notably, exploratory follow-up models demonstrated that TOHRN accuracy was a significant partial mediator of the relationship between age and composite Z-scores of global neurocognition.
Conclusions: Findings indicate that neurocognition plays an important mediating role between age and accuracy on an electronic patient portal task. Moreover, this relationship seems to be bidirectional, such that individuals with worse cognitive performance demonstrate difficulty successfully utilizing electronic patient health portals to complete important health-related behaviors. Future studies might examine the possible benefits of various cognitive supports to improve the navigability of patient health portals for older adults.
Keywords: activities of daily living, technology

32 Baseline Differences in Driving Frequency as a Predictor of Cognitive Decline

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Objective: Driving is a complex task heavily dependent on executive functions and processing speed. Given that these cognitive domains may be the first to deteriorate in the aging brain, driving variables associated with a decreased ability to drive (e.g., cessation, frequency) may be particularly early indicators of cognitive decline. Although research findings connect driving cessation to higher rates of cognitive decline, prior research has not examined daily driving frequency in this context. Thus, the objective of the current study was to evaluate the predictive utility of driving frequency toward objective cognitive decline beyond other factors (e.g., depression, general functional mobility).
Participants and Methods: The sample included 1,426 older adults aged 53 to 98 years at baseline (Mage = 77.6 years, SD = 7.1; 71% female, 94% white) from the Rush University

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Memory and Aging Project. Participants completed batteries of questionnaires and neuropsychological tests at baseline and yearly follow-ups (M = 6.8 years, SD = 4.9). Self-report measures included driving frequency (i.e., number of typical days driven per week at baseline), distance traveled in daily life [modified version of the Life Space Questionnaire], and depression symptoms [10-item Center for Epidemiologic Studies Depression scale (CES-D)]. Neuropsychological tests measured episodic memory [Word List Memory, Word List Recall, Word List Recognition, and immediate and delayed recall trials from East Boston Story and Logical Memory Story A], semantic memory [Verbal Fluency, 15-item Boston Naming Test, 15-item word reading test], working memory [Digit Span: forward, backward, ordering], perceptual orientation [Judgement of Line Orientation, Standard Progressive Matrices], processing speed [Symbol Digit Modalities Test, Number Comparison, Stroop word reading and color naming], and global cognitive ability [average of all tests]. Domain scores of objective cognitive functioning were calculated via averaged z-scores. Multilevel mixed effects models were conducted to examine driving frequency, depression, life space, follow-up year, and demographics as predictors of changes in each cognitive domain over time. **Results:** Greater driving frequency uniquely predicted reduced rates of cognitive decline in global cognitive ability (β = -0.05, t(1068) = -2.721, p = .007) as well as in working memory (β = -0.06, t(1109) = -2.338, p = .020), perceptual orientation (β = -0.05, t(1137) = -2.245, p = .025), and processing speed (β = -0.10, t(1059) = -3.982, p < .0001) while accounting for all other predictors. The interaction between driving frequency and follow-up year was significant for all models in that greater driving frequency lessened the negative effect of time on cognitive decline. **Conclusions:** Our finding that less driving frequency was also associated with greater cognitive decline extends previous findings connecting driving cessation to greater rates of decline. Future research should explore changes in driving frequency over time to better understand the relationship between functional and cognitive decline.

Keywords: cognitive functioning, driving, everyday functioning
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33 Health Literacy in Older Adults: Relationship to Cognitive Function and the Healthy Aging Activity Engagement Scale

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Objective: With the aging population in the U.S. increasing and the demand for health care services also on the rise, it is vital that we understand health literacy in older adults and how this relates to engagement in healthy behaviors in everyday life. Low health literacy has been associated with lower physical function, lower mental health, and lower medication adherence. We hypothesized that poorer health literacy would be associated with poorer executive functioning, working memory, and self-reported engagement in healthy aging lifestyle behaviors.
Participants and Methods: Fifty older adults (age: *M* = 71.08, *SD* = 7.67; education: *M* = 16.90, *SD* = 2.47; 70% female) were administered a battery of neuropsychological tests, a health literacy measure (Newest Vital Sign; NVS), and a lifestyle behaviors questionnaire (Healthy Aging Activity Engagement Scale; HAAE) remotely via video conferencing. The cognitive domains assessed included memory (Rey Auditory Verbal Learning Test short and long delay), executive functioning (verbal fluency and category fluency switching), and attention/working memory (Digit Span Forward and Backward). For the NVS, participants were presented with a nutrition label for a pint of ice cream and asked to interpret its verbal and numerical information to make health-related decisions. Typically, this measure solely uses the accuracy score to assess health literacy, but this study also examined time to completion as an outcome measure. The HAAE is a self-report questionnaire that assesses an individual's engagement in healthy lifestyle

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behaviors across multiple domains (e.g., physical, cognitive).
Results: Spearman's correlation indicated that there was no significant relationship between the NVS accuracy and time to completion scores, $r(47) = -.13$, $p = .38$. Longer time to completion was significantly associated with lower executive functioning abilities, $r(47) = -.38$, $p = .009$, while higher accuracy was significantly associated with higher memory abilities, $r(48) = .37$, $p = .009$. Follow-up Spearman's correlation, controlling for age, indicated that there was no significant relationship between engagement in healthy lifestyle behaviors and either the NVS accuracy, $r(46) = .03$, $p = .87$, or time to completion, $r(43) = -.08$, $p = .57$, scores.
Conclusions: The lack of correlation between the NVS time to completion and accuracy scores suggests that these measures may be capturing different aspects of performance. Further, time to completion was associated with executive functioning and accuracy with memory, suggesting that these cognitive abilities may be important for the processing and comprehension of health-related information. Future work might examine whether the time to completion measure also captures aspects of health literacy. Neither the NVS time to completion nor accuracy measure was related to self-reported engagement in healthy aging lifestyle behaviors. To improve health interventions, future studies with larger sample sizes and a more diverse population will be needed to better understand health literacy and its relation to cognition and lifestyle behaviors in older adults.
Keywords: aging (normal), neuropsychological assessment, cognitive functioning

34 The Effects of Age on Relationships Between Neuropsychological Performance and Cerebral Oxygen Metabolism and Blood Flow

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Objective: The physiological basis of age-related cognitive decline is still unknown. Brain aging processes are complex, involving many interacting physiological systems. Age-related changes in metabolic processes arise from altered pathways and cellular damage that increase steadily over the lifespan. Vascular aging involves stiffening of arteries that can cause changes in cerebral blood flow and vascular reactivity. It is important to characterize these phenomena in older people and understand their relationship to their cognitive performance, and compare those relationships to determine what underlying age-related physiological changes are impacting cognition.
Participants and Methods: In groups of younger (20-35) and older (55-70) adults, we used the T2-relaxation under spin tagging (TRUST) MRI technique along with arterial phase contrast scans to estimate cerebral blood flow and resting cerebral metabolic rate of oxygen consumption. Following their scan, participants underwent a neuropsychological battery consisting of many different tasks including the Digit Symbol Substitution Task, Digit Span task, Box Completion task, Matrix Reasoning task, and Identical Pictures Task. Participants also completed the Beck Depression Inventory.
Results: We find that the patterns of correlations between the neuropsychological tasks and the physiological measures is quite different between younger and older adults. In older adults, resting cerebral blood flow was positively related to processing speed tasks while negatively correlated to the same tasks in younger adults. Older adults also showed a relationship between blood flow and the Digit Span Backward task, while younger adults show no relationship at all. There were no relationships between performance on perceptual speed tasks and cerebral metabolism in younger adults, but significantly positive relationships in the older adults. The two groups demonstrate exact opposite correlations with the Box Completion task and cerebral metabolism. Overall, cognitive performance in younger adults seemed less related to either blood flow or cerebral metabolism than in older adults. We also saw a significant anticorrelation between scores on the Beck Depression Inventory in older adults and no such relationship in younger adults.

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Conclusions: It is clear from our results that cognitive performance in older adults is significantly influenced by blood flow and metabolism in ways that differ from younger adults, demonstrating the dependence in older adults on physiological state that emerges as a consequence of age-related physiological changes. However, this dependence is a result of morphological and functional changes in brain vasculature rather than simply metabolic functional changes. This might indicate that the main target of efforts to improve age-related cognitive decline should be improving vascular health.
Keywords: aging (normal)**,** brain function**,** vascular cognitive impairment

35 Openness to Experience and Activity Engagement: Protective Factors Against Longitudinal Decline in Attention/Executive Functions and Verbal Memory in Older Adults

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Objective: Due to the interindividual variability in the rate of cognitive decline in the aging population, more work is needed to understand the biopsychosocial factors that may be differentially contributing to these cognitive changes. The current study examined whether the protective effect of Openness on the attenuated decline of Attention/Executive Functions (AEF) and verbal memory differed as a function of regular engagement in Cognitively Stimulating Activities (CSA) or Physically Stimulating Activities (PSA) over the course of five years.
Participants and Methods: The sample included 538 cognitively healthy, community-dwelling older adults (mean age= 75.86 ± 6.44; %female= 55) enrolled in a longitudinal cohort study. Openness was assessed using the Big-5 Inventory. Activity engagement was assessed using the Leisure Activity Questionnaire. AEF was examined as a composite variable consisting of the Trail Making Test – Parts A & B, Controlled Oral Word Association Test – Letter and Semantic Fluencies, and the Digit Symbol Substitution Test. Verbal memory was examined as a composite variable consisting of various subtests from the Repeatable Battery for the Assessment of Neuropsychological Status (List Learning, Story Memory, List Recall, List Recognition, and Story Recall).
Results: Adjusted linear mixed effects models revealed that higher baseline levels of Openness were not independently and significantly associated with attenuated declines in either AEF (p= 0.737) or verbal memory (p= 0.879) over time. CSA engagement did not moderate the associations between Openness and trajectories of decline in AEF (High CSA: p= 0.871, Low CSA: p= 0.990) and verbal memory (High CSA: p= 0.606, Low CSA: p= 0.160). However, longitudinal associations of Openness with AEF and verbal memory significantly differed as a function of PSA engagement, such that the advantage of higher Openness on attenuating cognitive decline was more pronounced in those with higher PSA engagement, compared to those with lower PSA engagement [(AEF: High PSA: p= 0.034, Low PSA= 0.042) (Verbal Memory: High PSA: p= 0.025, Low PSA= 0.031)].
Conclusions: The results of the study are important as they supplement existing literature suggesting the advantages of increasing physical activity in older age as a potential avenue for attenuating cognitive decline. Physical activity is a promising intervention that is low-cost and widely accessible to the majority of adults given the wide range of activities and intensity levels inherent in its definition. As long as an individual is willing and open-minded to engaging in some type of consistent and stimulating movement, their risk of cognitive decline is likely reduced.
Keywords: personality**,** cognitive reserve**,** everyday functioning
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36 Examining Well-being as a Moderator in the Development of Cognitive Decline in Older Adults with High Harm Avoidance

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Objective: The dual-factor model of mental health highlights the need to consider both constructs associated with psychopathology and subjective well-being in relation to outcomes. In separate studies, harm avoidance, which is associated with behavioral inhibition, and subjective well-being have been negatively and positively associated with cognition and change over time. The current study aimed to examine both constructs in a single model to examine well-being as a moderator of the association of harm avoidance with cognitive decline.
Participants and Methods: Older adult participants (N =1249), from the Rush Memory and Aging Project, were examined. Depression was measured via the Center for Epidemiological Studies Depression scale. Harm Avoidance was measured using the 35 item Harm Avoidance scale from the Temperament and Character Inventory, which includes 4 subscales (fatigability, shyness, fear of uncertainty, and anticipatory worry). well-being was measured using the Ryff's Scales of Psychological well-being which has six subscales (self-acceptance, autonomy, environmental mastery, purpose in life, positive relations with others, and personal growth). Cognition was measured in five domains including, Episodic Memory (i.e. logical memory), Working Memory (i.e. digit span), Semantic Memory (i.e. Boston naming, category fluency, and the National Adult Reading Test (NART)), Perceptual Speed (i.e. Symbol Digits Modality Test (oral), number comparison, Stroop color naming, and Stroop word reading), and Visuospatial ability/perceptual orientation (i.e. Line orientation, and progressive matrices). Linear mixed-effects models with demographic variables (i.e. age, education), harm avoidance, depression, time, and interactions between harm avoidance, well-being, and time were examined for each cognitive domain.
Results: Well-being was uniquely associated with higher scores in semantic memory, working memory, perceptual speed, and overall cognition. For episodic memory, there was a significant 3-way interaction, such that the negative effect of harm avoidance over time was reduced in those with higher well-being. For every cognitive domain, there were significant 2-way interactions such that the positive effect of well-being was reduced over time. Finally, for global cognition and episodic memory, there were significant 2-way interactions such that the negative effect of harm avoidance was increased over time.
Conclusions: Well-being and other positive psychological constructs can play a role in the development of cognitive decline. This study shows that harm avoidance and well-being are associated using the dual-factor model of mental health which highlights the importance of both indicators of distress and well-being in relation to cognition. These results show that well-being has a buffering effect for negative mental health associations with cognition.
Keywords: cognitive functioning**,** personality

37 BDNF Polymorphism Amplifies the Negative Effect of Depression on Memory in Normotensive but Not Hypertensive Older Adults

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Objective: The negative effect of depression on cognitive functioning is well documented. Several factors likely contribute to this relationship including cardiovascular health and variations in the brain-derived neurotrophic factor (BDNF) gene (Rs6265) that results in a valine to methionine substitution at codon 66 (Val66Met). Both hypertension and BDNF Val66Met polymorphism are associated with cognitive dysfunction as well as depression in late life. The purpose of the present study is to investigate moderating effects of hypertension and BDNF ValMet66 polymorphism on the relationship between depression and cognitive functioning in older adults.

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Participants and Methods: The sample included 108 community-dwelling Veterans drawn from two clinical trials investigating the neuroprotective effects of activity-based intervention in older adults. Data was collected at the VA Palo Alto Health Care System. Participants in the present study were between 54 and 88-years old (mean age = 71.32, SD = 9.19). Approximately 10% of the sample had a depressive disorder, 34% were positive for the BDNF Val66Met polymorphism, and 54% had hypertension. Depressive disorders were assessed using the Mini Neuropsychiatric Interview for the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV). BDNF was collected via venipuncture. Hypertension was determined by a resting systolic blood pressure ≥ 130 mmHg or self-report. Cognitive measures included the Delayed Recall trial from the Rey Auditory Verbal Learning Test (unstructured verbal memory), Logical Memory II (LM2) from the Wechsler Memory Scale-4th Edition (structured verbal memory), Digit Span Forward from the Wechsler Adult Intelligence Scale, 4th-Edition (attention), Trail Making Test A (processing speed), and Trail Making Test B (executive function). Age was a covariate in each model.
Results: The overall model was significant ($p<.001$) and accounted for 26% of the variance in LM2 ($R^2 = .26$). Depression and hypertension were each significant predictors of LM2 ($p < 0.05$). Hypertension also moderated the relationship between depression and LM2 ($p = 0.001$). A three-way interaction emerged between hypertension, BDNF Val66Met, and depression ($p = 0.009$). Simple slopes analyses were used to further investigate this relationship. Depression, BDNF Val66Met, and hypertension had no effect on unstructured verbal memory, attention, processing speed, or executive function ($p>.05$).
Conclusions: The impact of hypertension on the relationship between depression and structured verbal memory was significantly affected by BDNF Val66Met. Specifically, those with the BDNF Val66Met polymorphism who were depressed but not hypertensive performed worse on LM2 than those participants without the BDNF polymorphism who were also positive for depression but negative for hypertension. In other words, the BDNF Val66Met polymorphism amplifies the negative impact of depression on structured verbal memory in normotensive older adults.
Keywords: depression, cognitive functioning, genetics

38 Childhood SES and Age-Related Cognition in Racially/Ethnically Diverse Older Adults

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Objective: Socioeconomic disadvantages and other social stressors in childhood have been linked to chronic diseases and dementia in late life. However, the underlying pathways through which childhood socioeconomic status (CSES) affects cognitive health in old age are not well understood. Previous studies include predominantly non-Latinx White participants. The purpose of this study was to investigate whether CSES moderates the relationship between age and cognition level and decline, and to determine whether CSES moderates this relationship differently across race/ethnicity groups.
Participants and Methods: Participants were 5045 racially/ethnically diverse older adults drawn from the Washington Heights Inwood Columbia Aging Project (mean age=75.6 (SD=6.4) years; 1262 non-Latinx White, 1531

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non-Latinx Black, 2252 Latinx; 67% women). Participants were followed up to 24 years, with an average of 4.62 years. We used generalized linear models to examine the relationship of age to 4 domains of cognition (memory, language, executive function, and visuospatial abilities) and to determine whether CSES moderated the age-cognition relationship across race/ethnicity groups. We did this in the full sample and in groups stratified by race/ethnicity. CSES was a composite factor score calculated on the entire sample that included number of siblings and parents' education and occupation; then divided into evenly distributed tertiles (low, medium, high). Covariates included sex/gender and years of education. We also examined differences in slope trajectories in memory to determine the role of CSES on memory decline.
Results: In the full sample, controlling for covariates, White participants had higher scores in all 4 domains, compared with Black and Latinx participants. There was no relationship between CSES and memory, visuospatial, and speed scores, but participants with low CSES had worse language scores compared with high CSES participants (B=-0.71, CI=-1.09,-0.32). Older low CSES participants had worse language scores compared with high CSES participants, but the effect of CSES was stronger at younger ages (Age*CSES, B=0.009, CI=0.004,0.014). There was no CSES*age interaction on memory, visuospatial, and speed scores. Models stratified by race/ethnicity revealed that the CSES*age interaction on cognition was similar in all groups. Lastly, preliminary longitudinal analyses showed that medium CSES participants had greater age-related memory decline than high CSES in the full sample, but not in race/ethnicity stratified groups.
Conclusions: Lower CSES was associated with lower language scores, however, the CSES gradient in cognition was widest in the younger group, and narrowed in the oldest old. Aging may be less detrimental to cognition in participants with low CSES, but it is also possible that an age-as-leveler effect explains these results. Participants with poor memory from low SES backgrounds may die at younger ages than high SES participants, introducing survival bias. Future work will incorporate joint survival longitudinal models to adjust for loss to death and follow-up, will dissect the individual CSES factors within race/ethnicity groups, and will explore the role of both childhood and adulthood SES on cognitive decline.
Keywords: cognitive functioning**,** aging (normal)
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39 Frontal gamma-aminobutyric acid concentration associated with age, but not cognitive performance in healthy older adults

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Objective: Age-related changes in frontal lobe integrity often associate with age-related cognitive declines. Gamma-aminobutyric acid (GABA) is the principal inhibitory neurotransmitter in the human brain and a central component of neuronal processing, facilitating modulation of neural circuitry and neuronal coding. Frontal GABA decreases with age, and lower GABA concentrations associate with poorer cognitive ability across various populations. This study explored associations among frontal GABA concentration, demographic variables, and cognitive performance in a sample of healthy older adults using a non-invasive neuroimaging technique, in vivo proton Magnetic Resonance Spectroscopy (MRS).
Participants and Methods: 206 healthy older adults (M age = 71.4, SD = 5.3) were recruited as part of a larger clinical trial at the University of Florida. All participants underwent 3T multimodal neuroimaging, including GABA-edited MRS. Gannet 3.1 extracted cerebrospinal fluid (CSF) corrected GABA concentration in International Units (IU) using RobustSpecReg. Participants also completed a cognitive screener, the Montreal Cognitive Assessment (MoCA), and executive function measures using

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1) the NIH Toolbox Cognition Battery (NIHTB) and 2) traditional paper-pencil measures (set-shifting: NIHTB Dimensional Change Card Sorting Test, Trail Making Test Part B; inhibition: NIHTB Flanker Inhibitory Control & Attention Test, Stroop Color-Word trial; and working memory: NIHTB List Sorting, Digit Span Total, and Letter-Number Sequencing). Multiple linear regressions examined demographic predictors (age, sex, and years of education) of frontal GABA concentration. Further analyses examined demographic factors and GABA concentration as predictors of cognitive performance on the MoCA and executive function measures.
Results: Linear regression found higher age predicted lower frontal GABA concentration (β=-0.14, p=0.05), with no relationships of sex (β=0.02, p=0.74) or years of education (β=-0.06, p=0.41). Frontal GABA concentration did not significantly predict MoCA score or executive function performance in switching/set-shifting, inhibition, or working memory (all p>0.05). Significant predictors for better MoCA performance included lower age (β=-0.25, p<0.001), female sex (β=0.16, p=0.02), and higher education (β=0.27, p<0.001). Education was a significant predictor of all cognitive measures (all p<0.05), except for Trail Making Test Part B (β=-0.04, p=0.61). Age was also a significant predictor for NIHTB List Sorting (β=-0.27, p<0.001), Letter-Number Sequencing (β=-0.30, p<0.001), and Trail Making Test Part B (β=-0.18, p=0.02).
Conclusions: We replicated previous findings demonstrating lower GABA concentration with higher age. Contrary to previous research, we found no association between frontal GABA concentration and performance on a cognitive screener, the MoCA. Inconsistencies with the existent literature may be related to differences in MRS voxel parameters (size and location), or participant inclusion/exclusion criteria. Additionally, there were no relationships between frontal GABA concentration and executive function in this large sample of healthy older adults. Given age-related decline in GABA and the established importance of GABAergic transmission in neuronal function, further studies should determine the utility of assessing age-related changes in relation to frontal GABA concentration as a marker for age-related cognitive changes. Assessing brain metabolites longitudinally may provide predictive value for monitoring progression to mild cognitive impairment or dementia. Additionally, understanding the impact of cognitive or neuromodulatory interventions on brain metabolite concentrations will be important for further elucidating brain-behavior relationships in older adult populations.
Keywords: aging (normal), neurotransmitter systems, frontal lobes
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40 A New Statistical Method in Tracing the Trajectory of Cognitive Functioning Throughout Lifespan: A Time-Varying Effect Model

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Objective: Time Varying Effect Model (TVEM; Tan, Shiyko, Li, Li, & Dierker, 2012) is a novel statistical tool that captures the relationship between variables over continuous time. TVEM can potentially be applied not only to investigate cognitive and neuropsychological functioning over the lifespan but also to answer interesting theoretical and clinical questions. TVEM created graphs with smooth curve lines modelling the relationship between variables at different time points or ages. The current study demonstrated the utility of TVEM on cognitive aging and explored human cognition across the lifespan.
Participants and Methods: Archival data was retrieved from the Health Retirement Study (HRS). The intensive longitudinal HRS data from 39,800 participants were analyzed with a diverse ethnoracial background. The HRS collects data every two years over a span of 20 years. Multiple neuropsychological tests were included in the analysis: Immediate Word Recall, Delayed Word Recall, Serial 7's Test, Vocabulary (from the WAIS), Telephone Interview for Cognitive Status, and a total cognition score that represented overall cognitive functioning. Three models were examined to demonstrate the trajectory of human cognition and the effect of race and education. The first model was an

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intercept only model with cognitive functioning as an outcome. In the second and the third model, race (as a categorical variable) and year of education (as a continuous variable) were separately added to the first model as indicators. P spline, with 10 knots as the maximum number, was used to estimate each model.

Results: TVEM was conducted using SAS 9.4 with TVEM SAS macro version 3.1.0. Figure 1 showed the trajectory of each cognitive decline over the lifespan (top left: the Vocabulary test, top middle: the Immediate Word Recall test, top right: the Delayed Word Recall test, bottom left: the Serial 7's Test, bottom middle: Telephone Interview for Cognitive Status, and bottom right: the total cognition score). In figure 1, the horizontal axis represented age while the vertical axis depicted cognitive performance. The blue area indicated the 95% confidence interval. With the same order, figure 2 showed Black American's cognitive performance, in comparison to White Americans as a reference group, and figure 3 manifested the effect of education on cognitive functioning over the lifespan. For figure 2 and 3, the vertical axis depicted the coefficient of the effect of race and education, respectively. When the blue area overlapped with the zero line, the effect was not significant at an alpha level of 0.05.

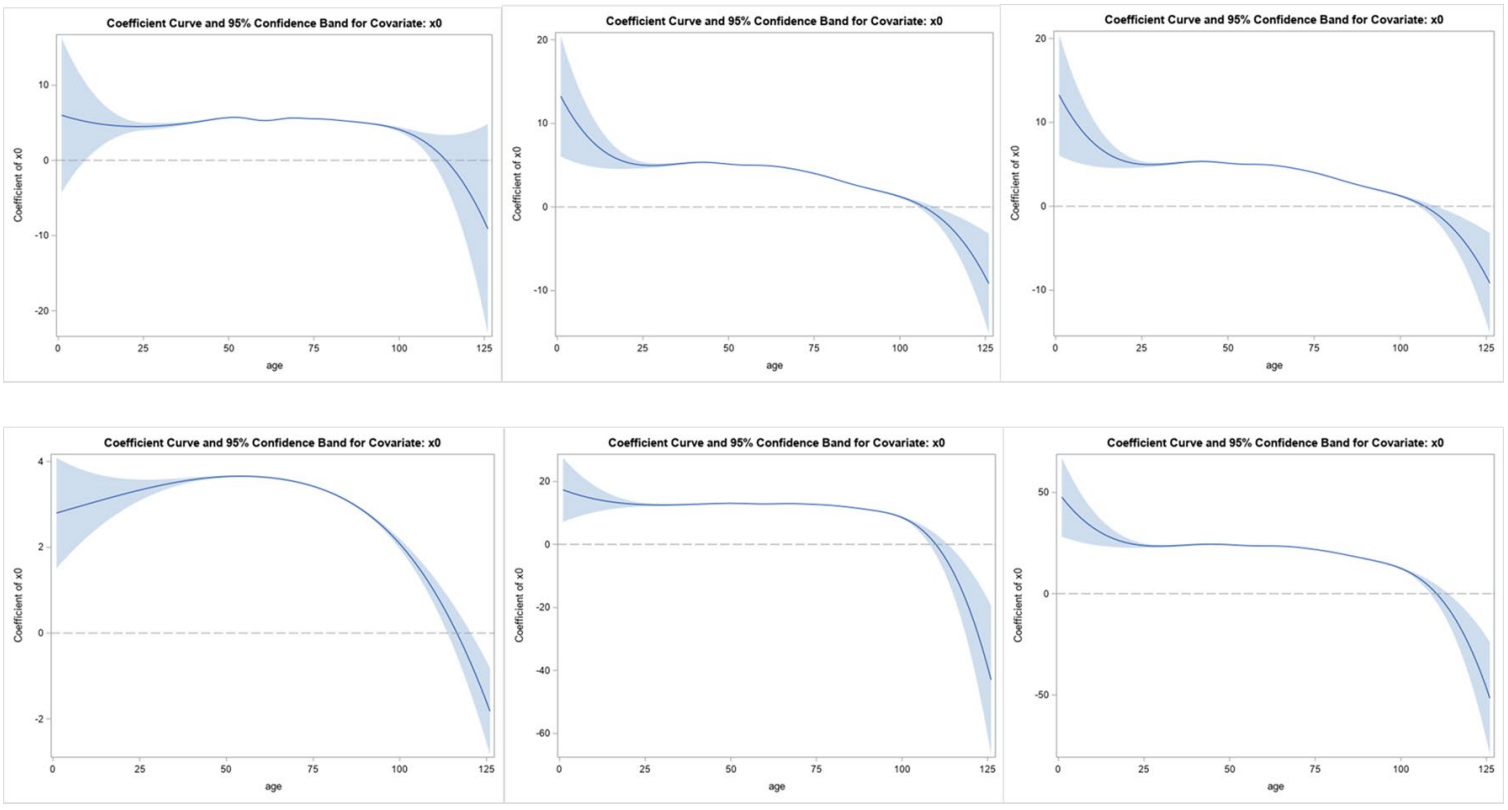

Figure 1

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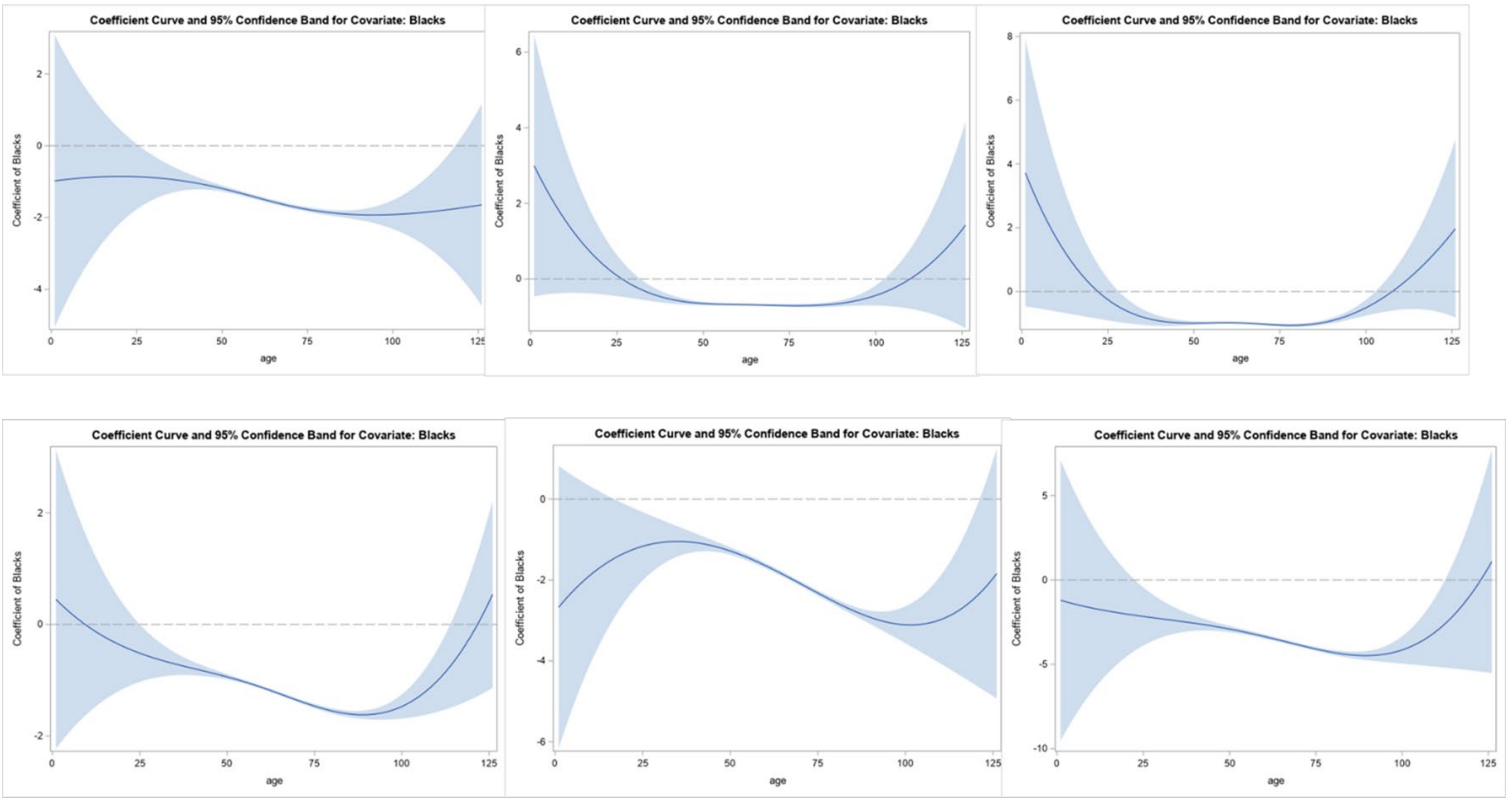

Figure 2

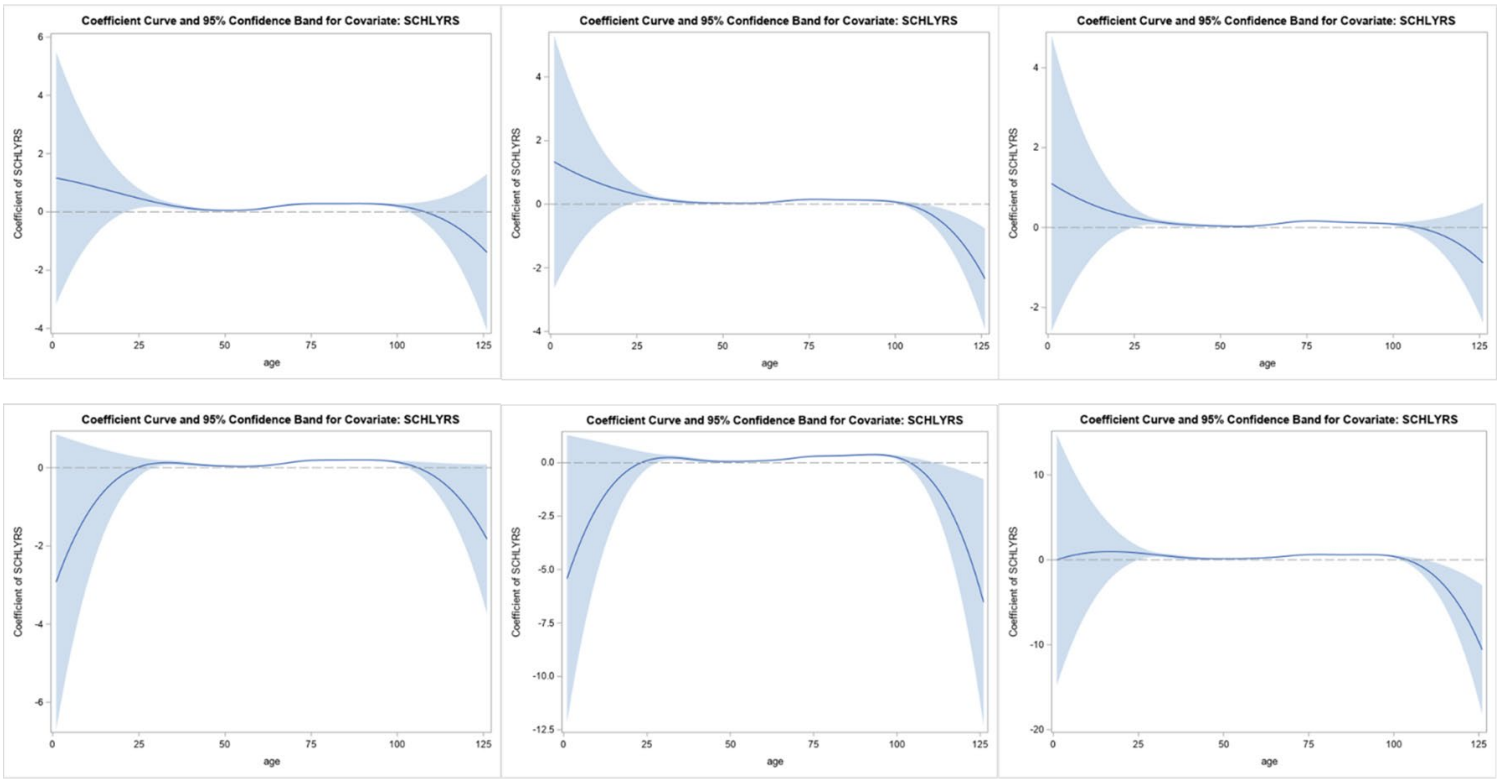

Figure 3

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Conclusions: The current findings were consistent with the literature. We demonstrated that verbal ability remained stable over the lifespan while performance on Serial 7's Test declined dramatically from age 70 and onward. Across all tests, Black Americans performed worse than their White counterparts across the lifespan, demonstrating a problematic cognitive health disparity, possibly due to a systematic racial inequality in education. In addition, in line with cognitive reserve theory, across all tests, higher education was associated with better cognitive outcomes, however only statistically significant on older adults (age between 70 and 100), potentially because of the ceiling effect (tests being too easy).

Keywords: cognitive functioning**,** teleneuropsychology**,** demographic effects on test performance

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41 Loneliness, Time Spent Alone, and Executive Function Among Older Adults

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Objective: Social interaction has long been theorized to play an important role in a variety of psychological phenomena (health outcomes, well-being, etc.). For older adults, losing loved ones, deteriorating health, and decreasing network size may increase their risk of experiencing loneliness and isolation, which may contribute to adverse health outcomes such as cognitive decline. However, the empirical literature on the relationship between social interaction and cognitive function in older age is mixed, perhaps stemming from differences in sample size and composition, the use of one or a few cognitive tests of executive function, and unclear evaluation of loneliness and/or isolation. In the present study, we investigated the relationship between social interaction and cognitive function in a large sample of cognitively unimpaired older adults. Participants received a comprehensive executive function battery. We measured loneliness subjectively through survey and isolation objectively through naturalistic observation.
Participants and Methods: Participants included 102 healthy, cognitively unimpaired, functionally independent older adults (age range = 65-90, *M* = 75.89, *SD* = 5.84). We measured subjective loneliness with the loneliness scale from the National Institutes of Health (NIH) Toolbox. We used the Electronically Activated Recorder (EAR) as an unobtrusive, observational ambulatory assessment method to sample ambient sounds from participants' daily lives to objectively determine their amount of social interaction (i.e., percentage of time spent alone) over the course of four days. Executive function measures included multiple tests allowing us to assess working memory, inhibition, shifting, and global executive function. We estimated the associations between loneliness, time spent alone, and executive function with multiple linear regression analyses, controlling for age, gender, and education.
Results: Loneliness was not a significant predictor of working memory (p = .11), inhibition (p = .18), shifting (p = .81), or global executive function (p = .22). Time spent alone was also not a significant predictor of working memory (p = .12), inhibition (p = .13), shifting (p = .92), or global executive function (p = .12). Corresponding Bayes factors indicated anywhere from substantial to very strong evidence (BF_{01} = 4.28 to BF_{01} = 47.62) in support of no relationship between these measures of executive function and either loneliness or time spent alone.
Conclusions: These findings suggest that among cognitively healthy older adults, there is not a cross-sectional relationship between multiple aspects of executive function and either subjectively experienced loneliness or their objectively observed time alone. While the impact of loneliness and time spent alone on executive function may be minimal, it is possible that other measures of social engagement might produce different results. Nonetheless, these findings suggest that there might be a larger gap than expected between the theoretical notion

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and empirical reality that social engagement is related to better cognitive functioning.
Keywords: aging (normal), executive functions
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42 APOE Modifies Relationships Between Perceived Stress and Prefrontal Cerebral Blood Flow

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Objective: Chronic stress increases risk for cognitive decline and this association is even stronger among carriers of the apolipoprotein E (*APOE*) ε4 allele. Despite evidence implicating neurovascular dysfunction as a mechanism underlying stress-related brain changes, no study to our knowledge, has directly explored relationships among *APOE*, perceived stress, and cerebral blood flow (CBF). To bridge this gap, the present study investigated the extent to which *APOE* status (ε4+, ε4-) modifies relationships between perceived stress and CBF in two prefrontal regions sensitive to stress (i.e., ventrolateral prefrontal cortex [vlPFC], dorsolateral prefrontal cortex [dlPFC]).
Participants and Methods: Participants were 92 men aged 56-66 with a mean age of 62 (SD= 2.55) and 13.6 years of education (SD= 2.1) from the Vietnam Era Twin Study of Aging (VETSA), of whom 25 were *APOE* ε4 carriers and 67 were not. Mixed-effect models were employed in R to explore the two-way interaction of *APOE* status (ε4+/ ε4-) and arterial spin labeling MRI-measured prefrontal CBF (i.e., vlPFC and dlPFC) on Cohen's Perceived Stress Scale (PSS) scores. Models adjusted for age, sex, education, and correlated observations (persons nested within twin pairs as a random effect). Results were considered significant at $p<0.0125$ (Bonferroni corrected).
Results: There were significant two-way interactions of APOE and prefrontal CBF on stress, such that perceived stress was positively associated with CBF in the left dlPFC and right vlPFC among *APOE* ε4 carriers but not among non-carriers. Relationships between perceived stress and right dlPFC and left vlPFC CBF did not differ by *APOE* status. Results also held after adjusting for depression symptoms and stressful life events.
Conclusions: Findings suggest that ε4 carriers with higher perceived stress experience CBF alterations in prefrontal regions, implicating vascular dysregulation as a potential mechanism underlying links between *APOE* ε4 and stress. This mechanism may, in turn, underly decline in cognitive functions mediated by these prefrontal regions. Higher prefrontal CBF among ε4 carriers with greater self-reported stress may reflect recruitment of neurovascular compensatory mechanisms and be indicative of a system under continuous stress. Given this data, future studies should seek to replicate these findings in larger and mixed sex samples, in relation to cognitive performance, and across more widespread brain regions to determine specificity of the findings.
Keywords: aging (normal)

43 Sleep Quality and Measures of Processing Speed in Young Adults

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Objective: Sleep disturbance, including fragmentation and insomnia, is common and has been found to lead to neurocognitive dysfunctions, including attention problems, depression, anxiety, stress, and a lack of impulse control1. To investigate these sleep impairments, clinicians and researchers rely on self-report measures, which remain the most practical and cost-efficient tool to use when monitoring sleep. The most widely used tool is the Pittsburgh Sleep Quality Index (PSQI), having the strongest evidence of reliability and validity in practice2. Additionally, processing speed is regarded as one of the most correlated and sensitive cognitive domains impacted by age.3 This study aims to examine the possible relationship between sleep and cognitive

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function among young adults to inform future research on s for early intervention of behaviors impacting cognitive function.
Participants and Methods: One hundred and forty-seven healthy undergraduate students were recruited from the University of Maine to participate in this study. Sleep quality was measured using the PSQI, and processing speed was measured via the NIH Toolbox (Oral Symbol Digit and Pattern Comparison Processing Speed), as well as, the Trails Making Test A. This data comes from a larger study conducted by the Maine Health, Aging, and Lifestyle Lab.
Results: Multiple hierarchical regression analyses were conducted to evaluate if sleep quality was significantly correlated to processing speed performance in this sample. First, correlation analyses revealed significant relationships between PSQI and Trails A. Neither Oral Symbol Digit nor the . Pattern Comparison Processing Speed scores were correlated with sleep quality and were therefore not entered into further analyses. A hierarchical multiple regression analysis was conducted, with demographic variables known to impact processing speed entered into the first step model and the PSQI entered into the second step of the model. Trails A was the outcome variable. Interestingly, the first step of the model (demographics) was not statistically significant, but the second model (adding in PSQI) was significant ($R2 = .264$, $p < .05$), with PSQI accounting for significant variance in Trails A scores ($b = .47$, $p < .05$).
Conclusions: We expected sleep quality to be significantly related to all measures of processing speed; however, the PSQI was significantly associated with only the Trails A. Limitations include the restricted range of scores in this healthy, college-age population. Despite this limited population, however, Trails A performance was already impacted by sleep quality in this population, thus demonstrating the importance of sleep quality across the lifespan. Future analysis is needed to continue to explore the relation between sleep quality and cognitive outcomes.
Keywords: brain function**,** cognitive functioning**,** sleep
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44 Compensatory Strategy Use in a Diverse Older Adult Sample: The Role of Aging Beliefs and Subjective Cognitive Decline

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Objective: Compensatory strategy (CS) use has been linked with improved real-world performance and prolonged functional independence in older adults with subjective cognitive decline (SCD). Individual difference factors (e.g., age, gender) have been shown to impact CS use, however, there has been limited examination of whether CS use differs by ethnic/racial group. Preliminary studies suggest that differences in CS use exist which may lead to aging-related functional disparities between ethnic/racial groups. Sociocultural-related aging beliefs have been shown to impact health-related behaviors in older adults, especially among under-represented populations (URPs) and therefore may influence CS use. The aim of the present study was to examine whether CS use differs by ethnic/racial group and if levels of SCD and aging beliefs may impact CS use in a sample of Non-Hispanic White (NHW; n=239), Black (n=270), and Hispanic/Latinx (n=298) U.S. older adult residents.
Participants and Methods: Participants (n=807; 67.2% female) were native English or Spanish speakers aged 55 or older (M=65.38, SD=6.40) who were recruited through online survey platforms (Amazon's MTurk or Qualtrics Panel). CS use was assessed using the Everyday Compensation Scale (EComp). SCD was measured using the Cognitive Function Instrument (CFI). The Expectations Regarding Aging 38-Item Survey (ERA-38) was used to assess aging beliefs. Mean differences in CS

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use between ethnic/racial groups was assessed using ANCOVA controlling for factors known to impact CS use and SCD: age, depressive symptoms (Geriatric Depression Scale-15 Item; GDS-15) and anxiety symptoms (Penn State Worry Questionnaire-Abbreviated; PSWQ-A). Mediation analysis was conducted using the SPSS PROCESS v3.5 macro to assess whether aging beliefs mediated the relationship between SCD and CS use.
Results: ANCOVA revealed significant group differences between ethnic/racial groups for CS use [F (2, 798) =11.960, p=0.03] and for SCD [F (2, 798) = 8.240, p < .001]. NHWs use CS more frequently (M=83.012, SD=1.943) compared to Latinx (M=71.059, SD=1.737) and Black (M=72.464, SD= 1.831) individuals, but there was no significant difference in CS use when comparing Latinx and Black groups (p > .05). Post-hoc analyses revealed that NHWs reported experiencing the highest levels of SCD (M=4.892, SD=.299) followed by Black (M=3.897, SD=.282) and Latinx (M=3.264, SD=.267) individuals. Aging beliefs mediated the relationship between SCD and CS use in NHWs (B=.636, SE= .006, 95% CI=.335, .987) and Blacks (B=.518, SE=.176, 95% CI=.205, .892) such that having lower levels of SCD and more positive aging beliefs were associated with less CS use. Aging beliefs did not mediate the relationship between SCD and CS use in the Latinx group.
Conclusions: CS are more frequently used by NHWs compared to Blacks and Latinx. More positive aging beliefs were associated with less compensatory strategy use despite higher level of SCD in NHWs and Blacks although no association was seen in the Latinx group. Future studies should explore whether there are other sociocultural factors that may impact CS use in Latinx individuals as well as exploring whether these relationships differ between Latinx subgroups.
Keywords: cross-cultural issues**,** adaptive functioning**,** memory complaints

45 Age Differences in the Effect of Depressive Symptoms and Objectively Measured Physical Activity on Immediate Memory in a Predominantly Black Sample

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Objective: Physical activity (PA) and depressive symptoms have both been linked to cognition, with PA being associated with better cognitive functioning and negative affective with worse cognitive functioning. However, the literature is based on self-report measures in predominantly non-Hispanic White samples. It also isn't clear whether PA and depressive symptoms have an interactive effect, or whether age moderates the effects of PA and negative affect on cognition. We investigated the interrelationships between depressive symptoms, immediate memory, and PA as measured by pedometer in a predominantly Black sample of late middle-aged to older adults.
Participants and Methods: Participants included twenty-eight adults aged 50 and older (mean age = 70.2; 82.1% Black; 85.7% female) who were administered the Digit Span Forward task, completed the Geriatric Depression Scale (GDS), and wore a pedometer for 14 days. Sex, education, race, and socioeconomic status were included as covariates in a regression model in which age, GDS scores, and PA level measured by pedometer predicted scores on Digit Span Forward.
Results: Higher PA levels were associated with better immediate memory at older ages but not younger ages, whereas depressive symptoms were associated with worse immediate memory at younger ages but not older ages. In people with low GDS scores, greater amounts of PA were associated with better immediate memory, but this was not the case for people with higher GDS scores. This effect was stronger at older ages.
Conclusions: These findings in a predominantly Black sample are consistent with previous research showing that PA is protective against cognitive decline and depressive symptoms. Findings further suggest that age makes a difference, and that depressive symptoms might

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minimize the benefits of PA on cognition. Future studies with larger samples and that include a longitudinal intervention component are needed to further clarify moderators of the impact of PA on cognitive functioning and mood.
Keywords: aging (normal), depression, cognitive functioning

46 Association of Gray Matter Network Covariance Related to Cerebrospinal Fluid ptau$_{181}$/Aβ$_{42}$ Biomarker Clusters of Alzheimer's Disease Risk with Cognitive Function in Healthy Older Adults

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Objective: While Alzheimer's disease (AD) is characterized by β-amyloid (Aβ) plaques and neurofibrillary tangles of phosphorylated tau (ptau), how preclinical signatures of these biomarkers relate to regional gray matter (GM) and cognitive function is unclear. Here, we sought 1) to identify a regional GM network covariance (GMC) pattern in structural MRI related to intrinsic clusters of cerebrospinal fluid (CSF) biomarkers reflecting the ratio ptau$_{181}$/Aβ$_{42}$ in a sample of cognitively unimpaired (CU) generally healthy older adults; and 2) to evaluate how this pattern of CSF ptau$_{181}$/Aβ$_{42}$-related GMC is expressed in relation to cognitive function in this cohort.
Participants and Methods: Participant data were drawn from the Alzheimer's Disease Neuroimaging Initiative (ADNI) and included 242 CU older adults [Mean(SD) Age=71.9(5.8) years, Sex (F/M)=139/103, Mean(SD) Education=16.7(2.5) years, Mean(SD) MMSE=29.0(1.2), APOE-e4 carriers (Yes/No)=75/167, with 3T T1 MRI scans, CSF measures of ptau$_{181}$ and Aβ$_{42}$, and composite measures of memory (ADNI-MEM), executive function (ADNI-EF), and preclinical AD (mPACC).
K-Means analysis was used to identify participant clusters of CSF ptau$_{181}$/Aβ$_{42}$ in the sample. A modified principal component analysis, the Scaled Subprofile Model (SSM; Alexander & Moeller, 1994) was applied to derive the regional GMC network predicting ptau$_{181}$/Aβ$_{42}$ cluster group membership. Associations between CSF ptau$_{181}$/Aβ$_{42}$-related GMC pattern expression and age-related differences in ADNI-MEM, ADNI-EF, and mPACC were tested using mediation analyses acquisition site, gender, years of education, and APOE-e4 carrier status as covariates.
Results: Cluster analysis of CSF ptau$_{181}$/Aβ$_{42}$ revealed optimal partitioning at a threshold of 0.02. The high-ratio cluster (n=67) had a greater proportion of female participants ($p \leq 6.00E-03$), more APOE-Ɛ4 carriers ($p \leq 2.21E-06$) and were older ($p \leq 1.18E-04$) than the low-ratio cluster group (n=175).
The SSM GMC pattern predicting the ptau$_{181}$/Aβ$_{42}$ clusters accounted for 6.91% of the variance in distinguishing between high- and low-CSF ratio biomarker groups ($p \leq 3.45E-05$). The covariance pattern exhibited relative reductions in right parahippocampal and inferior temporal regions, left insula and superior temporal areas, and regions in bilateral ventromedial prefrontal cortices.
The CSF ptau$_{181}$/Aβ$_{42}$-related GMC pattern significantly mediated the association between age and ADNI-EF (-0.004, (s.e: 0.002), 95%CI [-0.009, -0.0002]), with higher expression of the network GMC pattern associated with poorer executive cognitive performance. No GMC pattern mediation effects were observed for ADNI-MEM and mPACC.
Conclusions: Our results showed that cognitively unimpaired older adults categorized as having a high CSF ptau$_{181}$/Aβ$_{42}$ ratio using unsupervised clustering were associated with higher expression of a GMC pattern characterized by relatively greater GM volume reductions in a regional network, including medial temporal and ventromedial prefrontal brain regions.

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This biomarker cluster related GMC pattern mediated the association between age and executive functions, but not memory, suggesting that executive cognitive abilities may be more sensitive to the preclinical effects of AD on regional GM volume.
Together, these findings suggest that clustering analyses, and multivariate network covariance methods, like SSM, can combine fluid biomarkers of AD with neuroimaging measures of regional brain volume, and have the potential for identifying those at greatest risk for cognitive aging and subsequent development of AD.
Keywords: aging (normal)**,** neuroimaging: structural**,** executive functions
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47 Racial Differences in Cardiovascular Risk and Executive Function are not Associated with White Matter Hyperintensities

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Objective: To assess if differences in cardiovascular risk factors are associated with differences in white matter hyperintensity burden (WMH) and executive functioning performance.
Participants and Methods: 153 participants (76 Black, 77 White) from Alzheimer's Disease Neuroimaging Initiative (ADNI), matched sex, and cognitive status. Executive functioning performance (ADNI-EF), Framingham Risk Score (FRS), and WMH volumes were obtained from the ADNI public dataset. Regression analysis was used to assess the relationship between racial group membership and executive performance, and serial regression models were used to evaluate the mediating role of cardiovascular risk and WMH on this relationship.
Results: There was a significant direct effect of racial group membership on executive performance (β = .56, SE = 0.1, p <.001). There were no differences in WMH burden across groups (p = .68). While racial group membership was associated with CVR (β = -1.37, SE = 0.56, p <.05), and WMH burden was associated with executive performance (β = -.25, SE = 0.08, p <.001), there was no significant mediating effect through CVR and WMH on the relationship between racial group membership and executive performance. Additional analyses revealed WMHs partially mediated the relationship between CVR and executive function in the total sample, but there was a differential relationship such that CVR appeared to significantly predict executive performance among Black, but not White members of the sample.
Conclusions: Results suggest that despite disparities in CVR that may partially explain racial differences in executive performance, these differences do not appear related to WMH in this sample. Exploratory analyses suggest a possible differential role of CVR on cognitive performance across groups.
Keywords: aging (normal)**,** cognitive functioning
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48 Time of Testing Moderates the Relationship Between Daytime Sleepiness and Learning/Memory Performance in Older Adults

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Objective: Changes in both sleep and cognitive performance are expected in aging. However, literature examining the relationship between sleep and cognition in older adults has been mixed. It is important to consider how other factors, such as time of testing, may influence this relationship. Older adults are known to exhibit an increasing preference for morning activities (i.e., "morning chronotype"). Most studies examining time of testing in older adults have focused on comparing older adults to younger adults on processing speed/executive functioning tasks. Given that memory changes are also common with aging, it is necessary to explore how time of testing might be related to sleep and memory performance. Thus, we examined the role of time of cognitive testing as a potential moderator in the relationship

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between daytime sleepiness and cognitive performance within learning/memory and processing speed/executive functioning in a sample of adults over 50.
Participants and Methods: Data were drawn from the archival dataset of a larger study of sleep and cognition, which consisted of 135 community-dwelling older adults without evidence of dementia (M_{age}=65.6, SD_{age}=8.9; 68.9% female; 91.1% white, non-Hispanic). Participants were administered multiple cognitive measures, including the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and Trail Making Test (TMT). Analyses used raw scores for learning/memory tasks (RBANS List Learning, Story Memory, List Recall, Story Recall) and processing speed/executive functioning tasks (RBANS Coding, TMT). The Epworth Sleepiness Scale (ESS) was used to examine participant report of daytime sleepiness. Time of testing was coded based on whether participants were assessed before (AM; *n*=75) or after (PM; *n*=60) 12PM. Age and depression scores (Center for Epidemiologic Studies Depression Scale-Revised) were used as covariates given their associations to both cognitive performance and sleep disturbances. The potential role of time of testing as a moderator was examined through regression analyses.
Results: For immediate list learning (B=-.25, SE=.12, *p*=.04) and story memory (B=-.20, SE=.10, *p*=.04), there were significant interactions between ESS scores and time of testing, such that the relationship between daytime sleepiness and learning/memory appeared to depend upon time of testing. Follow-up analyses showed that, for those tested in the afternoon, greater daytime sleepiness was associated with worse learning/memory performance ($r_{listlearning}$=-.30, *p*=.02; $r_{storymemory}$=-.27, *p*=.04). In contrast, these constructs were not associated in morning testing ($r_{listlearning}$=.12, *p*=.32; $r_{storymemory}$=.17, *p*=.16). The interactions between ESS scores and time of testing were not significant for delayed learning/memory or processing speed/executive functioning tasks (*p*'s>.05), suggesting that time of testing did not moderate the relationships between daytime sleepiness and performance within these domains.
Conclusions: We found that time of testing was a significant moderator of the relationship between daytime sleepiness and immediate learning/memory performance, but not delayed learning/memory or processing speed/executive functioning in individuals over 50. These findings highlight the importance of considering time of day of testing when evaluating the relationships between sleep-related variables and cognitive performance in older adults. Future studies should expand upon these findings by examining the role of time of testing in the relationships between other sleep-related variables and cognition.
Keywords: aging (normal), sleep

49 Neuropsychological Correlates of Older Adult Financial Vulnerability During the COVID Pandemic

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Objective: The COVID-19 pandemic has disproportionately impacted the health and financial wellbeing of older adults. Age-related variations in cognitive ability may contribute to these outcomes; however, to our knowledge, no data exists on these associations. We investigated the neuropsychological correlates of financial vulnerability and health among older adults during the COVID-19 pandemic.
Participants and Methods: Twenty-nine older adult participants (mean age=65.26, s.d.=7.70; mean education=16.66, s.d.=2.08; 62.1% female; 85.2% White, 3.7% Native Hawaiian or other Pacific Islander, 7.4% Asian, 3.7% Other) without dementia (mean MoCA=26.5, s.d.=2.11) were recruited as part of the Finance, Cognition, and Health in Elders Study (FINCHES) Version 2.0. Participants completed a battery of neuropsychological measures (Brief Test of Adult Cognition by Telephone (BTACT); Oral Trail Making Test (OTMT)), in addition to measures of financial vulnerability (Financial

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Exploitation Vulnerability Scale (FEVS); financial exploitation (FE) status), and health (GAD-7; PHQ-9; Medical History Checklist). All measures were administered over the telephone to accommodate social distancing guidelines.
Results: Higher financial exploitation vulnerability (FEVS) was associated with lower performance on the composite BTACT cognitive measure (r=-0.41, p=0.02). When cognitive subtests were explored in post-hoc analyses, this was primarily attributed to lower performance on the category fluency subtest (r=-0.47, p=0.009). Higher FEVS was also associated with higher scores on the PHQ-9 (r=0.38, p=0.04), and on the question "How much do you feel like COVID is impacting your life right now?" (r=0.759, p<0.001). BTACT category fluency performance was negatively associated with impact from COVID (r=-0.451, p=0.040). Five participants (17%) reported experiencing some form of financial exploitation (FE) during the pandemic. No demographic differences were observed In between-group comparisons (FE vs. non-FE); however, FE participants showed higher FEVS (t=1.567, p=0.034), lower performance on the BTACT number series subtest (t=-0.089, p=0.044), better performance on the OTMT Part A (t=0.672, p=0.015), and more life impact from COVID (t=0.369, p=0.009).
Conclusions: These findings suggest cognitive ability is an important factor when considering financial vulnerability and health outcomes in older adults during the COVID-19 pandemic. Results specifically implicate measures of frontally-mediated brain network functioning as sensitive to these considerations. Future work is needed to clarify the temporal aspects of these associations.
Keywords: aging (normal), decision-making, cognitive functioning
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50 Selective Vulnerability of Medial Temporal Regions to Blood Pressure Variability and Cerebral Hypoperfusion in Older Adults

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Objective: Blood pressure variability is an emerging risk factor for stroke, cognitive impairment, and dementia, independent of average blood pressure levels, possibly through links with cerebral hypoperfusion. Recent evidence suggests visit-to-visit (e.g., over months, years) blood pressure variability is related to cerebral perfusion decline in brain regions vulnerable to Alzheimer's disease. However, less is known about relationships between short-term (e.g., < 24 hours) blood pressure variability and regional cerebral perfusion, and whether these relationships may differ by age.
Participants and Methods: We investigated short-term blood pressure variability and concurrent regional cerebral microvascular perfusion in a sample of community-dwelling older adults (n = 33) without history of dementia or stroke and healthy younger adults (n = 26). Blood pressure was collected continuously during a 5-minute resting pseudo-continuous arterial spin-labelling MRI. Blood pressure variability was calculated as variability independent of mean, a commonly used index of blood pressure variability uncorrelated with average blood pressure levels. Cerebral blood flow was determined for several brain regions implicated in cerebrovascular dysfunction in Alzheimer's disease. Gray matter volume from these same regions and white matter hyperintensity severity were also determined. Multiple linear regression examined blood pressure variability and regional cerebral perfusion levels in older and younger adults separately after controlling for age, sex, and antihypertensive use.

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Results: Elevated systolic blood pressure variability was related to lower levels of concurrent cerebral perfusion in medial temporal regions: hippocampus (ß = -.60 [95% CI -.90, -.30]; $p < .001$), parahippocampal gyrus (ß = -.57 [95% CI -.89, -.25]; $p = .001$), entorhinal cortex (ß = -.42 [95% CI -.73, -.12]; $p = .009$), and perirhinal cortex (ß = -.37 [95% CI -.72, -.03]; $p = .04$), and not in other regions, and in older adults only. A similar pattern emerged when controlling for corresponding regional gray matter volume and white matter hyperintensity severity.
Conclusions: Findings suggest a possible age-related selective vulnerability of the medial temporal lobes to hypoperfusion in the context of blood pressure fluctuations, independent of average blood pressure, white matter hyperintensities, and gray matter volume, which may underpin the increased risk for dementia associated with elevated BPV.
Keywords: cerebral blood flow**,** aging (normal)

51 System and Network Segregation relates to Cognition in the Healthy Oldest-Old

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Objective: The network architecture of the human brain, as measured using functional connectivity, has been shown to relate to cognitive function. The network architecture is therefore an important focus of cognitive aging research. Measures such as network integration (how strongly the nodes of a network are connected) and segregation (whether networks are more connected to elements of the same network or to different ones related to dedifferentiation), modularity, and participation coefficient are powerful descriptors of the interactions of brain areas. Most of the work in this domain has studied younger adults and older populations under 85 years of age. Little work has described functional network properties in the healthy oldest-old, where the impact of undiagnosed Alzheimer's and Parkinson's Disease are low, but individual variation in cognitive performance is high.
We describe brain networks in a group of healthy aging oldest-old participants and relate brain network metrics to measures of cognition.
Participants and Methods: Data are part of the McKnight Brain Aging Registry, a multi-center study. For this analysis, we included 146 community-dwelling, cognitively unimpaired older adults, ages 85-99, who had undergone structural and BOLD resting state MRI scans and a battery of neuropsychological tests. Exploratory factor analysis identified overall cognition and cognitive domains of memory, executive functioning- sustained attention (EF-SA), and executive functioning- control (EF-C). We preprocessed BOLD scans using fmriprep, Ciftify, and XCPEngine algorithms. We used connectivity-based parcellation to define cortical nodes in our sample. Segregation (balance of within-network and between-network connections), participation coefficient (degree of between-network connections), and mean within-network connectivity were measured within the association system and three well-characterized networks: Default Mode Network (DMN), Cingulo-Opercular Network (CON), and Fronto-Parietal Network (FPN). Two forward selection hierarchical regressions were performed to assess the predictors of overall cognition. We used canonical correlation to assess the relationship between cognitive domains and network metrics.
Results: We found that the brain networks of healthy oldest-old individuals are identifiable, organized, and segregated from one another. Association system properties were related to overall cognition in healthy oldest-old adults. Of the association system properties, system segregation was the greatest predictor of overall cognition(R^2=.162). Overall cognition was also related to several network properties of the DMN, CON, and FPN, including each network's segregation. Of these, segregation of the FPN was the greatest predictor of overall cognition(R^2=.174). Canonical Correlation

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revealed a strong relationship between EF and network metrics(r=.41,p<.001). The network metric canonical variable was most related to FPN segregation(r=.341,p<.001).
Conclusions: We provide a healthy oldest-old (85+) cortical parcellation that can be used in future work in this age group. Segregation of the association system and its component networks are related to overall cognition (including memory, executive functioning, and attention) in the healthy oldest old. Compared to other association system properties, segregation may be a more sensitive metric to cognitive performance in aging populations. This work shows the importance of network segregation of the oldest-old brain to cognition and that the FPN plays a major role in supporting overall cognition and executive functioning in an aging population.
Keywords: aging (normal)**,** brain function**,** cognitive functioning
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52 The Influence of Mood State on Older Adults' Executive Functioning in the Real World

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Objective: Changes in mood state have been shown in the laboratory to inhibit executive functioning (EF), especially in older adults. Older adults exhibited decreased scores in EF tasks after experiencing an experimentally induced positive or negative mood state (Phillips, et al., 2002). In this study, we investigate if self-reported mood state is related to performance on an EF travel task in the real world. We hypothesize that stronger self-reported mood states will be associated with poorer real-world executive performance and that participants with self-reported positive and negative mood states will have lower EF scores than individuals with neutral mood states.
Participants and Methods: Fifty-four older adults (Age, M = 70.54 years; Female = 39; Education, M = 16.87 years) took part in a larger naturalistic assessment study via telehealth. A "function-led" assessment titled the "Overnight Trip Task" (OTT) was designed as a measure of EF to better predict everyday functional ability. Participants were provided with a prompt that they could refer to as needed, which included a background story from which they made inferences and followed rules to successfully pack a real bag. Immediately after completing the task, participants filled out a short questionnaire where they selected from a predetermined list all mood states they experienced while completing the task. Participants also completed a general neuropsychological battery, which included a cognitive screening measure, EF planning task, and the Geriatric Depression Scale (GDS).
Results: Contrary to our hypothesis, performance on the OTT task was not significantly related to total number of self-reported mood states ($r = 0.1$, $p > 0.05$). Participants were then categorized into groups based on mood states selected: "negative (N = 12)," "positive (N = 28)," and "neutral (N = 14)." The mood state groups did not significantly differ in performance on the OTT task ($F = 1.51$, $p > 0.05$). The mood state groups did, however, differ in responses on the GDS ($F = 22.86$, $p < 0.01$), with participants in the negative mood state group self-reporting significantly more depressive symptoms than the positive and neutral mood state groups (ps < 0.01). Furthermore, GDS scores did not significantly relate to OTT performance ($r = 0.20$, $p > 0.05$). Performance on the OTT positively correlated with scores on a lab-based EF planning subtest (UPSA; $r = 0.30$, $p = 0.01$) and was significantly related to general cognitive ability (TICS; $r = 0.38$, $p < 0.01$).
Conclusions: In conclusion, our hypotheses were not supported. Self-reported mood state did not influence performance on an in-home EF travel task. This effect remained non-significant when looking at both total number of affective states and the affective category. Though the in-home OTT did relate to other EF tasks, it did not relate to the GDS, suggesting that neither immediate, nor long-lasting mood states influenced OTT scores. Performance was influenced by general cognitive ability. These results are limited by a small sample size. Further research is needed to explore the

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influence of affect on cognition in non-laboratory based tasks of EF.
Keywords: aging (normal), emotional processes, executive functions
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53 The Influence of Processing Speed, Attention, and Inhibition on Texas Functional Living Scale Performance

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Objective: Attention, executive functioning, and processing speed have all been implicated in their relationship to age-related cognitive and functional decline among older adults. The current study sought to examine relationships between adaptive functioning, as measured by the Texas Functional Living Scale (TFLS) and cognitive performance.
Participants and Methods: Data from 530 older adults (M_{age} = 74.58) who previously completed neuropsychological evaluations at an outpatient clinic were used to conduct analyses. Initially, a confirmatory factor analysis (CFA) was used to develop a three-factor cognitive model consisting of attention, inhibition, and processing speed. Notably, speeded components were absent from or factored out of variables that made up attention and inhibition factors. Relationships between cognition and adaptive functioning were further assessed using a hierarchical regression to predict adaptive functioning performance.
Results: The CFA demonstrated an adequate fit for the three-factor model (CFI = .94, RMSEA = .07, SRMR =.07). Results further indicated that processing speed was the sole predictor of adaptive functioning performance when all three cognitive variables were present within a single regression model.
Conclusions: Overall, the current results highlight relationships between the TFLS and individual cognitive domains that have not been previously explored. Additionally, these findings support previous research suggesting the importance of processing speed as it relates to functional decline among older adults.
Keywords: adaptive functioning, activities of daily living, cognitive functioning

54 Getting to the Point: Off-Topic Verbosity and Sustained Attention among Young Adults and Older Adults

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Objective: Off-topic verbosity (OTV) is tangential discourse that contains irrelevant and excessive information. There is evidence that older adults have higher levels of OTV than young adults, which the inhibitory deficit hypothesis posits stem from age-related neurocognitive changes in attention and executive functioning. Previous research on OTV and neurocognitive functioning has used brief measures; in this study, we examined OTV in relation to a lengthier measure of sustained attention.
Participants and Methods: Participants (N = 142) consisted of young adult (*n* = 61; age range: 18-28, *M* = 20.57, *SD* = 2.33) college students and healthy, community-dwelling older adults (*n* = 81; age range: 60-98, *M* = 76.35, *SD* = 8.21). Participants provided speech samples that were rated for tangentiality, egocentrism, and quantity of speech. Participants were also administered the Conner's Continuous Performance Tests – III (CPT-3), a sustained attention task that measures inattention and impulsivity.
Results: Age had a multivariate effect on speech characteristics, with older adults scoring higher on tangentiality and egocentrism. When inattention (CPT-3 omission errors) and impulsivity (CPT-3 commission errors) were included in the model as covariates, age cohort no longer had a significant multivariate effect. At

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the univariate level, inattention was related to tangentiality.
Conclusions: Consistent with prior research, older adults displayed higher levels of OTV than young adults, specifically displaying higher levels of the tangentiality and egocentrism. Inattention and impulsivity mediated age cohort differences in OTV. Consistent with the inhibitory deficit hypothesis, age-related changes in attentional deficits seem to stem from the difficulty of older adults in inhibiting irrelevant stimuli and sustaining attention on conversational topics.
Keywords: aging (normal)**,** language**,** attention
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55 Relationship Between Air Quality, Physical Activity, and Cognitive Decline

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Objective: Particulate matter (PM), or particulate pollution, is a term for particles in the air that may be microscopic and inhalable. Particulates may seep into the bloodstream creating serious health risks, and exposure to PM has been linked to decreased cardiovascular and respiratory functions. There is a dearth of literature examining the impact of PM on cognition, though existing studies suggest that poorer air quality is related to decreased cognitive performance. Lower air quality is also related to less time spent outdoors and reductions in physical activity, both of which may also have harmful effects on cognitive functioning.
Participants and Methods: To evaluate the impact of air quality on subjective cognitive functioning, data from the Center for Disease Control's (CDC) Healthy Aging Data Portal (HADP) and the United Health Foundation (UHF) was utilized. HADP data consisted of the percentage of adults (age 50+) who reported worsening cognitive decline and the percentage of adults (age 50+) who had not engaged in leisure-time physical activity in the past month. UHF annual reports regarding air pollution were used to determine PM, assessed by micrograms of fine particles in the air per cubic meter. All data was from 2019, and thirty-two states were included due to limited HADP data. A linear regression analysis was used to predict subjective cognitive decline rates based on air quality and physical activity individually. Another linear regression was completed to predict subjective cognitive decline based on air quality and physical activity combined. Hypotheses for the analyses were as follows: 1) An association will exist between air quality and subjective cognitive decline, and 2) Lower physical activity associated with high PM environments will be related to cognitive decline beyond what is associated with high PM alone.
Results: A linear regression using subjective cognitive decline based on air quality (PM) was significant ($F(1,30) = 8.041$, $p = .008$), with an R^2 of .211. A second linear regression using subjective cognitive decline based on physical activity (PA) was not significant ($F(1,30) = 3.260$, $p = .081$), with an R^2 of .068. A third linear regression using subjective cognitive decline based on air quality and physical activity was significant ($F(2,29) = 7.180$, $p = .003$), with an R^2 of .331. Air quality and physical activity combined were able to explain approximately 33.1% of the variance in subjective cognitive decline percentages in the model.
Conclusions: The purpose of the study was to evaluate the impact of air quality on subjective cognitive functioning. A second goal was to determine if air quality and physical activity combined were able to significantly predict subjective cognitive decline, as it is plausible that the quality of air would influence an individual's physical activity levels. Findings indicate that air quality and physical activity are able to predict subjective cognitive decline percentages by state at a statistically significant level. This study provides support for a growing body of research highlighting the impact of environmental factors on cognitive function. Limitations of this study include the lack of an objective cognitive functioning assessment and not including mood as a predictive variable. Future studies should address these limitations.
Keywords: cognitive functioning**,** environmental pollutants / exposures

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56 Sex Differences in Regional Cerebellar Volume Across the Adult Lifespan: A Comparison of Linear and Quadratic Relationships

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Objective: Differences in cerebellar volume have been associated with cognitive and motor performance in older adults. While cognitive and motor decline is common in older age, performance in these domains significantly decreases following menopause (a reproductive stage characterized by significant drops in estrogen) in females. The cerebellum is dense with estrogen receptors and variability in estrogen levels relates to structural and functional cerebellar changes. Prior work suggests regional cerebellar volume has a non-linear relationship with age, which varies by sex. Given the notable hormonal differences between females and males, characterizing age associations with linear and quadratic relationships in each sex seperately may improve our ability to predict clinical cognitive or motor decline. Furthermore, there is a higher incidence of Alzheimer's disease (AD) in females that exceed survivor effects. Reduced cerebellar volume has been linked to AD and cognitive deficits. Thus, targeting cerebellar age-volume associations by sex may provide insight into patterns for healthy aging as compared to neuropathology.
Participants and Methods: Participants included 530 healthy adults (ages 18-88; 49% female) from the Cambridge Centre for Ageing and Neuroscience database. T1-weighted images were processed using CERES. Analyses include linear and quadratic regressions to evaluate for age-volume associations, with age as the predictor and right and left adjusted regional cerebellar volumes (i.e., Lobules I-II, III, IV, V, VI, VIIB, VIIIA, VIIIB, IX, X, and Crus I and II) as the outcome in males and females separately. Bonferroni correction was applied to account for multiple comparisons (.05/24 for significance at p = 0.002083).
Results: Linear regressions in males revealed a significant relationship with age in bilateral Lobules III, IV, V, VI, VIIB, VIIIA, VIIIB, IX, X, and bilateral Crus I and Crus II [F(1,266) > 11.960, (p<.001)], after correction. In females, there was a significant linear relationship between age and adjusted regional cerebellar volume in bilateral Lobules III, IV, VI, VIIB, VIIIA, IX, left Lobule V, right Lobule X, and bilateral Crus I and Crus II [F(1,260) > 12.080, (p<.001)]. The quadratic regressions were not significant for any region in males and females (p>.05 and p>.002, respectively). However, quadratic associations in females for Lobule VI (right and left) were significant or approaching significance using traditional measures, but did not survive Bonferroni correction (p = .011 and p = .056, respectively).
Conclusions: Both sexes demonstrated significant linear associations between age and cerebellar volume across the majority of regions examined. Linear associations weren't wholly consistent between sexes, suggesting that males experience more global cerebellar differences, whereas females may demonstrate a slightly different rate or pattern of age-related structural cerebellar changes. Understanding cerebellar age-volume associations in healthy aging by sex is vital for identifying neuropathology especially in the context of AD incidence in females. Further exploration of these relationships in a longitudinal sample may provide greater insight on volumetric regional cerebellar sex differences and patterns of cognitive and motor decline in aging and AD.
Keywords: brain structure, aging (normal)
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57 Neural Efficiency & Dual-Task Walking Performance in Older Adult Musicians

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Objective: Music making is a unique, multifaceted activity that has been linked to improved cognitive functioning across numerous domains and related neuroanatomical changes in children and adults. However, the effect of music making on cognition in older adulthood has been relatively under-studied. Characterizing this relationship, including underlying neural mechanisms and associations with executive functioning, is essential for broadening our understanding of music's role in healthy aging. Additionally, there is a notable lack of research on the relationship between music making and physical variables such as gait, which has important implications for the aging population. Thus, the purpose of this study was to assess neural, cognitive, and physical correlates of music making in a sample of healthy older adults using an ecologically valid dual-task walking paradigm.
Participants and Methods: Study participants (N=415) consisted of relatively healthy community-dwelling older adults, aged 65 years or older. Participants were identified as musicians if they currently played a musical instrument or sang on a weekly basis (n=70). A dual-task walking paradigm with portable neuroimaging (functional near-infrared spectroscopy; fNIRS) was administered in which participants completed three task conditions: 1) single-task-walk; 2) single-task-alpha (cognitive interference); 3) dual-task-walk requiring the participant to perform the two single tasks simultaneously. Outcome measures across tasks included neural activation in the prefrontal cortex as assessed via fNIRS, as well as cognitive performance and gait velocity. Improved neural efficiency was established by the presence of lower task-related brain activation in the context of similar or better behavioral performance. Linear mixed effects models examined the impact of music making on neural activation and task performance in addition to moderating change in these variables from single to dual-task conditions.
Results: Across the study sample (53.3% women; 76±6.55 years old), neural activation increased from single- to dual-task conditions ($p < 0.001$), as expected. Music significantly moderated change in neural activation from single-task-alpha to dual-task-walking, with musicians demonstrating similar activation levels between these task conditions ($p=0.014$), in comparison to the increased activation observed in non-musicians. Additionally, while behavioral performance declined from single- to dual-task conditions, as anticipated, this decrease was significantly attenuated in musicians, as shown in analyses of both cognitive performance ($p < 0.001$) and gait velocity ($p < 0.001$). Finally, the main effect of music on gait velocity was significant, with musicians demonstrating faster gait across task conditions ($p=0.014$).
Conclusions: Given evidence of lower prefrontal cortex activation in the context of similar or improved behavioral performance, current results indicate the presence of enhanced neural efficiency in older adult musicians. Furthermore, improved dual-task performance in older adult musicians was observed including better cognitive performance and faster gait velocity. Study results have important clinical implications for healthy aging, as executive functioning (of which dual-tasking is a distinct facet) has been shown to play a role in maintaining functional ability in older adulthood. Additionally, the presence of neural efficiency in older adult musicians may indicate enhanced cognitive reserve that can serve to protect against adverse health outcomes.
Keywords: aging (normal), executive functions, neuroimaging: functional
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58 The Effect of Gender on Older Adults' Perceived Memory Abilities

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Objective: There is minimal research investigating whether taking neuropsychological test difficulty affects the examinee's sense of their cognitive abilities during the evaluation. This is important in terms of understanding the impact of the varying levels of cognitive

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challenge experienced during an assessment (e.g., rapport, following through with recommendations, outcome expectations). The current study examined changes in self-reported memory abilities following the administration of standardized neuropsychological tests with varying levels of difficulty.
Participants and Methods: Healthy older adults (*n* = 33) ranging in age from 66 to 88 were recruited from the community. A within-subjects design was used that counterbalanced the administration of the tests. Self-report memory ability was assessed at baseline and after each test.
Results: A one-way ANOVA showed a main effect for gender on reported memory ability, $F(1, 32) = 4.593$, $p = .04$. Post-hoc tests showed that male-identifying people rated their memory significantly lower than female-identifying people following the difficult memory test.
Conclusions: This study provides further insight into the examinee's experience while undergoing a neuropsychological evaluation. Test difficulty may have an impact on patients' engagement in future testing as well as cooperation and rapport, and gender may play a role in older adults' perceived performance on memory tests. These findings have implications for the assessment process and how the examinee responds to memory challenges afterwards. Future research and applications will be discussed.
Keywords: assessment**,** aging (normal)**,** memory: normal
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59 Real-World Goal Setting and Follow Through in Young and Older Adults

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Objective: The ability to generate, plan for, and follow through with goals is essential to everyday functioning. Compared to young adults, cognitively normal older adults have more difficulty on a variety of cognitive functions that contribute to goal setting and follow through, including episodic future thinking. However, how these age-related cognitive differences impact real-world goal planning and success remains unclear. In the current study, we aimed to better understand the impact of older age on everyday goal planning and success.
Participants and Methods: Cognitively normal young adults (18-35 years, n= 57) and older adults (60-80 years, n= 49) participated in a two-session study spanning 10 days. In the first session, participants described 4 real-world goals that they hoped to pursue in the next 10 days. These goals were subjectively rated for personal significance, significance to others, and vividness. Ten days later, participants rated the degree to which they planned for and made progress in their real-world goals since session one. They also completed the self-report prospective and retrospective memory questionnaire (PRMQ), among other surveys. Older adults also completed a battery of neuropsychological tests.
Results: Relative to the young adults, cognitively normal older adults described real-world goals that they perceived as more important to other people ($p=0.032$), and they reported more goal planning during the 10 day window ($p<0.001$). There was not a statistically significant age group difference, however, in real-world goal progress. Nonetheless, within the older adult group, more goal planning during the 10 day window was associated with more goal progress ($r=0.42$, $p=0.002$). Also, among young adults, individuals who reported less difficulty with their daily prospective memory on the PRMQ tended to engage in more goal planning ($r=-0.28$, $p=0.03$). Interestingly, this planning was not associated with increased goal progress in younger adults ($r=0.21$, $p=0.13$). Across the entire sample, real-world goals that were imagined more vividly also tended to be more personally significant ($r=0.337$, $p<0.001$). Within the older cohort, those who scored lower on the Rey Complex Figure Test (RCFT) long delay recall trial reported that their goals were

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more similar to ones that they had set in the past (r= -0.34, p=0.02).
Conclusions: Although older adults tend to show decline in several cognitive domains relevant to goal setting, we found that cognitively normal older adults did not make significantly less progress toward a series of real-world goals over a 10-day window. However, relative to young adults, older adults tended to pursue more socially-oriented goals. Older adults also appear to rely on planning more than young adults to make progress toward their goals, and older adults with lower episodic memory may pursue more habitual goals. While younger adults with worse prospective memory engaged in more planning, their planning was not shown to correlate with increased goal progress. These findings are in line with prior research suggesting that cognitive aging effects may be more subtle, or non-existent, when assessed in real-world contexts.
Keywords: memory: prospective**,** aging (normal)

60 Do Age-Related Brain Activation Differences Survive Controlling for Performance? Comparison Using a Working Memory Paradigm

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Objective: Older adults show increased activity in the dorsolateral executive control network (DECN) compared to younger adults when completing challenging cognitive tasks. This increased activity is commonly interpreted as compensatory activation. However, ability could be a hidden mediator of the increased activation if greater mental workload is evidenced by a larger BOLD signal and poorer ability leads to greater mental workload. Here, we investigated whether increased neuronal activity among older adults is still present when correcting for differences in performance. We hypothesized that older adults would show greater DECN activity in comparison to younger adults across all levels of load, and this this trend would persist after controlling for differences in performance within load.
Participants and Methods: Blood-Oxygenation-Level-Dependent (BOLD)-sensitive T2*-w images were acquired from 29 healthy adults (M=52.9 years, SD = 23.6 years, range = 28-85, 48% female), on a Siemens 3-Tesla Skyra . Participants completed a Sternberg task wherein we manipulated both memory load (number of items to be remembered) and logic load. Logic load was manipulated by presenting a colored test letter (i.e., blue or red), allowing 3 levels of Boolean logic level: disjunction, (e.g., repeated or red), conjunction (e.g., repeated and red), and disjunction of two conditions for the third load level (e.g., repeated and red -or- new and blue). Data were analyzed using linear mixed-effects models. We examined both the maintenance and probe stages of the task. We controlled for performance differences using a novel psychometric application of the generalized linear and latent variable model.
Results: During the maintenance stage of the task, when only memory load was manipulated, age did not significantly predict neuronal activity in either the left (b = .02, p = .293) or right (b = .02, p = .390) DECN. In contrast, during the probe stage of the task, when rule load was also present, age was positively associated with neuronal activity in both the left (b = 0.10, p = .006) and right (b = 0.11, p < .010) DECN. Moreover, even after controlling for differences in performance, older adults continued to show significantly greater bilateral activity during the probe stage of the task in comparison to younger adults at all task levels.
Conclusions: Results demonstrated that greater activity in the DECN among older adults is not solely explained by poorer ability to perform the task. Whether this activity should be interpreted as compensation for decreasing neural efficiency is unclear, as several competing theories have also been proposed (e.g., dedifferentiation and alternative strategy use). Additional research is needed to determine how best to interpret neural activation differences with age.
Keywords: executive functions**,** working memory**,** aging (normal)

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61 Relationship of High Blood Pressure and Hypertension Management with MRI Markers of Cerebrovascular Disease

Chelsey C. Nwadike, Indira C. Turney, Justina F. Avila-Rieger, Miguel Arce, Kay C Igwe, Krystal K Laing, Erica Amarante, Nicole Schupf, Richard P. Mayuex, Adam M. Brickman, Jennifer J. Manly
Columbia University, New York, New York, USA

Objective: Racial/ethnic disparities in prevalence of hypertension are exacerbated by differences in blood pressure control. Older adults with better management of hypertension have higher cognitive test scores and lower dementia risk than people whose hypertension is unmanaged, but less is known about the relationship of hypertension management to MRI markers of cerebrovascular disease. We examined the relationship of diagnosis and management of hypertension with WMH burden in a racially/ethnically diverse, community-based cohort of older adults.
Participants and Methods: Participants were 789 older adults (279 Latinx, 217 White, 293 Black; M age=74.81yrs; 60% women) from the Washington Heights- Inwood Columbia Aging Project. At the time of MRI scan, we collected blood pressure (BP), self-reported history of hypertension diagnosis, and WMH volume. Participants were categorized into 4 groups depending on self-reported hypertension diagnosis (with and without hypertension diagnosis) and their measured BP (high = systolic ≥ 130 or diastolic ≥ 80; low = systolic < 130 or diastolic < 80. ANOVA was used to examine mean differences in WMH volume across managed and unmanaged hypertension groups. We conducted these analyses in the overall sample and then repeated the analyses within groups stratified by race/ethnicity.
Results: Overall, participants with hypertension had more WMH than participants without hypertension, and the group with the highest WMH burden were diagnosed hypertensives with elevated BP. We then conducted analyses within each racial/ethnic group, and found that among Latinx participants those with elevated BP had the highest WMH burden, regardless of hypertension diagnosis. In White participants, the group with the highest WMH burden were people without a diagnosis of hypertension and elevated blood pressure. In Black participants, diagnosed hypertensives had higher WMH burden than those without a diagnosis. Among Black people with hypertension, WMH burden was similar, regardless of whether blood pressure was managed or unmanaged.
Conclusions: Hypertension diagnosis and high BP were related to greater WMH burden, but stratified analyses revealed potential variation by race/ethnicity group. Greater WMH burden in Black participants was strongly associated with hypertension diagnosis, while WMH burden in White and Latinx participants was closely tied to BP management. Results suggest that interventions aiming to reduce disparities in cerebrovascular health among older adults may need to prioritize different approaches to treatment depending on race/ethnicity. Our future work will further examine the risk and resilience factors that may play differential roles in WMH burden across race/ethnicity and sex/gender.
Keywords: neuroimaging: functional**,** hypertension

62 Stroke Risk Profile, TNF-a, and Intra-Individual Variability in Processed EEG During Knee Replacement Surgery Contribute to Pre- Post-Operative Cognitive Change

Catherine Dion, Erin M Formanski, Jared J Tanner, Karen McFarland, Catherine C. Price
University of Florida, Gainesville, FL, USA

Objective: Clock drawing performance slows for older adults after total knee arthroplasty (TKA; Hizel et al., 2018) and there are brain-behavioral associations with intra-individual variability on an EEG-derived index during TKA (Hernaiz et al., 2019). Vascular burden is linked to reduced attention and executive function deficits, accompanied by a slowing of motor performance and information processing (O'Brien et al.,

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2003). Similarly, persistently high levels of inflammation contribute to accelerated cognitive aging and dementia (Raz & Rodrigue, 2006; Russo, Barlati, & Bosetti, 2010). The current study integrated these predictive factors to study their independent and combined impact on cognitive change after elective TKA. We hypothesized greater cardiovascular, peripheral inflammation, and Bispectral Index Monitoring (BIS™) intra-individual variability would collectively explain a significant portion of variance in three primary latencies on digital clock drawing (dCDT) to command and copy conditions at 3-weeks following surgery.
Participants and Methods: Participants were prospectively recruited and IRB-consented. All completed baseline cardiovascular evaluation and blood draw, intra-operative EEG-derived monitoring, and dCDT at preoperative baseline and 3-weeks after surgery. Cardiovascular burden was operationalized using the Framingham Stroke Risk Profile (FSRP-10) and inflammatory markers of interest included IL-6, IL-8, IL-10, TNF-a, and hsCRP. We acquired 2-channel EEG-derived intra-individual variability from tourniquet inflation to tourniquet release, thereby establishing a consistent period of examination. Intra-individual variability was calculated as the squared deviation from the mean BIS value over the duration of measurement. Clock drawing to command and copy was acquired with digital pen technology and scored with semiautomatic rater-guided software (Souillard-Mandar et al., 2016). Outcome latency variables of interest: 1) total completion time in seconds (TCT), 2) time prior to setting the first hand in seconds (pre-first hand latency; PFHL), and 3) seconds after drawing the clock face to next pen stroke (post-clock face latency; PCFL).
Results: The final sample included 54 participants age 60+ without dementia (age= 69.81 years, 46.6% female, education= 15.19 years). At 3-weeks, participants took, on average, six seconds longer to complete the drawing compared to baseline performance, and two seconds longer to set the first clock hand. Correcting for age and baseline clock drawing performance, separate multiple linear regressions showed FSRP-10 (ß= .402, p= .009), TNF-a (ß= -.330, p= .010), and intra-individual BIS variability (ß= .261, p= .016) contributed to post-operative command TCT. There were no statistically significant findings with PFHL and PCFL.
Conclusions: For older adults without dementia receiving TKA, higher cardiovascular burden, lower TNF-a, and higher intra-individual BIS variability significantly contributed to longer post-operative total command clock drawing time over and above age and baseline performance. Knowing that command total completion time is sensitive to numerous cognitive domains (Dion et al., 2020), our findings are consistent with literature showing poorer attentional, executive functioning, and speed of information processing in individuals with higher cardiovascular burden (O'Brien et al., 2003). Levels of pro-inflammatory cytokine TNF-a and fluctuations during general anesthesia as recorded on EEG-derived index may also help explain postoperative slowing during clock drawing at 3-weeks post-surgery.
Funded by: K07 AG066813; R01 AG055337; R01 NR014810; and Barber Scholarship
Keywords: aging (normal)**,** vascular cognitive impairment**,** cognitive functioning

63 The Impact of Working Memory and Impulsivity on Eating Behaviors in Older Adults

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Objective: Executive function and attention have established relationships with eating behaviors, although the mechanisms through which they impact eating behavior are not well understood. One potential mechanism worthy of inquiry is impulsivity as it is associated with both executive function, attention, and eating behavior. The current study investigated the extent to which impulsivity mediated the relationship between aspects of executive

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function (e.g., inhibitory control), attention, and eating behaviors in older veterans.
Participants and Methods: The study was a cross-sectional and included 116 Veterans age 54 to 88 (m = 71.15, SD = 9.16). Participants were screened as part of a larger study investigating the effects of activity-based interventions on late life brain health. The sample was largely male (94%) with an average BMI of 28.83 (SD= 5.44, Range = 16 – 46). The Stroop Color Word Test was used to assess visual attention and processing speed (Color Trial) and inhibitory control (Color Word Trial). Impulsivity was evaluated with the Barratt Impulsiveness Scale. The degree of cognitive control in daily food intake (i.e., Cognitive Restraint) was assessed with Three-Factor Eating Questionnaire. Body mass index (BMI) was a covariate in analyses due to its significant relationship with both predictors and outcome variables.
Results: Hierarchical regressions indicated that visual attention was significantly associated with cognitive restraint. Furthermore, attentional impulsivity significantly contributed to the variance in cognitive restraint. Attentional impulsivity was found to partially mediate the relationship between visual attention and cognitive restraint. Analyses examining the relationship between inhibitory control, attentional impulsivity, and cognitive restraint were non-significant.
Conclusions: Attentional impulsivity was found to partially mediate the relationship between visual attention, but not inhibitory control, and cognitive control of eating behavior. These results suggest that attentional impulsivity may be an important link between visual attention and cognitive restraint of eating behavior. The findings from the present study support previous literature in younger populations. Exploring the link between attention, executive function, and impulsivity is important to our understanding of healthy eating behaviors in older adults.
Keywords: attention**,** executive functions
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64 Associations Between Socioeconomic Mobility, Biological Aging, and Memory Trajectories

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Objective: We examined the relationship between life course socioeconomic mobility and late life memory trajectories and the extent to which indicators of biological aging mediated this relationship across racial/ethnic and sex/gender groups.
Participants and Methods: We used data from 3,997 adults aged 50-100 (42% male, mean age: 70.1) in the U.S. Health and Retirement DNA-methylation sub-study. Childhood SES (cSES) was defined by parental education, father's occupation, perception of familial SES, and experienced hardships and was normalized by birth cohort. Adult SES was defined by wealth averaged across 5 years and was sex, age, and inflation adjusted. We defined mobility as the residualized change between childhood SES and expected adult SES. Biomarkers of aging were quantified using three DNA-methylation measures PhenoAge, GrimAge, and DunedinPoAm. Memory performance was measured by averaging immediate and delayed word recall at the 2016 visit. Latent growth curve modeling was used to estimate average rate of memory decline throughout study participation with time centered at the DNA-methylation blood draw (2016). Linear regressions of mobility to 2016 memory performance and mobility to memory decline were analyzed by sex/race/ethnicity groups and compared. An

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additional analysis examined mobility within individuals defined as low cSES (<50 percentile; n=1,882). We grouped these participants into downward (lcSES-D), moderate upward (lcSES-M), and high upward (lcSES-H) mobility and compared them in stratified linear regression analyses. Biomarkers of aging were examined as potential mediators of the relationship between mobility and memory trajectories. **Results:** Increased life course socioeconomic mobility was associated with higher memory performance (β 0.237 95% CI [0.206, 0.269]) and slower biological aging (effect size range -0.21 to -0.25). Increased socioeconomic mobility was associated with slower memory decline (β 0.0109 95% CI [0.0055, 0.0163]); stratified analyses revealed that this relationship was driven by larger associations in Latinx (β 0.0208 95% CI [0.001, 0.041]) and black women (β 0.0151 95% CI [-0.0034, 0.0336]), but not in other sex/race groups. Accelerated biological aging was associated with decreased memory performance (effect size range -0.064 to -0.109) and faster memory decline (effect size range -0.0104 to -0.0146). Biological aging mediated 5-12% of the mobility-2016 memory performance gradient compared to 20-34% of mobility-memory decline gradient. Among those with low cSES, individuals with moderate upward mobility (β 0.300 95% CI [0.216, 0.383]) and high upward mobility (β 0.642 95% CI [0.523, 0.761]) demonstrated higher memory performance compared to those with downward mobility. However, only those with high upward mobility (lcSES-H) had slower memory decline compared to those with downward mobility (lcSES-D) (β 0.050 95% CI [0.030, 0.070]). **Conclusions:** These results support that the negative impact of low cSES on late life memory trajectories is attenuated by upward socioeconomic mobility. This relationship is mediated in part by DNA methylation biomarkers of aging. Taken together, these results show that changes in socioeconomic status may be neuroprotective and that such neuroprotection is partly mediated by a slowing of biological processes of aging. These findings support poverty reducing interventions as public health strategies aimed at protecting healthy cognitive aging.

Keywords: aging disorders**,** memory disorders**,** childhood maltreatment

LIVE Student Liaison Committee (SLC) Student Welcome

7:30 - 8:30am
Wednesday, February 2, 2022

CE Workshop 07: Sexual and Gender Minority Populations and Risk for Alzheimer's Disease and Related Dementias

Presenter: Whitney Wharton

8:00 - 9:30am
Wednesday, February 2, 2022

Abstract & Learning Objectives:
By 2030, there will be nearly six million sexual and gender minority (SGM) older adults aged 50 and older in the U.S. who identify as lesbian, gay, bisexual, transgender, and/or queer. This number will more than double by 2050. Approximately 350,000 SGM older adults in the U.S. currently are living with Alzheimer's disease and related dementias (ADRD), with projections nearing one million by 2030. SGM older adults experience greater health disparities than their heterosexual counterparts. Several recent studies have shown a higher prevalence of risk factors for ADRD, including higher rates of cardiovascular disease, hypertension, diabetes, depression or frequent mental distress, and subjective cognitive decline. In addition, SGM older adults are less likely to have informal caregiving support and for those with caregivers, their caregivers often lack access to inclusive services and resources. In addition to healthcare access and trust, research participation from SGM older adults is extremely limited and the sparse research suggests that SGM older adults are interested in being engaged in research, but concerns regarding the lack of inclusive services and mistrust need to be addressed to improve participation in ADRD research, including clinical trials and intervention research studies. Here we discuss the aforementioned health disparities and research participation barriers experienced

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by SGM adults, as well as new initiatives to combat these barriers.

Upon conclusion of this course, learners will be able to:
- Summarize LGBTQ aging and caregiver gaps in healthcare
- Describe the gaps in research regarding aging and caregiving pertaining to LGBTQ community members
- Discuss research designed to address knowledge gaps in LGBTQ aging and caregiving, as well as information about how investigators and Centers can collect these data and take part in the registry to ensure inclusion of LGBTQ individuals

CE Workshop 08: Harnessing the Potential of Real-Time fMRI for Neurorehabilitation

Presenter: Stephen LaConte

8:00 - 9:30am
Wednesday, February 2, 2022

Abstract & Learning Objectives:
This workshop will describe how functional magnetic resonance images can be analyzed in real-time (rtfMRI) to enable closed-loop experiments and neurofeedback. Dr. LaConte's lab has developed machine learning-based rtfMRI that continuously tracks a subject's sensory/behavioral/psychological states during ongoing brain imaging. This approach will be compared and contrasted with rtfMRI studies that track activity in functionally localized brain regions. In both cases the lecture will present experiments that highlight rtfMRI's potential for basic science discovery as well as neurofeedback-based therapy. Finally, drawing from the speaker's research, the future outlook in terms of both challenges and technological opportunities will be presented. Briefly, the challenges will be discussed in terms of limitations of neuroimaging, neuropsychological testing, and their intersection. The opportunities include new designs that incorporate resting state networks such as the default mode network as well as technological advances in both instrumentation and data analysis. These technology advances may facilitate porting fMRI's advantages to cheaper and more flexible platforms. The technical level of the lecture is intended to be highly accessible to those with and without neuroimaging and fMRI expertise.

Upon conclusion of this course, learners will be able to:
- Summarize basic tradeoffs between fMRI and other neurorecording technologies
- Summarize successful applications of real-time fMRI neurofeedback
- Critique differences between whole-brain and functionally defined region-of-interest based real-time fMRI
- Assess new technologies that promise to translate existing real-time fMRI methods to more flexible and cheaper approaches
- Critique the existing literature and potential for real-time fMRI to enable rehabilitation and therapy

Symposium 14: Cognitive Health Promotion Across the Lifespan: A Growing Practice Opportunity for Neuropsychologists

8:00 - 9:30am
Wednesday, February 2, 2022

25 Cognitive Health Promotion Across the Lifespan: A Growing Practice Opportunity for Neuropsychologists

Chair

Christine Ghilain
Private Practice, Parsippany, USA

Discussant

Christine Ghilain
Private Practice, Parsippany, USA
Karen Postal
Harvard Medical School, Boston, USA
Michelle Braun
Ascension Wisconsin All Saints Hospital, Racine, USA

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In the context of our everchanging healthcare landscape, promoting cognitive health and wellbeing is becoming increasingly critical. We as neuropsychologists are on the frontlines of assessment and intervention with aging populations, and those working with pediatric populations are uniquely positioned to support the initiation of health-promoting behaviors at earlier ages. Neuropsychologists are often called upon when something is notably going awry: “Jonny is struggling to focus” or “mom isn’t remembering to take her pills.” We evaluate, assess and put plans in place to bolster identified areas of weakness or provide compensatory strategies for untreatable deficits. We react and respond to the concerns placed before us by parents, families, or clients. Rare is the client who calls for an appointment with no identified concerns. Rarer is the client calling for their “preventative care” neuropsychological evaluation appointment. Nonetheless, this talk is geared towards the health-promoting, preventative care opportunities in neuropsychology, and the methods we can use to engage with our clients across the lifespan to promote healthy brain aging.
In the first segment, we present five modifiable factors that promote healthy cognitive aging, including (1) exercise, (2) nutrition, (3) sleep hygiene, (4) stress management and (5) engagement in cognitively and socially stimulating activities. These components are all subsumed under the umbrella of “positive neuropsychology.” We briefly review the state of the research, highlighting the evidence for how each of these behaviors impact cognitive functioning. In the second segment, we provide strategies for how to approach these topics with clients. We review methods to elicit information about the client’s engagement in these behaviors during the intake interview, as well as ways to engage in conversations about these factors promoting brain health and wellness in feedback, even in the context of a targeted evaluation. In the third segment, we provide the rationale and the tools necessary to extend these conversations to pediatric populations. The research supporting brain health is booming in adult and geriatrics populations, but we know early intervention is key to optimizing outcomes. The goal of this symposium is to empower neuropsychologists to discuss these five pillars of brain health with clients of any age, and to provide the resources and evidence base to ensure these conversations are successful.
Keywords: aging (normal), cognitive functioning, quality of life

678 Maximizing Brain Health in Adult and Geriatric Populations

Christine Ghilain[1], Karen Postal[2], Michelle Braun[3]
[1]Private Practice, Parsippany, New Jersey, USA. [2]Harvard Medical School, Boston, Massachusetts, USA. [3]Ascension All Saints Hospital, Racine, Wisconsin, USA

Objective: Based on the current rate of diagnosis, Alzheimer’s Disease International (ADI) predicts over 152 million people will be living with dementia by the year 2050. Without intervention, this prediction has overwhelming human and economic implications. As such, many researchers are dedicating their efforts to identifying methods of intervention to slow cognitive decline in aging populations. To date, researchers have focused on several modifiable risk factors for dementia, including diabetes, hypertension, obesity, physical inactivity, depression, smoking, stress, and low educational attainment. The Finish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) is a large-scale randomized control trial (RCT) that has demonstrated the benefit of multidomain lifestyle intervention on cognition in at-risk seniors. Excitingly, World-Wide FINGERS (WW-FINGERS) is extending the successes from the FINGER trial to over 25 countries, maintaining core methods while tailoring protocols and intervention strategies to unique cultures and contexts across the globe.
Given the demonstrated success of a multidisciplinary lifestyle intervention, the aim of part one of the presentation is to discuss the state of the science across five pillars of positive neuropsychological intervention, including exercise, nutrition, sleep hygiene, stress management and engagement in cognitively and socially stimulating activities. The goal is to provide neuropsychologists with research to

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support their discussion of these factors with clients.

Objectives: Review the state of the science of cognitive health promotion.
Participants and Methods: Summary of the literature in diverse aging populations.
Results: Risk factor modification supports enhanced cognitive health.
Conclusions: Neuropsychologists can uniquely promote healthy cognitive aging.
Keywords: aging (normal)**,** cognitive functioning**,** quality of life

680 Starting the Conversation: How to Discuss Health-Related Behaviors with Clients

Christine Ghilain[1], Karen Postal[2], Michelle Braun[3]
[1]Private Practice, Parsippany, New Jersey, USA. [2]Harvard Medical School, Boston, Massachusetts, USA. [3]Ascension All Saints Hospital, Racine, Wisconsin, USA

Objective: Approaching positive neuropsychological topics with clients is not an exacting, one-size-fits-all science. As neuropsychologists, we gather information about pertinent medical and neurological diagnoses, educational attainment and vocational course, current and former psychosocial stressors, broader family history, and daily independence. We view this information through the lens of the unique cultural context of the individual, and collaborate with clients to determine the best ways to promote brain health. Just as we use feedback sessions to outline the projected course of recovery following an acute neurological insult or the course of decline following diagnosis of a neurodegenerative condition, we can also use the feedback session to empower our clients to maximize their brain health, perhaps slowing the course of the identified decline.

In the second segment of our talk, our aim is to discuss methods and approaches to broaching the aforementioned positive neuropsychological topics with clients. We present methods for gathering information about diet, exercise, sleep and social habits during intake, and providing culturally appropriate education and recommendations to encourage engagement in these health-promoting behaviors long term.

Objectives: Discuss strategies to engage clients in cognitive health promotion.
Participants and Methods: Tailoring cognitive health interventions to diverse populations.
Results: Neuropsychologists use the evaluation and feedback session to effectively promote cognitive health.
Conclusions: Neuropsychologists play a crucial role in supporting cognitive health with diverse clients.
Keywords: aging (normal)**,** cognitive functioning**,** quality of life

683 Starting Young: Approaching the Topic of Brain Health with Pediatric Populations

Christine Ghilain[1], Karen Postal[2], Michelle Braun[3]
[1]Private Practice, Parsippany, New Jersey, USA. [2]Harvard Medical School, Boston, Massachusetts, USA. [3]Ascension All Saints Hospital, Racine, Wisconsin, USA

Objective: As a child, being told to finish the broccoli on the plate is rarely met with enthusiastic compliance. As a result, children may get creative and throw their food away or feed it to a pet, unaware that their parents' rules are meant to better their health.

In the third segment of our talk, we aim to get creative in our own right, empowering pediatric neuropsychologists to approach these health-boosting conversations with patients and their parents. Our ultimate goal is to support parents in their quest to instill healthy habits in our youngest of clients. As pediatric neuropsychologists, we are uniquely positioned to lay the foundation for optimizing brain health before the unhealthy habits take hold. A brief review of the current state of positive neuropsychology in pediatrics will be provided. Special consideration of particular populations (e.g., the importance of nutrition education for children with metabolic disorders) will be

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outlined. Methods to view recommendations through the cultural lens of the family will be presented. Sample questions to ask during the initial intake will be provided to structure initial data gathering. Fun and age-appropriate methods of introducing health behaviors as well as resources for both neuropsychologists and parents will be reviewed.

Objectives: Empower pediatric neuropsychologists to approach health promoting behaviors with their youngest clients.
Participants and Methods: Creatively promoting healthy behaviors in diverse pediatric clients.
Results: Encouraging health-promoting behaviors that are more likely to be continued into adulthood.
Conclusions: Neuropsychologists can support health-promoting behaviors at all ages, including in children!
Keywords: aging (normal)**,** cognitive functioning**,** quality of life

Symposium 15: National Neuropsychology Network: Progress in Collaborative Assessment, Diagnostics, and Psychometrics

8:00 - 9:30am
Wednesday, February 2, 2022

19 National Neuropsychology Network: Progress in Collaborative Assessment, Diagnostics, and Psychometrics

Chair

Robert Bilder
UCLA, Los Angeles, USA

Discussant

Russell Bauer
University of Florida, Gainesville, USA

The National Neuropsychology Network (NNN) was formed in 2019 with support from the National Institute of Mental Health (R01MH118514; see https://www.nnn.ucla.edu/) to establish a four-site project that aims to collect clinical neuropsychological (NP) assessment data, aggregate these data for deposit on the NIMH Data Archive (NDA), and conduct analyses to help develop proposals for new measurement methods that could increase efficiency and access to high quality NP services. Part of the NNN mission was development of technology infrastructure to capture relevant NP history and self-report data, and to enable computer/iPad methods to record patient responses and automatically score the most widely used NP tests, and to generate easy-to-use results outputs. This symposium reviews progress towards those goals, based on our experience developing infrastructure and results obtained so far from the first 4,643 patients enrolled. Presentations include: (1) Progress and challenges in development of the Structured History Protocol for Neuropsychology (SHiP-NP), which is now available for open access use (Lucia Cavanagh). This presentation reviews the progress developing the SHiP-NP from diverse clinical NP adult history forms, harmonizing these variables to common data elements (CDEs) used by NIH and other research entities to capture demographic, social determinants of health, and medical history variables, and a branching algorithm that administers self-report measures to capture psychiatric symptoms. Initial results are shown highlighting completion rates, time to completion, and descriptions of the data received relative to diagnostic outcomes.(2) Progress in development of the System for Acquisition of Item Level Observations and Responses (SAILOR)(Laura Umfleet). Our collaboration with Pearson Assessment and implementation of Q-interactive enabled item-level data collection for the Pearson tests, and we have now developed independently the SAILOR platform to acquire data on other widely used tests, based on agreements reached with Pearson for tests not on Q-interactive and other test publishers, including Psychological Assessment Resources, MHS, and ProEd, Inc. (3) Initial results from our multi-center diagnostic work, focusing on psychiatric comorbidities among patients with primary neurologic diagnoses (David Loring). This work highlights the prevalence (~34%) of psychiatric

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diagnoses (particularly depression, anxiety, and PTSD), not previously identified as primary diagnoses, that may be detected when systematic screening methods are used. (4) Initial results from analyses to determine the dimensionality of NP batteries (Robert Bilder). Exploratory factor analyses including multiple variables per test reveal prominent "test" factors (probably due to shared method variance) that lead to questions about interpreting patterns of findings within tests, but identification of nine principal components measured by 41 test variables. Regression models showed that only 21 variables are needed to explain more than 90% of the variance in each of the nine domains identified by the principal components analysis. This indicates even before reducing test length with adaptive testing strategies informed by item response theory, efficiency of the standard battery may be approximately doubled. These findings may inform the design of more efficient NP batteries. Discussion (Russell Bauer, discussant) will focus on the implications of these developments and findings for the future development of collaborative knowledge and resource sharing, and the design of NP assessment strategies of the future.

Keywords: assessment**,** neuropsychological assessment*,* psychometrics

757 Advancements and challenges in the clinical application of the Structured History Protocol for Neuropsychology

Lucia Cavanagh
UCLA Semel Institute, Los Angeles, CA, USA

Objective: Neuropsychology has fallen reliant on outdated and labor-intensive methods of data collection. While several efforts to develop more efficient cognitive assessment paradigms are ongoing (e.g., NIH Toolbox, QInteractive, etc.), less attention has been devoted to advancement in other aspects of the neuropsychological evaluation, namely the assessment of "non-cognitive" variables, such as sociodemographics, functional abilities, and psychiatric symptoms. Typically gathered through clinical interviews and self-report measures, these individual-level variables are integral components of the neuropsychological evaluation that can have profound implications for the interpretation of cognitive testing, diagnostic outcomes, and treatment recommendations. Broad diversity in the way this information is collected has undermined efforts to harmonize and share data across sites. Drawing on existing initiatives, we identified a set of common data elements (CDE) with transdiagnostic relevance for neuropsychology, including demographics, medication use, and medical/psychiatric history. The Structured History Protocol for Neuropsychology (SHiP-NP) is a standardized history protocol developed to harmonize clinical data collection across NNN sites and facilitate data analysis. Since its initial development, the SHiP-NP has undergone several modifications and its use has been expanded to all four participating NNN sites. The aim of this presentation is to provide an overview of the methodology, content updates, and overall user interface of the SHiP-NP and to evaluate its feasibility in real-world clinical settings.
Participants and Methods: Participants were patients referred for neuropsychological evaluation across NNN participating institutions. At the discretion of individual clinicians, participants were invited to provide self-report and historical data via the SHiP-NP web portal prior to their clinical appointment. Demographic and medical history data was based on the PhenX Toolkit and NINDS CDE conventions. Psychiatric symptoms were based on the APA DSM-5 Level 1 and Level 2 Cross-cutting measures, which include Patient-Reported Outcomes Measurement Information System (PROMIS) short-forms for Depression, Anxiety, Anger, and Sleep Problems and self-report ratings of Mania, Substance Use, Repetitive Thoughts and Behaviors, and Somatic Symptoms. Everyday functioning and disability ratings were assessed by the World Health Organization Disability Assessment Schedule 2.0 and Quality of Life in Neurological Disorder (Neuro-QoL) battery short-forms.
Results: 179 participants completed the SHiP-NP history questions. 142 participants completed the CDE rating forms assessing psychiatric symptoms, quality of life, and functional status. Over 97% of completed forms were obtained from two of the four participating

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sites, indicating variability in utilization across clinics. Monthly completion rates across a 6-month span ranged from 33%-100%, with an average rate of 48%. Additional descriptive outcomes of the participating sample and concurrent validity of CDE forms will be reviewed.
Conclusions: The SHiP-NP provides an evidence-based structured clinical protocol for guiding neuropsychological (NP) assessments that is consistent with NIH CDEs. Its online platform can facilitate clinical work and enhance patient accessibility to clinic forms, while simultaneously creating a database repository for ongoing multi-site data aggregation. Despite its many potential benefits, it remains underutilized in the participating clinics and completion rates among patients were suboptimal. Barriers to widespread use are discussed, including logistical challenges associated with altering clinic workflows, reluctance and/or lack of awareness by individual clinicians, and time commitment for patients.
Keywords: technology**,** assessment**,** everyday functioning

776 Optimizing Collaborative Neuropsychology with a System for Acquisition of Item-Level Observations and Responses (SAILOR): Update from the National Neuropsychological Network

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Objective: Many neuropsychological clinics enter data into local databases that are clinic-specific, difficult to share, and contain test summary scores instead of item-level data. The overall goal of the National Neuropsychology Network (R01MH118514), launched in 2019, is to develop infrastructure to facilitate collaboration across clinics and academic centers. Data aggregation will facilitate advancement of NP practice across the globe by allowing item level characterization of common assessment measures across multiple clinical conditions and diseases, and will eventually permit rapid characterization of novel assessment measures through test deployment with participating NNN sites. Initial NNN goals include increasing clinical assessment efficiency while simultaneously expanding diagnostic test validity through advanced psychometric methods and technology. Since its inception, NNN has continued to develop and revise its automatic data capture software for real time item level database entry for common neuropsychological measures that are not included in the Pearson Q-Interactive assessment system. The NNN data capture interface, System for Acquisition of Item Level Observations and Responses (SAILOR), is a web-based interface permitting item-level response capture for commonly administered neuropsychological measures.
Participants and Methods: NNN has enrolled 4,643 participants across four academic medical centers. Item-level neuropsychological data are captured using Pearson's Q-Interactive (QI) software, as well as the recently developed NNN SAILOR. This portion of the symposium discusses the current state of the NNN and showcases the SAILOR and other features of the NNN digital technology.
Results: The SAILOR consists of a web-based data interface that can be accessed through all common data computer operating systems. It currently includes separate modules for the Boston Naming Test, Benton Facial Recognition Test, Judgment of Line Orientation, Brief Visuospatial Memory Test-Revised, Finger Tapping Test, Grooved Pegboard Test, Hopkins Verbal Learning Test, Trail Making Test, Verbal Fluencies, Test of Premobid Function, Test of Memory Malingering, Rey Complex Figure Test, Wisconsin Card Sorting Test, Symbol Digit Modalities, Emory Semantic Fluency Paradigm, Columbia Auditory Naming, Beck Anxiety Inventory, and Beck Depression Inventory, 2nd edition. Deidentified test data entered using SAILOR are subsequently uploaded to the NIMH Data Archive (NDA) repository without risk of exposing Protected Health Information (PHI). This presentation will provide an overview of the methodology, user interface, and contents of the NNN SAILOR and will describe opportunities and possible barriers to its more widespread use.

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Conclusions: NNN has successfully created a standard for item-level data capture that enables widespread data aggregation without significant disruption to clinical workflows. Although SAILOR automatically captures item-level responses from common neuropsychological tests used by current NNN participating institutions, NNN is currently in Phase 1 of SAILOR development. Continued SAILOR growth will include other established clinical measures as well as novel neuropsychological tasks. As NNN expands through the addition new clinical sites, SAILOR will serve as a model for future neuropsychological research collaboration by allowing access to NNN methods, test procedures and software, and archived NNN data. The infrastructure provided by the NNN aims to propel future projects that will establish the concurrent and incremental validity of diverse novel assessment methods, including innovative adaptive and short form tests of existing tests, novel assessment procedures, and improved psychometric understanding of established and novel neuropsychological measures.

Keywords: technology**,** neuropsychological assessment**,** computerized neuropsychological testing

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603 Improved Identification of Psychiatric Comorbidities in Patients with Primary Neurologic Diagnoses: Role of the National Neuropsychology Network

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Objective: Behavioral and psychiatric comorbidities of common neurologic diseases can negatively impact a patient's quality of life, yet these comorbidities are often under-identified and under-treated. Since these comorbidities can coexist with a presumed common biologic substrate (e.g., epilepsy) or develop as a medication side effect (e.g., Parkinson's disease), they are often not independently characterized in the neurologic workup and subsequent neuropsychological referral question. As part of its standard data collection procedures, the National Neuropsychology Network (NNN) includes pre-evaluation diagnosis (i.e., referral diagnosis) and post-evaluation diagnoses derived from the neuropsychological evaluation results.

Participants and Methods: Participants were 634 patients referred for neuropsychological evaluation across NNN participating institutions who did not have a psychiatric diagnosis as one of the 2 primary referral diagnoses and had post-evaluation diagnoses entered into the NNN database. Post-evaluation behavioral and psychiatric comorbidities for the first 2 diagnoses listed were characterized as primarily depression, anxiety, post-traumatic stress disorder (PTSD), or multiple comorbid diagnoses.

Results: Across all post-evaluation diagnoses, behavioral and psychiatric comorbidities were identified in approximately 34% of participants. When listed, depression was identified as a comorbidity in 82 (12.3%), anxiety in 65 (12%), and PTSD in 35 (5.5%). The remaining 34 (5.5%) participants were diagnosed with a combination of multiple comorbidities.

Conclusions: These findings demonstrate the utility of neuropsychology identification of behavioral and psychiatric comorbidities of common neurologic diseases that are not explicitly identified at the time of the neuropsychological referral. This should not be surprising since characterization of depression and anxiety are typical components of formal neuropsychological evaluations. Review of the data also indicates variability in specific diagnostic codes used, however, particularly since many diagnoses are based upon screening evaluations and not following formal psychiatric interview. While realizing the billing diagnoses are at times influenced by institutional billing conventions, these data demonstrate the importance of reaching consensus regarding the best way to characterize comorbidities from psychological screening tests to increase the reliability and accuracy of post-evaluation diagnoses. Careful reporting of behavioral and psychiatric comorbidities will not only increase quality of care at the individual level, but also characterize these risks across a larger patient series.

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Keywords: depression**,** anxiety**,** post-traumatic stress disorder

630 Doing More with Less: Test- and Battery-Level Psychometric Results from the National Neuropsychology Network (NNN) Data Base

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Objective: The access to high quality neuropsychological (NP) assessment may be limited by inefficiencies in existing methods. Psychometric strategies may help identify redundancies and enable the development of novel examination methods that selectively acquire the most informative data for the diagnostic questions being interrogated.
Participants and Methods: Participants were drawn from the National Neuropsychology Network (NNN), a four-site collaborative project supported by the National Institute of Mental Health (R01MH118514; see www.nnn.ucla.edu). Among the first 4,643 patients enrolled, data were available for up to 1,837 participants on a range of tests including the WAIS-IV, WMS-IV, D-KEFS, and CVLT 3. We identified the most widely used 106 variables from these tests. Initial analyses further narrowed the scope of exploratory factor analytic and regression modeling to 41 variables from 27 separate test or subtest procedures, after removing those that were computationally interdependent (e.g., WAIS-IV FSIQ and Index scores were removed and individual subtest scores retained, with similar approaches for other tests) or if the total subsample was too small (n<50) to estimate correlations with other variables.
Results: Principal Components Analysis with mean substitution of missing values yielded 9 factors with eigenvalues greater than 1, explaining 71% of variance in the 41 test variables, with KMO Test of Sampling Adequacy = .87. After Promax rotation, six factors had high loadings selectively on measures within a given test (e.g., CVLT (two factors), Color Word Interference Test, Trail Making Test, Verbal Fluency, Digit Span), two factors represented WAIS-IV subtests tapping conceptual reasoning and perceptual processing, and one factor represented declarative learning and memory. The factors were intercorrelated (average r=.21; min r=.03; max r=.47). Linear regression models predicting factor scores showed that more than 90% of the variance in each factor could be explained by 1 to 4 individual variables, with a total of only 22 variables needed to explain this variance across all 9 factors and all 41 test variables.
Conclusions: The results indicate that conventional NP test batteries contain extensive redundancy, and efficiency might be at least doubled relative to current practice. Tests may measure differentiable abilities but when analyzing large numbers of test variables, method variance probably leads to identification of factors within tests. The current analyses reveal that those test-based factors can be well measured with only about half the total number of variables, and some test procedures might be eliminated to enhance efficiency without significantly sacrificing measurement precision. Further investigation is warranted to: (a) examine other factor analytic strategies, including bifactor models (the possibility that there may exist a common factor reflecting 'g' is suggested by the correlations between factors observed after our oblique rotation); (b) determine the degree to which these results hold within specific diagnostic groups (e.g., amnestic syndromes, aphasias); (c) determine the degree to which factor structure is the same across cultural and linguistic contexts (i.e., by examining measurement invariance and differential test and item functions; (d) use alternate imputation methods to manage missing data given the non-experimental “real world” data acquisition methods; and (e) use item response theory to maximize measurement efficiency within tests using adaptive testing strategies.
Keywords: neuropsychological assessment**,** psychometrics**,** neurocognition

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988 Discussion - Symposium 15: National Neuropsychology Network: Progress in Collaborative Assessment, Diagnostics, and Psychometrics

Russell Bauer
University of Florida, Gainesville, FL, USA

Poster Session 02: Dementia | Technology

8:30 - 9:30am
Wednesday, February 2, 2022

1 Handicraft Art Leisure Activities and Cognitive Reserve

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Objective: With increasing age, older individuals face a higher likelihood of developing dementia. The rate of cognitive decline resulting from dementia is not equivalent for all, as some patients with dementia are able to function independently longer than others, despite having similar disease burden. The cognitive reserve (CR) theory provides one explanation for the differing rate of decline. CR suggests that there are factors — most notably, educational and occupational attainment — that can protect against the cognitive decline that is a hallmark of dementia. Although the beneficial effects of these notable CR factors are clear, they may not be modifiable. Participation in leisure activities may represent a more modifiable factor. Some research hints at beneficial effects of leisure activities, although specific leisure activities have not been examined. The present study sought to examine handicraft art leisure activities (HALAs). HALAs refer to a shared grouping of handicraft (e.g., knitting, sewing, gardening, woodcraft, etc.) and artistic activities (e.g., painting, drawing, sculpting, etc.). HALAs are often included in studies as one of many cognitive leisure activities, speaking to their stimulating, novel, and creative nature. Studies have concluded that when these activities are used as part of a cognitive training program, patients with moderate dementia showed improved cognitive function. However, only in a handful of studies have HALAs been studied independently. The present study examined the relations between handicraft art leisure activities (HALAs) and multiple cognitive domains. We hypothesized that HALA activities would account for statistically significant variance in perceptual reasoning and working memory using a hierarchical regression.
Participants and Methods: Archival WAIS-IV, WMS-IV, and demographic data for 50 California retirement community residents was examined. A hierarchical regression was used to analyze if HALA participation accounted for statistically significant variance over and above the established CR factors of education, age, depression, and occupation. To construct this statistical model, we entered the age and depression in the first step of the regression, followed by occupational attainment and educational attainment in the second step, and participation in HALAs in the third step. This procedure allowed us to determine if HALAs accounted for significant variance over and above the other CR factors previously identified in the literature. The dependent variables were the WMI and PRI indices of the WAIS-IV assessment.
Results: Results revealed that HALA participation accounted for statistically significant variance in working memory performance over and above the established CR factors of education, age, depression, and occupation, R^2 change = .06, $F(1, 42) = 3.92$, $p = .05$. However, HALA participation did not account for statistically significant variance in working memory performance over and above the established CR factors of education, age, depression, and occupation, R^2 change = .004, $F(1, 41) = 0.17$, $p = .69$.
Conclusions: It is reasonable from these results to suggest that HALA participation among older adults could contribute to the retention of working memory, supporting the role of HALA participation as a CR factor.
Keywords: aging disorders**,** dementia - Alzheimer's disease**,** cognitive reserve
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2 Association between pulse pressure and structural neuroimaging markers related to Alzheimer's disease in Down syndrome

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Objective: Although individuals with Down syndrome (DS) have low prevalence of vascular risk factors, such as hypertension, it largely unknown whether variability in such vascular factors contribute to Alzheimer's disease (AD) risk in this population. Pulse pressure, the difference between systolic pressure and diastolic pressure, is an index of vascular aging and a marker of increased arterial stiffness. While blood pressure has been more frequently investigated in the context of dementia, fewer studies have studied the role of pulse pressure in relation to AD biomarkers, and none to our knowledge have explored the link between pulse pressure and imaging markers in the context of DS. In the non-DS population, elevated pulse pressure is associated with greater risk for clinical AD, and with increased levels of amyloid and tau pathology. In the current study of adults with DS, we investigated the associations between pulse pressure and entorhinal cortical (EC) thickness and regional white matter hyperintensity (WMH) volume, two neuroimaging markers that are associated with AD risk and progression, and tested whether these relationships were moderated by clinical AD diagnostic status.
Participants and Methods: In 131 adults with DS (mean age (SD) = 50.1 (7.1) years, 40% women) from the Alzheimer's Disease in Down Syndrome study, we derived average entorhinal cortex thickness and regional WMH volume. Pulse pressure was calculated as the difference between systolic blood pressure and diastolic blood pressure and clinical diagnosis (cognitively stable, mild cognitive impairment [MCI], dementia) was assigned by consensus panel using a well-validated approach. We used separate general linear models to examine the association of pulse pressure, diagnosis, and their interaction, with entorhinal cortex thickness and regional WMH, while further adjusting for age, sex/gender, and history of hypertension.
Results: Higher pulse pressure was associated with lower entorhinal cortex thickness in those diagnosed with MCI and dementia (pulse pressure x diagnostic group interaction, β=-0.746, p=0.029). Higher pulse pressure was also associated with increased parietal WMH volume specifically, but similarly across diagnoses (main effect of pulse pressure on parietal WMH, β=0.232, p=0.023).
Conclusions: These findings suggest that pulse pressure, a potentially modifiable risk factor, contributes to cerebrovascular and neurodegenerative indices that are associated with risk for AD in DS.
Keywords: neuroimaging: structural**,** cerebrovascular disease**,** dementia - Alzheimer's disease
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3 Distress About Neuropsychiatric Symptoms is Associated With Caregiver Cognition

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Objective: Caregivers provide over 17 billion hours of care to individuals with Alzheimer's disease and related dementias (IWADRD). Caregivers have increased risk for mental health and health concerns, and potentially for cognitive impairment or decline. Caregiving for IWADRD is associated with increased stress/burden beyond that experienced by caregivers of individuals with other chronic conditions. One contributor to caregiver

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stress/burden is neuropsychiatric symptoms in IWADRD, which are related to caregiver mental and physical health. Perceived stress generally is associated with worse cognitive functioning and may increase risk for cognitive decline; thus, neuropsychiatric symptoms may be related to cognitive ability in caregivers via its association with stress. We examined the relationship of neuropsychiatric symptoms to perceived stress and cognitive functioning in caregivers of IWADRD. We hypothesized that perceived stress would mediate the relationship between neuropsychiatric symptoms and cognitive performance in caregivers.
Participants and Methods: Data were taken from a deidentified database of 31 caregivers of IWADRD who had participated in a larger study of caregiving and health. Caregivers were 50-90 years of age (mean=63.3, SD=11.2), were 78% female, 93% White, and 69% with college or higher levels of education. 88% saw the IWADRD at least 2 times a week, and 35.5% lived with the IWADRD. 58.1% were first degree relatives of the IWADRD.

Neuropsychiatric symptoms in IWADRD were assessed with severity and distress subscales of the Neuropsychiatric Inventory (NPI). Perceived stress was assessed with the Perceived Stress Scale. Memory and psychomotor speed were assessed with the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) list recall and story recall, coding, and semantic fluency subtests.
Results: NPI distress was related to perceived stress (r=.42, p=.029) and to cognitive performance (rs=-.32-.49). NPI severity was not related to any variables (rs -.14-.14). Perceived stress was also associated with memory (list and story recall, rs-.31 and -.49) and psychomotor processing speed (coding and semantic fluency (rs -.40 and -.43). Mediation models partially supported our hypotheses (models for list recall and coding were significant, but not for story recall or semantic fluency).
Conclusions: Results suggest that caregiver distress associated with neuropsychiatric symptoms is related to caregiver cognition via its relationship with general stress. These preliminary findings should be replicated in larger, more diverse samples of caregivers of IWADRD. Prospective studies examining the relationship of neuropsychiatric symptoms and stress to cognitive decline in caregivers should also be conducted. Future studies could also examine the underlying factors contributing to this relationship (such as cortisol). Further studies should also examine whether better management of neuropsychiatric symptoms in IWADRD can improve wellbeing of their caregivers, which is important not only to caregiver mental, physical, and cognitive health, but also to provision of quality care to their loved ones. Interestingly, it was not severity of the neuropsychiatric symptoms, but caregiver distress associated with the symptoms, that was related to overall stress and cognitive performance, suggesting that interventions might increase focus on caregiver support for symptom management and not just on symptom presence in IWADRD.
Keywords: dementia - Alzheimer's disease**,** chronic stress**,** caregiver burden
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4 Phenotypic Subtypes of Progressive Dysexecutive Syndrome due to Alzheimer's Disease: a Series of Clinical Cases

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Objective: Recently, diagnostic criteria for a progressive dysexecutive syndrome due to Alzheimer's disease (dAD) were proposed. Observations from the behavioral neurology clinic however suggest substantial heterogeneity in clinical presentation, progression, brain imaging findings, and neuropsychological profiles within this syndrome. Our objective was to describe this clinico-radiological heterogeneity through a series of clinical cases.
Participants and Methods: We report a case series of 6 patients with a dysexecutive syndrome and positive biomarkers for AD pathophysiology. Average age at diagnosis was 57.3 years, and patients were followed-up annually with neurological examination, neuropsychological testing, and multimodal imaging for an average of 3.7 years. Chief cognitive complaints pertained to short-term memory and complex thinking. Cases were

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divided into three subtypes based on their pattern of FDG-PET hypometabolism: predominantly-left parieto-frontal (ldAD), predominantly-right parieto-frontal (rdAD), or predominantly-biparietal (bpdAD).
Results: Prominent executive dysfunction was evidenced in all patients. ldAD cases showed greater impairment on measures of verbal working memory and expressive language compared to other subtypes. Conversely, rdAD cases showed more severe alterations in measures of visual abilities compared to those assessing verbal capacities and committed more perseverative errors on a measure of cognitive flexibility. bpdAD cases presented with a milder pattern of cognitive dysfunction with relative sparing of working memory and showed a slower rate of clinical progression. Both rdAD and bpdAD patients and developed neuropsychiatric symptoms (i.e., delusions, hallucinations, depression), whereas none of the ldAD patients did. There was a relative correspondence between patterns of tau deposition and FDG hypometabolism that was specific to each dAD subtype, whereas patterns of amyloid deposition did not differ between subtypes. All dAD cases could be differentiated from two clinical cases of atypical AD variants (language and visual) in terms of cognitive complaint, neuropsychological profile, and neuroimaging findings, which suggests that dAD subtypes represent clinical entities separable from other variants of the disease.
Conclusions: The presence of distinct dAD phenotypes has clinical relevance for diagnosis, prognosis and symptom management, and prompts for future investigations to uncover the biological mechanisms underlying this clinico-radiological variability.
Keywords: dementia - Alzheimer's disease**,** executive functions**,** neuroimaging: functional

5 Relationships among Factors of Burden and Positive Aspects of Caregiving in Dementia Caregivers

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Objective: A negative correlation between positive aspects of caregiving and burden is well-established in dementia caregivers; however, relationships among elements of these multifaceted constructs have not been previously examined. It has been suggested that a positive appraisal of caregiving may be protective against burden, but less so in the context of certain elements of caregiver burden, for example, impact on life due to daily care needs. However, because past work has focused on positive aspects of caregiving overall, it is not clear if certain elements would be more closely associated with factors of caregiver burden, and thus serve as more specific targets for intervention. The current study sought to explore the complexity of the relationships among factors of caregiver burden and positive aspects of caregiving.
Participants and Methods: A sample of 527 dementia caregivers was drawn from a registry of continuously enrolled patients of an outpatient geriatric clinic that provides specialty services for dementia. Caregivers completed the Zarit Burden Interview (ZBI) and Positive Aspects of Caregiving (PAC) scale. Demographic information was extracted from medical records. Factor analysis was used to determine PAC and ZBI factor structures. Pearson correlations were conducted to examine zero-order relationships among variables. Hierarchical multiple regression analyses then examined whether factors of the PAC differentially predicted ZBI factors.
Results: Zero-order correlations replicated prior findings of a negative relationship between the PAC and ZBI ($r=-.28$, $p<.001$). Factor analysis of the PAC aligned with a two-factor structure: Self-Affirmation and Outlook on Life. Exploratory Factor Analysis of the ZBI supported a four-factor structure: Impact on Life, Impact on Relationships, Guilt/Uncertainty, and Overwhelm. Zero-order correlations among all PAC and ZBI factors were significant ($r=-.11$ to $-.31$, $p<.01$). After controlling for demographic variables likely to influence caregiving, regression analyses indicated that PAC Outlook on Life significantly predicted ZBI Impact on Life,

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with higher Outlook on Life scores associated with lower Impact on Life scores (B=-.599, SE=.171, β=-.204, p=.001). Both PAC Outlook on Life (B=-.311, SE=.090, β=-.196, p=.001) and PAC Self-Affirmation (B=-.122, SE=.049, β=-.143, p=.01) predicted ZBI Impact on Relationships, such that higher Outlook on Life and Self-Affirmation scores predicted lower Impact on Relationships. Neither PAC factor predicted ZBI Guilt/Uncertainty or Overwhelm factors.
Conclusions: Although overall and factor scores of the ZBI and PAC were negatively and significantly related, the strongest relationships were found among PAC factors and the Impact on Life and Relationships factors of the ZBI. However, while past work has suggested that efforts to enhance positive appraisals of caregiving may not be of benefit when burden is linked to instrumental caregiving needs, the current study suggests that a more focused approach targeting caregivers' Outlook on Life might be useful in this case. Because neither aspect of PAC predicted feelings of guilt and uncertainty or overwhelm, other approaches may be more useful for these problems. Future work should explore whether interventions specifically targeting the Outlook on Life factor of PAC differentially impact factors of caregiver burden.
Keywords: caregiver burden**,** dementia - Alzheimer's disease

6 Alzheimer's Disease CSF Biomarkers Associate with Item-Level Semantic Fluency Performance in Older Adults Without Dementia

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Objective: Sensitive cognitive markers can provide added value combined with biomarkers for identifying people at high risk of Alzheimer's disease for clinical trial selection. Additionally, they contribute unique potential to detect cognitive change before the clinical diagnosis of Alzheimer's disease can be established. Novel cognitive metrics can be derived from the items produced in the semantic fluency task, such as how often a word occurs in daily language (lexical frequency) or the age at which a child acquires a word (age of acquisition). We investigated whether the mean lexical frequency and age of acquisition of animal fluency output were associated with cerebrospinal fluid (CSF) biomarker status among older adults without dementia.
Participants and Methods: Using logistic regression models, we analyzed mean lexical frequency, mean age of acquisition, and the traditional number score among 36 individuals with amyloid (13neg/23pos), phosphorylated tau (p-tau; 18 neg/18pos), and neurofilament light (NfL; 19 neg/17pos) CSF biomarkers (cognitively normal = 13, mild cognitive impairment = 23; mean age = 72.1±7.2). We calculated mean lexical frequency for each individual based on the log value of the ten lowest lexical frequency values—extracted from the SUBTLEXus database—of their produced words across 60 seconds. Similarly, we calculated mean age of acquisition for each individual based on the ten latest acquired words based on the Kuperman et al. ratings. Lexical frequency was multiplied by -1 such that lower values represented worse performance, and all three fluency values were standardized for comparison. Model covariates included age, sex/gender, and education.
Results: Both lexical frequency (odds ratio (OR) = .26 [95% confidence interval (CI) = .08-.79], p = .017) and age of acquisition (OR = .36 [.14-.93], p = .034) were associated with NfL status, with worse performance in biomarker-positive individuals. In contrast, we found no relationship between the traditional total number score and NfL status (OR = .49 [.21-1.1], p = .098). The relationship of lexical frequency and NfL status even remained while controlling for traditional total number (OR = .19 [.04-.97], p = .046)—but not in the age of acquisition model (OR = .364 [.10-1.37], p = .135). None of the metrics were related to amyloid or tau status.
Conclusions: These results show the potential for more sensitive cognitive metrics by using item-level data of semantic fluency instead of total number score. Despite limited power due to small sample size and a dichotomous

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outcome—because of non-linear development of biomarker levels—we demonstrated a relationship between linguistic metrics of semantic fluency and NfL, a biomarker of neurodegeneration. The absence of relationships with amyloid and p-tau emphasizes the need to further develop more sensitive markers of cognition that track with all biomarkers of Alzheimer's disease. As semantic fluency is a hybrid task engaging both semantic memory and executive functioning, future directions include investigating if different biomarkers associate with different cognitive aspects captured by item-level metrics.
Keywords: semantic processing**,** dementia - Alzheimer's disease**,** cognitive processing

7 Everyday Cognition (ECog) in a Clinical Context: Correlation with Clinical Tools and Concordance with Team Consensus Diagnosis

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Objective: Accessible, reliable, and cost-effective screening instruments for dementia, particularly in communities without access to major medical centers and/or specialty memory care are needed. The Everyday Cognition (ECog) scale is a self-report measure designed to assess functional declines secondary to cognitive decline. We sought to: (1) explore the degree of agreement between ECog scores and interdisciplinary team diagnosis; and (2) examine relationships between ECog domain scores and commonly used neuropsychological tests (NPTs). Based on findings from the extant literature, we hypothesized that mean ECog domain scores will be negatively, and at least weakly, correlated with demographically-corrected scores on common NPTs with demographic corrections.
Participants and Methods: A retrospective chart review was completed at an outpatient, interdisciplinary memory clinic. Patients between ages 20 and 85 (n = 88) who completed both ECog: Self-Report (ECS) and NPTs were included. Exclusion criteria were factors that would confound performance on cognitive testing (e.g., deafness, blindness, unstable medical conditions, substance use disorders, intellectual disabilities, non-native English speakers, etc.). Extracted variables included: (1) mean ECS score; (2) Boston Naming Test – Second Edition (BNT-2; measure of confrontation naming); (3) Trail Making Test – Form B (TMT-B; measure of executive functioning); and (4) interdisciplinary team diagnosis (e.g., no diagnosis, mild cognitive impairment, dementia). Analyses: (1) Mean ECS scores were calculated and coded based on diagnostic group. Final team diagnosis was coded in a similar fashion. Rate of agreement was determined with Kendall's W; (2) Relationship between ECS language items (ECS-L) and demographically-corrected scores for the BNT-2 was examined with a Spearman correlation; and (3) Relationship between Executive Functioning: Divided Attention items (ECS-EFDA) and demographically-corrected scores for TMT-B was examined with a Spearman correlation.
Results: (1) Statistically significant agreement between ECS and team diagnosis was identified (n = 84, W = .329, p < .001). Statistically significant relationships between ECS domain scores and performances on NPTs with demographic correction were not identified: (1) ECS-L scores were positively skewed and logarithmic transformation was conducted; however, results were unchanged, so original data were used. ECS-L and BNT-2 (n = 76, $r_s(74) = -.018$, p = .874); and (2) ECS-EFDA and TMT-B (n = 50, $r_s(48) = .219$, p = .126).
Conclusions: The rate of agreement between ECS scores and team diagnosis was relatively weak. 60% of the sample met clinical criteria met clinical criteria for dementia with Alzheimer's disease pathology suspected in over 66% of the sample, thus one possible explanation would be pathognomonic reduced awareness of deficits, or anosognosia. Contrary to prior findings, significant correlations between ECS domains and NPTs were not identified. Our sample was predominantly white and relatively well-educated, which limits generalizability. Additionally, time between ECog administration

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and NPTs averaged four months, and it is not possible to determine what degree of decline may have occurred in that period. While our findings suggest predictive limitations, this measure may reflect the patient's perceived level of cognitive/functional decline. Future work will explore rate of agreement between ECog: Informant-Report and team diagnosis and the frequency of correct versus incorrect diagnosis.
Keywords: dementia - Alzheimer's disease, self-report, psychometrics
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8 The Role of Caregiver Self-Mastery in the Relationship Between Caregiver Burden and Caregiver Communications

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Objective: Individuals with dementia are often cared for by informal caregivers. These caregivers assist in a variety of ways, including coordination of a care recipient's health services. Previous work shows that caregiver burden is positively associated with caregiver communications with providers (i.e., more burdened caregivers call clinic staff more frequently). Because additional communications add to clinic workload, efforts to understand this relationship are important. Caregiver self-mastery, or the extent to which one feels a sense of control, is negatively linked to caregiver burden, and may influence the relationship between caregiver burden and clinic communication behavior. The aim of the present study was to investigate whether greater caregiver self-mastery would moderate the relationship between frequency of caregiver communications and caregiver burden.
Participants and Methods: Participants were 165 patient-caregiver dyads in a clinical registry of an outpatient geriatric clinic that provides specialty services for dementia. Patient-caregiver demographics and self-report measures including the Zarit Burden Interview (ZBI) and Self-Mastery Scale (SMS) from the initial intake appointment and caregiver communications over the subsequent 12 months were gathered by medical chart review.
Results: Pearson correlation was used to confirm a significant relationship between caregiver burden and caregiver communications ($r=.16$, $p<.05$). Linear regression analysis utilizing bootstrapping procedures examined whether caregiver self-mastery moderated the relationship between caregiver burden and caregiver communications. Results indicated that the model was not significant ($R^2=.03$, $F(3, 161)=1.53$, $p=.21$). Examination of bias-corrected confidence intervals indicated that neither caregiver self-mastery (BC_a 95% CI[-1.54, 1.02]) nor caregiver burden (BC_a 95% CI[-.79, .82]) were independent predictors of caregiver communications. The interaction term (BC_a 95% CI[-.03, .05]) indicated moderation did not take place.
Conclusions: The hypothesis that caregiver self-mastery would moderate the relationship between caregiver burden and caregiver communications was not supported. Although it is possible that the expected relationship does not exist, it is also possible that moderation was not observed due to methodological factors, such as examination of these relationships very early in the disease process or examination of the frequency of all communications including both caregiver concerns (e.g., behavior management) as well as routine calls (e.g., medication refills). Future work should examine this question longitudinally, with attention to differences in communication types.
Keywords: caregiver burden
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9 Metacognition and Everyday Functioning in Mild Cognitive Impairment and Alzheimer's Disease

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Objective: Metacognition, the insight into one's own cognitive abilities, declines in mild cognitive impairment (MCI) and Alzheimer's disease (AD). Self- and informant-ratings of metacognition may be biased and inaccurate. Our study examines whether objective metacognition accuracy predicts everyday functioning in healthy aging, MCI, and AD.
Participants and Methods: Participants included healthy older controls (*n*=48), individuals with MCI (*n*=57), and persons with AD (*n*=26). The functional status of participants was assessed using the Everyday Cognition (ECog) scale, which measures activities of daily living (ADLs) relevant to the domains of memory, language, visuospatial skills, planning, organization, and divided attention. Metacognition was assessed by asking participants to make predictions about their performances prior to completing neuropsychological tests and then make postdictions about their performances after completing the tests. Metacognition accuracy was defined as the difference between objective test performances and predictions versus postdictions. The neuropsychological tests included: Wechsler Memory Scale-III Visual Reproduction I & II (VRI & VRII), California Verbal Learning Test-II (CVLT-II) Trial 5 & Delayed Recall, and Rey-Osterrieth Complex Figure Test (ROCFT) Copy & 3-Minute Recall.
Results: Regression analyses revealed that for controls, ROCFT 3-Minute Recall metacognition accuracy significantly predicted ECog scores related to planning, organization, and divided attention. For MCI, VRII metacognition accuracy significantly predicted ECog scores related to memory, planning, organization, and language. Additionally, CVLT-II Delayed Recall significantly predicted ECog scores related to language. For AD, VRII metacognition accuracy significantly predicted ECog scores related to memory. In contrast, VRI, CVLT-II Trial 5, and ROCFT Copy metacognition accuracies were not significantly predictive of any ECog scores.
Conclusions: Overall, we found that metacognition accuracy predicted ADLs within specific cognitive domains. For controls, metacognition accuracy for visuospatial memory predicted ADLs in the domains of planning, organization, and divided attention. For MCI, metacognition accuracy for visual memory predicted ADLs in the domains of memory, planning, organization, and language, while metacognition accuracy for verbal memory predicted ADLs in the domain of language. For AD, metacognition accuracy for visual memory predicted ADLs in the domain of memory. These finding indicate that insight into one's own cognitive abilities is important for specific everyday functions, particularly in older adults with significant cognitive impairment.
Keywords: metacognition**,** everyday functioning**,** cognitive functioning
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10 Education is Related to Cognitive Profiles at the Time of Alzheimer's Disease Diagnosis

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Objective: Cognitive profiles form the basis of dementia diagnosis, providing valuable insights into the distribution of underlying neuropathology. Educational attainment, a component of cognitive reserve, is known to affect cognitive functioning; less is known regarding its effect on cognitive profiles, that is, the pattern of strengths and weaknesses across specific cognitive domains. Individuals diagnosed with Alzheimer's Disease (AD) dementia typically demonstrate impairment in episodic memory, but often show different patterns of performance in language and executive function domains. Our aim is to understand the extent to which education may influence cognitive performance across memory, language, and executive function at the time of AD diagnosis.

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Participants and Methods: The sample of participants included 74 older adults from the Long Life Family Study who merited research diagnosis of incident AD via clinical consensus based on neuropsychological tests, measures of daily functioning, and informant questionnaires. To create cognitive profile scores, raw scores on neuropsychological tests at the time of dementia diagnosis were converted to z-scores using within sample means and standard deviations. Participants' three cognitive profile scores reflect the z-score discrepancies between each of two scores including: episodic memory (Logical Memory Delay), language (Animal Fluency), and executive function (Trail Making Part B). Bivariate correlations first examined the association between education and each cognitive domain. Linear regressions were then conducted to investigate the associations between education and profile scores. Age and sex were included as covariates in the analyses.
Results: The sample included 31 male and 43 female participants aged 73 to 106 years (*M*=93, *SD*=7.74), with education ranging from 7 to 20 years (*M*=14, *SD*=3.08). In bivariate analyses, there was a trend toward an association between education and memory (*r*=.23, p=.08), but not language (*r*=.16, *p*=.21) or executive function (*r*=-.06, *p*=.65). However, regression analyses controlling for sex and age revealed that profile scores correlated with education, such that more years of education was associated with greater impairment of the executive-memory profile score (*p*=.02), and a trend with the executive-language profile score (*p*=.05), but not with the language-memory profile score (*p*=.61).
Conclusions: Education may play a role in cognitive profiles at the time of AD diagnosis. Patients with fewer years of education may show less compromised executive function in relation to episodic memory or semantic fluency. This should be taken into account when interpreting the meaning of cognitive profiles at the time of AD diagnosis. Understanding the influences of education on cognitive profiles can be valuable for the development of more specific diagnostic tools for individuals with different levels of educational attainment, as well as contribute to the differential diagnosis of dementia subtypes, in both research and clinical contexts.

Keywords: dementia - Alzheimer's disease, cognitive functioning, aging disorders

11 Longitudinal Intraindividual Cognitive Variability is Associated with Reduction in Regional Cerebral Blood Flow among Alzheimer's Disease Biomarker-Positive Older Adults

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Objective: Intraindividual variability (IIV) across neuropsychological measures within a single testing session is a promising marker predictive of cognitive decline and development of Alzheimer's disease (AD). We have previously shown that greater IIV is cross-sectionally associated with reduced cerebral blood flow (CBF), but not with cortical thickness or brain volume, in nondemented older adults who were amyloid beta (Aβ) positive. However, there is little known about the association between change in IIV and CBF over time. Therefore, we examined longitudinal change in IIV and CBF as well as interactions with of IIV and AD biomarker status on changes in regional CBF.
Participants and Methods: Fifty-three nondemented Alzheimer's Disease Neuroimaging Initiative (ADNI) participants underwent baseline lumbar puncture to obtain cerebrospinal fluid (CSF), neuropsychological testing, and magnetic resonance imaging (MRI) exams at baseline and 12 month follow-up evaluation. IIV was calculated as the intraindividual standard deviation across 6 demographically-corrected neuropsychological measures, which included two measures of memory, two measures of language, and two measures of processing speed/executive function. Mean neuropsychological performance

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was computed as the mean of the 6 z-scores. Pulsed arterial spin labeling (ASL) MRI was acquired to quantify CBF. Six free-surfer derived *a priori* CBF regions of interest (ROIs) were examined: entorhinal cortex, hippocampus, inferior temporal cortex, inferior parietal cortex, rostral middle frontal gyrus, and medial orbitofrontal cortex. AD CSF markers were processed using Elecsys® immunoassays; AD biomarker positivity was determined using a published CSF p-tau/Aβ ratio cut-score (Schindler et al., 2018). Change scores were calculated for IIV, CBF, and mean neuropsychological performance from baseline to 12 months.
Results: Hierarchical linear regression models showed that after adjusting for age and sex, there was a significant interaction between IIV change and biomarker-positivity (p-tau/Aβ+) for change in entorhinal (β=-0.335, p=.047) and hippocampal CBF (β =-0.380, p=.020) but not for the other ROIs (p-values > 0.05). Specifically, increases in IIV were associated with reductions in entorhinal and hippocampal CBF among individuals who were p-tau/Aβ+ (n=21). In contrast, there were no significant associations between change in IIV and CBF among those who were biomarker-negative (p-tau/Aβ-; n=32). Findings remained similar when analyses were performed additionally adjusting for change in mean level of neuropsychological performance.
Conclusions: Changes in IIV may be sensitive to changes in regional hypoperfusion in AD-vulnerable regions among AD biomarker-positive individuals above and beyond demographics and mean neuropsychological performance. These findings provide further evidence supporting IIV as a potential marker of cerebrovascular brain changes in individuals at risk for dementia. Future studies should examine how IIV may predict brain and cognitive changes in more diverse samples and among those with greater vascular risk burden.
Keywords: cerebral blood flow**,** neuroimaging: functional**,** dementia - Alzheimer's disease
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12 Exploring White Matter Hyperintensities & Alzheimer's Disease Biomarker Relationships Across Racial Groups

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Objective: There is a higher incidence of Alzheimer's Disease (AD) in Black Americans (BAs) than in Nonhispanic Whites (NHWs). However, the specific causes of these disparities have yet to be elucidated. Some studies implicate the higher prevalence of AD risk factors in Black Americans as a possible explanation. For example, they are more likely to develop vascular diseases, which usually manifest in the brain as white matter hyperintensities (WMHs), signs of weakened white matter integrity, and a common AD risk factor. Additionally, studies on general AD populations have shown that biomarkers Aβ42 and tau were usually closely linked to total WMH volumes. Given this information, we aimed to explore whether race would modify the

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relationship between cerebrospinal fluid (CSF) tau and Aβ42 and white matter hyperintensities.
Participants and Methods: Our analysis involved a cohort of cognitively normal individuals, including 16 BAs and 43 NHWs, that were at risk for developing AD. Fluid Attenuated Inversion Recovery scans and cerebrospinal fluid (CSF) were collected at Emory University and obtained CSF Aβ42 and CSF total tau levels. FLAIR data was analyzed using a code developed by the Brickman lab at Columbia University. Briefly, voxels containing WMHs were overlaid onto a lobar atlas to derive lobe-specific WMH volumes (temporal, frontal, occipital, parietal, cerebellar). We constructed linear models and included WMH volume as our outcome variable, race and gender as fixed factors, CSF tau and CSF Aβ42 as independent variables, and Age and gender as covariates. We also included race X tau and race X Aβ42 interaction terms.
Results: We found t.tau and Aβ42 levels and WMH volumes were more closely related in the parietal ($B = -0.003$, $t = -4.688$, $p < 0.001$) and temporal lobes ($B = -0.004$, $t = -6.076$, $p < 0.001$) of BAs than in NHWs. This disparity was observed in a cohort of cognitively normal controls.
Conclusions: Though we cannot make strong causal inferences, the results of our analysis provide support for further investigation into WMH as a possible contributor to racial disparities in Alzheimer's Disease.
Keywords: dementia - Alzheimer's disease
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13 Worse Working Memory is Associated with Greater Brain Pathology Burden in Autosomal Dominant Alzheimer's Disease

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Objective: Episodic memory difficulties are an early cognitive marker of Alzheimer's disease (AD), and research suggests working memory plays a role in episodic memory processes. We examined data from individuals with an autosomal dominant Alzheimer's disease (ADAD) mutation – who have virtual certainty of developing the AD clinical syndrome by mid-life – and non-carrier family members, with the objectives of (1) examining differences in working memory between adult ADAD mutation carriers and non-carriers and (2) characterizing working memory's association with markers of AD brain pathology using positron emission tomography (PET) imaging of amyloid in the neocortex and tau in the entorhinal and inferior temporal cortices.
Participants and Methods: 65 members of the Colombian Presenilin 1 (*PSEN1)* E280A cohort (29 non-demented mutation carriers [5 with early mild cognitive impairment due to ADAD]; 36 age- and education-matched non-carrier family members) underwent clinical and cognitive testing in Medellín, Colombia (e.g., the Mini-Mental State Examination [MMSE] and select Wechsler Adult Intelligence Scale, Fourth Edition [WAIS-IV] subtests) and traveled to Boston, USA for PET imaging of neocortical amyloid (Pittsburgh Compound B [PIB]) and medial temporal lobe tau (Flortaucipir [FTP]). A working memory composite score was created by summing z-scores, using non-carrier data as a normative reference, of raw scores on Digit Span Backward and Letter-Number Sequencing from the Spanish version of the WAIS-IV. Mann-Whitney *U* tests were used to assess differences between carriers and non-carriers on demographic, cognitive, and neuroimaging variables, and chi-squares to evaluate differences on categorical variables (e.g., biological sex). Spearman correlations were conducted to examine associations between the

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working memory composite with demographics and PET measures in carriers and non-carriers; correlation coefficients between the groups were compared using a Fisher *z* transformation. **Results:** Carriers had lower MMSE scores, a higher proportion of individuals with mild cognitive impairment (6:0) and higher levels of bilateral entorhinal tau, inferior temporal tau, and neocortical amyloid relative to non-carriers (p<.003 for all); there was no difference between the groups on the working memory composite (*U* = 464.00, z = -0.76, *p* = .44). In carriers, the working memory composite was more negatively associated with age *(*ρ=-.70, *p*<.001) than in non-carriers (ρ=-.21, *p*=.21); *z*=2.49, *p*=.006. Similarly, relative to non-carriers, mutation carriers exhibited a significantly stronger negative association between working memory with bilateral inferior temporal tau (carriers: ρ=-.50, *p*=.006; non-carriers: ρ=-.07, *p*=.66; *z*=1.82, *p*=.04) and a trend with bilateral entorhinal tau (carriers: ρ=-.56, *p*=.001; non-carriers: ρ=-.23, *p*=.27; *z*=1.54, *p*=.06), but not with bilateral neocortical amyloid (carriers: ρ=-.48, *p*=.009; non-carriers: ρ=-.18, *p*=.28; *z*=1.28, *p*=.10). **Conclusions:** Worse working memory was associated with older age (a proxy for ADAD progression) and with greater inferior temporal tau burden in non-demented ADAD mutation carriers relative to non-carrier family members. Working memory test performance may not, in itself, overtly discriminate between non-demented ADAD carriers and non-carriers, but appears to worsen with advancing age in ADAD carriers and correlates with temporal lobe AD pathology. Future work should examine performance on other working memory measures in ADAD and their associations with AD biomarkers, particularly with larger samples and using longitudinal methods.

Keywords: working memory**,** dementia - Alzheimer's disease**,** positron emission tomography

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14 Associations of Category Fluency Clustering and Switching Performance with in vivo Brain Pathology in Autosomal Dominant Alzheimer's Disease

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Objective: Category fluency is known to be impaired in Alzheimer's disease (AD). Beyond the total fluency score, it is possible to study clustering and switching, which provide insight into subtle inefficiencies in executive function and word retrieval processes that may be impacted very early in the disease. We examined category fluency clustering and switching, and their associations with markers of AD brain pathology, in non-demented mutation carriers of an autosomal dominant AD (ADAD) mutation and non-carrier family members. **Participants and Methods:** 48 non-demented carriers of the Presenilin1 E280A ADAD mutation (mean age [SD]: 37.4 [7.2], 28 females, 8 carriers with mild cognitive impairment) and 51 non-carrier family members (mean age [SD]: 36.2 [6.0], 31 females) from Colombia completed cognitive testing, including category fluency (animals) and the Mini-Mental State Examination (MMSE). A subset of participants (30 carriers and 32 non-carriers) underwent positron emission tomography (PET) amyloid and tau imaging. Non-parametric Mann-Whitney *U* tests were used to assess group differences between carriers and non-carriers on demographics, as well as category fluency total score, category fluency clustering (number of words within semantic clusters), and category fluency switching (percent of switches between clusters [relative to total score]). Spearman correlations were used to assess associations between category fluency clustering and switching, demographic variables (e.g., age and

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education) and PET measurements of amyloid-β (mean cortical) and regional tau (entorhinal and inferior temporal cortices); correlations between carriers and non-carriers were compared using Fisher *z* transformations.
Results: Carriers and non-carriers did not differ on age or education (all p >.45). Carriers had worse performance on the MMSE and greater neocortical amyloid-β and regional tau burden (all p <.01). The groups did not differ on the total number of animals generated (mean [SD]: carriers = 20.5 [4.2]; non-carriers = 19.8 [3.6]), the number of items contained within clusters (carriers = 12.5 [5.0]; non-carriers = 12.8 [4.3]), nor the number of switches (carriers = 11.5 [2.9]; non-carriers = 10.4 [2.7]). Relative to non-carriers, in carriers: (1) fewer items in clusters was associated with older age (ρ= -.34, p=.02 vs. ρ= .11, p=.46; z=2.24, p=.01), more amyloid-β (ρ= -.45, p=.01 vs. ρ= .15, p=.43; z=2.38, p=.009) and more entorhinal tau (ρ= -.59, p=.001 vs. ρ= -.13, p=.49; z=2.05, p=.02); and (2) lower fluency total score was associated with more entorhinal tau (ρ= -.46, p=.01 vs. ρ= .15, p=.43; z=2.43, p=.008).
Conclusions: Non-demented ADAD carriers and age- and education-matched non-carrier family members did not differ on animal fluency total score, clustering, and switching. Relative to non-carriers, however, ADAD carriers exhibited a stronger association between category fluency clustering with AD brain pathology and age – a proxy for disease progression in ADAD – suggesting a potential impact of AD pathophysiology on executive functions that may underpin efficient word retrieval performance. Future research may extend this work by using three-trial category fluency (e.g., animals, vegetables, and fruits), phonemic fluency tests, and object naming tests, all of which may provide additional perspectives on quantitative and qualitative aspects of fluency in ADAD.
Keywords: fluency**,** dementia - Alzheimer's disease**,** positron emission tomography

15 Investigation of Age- and Sex-Normed Hippocampus and Entorhinal Volumes a s Predictors of Subjectively Perceived Decline

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Objective: Alzheimer's disease (AD) is classically associated with atrophy of the hippocampus and entorhinal cortex, two hubs of memory function. Subjectively perceived cognitive decline may be the first detectable sign of AD, but the neural basis of subjective decline is not well understood. We investigated whether volumes of medial temporal structures (hippocampus, entorhinal cortex) were associated with subjective change in cognitive function for different stages of AD. We hypothesized that subjective decline would be associated with lower entorhinal volumes, a brain region expected to be affected in AD earlier than the hippocampus. Furthermore, we examined these associations by using both raw and norm-referenced volumes in order to explore the potential clinical usage of age- and sex- normative regional volumes.
Participants and Methods: We analyzed the ADNI2 (Alzheimer's Disease Neuroimaging Initiative) baseline data (n=790) of four diagnostic groups [cognitively normal (CN), AD, subjective memory complainers (SMC), mild cognitive impairment (MCI)]. Means and standard deviations were calculated from CN participants' hippocampus and entorhinal volum e for two age groups (above or below 75) and two sex groups (male or female). The means and standard deviations calculated from CN groups were used to create normed z-scores for brain volumes in the other diagnostic groups. We employed the Everyday Cognition (ECog) total score as an index of subjectively reported cognitive decline, and a memory subdomain ECog score as subjectively reported memory decline. We ran linear regressions to examine associations between normed and raw brain region volume and subjective cognitive/memory change, controlling for intracranial volume (ICV). Separate models with raw volumes accounted for age, sex, and ICV as covariates. We applied the Bonferroni correction for multiple testing across diagnostic groups (reported as a q-value).

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Results: Entorhinal cortex volumes were not associated with subjectively reported cognitive memory decline for any of the diagnostic groups, regardless of using raw or normed values. After Bonferroni correction, regression models revealed that smaller raw hippocampal volumes (mm3) were associated with greater subjectively reported memory decline only in MCI (t=6.36, p=0.0009, q = 0.003). In the repeated analysis using normed volumes, we observed the same association in MCI, however, it did not survive multiple-comparison correction (t=-2.25, p=0.03, q=0.09). Additionally, the analysis with raw volume revealed that older participants in the MCI group showed greater subjectively reported memory decline (t= -3.14, p=0.002, q=0.006). This variable could explain why norm hippocampus analysis showed only a trend-level significance.
Conclusions: Contrary to our hypothesis, the entorhinal cortex did not show associations with subjectively reported decline in any of the diagnostic groups. However, smaller raw hippocampal volume was associated with greater subjectively reported memory decline among participants with MCI. Despite well-established advantages of norm-referenced scores for clinical usage, our study indicated that age- and sex-normed brain volume did not have obvious advantages when used to predict subjectively reported decline. Our observation that subjective memory decline was accounted for by age may guide our use of norm-referenced regional volumes to understand or predict the risk of cognitive decline.
Keywords: memory complaints**,** neuroimaging: structural**,** normative data

16 Comparison of a Clinical Neuropsychological Test Battery to Amyloid Biomarker Status in Older Patients With Cognitive Impairment

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Objective: Clinical diagnostic decisions about prospective neurodegenerative conditions are based on evidence of cognitive changes relative to approximated premorbid functioning. Patterns of change that map onto “typical” syndromic profiles aid speculation about underlying etiology. Recently, new technologies have stimulated interest in a biomarker-defined diagnosis of Alzheimer’s disease (AD), which includes abnormal levels of ß-amyloid. Although select studies have documented associations between neuropsychological measures and biomarker status, the majority are in clinical trials or AD Research Centers, which may not be generalizable to outpatient clinical settings. The objectives of this study were to 1) document the concordance between clinical neuropsychological diagnosis and amyloid status; and 2) identify measures that led to discordance between clinical diagnosis and amyloid status.
Participants and Methods: Eighty-eight patients (M age = 71.1 years, SD= 9.0; 56% female; 93% non-Hispanic White) presented for a clinical neuropsychological evaluation at an outpatient clinic. Patients obtained amyloid biomarkers (amyloid PET or lumbar puncture) through a specialty memory clinic; they were excluded if the neuropsychologist knew their amyloid status at the time of evaluation (N=2). Outcomes of interest were clinical diagnosis based on the neuropsychologist’s etiologic impression (coded as non-AD [NP-], uncertain/indeterminate, or possible/probable AD [NP+] by three expert raters through consensus process) and amyloid status (negative [A-], indeterminate, or positive [A+] based on established cutoffs).
Results: Sixteen patients had uncertain clinical diagnosis based on their neuropsychological evaluation. Eleven (69%) were A+, 2 were A- (12%), and 3 (19%) had indeterminate amyloid status. For the remaining patients with non-indeterminate amyloid results, 49 (76.6%) showed concordance between their clinical diagnosis and amyloid status (11 NP-/A-, 38 NP+/A+). A larger proportion of patients had a clinical diagnosis of non-AD but positive amyloid

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biomarkers (NP-/A+, N=6; 35% of A+) than a clinical diagnosis of possible AD but negative amyloid biomarkers (NP+/A-; N=9; 19% of A-), X2 = 12.1, p = .001. When compared to the NP-/A- group, the NP+/A- patients had significantly lower performance on the Neuropsychological Assessment Battery Story delayed recall (t=3.37,p =.004) and trends toward reduced performance on the Hopkins Verbal Learning Test delayed recall (t=1.74, p=.10) and Brief Visuospatial Memory Test-Revised delayed recall (t=1.78, p=.09). No neuropsychological tests differed between the NP+/A- group and NP+/A+, presumably due to the small sample size of NP+/A-.
Conclusions: Collectively, these findings suggest that clinical neuropsychological evaluation yielded 76.6% accuracy in predicting amyloid status, with delayed memory being the primary cognitive variable driving neuropsychological diagnosis. Neuropsychologists more accurately predicted which patients were A+ compared to A-. These findings demonstrate the utility of neuropsychological assessment in identifying patients with AD-related amyloid pathology and extend prior research findings to a generalizable clinical setting. Further analyses will be conducted to 1) establish which cognitive variables improve prediction accuracy of amyloid status in patients presenting with an atypical cognitive profile (i.e., non-amnestic profile) and 2) identify relationships between cognitive variables, tau and neurodegeneration.
Keywords: neuropsychological assessment, dementia - Alzheimer's disease
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17 A Novel Computer Adaptive Word List Memory Test Optimized for Remote Assessment: Associations with Alzheimer's Disease Biomarkers of Neurodegeneration in Non-Demented Older Women

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Objective: Alzheimer's disease (AD) is the leading cause of dementia, affecting over 6 million Americans. Sensitive and reliable cognitive testing is needed for early detection and disease monitoring. Remote self-administered cognitive testing may increase access in clinics and research centers, especially amongst underrepresented and rural populations. Mayo Test Drive (MTD): Test Development through Rapid Iteration, Validation and Expansion, is a web-based platform for novel (Stricker Learning Span; SLS) and open access (Symbols Test) remote self-administered cognitive measures, optimized for smartphones. The SLS is a computer adaptive word-list memory test that matches test difficulty to user performance and visually presents words for learning exposures and 4-choice recognition to test encoding (5 learning trials, delay). Symbols is a measure of processing speed (4 12-item trials). We previously reported that SLS and Symbols demonstrate good test-retest reliability and construct validity. This study examines associations between the SLS and MRI measures of neurodegeneration including composite AD-signature cortical thickness (AD-Sig; entorhinal cortex, inferior temporal, middle temporal, and fusiform), entorhinal cortical thickness (ERC), and hippocampal volume (HV).
Participants and Methods: Our sample included forty-eight women enrolled in the Specialized Center of Research Excellence (SCORE) on Sex-Differences study who completed an ancillary MTD study and had all neuroimaging and cognitive testing measures of interest. A subset of SCORE participants underwent structural magnetic resonance imaging (3T General Electric, preprocessed with Freesurfer) and all completed in-person neuropsychological testing including the Auditory Verbal Learning Test (AVLT) and Digit Symbol Coding (Coding) within the past 2 years (Mean=10 months). Participants (93.7% White, Mean age=66.7 years, Mean education=14.7 years) were recruited via email or phone and emailed a link to complete MTD tests remotely on their own device. We examined SLS max

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span (maximum span attained across all learning trials), 1-5 correct, delay, and sum of trials (1-5 + delay). Symbols was administered during the SLS delay. Pearson partial correlations controlling for age and education were used to examine the relationship between neurodegenerative biomarkers and cognitive scores. Significance was set at $p<.05$.
Results: Participants were non-demented (3MS Mean = 96.4) and did not have significant neurodegeneration (AD-Sig cut-off 2.68mm, all N-). SLS max span, 1-5 correct and sum of trials were significantly correlated with AD-Sig (r's=.35-39, $p<.05$) and ERC (r's=.32-.35, $p<.05$). SLS delay associations with cortical thickness measures did not reach significance (r's=.27-.29, $p<.10$). SLS measures were not significantly correlated with HV (r's=.20-.27, $p>.05$). Other indices were not significantly correlated with neurodegenerative biomarkers, partly due to limited power (AVLT 1-5 total, delay, sum of trials and recognition %correct, r's=.03-.29, $p>.05$; Symbols Test and Coding, r's=.-.10-.13, $p>.05$).
Conclusions: Preliminary results indicate the Stricker Learning Span is correlated with AD biomarkers of neurodegeneration in non-demented older women. Future longitudinal work in larger samples will determine the utility of the SLS as a marker of AD risk and establish normative data. MTD is a platform with unique potential for increasing access to sensitive cognitive screening measures and may provide an option for hybrid (remote + in-person) cognitive assessment to aid triage and monitoring.
Keywords: aging disorders**,** assessment**,** teleneuropsychology
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18 The Sequencing Sign: A Potential Method to Identify Patients with Alzheimer's Disease

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Objective: Digit Span is one of the most frequently used attention/working memory measures (Rabin et al., 2016). Clinical observations have shown that, within the Digit Span subtest, patients with Alzheimer's disease (AD) often particularly struggle with Digit Span Sequencing (DSS). However, their poor performances appear related to confusion that the first item is already in sequential order and rapid forgetting of instructions, as opposed to failures of working memory. The current study explored if this pattern, referred to as the Sequencing Sign (SS), can predict AD.
Participants and Methods: Included patients were at least 65 years old and completed Digit Span from the Wechsler Adult Intelligence Scale–Fourth Edition (WAIS-IV) during outpatient neuropsychological evaluations. Exclusion criteria included failure of at least one stand-alone performance validity measure. One patient was also excluded due to use of an interpreter for test administration. The sample consisted of 56 patients without the SS (mean age=76, mean education=14 years; 30% Mild Neurocognitive Disorder [NCD], 57% Major NCD; most common etiologies=16% Parkinson's disease, 16% AD, 11% mixed AD and vascular dementia, 11% stroke, aneurysm, or hemorrhage) and 24 patients with the SS (mean age=81, mean education=14 years; 4% Mild NCD, 88% Major NCD; 67% AD, 17% mixed AD and vascular dementia). Binary logistic regression was conducted to examine the utility of the SS for predicting a diagnosis of AD. Pearson correlations were also calculated for the SS group between DSS scaled scores and scaled scores on other tests of attention/working memory (WAIS-IV Digit Span Forward/Backward and Spatial Span Forward/Backward from the Wechsler Memory Scale–Third Edition). Last, cross-tabulation was used to determine the SS's specificity and sensitivity.
Results: The logistic regression odds ratio showed that patients with the SS were 12.5 times more likely to be diagnosed with AD than patients without the SS ($p<.01$). The SS's specificity was 0.91, while sensitivity was 0.56. Additionally, DSS was not correlated with Digit Span Forward or Backward and was negatively correlated with Spatial Span Forward and Backward (r=-.52 for both; $p<.05$) in the SS

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group, suggesting that the group's poor DSS performance is not due to overall attention/working memory deficits.
Conclusions: The current study suggests that the SS may be useful for predicting AD. The SS demonstrated strong specificity, with weaker sensitivity, indicating that its presence is a good marker of AD. However, its absence does not exclude AD. Additionally, results suggest that DSS may not be a useful working memory test for patients with AD, as it was either not correlated or negatively correlated with other attention/working memory measures. Future research should attempt to cross-validate these findings and also explore the base rate of the SS in patients with AD compared to other types of dementia. If the SS is confirmed to be specific to patients with AD, and if the current findings can be cross-validated, this would suggest that the SS is a useful piece of data for clinicians to consider in determining whether to assign a diagnosis of AD.
Keywords: dementia - Alzheimer's disease**,** working memory**,** neuropsychological assessment
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19 Poorer Cognitive Function is Associated with Changes in Naturalistic Driving Behavior

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Objective: To determine if a traditional short-term memory task and preclinical Alzheimer disease (AD) biomarkers are associated with driving behavior, a complex instrumental activity of daily living (IADL).
Participants and Methods: Cognitively normal participants (Clinical Dementia Rating 0) were enrolled from a prospective, longitudinal driving study at the Knight Alzheimer's Disease Research Center at Washington University. Participants (n=254) were ≥ 65 years of age, required to have neuropsychological data, as well as one full year of naturalistic driving data prior to the beginning of the COVID-19 lockdown in the United States (March 2020). Participants were not required to have amyloid biomarker unless included in the biomarker models (PET n=155; CSF n=153). Naturalistic driving behavior data was collected utilizing the Driving Real World In-vehicle Evaluation System (DRIVES). DRIVES variables included number of trips per month, number of days driven, route straightness, distance travelled, trip time, hard braking, hard acceleration, overspeeding, and idle time. CSF was processed using Lumipulse G1200 automated assay system and analytes included $A\beta_{42}/A\beta_{40}$. Positron Emission Tomography (PET) and amyloid tracers (AV45 and Pittsburgh compound B (PIB)) assessed level of cerebral amyloid. Cognition was assessed utilizing a z-score composite made up of Free and Cued Selective Reminding – Free Recall, Category Fluency - Animal Naming, CVOE Switch Accuracy, Trails A and B, and Letter Number Sequencing. Linear mixed effect models were utilized to examine group differences between cognitive performers (low, average, high) and changes in naturalistic driving behaviors over time. In independent models with CSF and PET, biomarkers were dichotomized into +/- based on established cut-offs. Baseline age and education were utilized as covariates in all models.
Results: Participants on average were older (73.9 ± 5.1), well educated (16.6 ± 2.3), and evenly distributed across sex (males=119, females=113). There were 254 participants at baseline, 249 with one-year follow up, 193 with two-year follow up, and 62 with three-year follow up data available. In cognitively normal participants, (Clinical Dementia Rating 0), those with lower cognitive scores are baseline were found to: drive fewer trips (p =.002), drive fewer days (p =.013), cover more distance per trip (p =.003), drive longer per trip (p =.001), and

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have greater idle time per trip over time (p =.004). When running parallel models with amyloid biomarkers, older drivers with a positive amyloid status via CSF drove fewer trips per month over time (p =.04) and those with a positive amyloid status via PET overspeed more frequently over time (p =.05). Together amyloid status and cognition did not show a statistically significant interaction with time for the driving behaviors.
Conclusions: Lower cognitive scores, not amyloid status, at baseline predicted changes in driving behaviors including fewer trips per month, fewer days driven per month, but more distance driven per trip, driving longer per trip, as well as greater idling time. Positive amyloid status at baseline predicted fewer trips driven per month and more frequent overspeeding. However, amyloid status and cognition did not interact to predict change in driving behaviors over time. The absence of amyloid status interactions may be due to the fact that all participants were CDR 0 with no cognitive symptoms. Therefore, any behavioral differences between amyloid negative and amyloid positive groups may not be large enough to detect at this stage.
Keywords: dementia - Alzheimer's disease**,** driving
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20 The Influence of Psychological Factors on Everyday Problem-Solving in Alzheimer's Disease

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Objective: It is well-known that the ability to perform activities of daily living (ADLs) is impacted by the Alzheimer's disease (AD) process. However, psychological factors can also indirectly influence the ability or motivation to perform ADLs. In this study, we examined the relationships among anxiety and depression on the Everyday Problems Test (EPT), an ADL measure of real-world problem solving, in older adults.
Participants and Methods: Participants included healthy older controls (n = 58), persons with MCI (n = 65), and persons with dementia (n = 18). All participants were administered the EPT to assess problem-solving skills that relate to ADLs. The Beck Anxiety Inventory (BAI) and the Geriatric Depression Scale (GDS) were also administered.
Results: An ANOVA revealed significant differences in EPT performance among the healthy older adult, MCI, and dementia groups. The healthy older adults outperformed the MCI group, who outperformed the dementia group. Regression analyses conducted separately for each group revealed that anxiety and depression did not predict EPT performance.
Conclusions: In general, we found that the ADL of real-world problem solving was impacted by the Alzheimer's disease process, as there were mild difficulties in the MCI group and significant difficulties in the dementia group. Performance on this ADL measure was robust to psychological factors, including anxiety and depression. Overall, these findings indicate that EPT is a measure that can be used to assess ADLs in older adults across the cognitive spectrum and is resistant to the effects of co-morbid psychological symptoms.
Keywords: aging disorders**,** depression**,** anxiety
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21 Effects of Stress Exposure Versus Appraisal on Episodic Memory Trajectories: Evidence for Risk and Resilience among Black Older Adults

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Objective: Exposure to chronic stressors, experienced disproportionately by Black older adults, is a risk factor for memory impairment. Black older adults also show higher rates of Alzheimer's disease and related dementias (ADRD) than White older adults. While racially patterned chronic stress exposure likely contributes to these disparities, less is known about the role of stress appraisal. Stress appraisal is defined as the extent to which individuals interpret stressful events as upsetting and has been shown to play an important role in mental health disparities; however, its role in cognitive aging disparities is poorly understood. This study examined the roles of chronic stress exposure and appraisal in racial disparities in episodic memory. Specifically, this study aimed to examine whether stress exposure mediates racial disparities in memory performance and whether stress appraisal offsets racial disparities in memory performance.
Participants and Methods: Participants included 16,924 Black and White older adults (M_{age}= 66, 23% Black) from the Health and Retirement Study (HRS) who completed measures of chronic stress exposure (health, financial, housing, relationships, and caregiving) in either the 2010 or 2012 wave. Participants appraised each endorsed stressor as not at all upsetting, somewhat upsetting, or very upsetting. Episodic memory was measured using a ten-item word list. Latent growth curves modeled longitudinal episodic memory performance over six years. Covariates included age, education, sex, wealth, chronic disease burden, and baseline wave (2010 or 2012).
Results: Black participants reported greater stress exposure than White participants, and greater stress exposure partially mediated Black-White disparities in initial memory (standardized indirect effect = –.002, p =.009). However, Black participants appraised stressors as less upsetting than White participants (t (12201) = 3.39, p < .001). Black-White disparities in initial memory were partially offset by Black participants' appraisal of stressors as less upsetting (standardized indirect effect = .002, p = .016).
Conclusions: Reducing chronic stress exposure may reduce racial disparities in ADRD risk. The counteractive effect of stress appraisal on Black-White disparities in episodic memory highlights resilience factors among Black older adults that should be characterized in future research to move beyond deficit models of ADRD inequality.
Keywords: memory disorders**,** aging disorders**,** cross-cultural issues
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22 Impact of Alcohol Use Disorder on Executive Functioning in an Alzheimer's Sample

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Objective: Existing literature suggests that individuals with Alcohol Use Disorder (AUD) are prone to neuropsychological deficits, particularly in executive functioning. AUD is a reported risk factor for development and severity of Alzheimer's Disease (AD), and alcohol and AD share similarities on effects on cognition and brain biochemistry. Executive functioning deficits are also common in AD. The severity of these deficits has not been examined in a population of AD with and without an AUD to examine possible compounding effects of impairment. This study aims to determine the neuropsychological consequences, specifically in executive functioning, of the presence of an AUD in an Alzheimer's sample. We hypothesized that individuals with AD and an AUD would demonstrate more severe executive functioning impairment than individuals with AD alone.
Participants and Methods: Archival data from the National Alzheimer's Coordinating Center (NACC) longitudinal Uniform Data Set Version 3 was utilized in the present study. Participant recruitment (n = 6886) was conducted from subjects in the National Institute on Aging's ADC Program in the United States. Measures included Trail Making Test B, Digit Symbol Modalities (SDMT), Digit Span Backwards, and subtests from the Montreal Cognitive Assessment (MoCA) (i.e., trail making test, cube, and clock-drawing). The analytic approach was to determine whether neuropsychological

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test scores are different in individuals with (n=31) and without (n=3513) a diagnosis of AUD in the Alzheimer's sample using an analysis of variance (ANOVA) test. Post-hoc analyses were performed for significant ANOVA coefficients. **Results:** Results indicated that individuals with AD and AUD had significantly different scores than individuals with AD alone on all examined measures of executive functioning. Significant differences were observed on Trail Making Test B total number of seconds to complete, number of commission errors, and number of correct lines, and Digit Span Backwards trials correct and digit span length. Further, significant differences between groups were observed on SDMT scores and on MoCA trails, cube, clock contour, clock numbers, and clock hands scores. Post-hoc analyses indicated that individuals with comorbid AUD and AD had lower scores than those in the Alzheimer's sample without an AUD. **Conclusions:** The global burden of both AUD and AD is increasing. Results suggest that individuals with comorbid AUD and AD have more severe deficits in executive functioning than those without AUD in the Alzheimer's sample. Individuals with AD and a significant drinking history should be assessed with a comprehensive neuropsychological battery to understand the severity of deficits, which may be worse than average individuals with AD at similar stages in terms of functioning and safety. Further, if AD is suspected in individuals entering AUD treatment, testing would be warranted to determine if the individual has the cognitive capacity to benefit from traditional psychosocial treatments. Providers should assess severity of deficits at treatment entry to consider an individual's ability to comprehend, learn, and integrate psychosocial treatment. Cognitive rehabilitation strategies should be incorporated into psychosocial treatment plans to improve efficacy of interventions, individualized care, and treatment outcomes.
Keywords: alcohol**,** executive functions

23 Parity is Associated with Decreased Later-Life Mental Status but not Specific Cognitive Abilities

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Objective: The literature has yielded conflicting results regarding the association between parity and later-life cognitive functioning. The majority of studies have been limited by the use of the Mini-Mental Status Exam (MMSE) to measure cognition, and have not examined potential associations with more specific cognitive abilities. Moreover, there has been little consideration of how socioeconomic status (SES) variables may mediate the parity and cognition relationship. In separate work by our group (Giudicessi et al) we have shown that associations between parity and measures of processing speed, verbal fluency, and episodic memory are mediated by SES factors. The present study aimed to replicate and extend this finding across a broader array of cognitive abilities as well as overall mental status. **Participants and Methods:** Data were utilized from cognitively normal, post-menopausal women from the Wisconsin Registry for Alzheimer's Prevention study (N = 834, mean age = 66.5, SD = 6.5 years). All women self-reported detailed reproductive history data including age of menarche and menopause, number of pregnancies, and number of children. Cognition and mental status were assessed by the WMS-R Logical Memory test, Trails A and B, WAIS-III Digit Span, Rey Auditory Verbal Learning Test (AVLT), and the MMSE. Multiple regression models were used to assess the relationship between performance on each task and parity (defined as a categorical variable with five levels 0, 1, 2, 3, and 4 or more children). All models were adjusted for age, APOE-e4 status, marital status, depressive symptoms, BMI, smoking status, years since menopause, age of menarche, and other health factors (e.g., history of hypertension, congestive heart failure). Years

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of education and total household income were used as proxies for SES.
Results: Having four or more children was negatively associated with lower scores on the logical memory, immediate and delayed conditions (ß=-2.21 to -1.10, p=0.03 to 0.04) while having three children was associated with lower digit span scores (ß= -0.91 p=0.03). However, none of the previous associations were significant after including SES factors in the model. Performance on the trail making test and AVLT were not significantly associated with parity, with or without accounting for SES. Compared to nulliparity, having four or more children was negatively associated with MMSE scores (ß= -0.02 p<0.001), and remained significant after accounting for SES (ß=-0.01, p=0.04).
Conclusions: We found that greater parity was specifically associated with poorer verbal memory, attention/working memory, and global cognition. Whereas the associations between parity and specific cognitive abilities were no longer significant after adjusting for SES, the association between parity and global cognition was sustained after adjustment for SES. Our results highlight the importance of accounting for social determinants of health when examining the relationship between parity and later-life cognition and suggest that the lower SES associated with greater parity may account for negative associations between parity and specific cognitive abilities.
Keywords: cognitive functioning**,** dementia - Alzheimer's disease

24 The Impact of Prospective Memory on Everyday Problem Solving in Mild Cognitive Impairment and Alzheimer's Disease

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Objective: Prospective memory is the ability to execute a planned action in the future. Prospective memory becomes increasingly impaired in the Alzheimer's disease (AD) process but remains important for performing activities of daily living (ADLs). The Everyday Problems Test (EPT) is an ADL measure that examines real-world problem solving ability. In this study, we examined whether two subtypes of prospective memory predict EPT performance in healthy aging, mild cognitive impairment (MCI), and AD.
Participants and Methods: Participants included healthy older controls (N=58), persons with MCI (N=65), and individuals with AD (N=18). To assess simple prospective memory, all participants were instructed that they should request a pill after completing each neuropsychological measure. To assess complex prospective memory, the number of pills requested depended on the type of test performed. EPT performance was measured using the total number of correct responses and completion time.
Results: ANOVAs revealed group differences in both EPT accuracy and completion time, with healthy controls scoring the best, followed by individuals with MCI, who were followed by individuals with AD. Regression analyses revealed that simple and complex prospective memory were not predictive of EPT accuracy or completion time in any group.
Conclusions: Our findings indicated that all groups significantly differed in real-world problem solving ability. Healthy older adults were most accurate and quickest to complete problem-solving ADLs. Simple and complex prospective memory did not predict problem-solving based ADL performance. This suggests that in older adults with mild cognitive difficulties, the ability to execute planned actions in the future does not impact problem solving skills. Overall, the pattern of performances reflects the AD continuum. Assessing prospective memory in those experiencing early cognitive symptoms is informative and can have real-world implications.
Keywords: memory: prospective**,** aging disorders**,** everyday functioning

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25 Neuropsychiatric Symptoms and APOE, but Not Sex, Predict Alzheimer's Disease Risk

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Objective: Neuropsychiatric symptoms (NPS) appear to predate cognitive decline in dementia. APOE e4 is known to increase risk for Alzheimer's disease (AD) and sex differences have been seen in AD risk and presentation (including incidence of neuropsychiatric symptoms). Few studies have examined the potential interactions between NPS and APOE to predict AD risk and none have also examined the potential moderating effects of sex. The current analysis utilized only participants with normal cognition at baseline, accounted for demographic variables, and examined the effects and possible interactions of NPS, APOE, and sex on risk of AD diagnosis.
Participants and Methods: Longitudinal data were drawn from the National Alzheimer's Coordinating Center (NACC) based on the following inclusion criteria: aged 50 or older; 2-10 visits over 2005-2017; at least three years of follow-up; normal cognition at baseline; and completion of relevant measures. Of this sample, 416 were diagnosed with AD during follow-up and 3832 retained normal cognition at all visits (total *N*=4248; 68% female, 84% White (non-Hispanic), 5% Hispanic/Latino, and 32% APOE e4 carriers). Mean baseline age was 71.1 years (*SD*=9.0); education, 15.8 years; length of follow-up data, 6.2 years.
Measures used included self-reported demographics (age, sex, years of education, and race/ethnicity), baseline Neuropsychiatric Inventory-Questionnaire (NPI-Q), Mini-Mental State Examination (MMSE), and clinical diagnosis.
NPS were operationalized as total NPI-Q score and domains of agitation/aggression, mood, frontal, and psychosis, by summing relevant items into domains. Separate survival analyses were used to examine risk of AD diagnosis for NPS total score and domains. Predictors were added in a stepwise fashion: NPS, APOE status, and sex; education, race, ethnicity, and baseline MMSE; interactions of NPS by APOE and NPS by sex; and a three-way interaction of NPS by sex by APOE.
Results: Total NPS and each domain of the NPI were related to increased risk of AD diagnosis at every step (all *p*'s<.001), with psychosis symptoms showing the highest risk. APOE e4 carriers were at higher risk for AD (*p*'s<.001). Sex did not independently predict incidence of AD. Only the frontal NPS domain (composite of apathy, euphoria, disinhibition, and irritability) showed an interaction with sex (*p*=.007), such that frontal symptoms showed a stronger predictive effect for men (*HR*=1.58) compared to women (*HR*=1.23). APOE did not interact with any symptom domain, and three-way interactions were nonsignificant.
Consistent with prior literature, lower MMSE scores at baseline were related to increased risk. Being White was also related to increased risk of AD diagnosis, contrary to most prior studies. Education and ethnicity were unrelated to AD risk.
Conclusions: Even in the presence of demographic factors and APOE, NPS predict risk of AD, showing that NPS may be an early sign of AD pathology before the onset of cognitive changes. Hallucinations and delusions may be a sensitive and specific warning sign, given their strong relationship to AD diagnosis and the low frequency of new psychosis symptoms in older adults.
Treatment and monitoring should be available for older adults with NPS for early detection of and intervention for behavioral and cognitive changes.
Keywords: neuropsychiatry**,** genetics**,** dementia - Alzheimer's disease
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26 The Distribution of Linguistic Metrics of Naturalistic Speech in Middle-Aged Adults Without Dementia Across Race/Ethnicity Groups

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Objective: Historically, neuropsychological measures have been biased and lack precision in identification of cognitive impairment when administered to Black and Latinx older adults. Linguistic markers of naturalistic speech may provide valuable information to identify early signs of cognitive decline since discrepancies in language production can be identified before behavioral symptoms of Alzheimer's disease occur. These linguistic metrics may have the potential to overcome some of the problems we have with our current neuropsychological tools when used among people from backgrounds that have traditionally been excluded from research. Examining differences in naturalistic speech among culturally diverse populations may lead to new diagnostic tools and more accessible testing methods. We investigated whether linguistic metrics extracted from samples of naturalistic speech differed across racial and ethnic groups.
Participants and Methods: Using general linear models, we analyzed the relationship between self-identified race/ethnicity group classification (non-Latinx White = 50, non-Latinx Black = 17, Latinx = 48) and 14 linguistic metrics extracted from naturalistic speech samples of middle-aged English-speaking individuals without dementia from the US-based ongoing prospective Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease. The linguistic metrics were: total number of words, filler words, empty words, lexical frequency, type-token ratio, Honoré's statistic, Brunet's index, definite articles, indefinite articles, pronouns, nouns, verbs, determiners, and content words. Models were adjusted for age (mean = 55.8±11.6), sex/gender (male=50, female = 65), and education (<high school (HS) = 5, HS = 19, >HS = 91). Multiple comparisons were corrected for using the Benjamini–Hochberg procedure with false discovery rate (FDR) = 10%.
Results: Non-Latinx Black (B=.290 [.064, .515], p=.012) and Latinx (B=.216 [.046, .387], p=.013) individuals on average used higher frequency words than non-Latinx White individuals. Latinx individuals had a lower Honoré's statistic (a measure of lexical richness) than non-Latinx White individuals (B=-1.159 [-2.115, -.163], p=.023) and used less fillers (B=-.208 [-.414, -.003], p=.047), with no difference between White and Black individuals (Honoré's statistic: B=-1.054 [-2.372, .264], p=.116; fillers: B=-.227 [-.498, .045], p=.101). However, none of these associations survived multiple comparison correction. Race/ethnicity did not relate differently to the other speech metrics.
Conclusions: Some of these lexical-semantic properties of spontaneous speech were differently distributed across race/ethnicity groups, but none of the relationships survived multiple comparison correction. These results suggest that linguistic metrics may be a less biased measure to evaluate early signs of cognitive decline than traditional neuropsychological assessments. Racial and ethnic differences in these linguistic metrics should be further deconstructed by also investigating the origins of the linguistic source data, e.g., a collection of spoken telephone conversations for lexical frequency. Since the power to detect relationships is limited by the sample's current size, particularly for the non-Latinx Black group, we intend to replicate these analyses as the cohort grows. Further evaluation is needed to determine the effects of race/ethnicity on linguistic metrics to help maximize their potential in improving neuropsychological measures that aim to detect early signs of cognitive impairment among both mid-life and late-life adults.
Keywords: semantic processing**,** dementia - Alzheimer's disease**,** cognitive processing

27 Associations Between Plasma Phosphorylated Tau and Domain-Based Cognition Across the Alzheimer's Disease Clinical Spectrum

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Objective: Novel blood-based biomarkers for Alzheimer's disease (AD) show potential for aiding diagnosis and tracking disease progression. Plasma phosphorylated tau181 (p-tau181) is one such biomarker and offers a high degree of sensitivity and specificity for AD pathology. Past studies show an association between plasma p-tau181 and memory and global cognition but its link with other cognitive domains and how these assocaitions differ across the cognitive spectrum is not well understood. Here, we examine how plasma p-tau181 relates to a comprehensive set of cognitive outcomes across the cognitive spectrum.
Participants and Methods: Data was obtained from the Alzheimer's Disease Neuroimaging Initiative (ADNI; (adni.loni.usc.edu). Participants (n=878, 73±7 years, 33% normal cognition (NC), 51% mild cognitive impairment (MCI), 16% dementia) completed baseline fasting venous blood draw for plasma p-tau181 quantification and comprehensive neuropsychological assessment. Plasma p-tau181 was measured on Simoa HD-X instruments (Quanterix; Palmqvist et al., 2021). Neuropsychological composite scores were calculated for the domains of memory, executive function (EF), language, and visuospatial abilities using item response theory. Linear regression models with ordinary least square estimates related plasma p-tau181 to each neuropsychological composite score. Models were adjusted for age, sex, education, cognitive diagnosis, and apolipoprotein (*APOE)*-e4 carrier status. Given the known changes in p-tau levels at different disease stages, a subsequent model evaluated *plasma p-tau181 x cognitive diagnosis* interactions on cognitive functioning.
Results: In main effects models, plasma p-tau181 was not associated with any neuropsychological composite scores (*p*-values>0.15). Cognitive diagnosis interacted with plasma p-tau181 on memory ($p<0.001$), EF ($p=0.006$), and language ($p=0.02$) composite scores, but not on visuospatial composite score ($p=0.39$). In stratified analyses, higher plasma p-tau181 was associated with worse memory composite scores in individuals with MCI (b=-0.25, $p<0.001$) but not those with dementia ($p=0.91$), while higher p-tau181 scores were associated with better memory performance in participants with NC (b=0.12, $p=0.03$). Higher plasma p-tau181 was associated with worse EF performance in participants with MCI (b=-0.11, $p=0.01$), but not in NC ($p=.24$) or dementia ($p=.08$). Likewise, higher plasma p-tau181 was associated with worse language performance in participants with MCI (b=-0.15, $p=0.001$), but not in NC ($p=0.16$) or dementia ($p=0.14$).
Conclusions: Plasma p-tau181 appears differentially associated with cognition across disease states, with robust associations noted across multiple cognitive domains in MCI, including areas of cognition most often affected at this stage of the disease. Surpisingly, p-tau181 was associated with better memory scores in NC and was unrelated to any cognitive domain in dementia. The lack of association in dementia could be related to lack of variability in both plasma p-tau181 levels and cognition. The counterntuitve finding in NC warrants further research to understand the evolution of this biomarker across the spectrum of AD.
Keywords: dementia - Alzheimer's disease

28 A Practical Clinical Procedural Memory Task Assessed in Patients with Amnestic Mild Cognitive Impairment and Probable Alzheimer's Disease.

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Objective: Procedural memory has been shown to be preserved in patients with Alzheimer's disease (AD) even as declines in episodic memory are apparent. While procedural memory can add to an understanding of patients' functional abilities, procedural learning and retention tasks are often not administered as part of standard clinical neuropsychological

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assessments given limitations, such as time constraints and difficulty of experimental tasks. The aim of this study was to assess a novel procedural learning and retention task that modified a readily available neuropsychological assessment measure, the Trail Making Test (TMT), within a clinical sample of patients with Amnestic Mild Cognitive Impairment (aMCI) and probable AD. We hypothesized that patients' procedural learning and retention would be relatively preserved compared to episodic learning and retention.
Participants and Methods: Participants were 40 patients seen consecutively in an interdisciplinary memory disorders clinic within an academic medical center and 26 healthy controls (HC). The clinical group was comprised of patients with probable AD (n=26) or aMCI; (n=14). Diagnoses were determined based on National Institute on Aging-Alzheimer's Association Criteria following comprehensive neuropsychological assessment, neuroimaging, and consensus agreement between multidisciplinary team members. There were no significant differences in age or education between groups (M_{age}=71.33; $M_{education}$=14.88 years). As expected, general cognitive abilities differed as a function of disease severity (M_{MMSE} for HC, 29.12 > aMCI, 27.79 > AD, 22.81). Part A of the TMT (TMT-A) from the Halstead-Reitan Neuropsychological Battery was repeatedly administered over five trials. After a 30-minute delay, the patient completed the TMT-A task again. The number of seconds to complete each trial was the primary variable of interest for procedural learning and retention. To measure episodic learning and retention, the California Verbal Learning Test-II Short Form (CVLT-II SF) was administered with the number of words recalled across four learning trials and delayed free recall being the primary variables of interest. Standard learning and retention scores were calculated for both tasks.
Results: A one-way MANOVA revealed a statistically significant difference between the three groups on the combined dependent variables (i.e., CVLT-II SF learning, CVLT-II SF retention, TMT learning and TMT retention), $F(8, 120) = 12.06$, $p < .001$, Wilks' $\Lambda = .307$, partial $\eta^2 = .446$. Follow-up ANOVAs revealed a significant main effect of group on episodic learning, HC (M=16.43) > AD (M=8.82) = aMCI (M=11.38), and episodic retention, HC (M=86.20) > aMCI (M=58.84) > AD (M=10.64). In addition, while a significant main effect of group on procedural learning was observed, HC (M=12.01) > AD (M=7.92) = aMCI (M=9.66), there was no main effect of group on procedural retention, HC (M=90.79) = aMCI (M=90.91) = AD (M=81.96).
Conclusions: Procedural learning and retention was relatively preserved in patients with aMCI and probable AD within the current study as measured by a modification of the TMT, a commonly used clinical measure. TMT is easily administered with this modification in the clinical setting and can provide a means of assessing an ability not typically documented during standard neuropsychological assessments.
Keywords: dementia - Alzheimer's disease**,** mild cognitive impairment**,** neuropsychological assessment
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29 Identifying Cell Signatures Correlated with Alzheimer's Disease Pathology and Dementia

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Objective: Whereas recent large cohort studies have identified multiple genetic and other risk factors for Alzheimer's Disease (AD), the effects of these risk factors on cell type composition in the brain are still under-explored. In this study, we integrated and re-analyzed publicly available single-nucleus RNA-seq (snRNA-seq) data from tissue extracted from the dorsolateral prefrontal cortex DLPFC of individuals from the Religious Orders Study (ROS) and the Memory and Aging Project (MAP) cohorts from Rush to investigate cell type-specific differences in individuals with

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and without a diagnosis of AD. For each individual, separate diagnoses of AD pathology and AD dementia were performed. Here, we investigated which cellular subtypes had significant associations in their overall proportions to AD pathology, dementia, or both. Ultimately, identifying these signatures in patients with AD provides insight into the intersections between the disease's molecular, cellular, and clinical components.
Participants and Methods: We re-analyzed existing single-nucleus RNA sequencing data from 99 individuals who varied in their diagnoses of AD dementia and AD pathology. We clustered nuclei into cell types and subtypes, including subdivisions of microglia, astrocytes, oligodendrocytes, and oligodendrocyte progenitor cells (OPCs). For each of these groups, we further divided nuclei subclusters; we also found gene expression markers that define certain subclusters in each cell group. Next, using the Wilcoxon rank-sum test, we looked for statistical differences ($p < 0.05$) in the proportion of each subcluster in individuals with and without AD pathology (condition 1), with and without AD dementia (condition 2), and both pathology and dementia together (condition 3). We corrected for multiple comparisons using the Benjamini-Hochberg False Discovery Rate Procedure.
Results: We found that most putative cell subtypes had unique combinations of gene expression markers, with some subclusters having more defined markers than others; a minority of groups did not have a clear marker. Our results suggest that the microglia subcluster 1 had higher proportions in condition 3 (individuals with AD pathology and dementia as compared to healthy controls, $p = 0.04041$). Similarly, the microglia subcluster marked by expression of the FCGBP gene showed higher proportions in condition 3 ($p = 0.03361$). The astrocyte subcluster marked by depression of the CHI3L1 gene had lower proportions in condition 2 ($p = 0.02378$) and condition 3 ($p = 0.04041$).The oligodendrocyte subcluster marked by expression of the CHRM5 gene showed lower proportions in condition 2 ($p = 0.02378$) and condition 3 ($p = 0.02378$). Finally, the OPC subcluster marked by expression of the PMP2 gene showed a decrease in cell proportion in conditions 1 ($p = 0.02378$) and 3 ($p = 0.02378$).
Conclusions: Our study finds associations between cell subclusters and their corresponding proportions among individuals with and without pathological and clinical manifestations of AD. This sets the stage for potential cell-type-specific modulations as therapeutic options for the disease. For example, we can examine significant subclusters and their markers to identify potentially targetable membrane receptors for that type. Thus, characterizing cell-type-specific changes and their associations with the disease is a key step towards targeted approaches to potentially delay disease onset, slow progression, and treat symptoms.
Keywords: genetic neuropsychology**,** naming**,** frontal lobes
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30 Inflammatory Biomarker S100B Predicts Conversion to Mild Cognitive Impairment and Alzheimer's Disease At Two Years Later

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Objective: Alzheimer's disease (AD) is a progressive neurodegenerative disease that places an epic burden on families, caregivers, and healthcare systems. With the projected rapid increase in cases in upcoming years, there is an urgent need to determine mechanisms and therapeutic targets to delay dementia onset. S100B is a calcium-binding protein that acts as a proinflammatory cytokine and has shown to be elevated among patients already diagnosed with AD. However, it is unknown whether S100B levels can predict future AD onset. The purpose of this study was to examine the relationship between S100B levels and conversion to AD, as well as further explore its relationship with diagnostic status in a deeply characterized sample of older adults.
Participants and Methods: Participants included 294 older adults (56-89 years, *M* =

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75.11 years, 117 females, 278 White, Non-Hispanic/Latino) from the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort categorized as cognitively normal (CN), mild cognitive impairment (MCI), or AD at the baseline visit. S100B levels at baseline were measured via cerebrospinal fluid. Logistic regressions were used to assess the relationship between S100B and diagnostic category at baseline, as well as S100B and conversion to MCI or AD at subsequent visits (i.e., 12-, 24-, and 36-month follow-up visits).
Results: Participants with a baseline diagnosis of AD (*M* = 0.449ng/ml) had higher levels of S100B than those in the MCI (*M* = 0.434ng/ml) and CN (*M* = 0.409ng/ml) groups. Although S100B levels did not predict conversion to MCI or AD at 12 months, S100B did predict conversion to MCI and AD at 24 months (*P* = 0.028; OR =1.53) and 36 months (*P* = 0.0019; OR =1.86).
Conclusions: Higher S100B levels at baseline predict conversion to MCI or AD at 24 and 36 months, suggesting that it may be a useful biomarker to determine future risk for conversion to dementia. S100B is known to have neurotoxic effects at higher levels and instigate inflammation. Higher levels of S100B are damaging due to their proinflammatory properties, which could influence or lead to conversion to AD.
Keywords: dementia - Alzheimer's disease
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31 Does Physical Activity Moderate the Association Between Cardiovascular Burden and Cognition?

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Objective: There is strong evidence that increase cardiovascular burden (CVB) is associated with faster decline in cognition and brain aging. Physical activity (PA) mitigates cognitive decline and the risk for dementia. However, very few studies have investigated the moderation effect of PA and on the relationship between CVB and cognition. Furthermore, there are mixed results on whether PA is a protective factor for cognition among carriers of apolipoprotein ε4 (APOE-ε4), a genetic risk factor for both cardiovascular diseases and Alzheimer's disease. We examined (1) whether PA moderates the relationship between CVB and cognition in a multiethnic cohort, and (2) whether the moderating effect of PA on the relationship between CVB and cognition differs by APOE-ε4 status.
Participants and Methods: A total of 2122 older individuals without dementia from the Washington Heights-Inwood Columbia Aging Project was selected for this study. Each participant underwent a structured in-person interview including an assessment of health and a neuropsychological assessment for global cognition, memory, language, visuospatial, and speed functioning. CVB was calculated as the sum of 6 dichotomous variables measuring presence or absence of clinical stroke, hypertension, dyslipidemia, diabetes, obesity, and heart diseases, which were assessed based on available information from self-reported questionnaires, medication use, measured height and weight, and blood tests. Total PA was measured using a self-reported Godin Leisure Time Exercise Questionnaire and was operationalized as none, low to moderate, and high amounts of total PA. Generalized linear modeling (GLM) was used to examine the main effect between CVB and cognitive z-scores. The moderation effect of PA on the association between CVB and cognitive performance was tested by adding the 2-way interaction term of 'CVB × PA' into the model. Finally, three-way interactions were tested by adding the 'CVB × PA × *APOE*-ε4' term to the models. The models were adjusted for age, sex, race, education,

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cohort wave, *APOE*-ε4, smoking, Mediterranean diet, and depression.
Results: Heavier CVB (range: 0-6, higher score indicating more burden) was associated with lower global cognition (coefficient (β)=-0.038, p<0.001), language (β=-0.051, p<0.001), speed (β=-0.052, p=0.003), and visuospatial (β=-0.039, p<0.001) scores, but not memory scores (β=-0.019, p=0.296). Greater LTPA (range: low, middle, high amounts of total physical activity) was associated with higher global cognition (p<0.001), language (p<0.001), speed (p<0.001), and visual-spatial scores (p=0.004), but not memory scores (p=0.798). The inverse association between CVB and visuospatial scores was stronger among participants with middle-level PA compared with those with no PA (p-interaction=0.043), but not for other cognitive functions (2-way interaction p>0.05). Furthermore, the moderation effects by LTPA on the association of CVB with global cognition, language, and visuospatial functions were stronger among the APOE-ε4 carriers compared with the non-carriers (3-way interaction p <0.05).
Conclusions: More CVB is associated with lower cognitive scores and greater PA is associated with higher cognitive scores. PA moderates the relationship of CVB and visuospatial function, but the moderation effect were not significant with other cognitive functions. PA may serve as a cognitive reserve factor to mitigate the detrimental effect of CVB on cognition. Compared with APOE-ε4 non-carriers, APOE-ε4 carriers had stronger PA modification effects on the relationship of CVB with global cognition, language, and visuospatial functions.
Keywords: apolipoprotein E**,** cardiovascular disease**,** diversity
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32 Platelet-Derived Growth Factor-BB and White Matter Hyperintensity Burden in APOE4 Carriers

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Objective: The apolipoprotein-e4 (APOE4) gene increases risk for developing late-onset Alzheimer's disease (AD) and has been linked to increased microvascular dysfunction, including pericyte degeneration and blood-brain barrier breakdown. Platelet-Derived Growth Factor-BB (PDGF-BB) is a glycoprotein involved in blood-brain barrier and pericyte maintenance. Increased PDGF-BB levels have been reported in white matter in AD brain tissue. However, the association between circulating levels of PDGF-BB and cerebral white matter damage in older adults remains unknown. We aimed to investigate this association and examine whether the association varies by APOE4 carrier status.
Participants and Methods: Participants included community-dwelling older adults (age range 55-90 years, M = 73.1 years; SD = 7.5; 60.9% male) from the Alzheimer's Disease Neuroimaging Initiative (ADNI) with characterization of plasma PDGF-BB, white matter hyperintensity (WMH) volume and APOE4 status (N = 64). Plasma samples from the ADNI cohort were analyzed using multiplex immunoassay panel, which yielded levels of PDGF-BB. Total WMH was determined based on the ADNI protocol to detect and quantify WMH using FLAIR and T2- weighted structural magnetic resonance (MR) images of the brain. Linear regression analyses examined the relationship between plasma PDGF-BB levels and WMH volume, adjusting for demographics and stratifying by APOE4 status. We further examined the relationship between verbal memory—as assessed by Rey Auditory Verbal Learning Test (RAVLT)—and PDGF-BB, adjusting for age and education, and stratified by APOE4 status.
Results: Greater levels of circulating PDGF-BB were related to greater WMH volume, even after accounting for age, sex, intracranial volume (ICV),and APOE4 carrier status (p = .040). Nineteen (29.2%) participants were APOE4 carriers, and all participants were either cognitively normal (n = 18) or had mild cognitive impairment (n = 46) at baseline study visit. When stratified by APOE4 status, the relationship between PDGF-BB levels and WMH volume was only significant for APOE4 carriers (p = .007), but not non-carriers (p = .448), after

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adjusting for age, sex and ICV. There was no association between PDGF-BB levels and RAVLT scores in APOE4 non-carriers. However, in APOE4 carriers, higher PDGF-BB levels were associated with lower RAVLT immediate (p = .006) and learning (p = .002) scores, adjusting for age and education.
Conclusions: These findings reveal a differential relationship between PDGF-BB levels and WMH volume as well as verbal memory for APOE4 carriers versus non-carriers. The APOE4 variant leads to accelerated cerebrovascular injury and cognitive decline. The mechanism by which PDGF-BB levels are related to white matter tissue injury and cognition remains unknown, however elevated levels of PDGF-BB in carriers may suggest a role for pericytes and blood-brain barrier dysfunction in white matter damage, vascular cognitive impairment and AD. Additional studies will elucidate the role of PDGF ligands and receptors in these conditions.
Keywords: apolipoprotein E**,** cerebrovascular disease**,** neuroimaging: structural

33 Improving the Identification of Diagnostic Conversion and Amyloid Status in Community-Dwelling Older Adults.

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Objective: Accurate identification and prediction of patients with cognitive impairment is often not achievable in a standard annual wellness visit. This study investigates the incremental value of easily obtained measures of clinical symptoms and biomarker status beyond a standard cognitive screening measure in predicting cognitive status and amyloid positivity in community dwelling older adults.
Participants and Methods: Vanderbilt Memory and Aging Project participants (n=288, 73±7 years, 42% mild cognitive impairment (MCI), 31% amyloid-positive) completed the Montreal Cognitive Assessment (MoCA), self- and informant-report cognitive questionnaires, fasting venous blood draw, and fasting lumbar puncture at baseline. Plasma tau and neurofilament light (NfL) were quantified using Single molecule array technology. *Apolipoprotein* (*APOE)*-e4 positivity was defined as e2/e4, e3/e4, e4/e4 genotypes. Outcomes included amyloid positivity and diagnostic conversion. Amyloid positivity was determined with a widely used cutoff score from cerebrospinal fluid levels of amyloid-b_{1-42}. Cognitive and diagnostic conversion status was determined using the Clinical Dementia Rating (CDR), which was completed at baseline and serially at 18-month, 3-year, 5-year, and 7-year intervals (mean follow-up time = 4.5±1.0 years). Diagnostic conversion was defined as an increase in CDR global score from baseline to any follow-up visit. Hierarchical linear regressions related MoCA score to amyloid positivity and diagnostic conversion adjusting for age, sex, education, and race/ethnicity as a base model. The following predictors were entered individually to determine the incremental change in concordance index (CI) of the overall model: *APOE*-e4 positivity, plasma tau, plasma NfL, self- and informant-report versions of the Everyday Cognition (ECog), and the Vanderbilt subjective cognitive decline (SCD) questionnaire. Models were examined separately by baseline diagnosis (cognitively impaired (CU) and MCI).
Results: MoCA score and covariates predicted amyloid positivity in individuals with MCI (CI=0.70; p=0.04) but not CU individuals (p=0.44). Incremental value was noted for self-report SCD (CI=0.79; p<0.05) and *APOE*-e4 positivity (CI=0.81; p=0.006) in CU individuals. ECog informant-report (CI=0.81; p=0.003) and *APOE*-e4 positivity (CI=0.85; p<0.001) provided additional value in MCI. Notably, *APOE*-e4 positivity had the highest incremental value of all predictors on amyloid status: CU (CI_{change}=0.06; CI=0.81, MCI (CI_{change}=0.15; CI=0.85). With respect to diagnostic conversion, MoCA was not

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a significant predictor (*p*-values>0.15). However, ECog self-report (CI=0.90; *p*=0.006), self-report SCD (CI=0.89; *p*=0.01), and *APOE*-e4 positivity (CI=0.89; *p*=0.001) predicted diagnostic conversion in CU. All variables were predictive of diagnostic conversion in MCI (CIs>0.85; *p*-values<0.04), including plasma NfL (CI_{change}=0.06; CI=0.89) and tau (CI_{change}=0.02; CI=0.85). Notably, ECog self-report had the highest incremental value in CU (CI_{change}=0.08; CI=0.90) while ECog informant-report was highest in MCI (CI_{change}=0.08; CI=0.92).
Conclusions: Measures of SCD may provide important information in determining biomarker status and prognosis, with self-reports relevant in CU and informant-report in MCI. *APOE*-e4 positivity was the most robust predictor of biomarker and clinical progression, regardless of clinical status. Plasma markers of tau and neurodegeneration predicted prognosis only in MCI, highlighting the relevance of these markers in prodromal dementia. Taken together, results suggest that adding easily obtained clinical measures or biomarkers to the standard of care (MoCA) may improve diagnostic and prognostic accuracy among community-dwelling older adults free of clinical dementia.
Keywords: dementia - Alzheimer's disease
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34 Plasma Phosphorylated Tau is Associated with Informant-Reported Subjective Cognitive Decline in Older Adults.

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Objective: A novel blood-based biomarker of tau phosphorylated at threonine 181 (p-tau181) has shown great promise in detecting incipient Alzheimer's disease (AD) and is highly correlated with cerebrospinal fluid and positron emission tomography measures of pathological tau. While the biological significance of plasma p-tau181 has been well established, less is known about its ability to detect subtle changes to cognition. Subjective cognitive decline (SCD) is defined as complaints about ones' own or a loved one's cognitive state and is thought to be elevated, especially in the prodromal stage of AD. This study investigates the association between plasma p-tau181 and self- and informant-reported SCD in community dwelling older adults.
Participants and Methods: Data was obtained from the Alzheimer's Disease Neuroimaging Initiative (ADNI; adni.loni.usc.edu). Participants (n=1184, 74±8 years, 34% normal cognition (NC), 47% mild cognitive impairment (MCI), 18% dementia) completed fasting venous blood draw for plasma p-tau181 quantification and self- and informant-reported Everyday Cognition (ECog) questionnaires as a measure of SCD. Plasma p-tau181 in ADNI was measured on Simoa HD-X instruments (Quanterix; Palmqvist et al., 2021). Linear regression models with ordinary least square estimates related plasma p-tau181 to self- and informant-reported ECog. Models were adjusted for age, sex, education, cognitive diagnosis, and *apolipoprotein E* (*APOE)*-e4 carrier status. Given the known changes in p-tau levels at different disease stages, a subsequent model evaluated *plasma p-tau181 x cognitive diagnosis* interactions on self- and informant reported SCD.
Results: In main effects models, plasma p-tau181 was associated with informant- (*b*=0.16, *p*=0.004), but not self-reported SCD (*b*=0.05, *p*=0.29). Cognitive diagnosis interacted with plasma p-tau181 on both informant- and self-reported SCD (*p*-values<0.001). In stratified analyses, higher plasma p-tau181 was associated with greater informant-reported SCD in MCI (*b*=0.19, *p*=0.03) and dementia (*b*=0.49, *p*=0.02), but not CU (*b*=0.02, *p*=0.63). Plasma p-tau181 was not associated with self-reported SCD in any individual diagnostic group (*p*-values>0.16).
Conclusions: Among community dwelling older adults, plasma p-tau181 was associated with higher informant-reported SCD, with results primarily driven by individuals with MCI and dementia. Plasma p-tau181 may be less associated with subtle cognitive changes prior to the onset of objective cognitive impairment, regardless of the source of the cognitive

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concern. This lack of association could be driven by the SCD measure which may not be sensitive to early changes or may lack sufficient variability at this cognitively normal state. It is also possible the subtle changes are driven by other factors beyond AD pathology. However, results continue to confirm the importance of considering informant-reports with MCI individuals and provide further evidence for the sensitivity of plasma p-tau181 to AD-related clinical changes.

Keywords: self-report**,** dementia - Alzheimer's disease

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35 Vascular Contributions to Subjective Cognitive Decline in a Multiracial Community Cohort

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Objective: Subjective cognitive decline (SCD) is increasingly considered as a potential pre-clinical marker of Alzheimer's disease (AD) following various studies linking it to AD biomarkers such as amyloid-β and tau burden. Little research, however, has focused on the links between SCD and cerebrovascular contributions of cognitive impairment and AD. Cerebrovascular markers such as white matter hyperintensities (WMH) and infarcts are associated with cognitive impairment and increase the risk for dementia. Further, Non-Hispanic Black (NHB) and Hispanic/Latinx populations have increased risk for both cerebrovascular burden and dementia, highlighting the need to understand the role that such biomarkers play in SCD across multiracial cohorts. This study explored the associations of SCD with WMH and infarcts among NHB, Hispanic/Latinx, and Non-Hispanic White (NHW) participants.
Participants and Methods: A total of 1395 participants without dementia (495 NHB, 492 Hispanic/Latinx, 408 NHW; 871 females; with mean age 76.36 (SD = 6.29); and mean education 12.20 (SD = 4.53)) from the Washington Heights-Inwood Columbia Aging Project were selected. SCD was assessed using a yes or no 10-item memory complaint questionnaire (e.g., "Do you have any problems with your memory?") and objective cerebrovascular markers (via magnetic resonance imaging). WMH were acquired from T2-weighted fluid-attenuated inversion recovery (FLAIR) images and coded as the total volume sum of WMH. Infarcts were visually detected and coded as none or at least one present. Two separate linear regression models examined SCD (dependent variable) and WMH or infarcts (independent variables). Race, age, sex/gender, education, and a composite score of self-reported medical diagnosis (*i.e.,* hypertension, diabetes, etc.,) were used as covariates in all analyses.
Results: Participant's SCD mean report was 2.64 (SD = 2.45, range of 0-10). The mean total sum volume of WMH was 4.38 cm^3 (SD = 5.90). and 617 (44%) participants had at least one infarct. Results showed that increased WMH volume was associated with increased SCD (β =.036, CI = [.014, .057], p = .001). There was no association between infarcts and SCD (β = .093, CI = [-.167, .354], p = .482). However, being female, years of education, and increased medical diagnosis were associated with increased SCD (p < .05).
Conclusions: SCD was associated with WMH but not with infarcts. The current study suggests that small vessel disease should be furthered explored in combination with AD pathology. Thus, SCD and WMHs together may provide valuable information regarding risk for preclinical dementia in a multicultural cohort. Extending this work with longitudinal analyses may further illustrate the utility of SCD in detecting brain changes prior to the manifestation of objective cognitive decline associated with mild neurocognitive disorder and dementia.

Keywords: memory complaints**,** multiculturalism**,** neuroimaging: structural

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36 Race Moderates the Relationship Between Socioeconomic Status and Caregiver Burden and Distress

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Objective: Caregivers of persons with dementia (PWD) often report high levels of psychological distress and burden. Several studies have found African American caregivers often report less distress and burden than white caregivers (Cuellar, 2002; Haley et al, 2004). Other studies indicate ethnic minorities are more likely to receive informal support, provide more care, and are of lower socioeconomic status (SES) when compared to white caregivers (Pinquart & Sörensen, 2005). Our study aimed to expand upon the extant literature by examining the relationship between caregiver race, SES, and caregiver burden in a sample of urban community-dwelling caregiving dyads.
Participants and Methods: One hundred and nine dyads of caregivers (80.7% female, mean age 63.3(10.2)) and community-dwelling persons with dementia (55% female, mean age 78.8 (8.4)) with at least one hospitalization in the previous 12 months were enrolled in the Dementia Care Ecosystem program at a large Southeastern urban health system. Caregivers were assessed using the Zarit Burden Interview and the Neuropsychiatric Inventory (NPI). Household net worth and caregiver years of education were used to predict NPI Total Distress and Zarit total scores in multiple regressions. Race was then evaluated as a moderating variable.
Results: Net worth was not a significant predictor of NPI Total Distress Score (p=0.063), and caregiver educational attainment approached significance (p=0.085). However, the relationship between net worth and NPI distress score was moderated by race, with no differences at lower levels of net worth but Black subjects reporting lower distress scores with increasing net worth, and white subjects reporting higher distress scores. The overall model approached significance for predicting Zarit Total Score (p=0.084). Individually, caregiver education was a significant predictor of the Zarit (p=0.037) while net worth was not a significant predictor. Race was again a moderating variable, with Black subjects reporting lower overall caregiver burden at higher net worth brackets compared to white counterparts
Conclusions: The relationship between socioeconomic variables and caregiver burden and distress is moderated by race, with Black subjects reporting lower distress and burden with higher net worth. Their white counterparts, in contrast, report higher distress and burden as SES increases. This is consistent with some literature suggesting lower rates of distress among Black caregivers. Higher caregiver educational attainment was associated with higher levels of total caregiver burden for all subjects. These findings suggest intervention needs may vary based on both caregiver race and education.
Keywords: caregiver burden**,** dementia - Alzheimer's disease**,** ethnicity

37 Blood pressure and t-tau in Spinal Fluid are associated with memory difficulties.

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Objective: The aim of the study was to examine if systolic blood pressure (SBP), total-tau (t-tau), and beta amyloid (Aβ) in cerebral spinal fluid (CSF) were associated with the results on Consortium to Establish a Registry for Alzheimer's Disease Word List (CERAD-WL) immediate and delayed recall, and Mini Mental State Examination (MMSE),

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in “younger” elderly persons, controlling for age and sex.
Participants and Methods: We included 72 participants, mean age: 62.9 (SD 8.6, range 41-76) from a Norwegian memory clinic; 8 were diagnosed with subjective cognitive decline, 32 with Mild cognitive impairment, 30 with Alzheimer disease, and 2 with combined Alzheimer’s disease and vascular dementia. Data were examined in a standard multiple regression using the CERAD-WL immediate and delayed recall and MMSE as dependent variables; and SBP, t-tau, and Aβ as independent variables, in three different analyses, controlling for age and sex.
Results: The strongest associations were found for CERAD-WL delayed recall. Standardized Beta was -0.313 (p = 0.004) for t-tau and -0.238 (p = 0.01) for SBP, explaining 45% of the variance in delayed recall of CERAD-WL. Dependent variables CERAD-WL immediate recall and MMSE yielded similar findings, but explained variance was poorer for these two variables.
Conclusions: Both elevated SBP and t-tau were associated with poorer cognitive performance, especially delayed recall. Those on cardiovascular medication were more impaired than were participants who were not on this medication —a finding that probably reflected cerebral incidents in the medicated group.
Keywords: dementia - Alzheimer's disease**,** memory complaints**,** memory complaints

38 Is Sex a Risk Factor for Cognitive Impairments?

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Objective: To investigate if and how sex affects the risk of developing mild cognitive impairment (MCI) or dementia using the data from the National Alzheimer's Coordinating Center (NACC).

Participants and Methods: Participants included in the current study were chosen from the NACC database who met the following three criteria: 1) who were evaluated between 06/09/2005 and 08/14/2016 as part of the Uniform Data Set (UDS); 2) who did not have a diagnosis of dementia at the baseline; 3) who had at least one follow-up visit. In total, there are 8,467 participants, of which 2,868 are males and 5,599 are females.

Data analysis was performed to compare the incidence, prevalence, and mortality rate between male and female sexes. Specifically, a Cox proportional hazards model was used to investigate how sex affects the risk of developing cognitive impairments in a follow-up period of more than 10 years.

Results: During a follow-up period of more than 10 years, male participants had a slightly higher incidence than female participants for either MCI or dementia. Moreover, the higher risk seen in male participants for MCI was also for MCI subtypes. Not surprisingly, a higher prevalence was also observed in male than female participants for either MCI or dementia. In this study sample, both sexes had comparable lifespan in years but male participants had a higher mortality rate than their female counterparts.
Conclusions: The male sex has been observed for associating with a higher risk of developing cognitive impairments along the aging process.
Keywords: mild cognitive impairment**,** dementia - other cortical**,** aging disorders

39 Experiences of Cognitive, Language and Personality Changes in Frontotemporal Dementia: Results from the FTD Insights Survey

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Objective: Frontotemporal dementia (FTD) is a progressive neurodegenerative disorder. The behavioral variant of FTD (bvFTD) is characterized by profound personality and behavioral changes, and the language variants of FTD, known as primary progressive aphasia (PPA), are typified by predominant language dysfunction. However, there is significant overlap in the features present in bvFTD and PPA. The experiences of these symptoms, from the perspective of diagnosed individuals and their care partners, can provide valuable information to optimize patient care. The current study draws on the results of a large survey completed by individuals diagnosed with FTD, as well as their care partners, to investigate symptom experiences across the domains of cognition, language, and personality.
Participants and Methods: In October 2020, 1241 participants, including individuals diagnosed with FTD or a related disorder, as well as biological relatives and care partners of diagnosed individuals, completed the FTD Insights Survey, administered and curated by the FTD Disorders Registry. This included 94 individuals diagnosed with bvFTD (*n*=62) and PPA (*n*=32), and 385 care partners of patients with mild/moderate bvFTD (*n*=276) or mild/moderate PPA (*n*=109). Frequencies of symptom reports in bvFTD and PPA were calculated, including memory problems (e.g., remembering recent events), deficits in thinking skills (e.g., problem solving, attention), language dysfunction (e.g., word finding difficulties), and personality or relationship problems (e.g., lack of motivation, not getting along with others).
Results: "Thinking" was the domain most affected in bvFTD, with 92% of participants endorsing some degree of dysfunction. In both bvFTD and PPA, the two most common thinking complaints were difficulties with decision making/judgment (84% in bvFTD, 68% in PPA) and problem solving (78% in bvFTD, 68% in PPA). "Language" was the domain most affected in PPA (99%), though language deficits were also frequently reported in bvFTD (70%). Difficulty finding the right word was the most common language complaint, and almost equally endorsed across the two disorders (66% in PPA, 61% in bvFTD). The second most common language problem in bvFTD was understanding long sentences (42%), while in PPA it was speaking (59%). Memory problems were also reported (84% in bvFTD, 76% in PPA); however, poor memory for recent events was the most common memory complaint in bvFTD (73%) while in PPA it was trouble remembering the names of new people (58%). Finally, personality and relationship problems were more common in bvFTD than PPA, but endorsed in both disorders (90% in bvFTD, 50% in PPA). A lack of interest in activities was the most common personality/relationship problem in PPA (41%), and was also highly endorsed in bvFTD (72%). Not realizing the impact of behavior on others and lack of motivation were the two most common personality/relationship issues in bvFTD (both 74%).
Conclusions: Despite differences in the phenotype and diagnostic criteria for bvFTD and PPA, patients and caregivers living with these diagnoses report significant overlap in cognitive, language, and personality/relationship difficulties. Individuals affected by FTD and their care partners provide valuable insights into the experience of living with the disease, information that should be taken into to consideration by healthcare providers, as well as researchers and pharmaceutical companies in the process of clinical trial and drug development.
Keywords: self-report**,** dementia - other cortical

40 Two Diseases are Worse Than One: Mixed Alzheimer's and Lewy Body Dementia Pathology Contributes to Steeper Rate of Decline

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Objective: To investigate the global cognitive decline trajectories in autopsy confirmed participants with Alzheimer's disease (AD), "pure" Lewy body dementia (DLB), and mixed DLB and AD (DLB+) pathology.
Participants and Methods: Cognitive deficits and rates of progression attributable to DLB, AD,

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and DLB+ neuropathology were investigated in three groups of participants from the longitudinal cohort of the Knight Alzheimer's Disease Research Center at Washington University. Participants were recruited as being cognitive healthy (n = 444) and were followed longitudinally. Two hundred and twenty-nine participants were assigned autopsy-confirmed diagnoses of pure DLB (n = 15), AD (n = 130), and DLB+ (n = 84). Subjects completed an annual battery of twelve neuropsychological tests and a Global Factor score was recovered using confirmatory factor analysis. The current model was identical to previously published findings. Random effects models compared longitudinal rates of cognitive decline in each group.
Results: A piecewise model with accelerated slope after a sharp inflection point provided the best fit for each group. The optimal inflection point for which the Global Factor declined was at two years prior to dementia diagnosis in the AD and DLB+ groups, and at three years prior to dementia diagnosis for the pure DLB group. The DLB+ group had a lower Global Factor score in the two years preceding dementia diagnosis compared to the other two groups but demonstrated a similar rate of decline following the inflection point as compared to the AD group. The pure DLB group had a slower rate of decline.
Conclusions: Examination of profiles of longitudinal decline reveals the presence of cognitive deficits preceding clinical diagnosis of dementia in these groups by two to three years. The presence of comorbid DLB and AD contributes to greater impairment in global cognition preceding dementia diagnosis. Additionally, the DLB+ group showed steeper decline in global cognition over time as compared to the group with DLB alone. In conclusion, the accumulative effect of comorbid neuropathology resulted in greater impairment and accelerated decline than either AD or LBD pathology alone. Identifying early cognitive deficits in patients with suspected dual pathology may encourage earlier treatment planning in preparation for accelerated decline.
Keywords: dementia with Lewy bodies**,** dementia - Alzheimer's disease**,** cognitive course

41 Harsh Reality vs. Virtual Reality: An Explorative Review of Immersive Virtual Reality in People Living with Dementia

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Objective: The primary aim of this exploratory review was to examine the existing literature surrounding virtual reality and its use in people living with dementia (PLWD). Additional aims include a review of articles that examine virtual reality use for PLWD that exhibit neuropsychiatric symptoms of dementia (NPS). Feasibility, implementation, and practicality of use in older adults with dementia are addressed in this review as well.
Participants and Methods: Articles included in this abstract were chosen from the PubMed indexed article search. Article publication year ranged from 2018-2021. Key words included: dementia, virtual reality, older adults, and psychiatric behaviors.
Results: The countless uses of immersive virtual reality (iVR) continue to be uncovered and explored as technology advances. In the field of mental health, iVR has been studied as a tool for psychological assessments [1], an intervention to assist with screening for mild neurocognitive disorder (MND) [2,3], and as a means to assess for different types of dementia [4]. If iVR can be used as a way to assess MND, can it also be used as an intervention for its behavioral and psychological affects? Many studies have weighed in on the use of iVR with PLWD; however, few studies have conducted participant research on its use to reduce neuropsychiatric symptoms of dementia (NPS) within this population. Recent studies have considered the feasibility[5-7]; tailorability [7,8]; ability to alter mood [5-7]; and reduction of medication burden [6] that iVR can offer. It has been noted that the use of iVR is highly feasible with PLWD [5-7] and the applications can be tailored to one's preference [7,8]. In the studies examined, participants' overall mood was more

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positive [1] following iVR use and the presence of apathy was greatly reduced [6,7,9,10]. There were some participants who did display side effects from the use of iVR [5-7]. Overall, the majority of participants voiced enjoyment from engaging in the iVR applications [6,7]. In addition to researching the feasibility of iVR with a general population, it is also imperative to examine the importance of this intervention with both rural and minority populations. This area of study is currently limited.
Conclusions: iVR's repertoire continues to expand as researchers find new and adaptive ways to utilize this tool. The mental health field has examined the ways in which iVR can be used as an assessment tool for various psychological disorders. Others have examined how iVR can be used as an intervention for NPS of dementia exhibited by PLWD. The studies have shown promising results for the feasibility and utility of iVR for this purpose. Future studies will need to examine the feasibility of virtual reality in both rural and minority populations, as research is lacking in this area.
Keywords: aging disorders**,** technology**,** dementia - other cortical

42 Estimating the Probability of Alzheimer's Disease: a Regression Model Based on Brain Folds and Curvatures.

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Objective: Recently, studies have used binary logistic regression models to estimate the variables that have a significant contribution to clinical diagnoses (e.g., in multiple sclerosis, dementia, movement disorders). Most neuroimaging studies that focused on the predictive factors of Alzheimer's disease and mild cognitive impairment reported predominantly cortical components (thicknesses, area, volume). This work proposes to compare different predictive models to distinguish mild cognitive impairment and Alzheimer's disease based on demographic, neuropsychiatric and structural neuroimaging data.
Participants and Methods: 355 patients with mild cognitive impairment (MCI) and 175 patients with Alzheimer's disease (AD) were extracted from the Alzheimer's Disease Neuroimaging Initiative database. Each subject was assessed with a NeuroPsychiatric Inventory and underwent a 3T MRI. Statistical MRI data (cortical thicknesses, area, mean curvature, folding index and volumes) were obtained via FreeSurfer 7.1.1. Binary logistic regression models were performed with IBM Statistics SPSS 27.0 software with the clinical group as dependent variable and demographic, neuropsychiatric and neuroimaging data as covariates. For each model the characteristics of sensitivity, specificity, positive and negative predictive values, Yule's Q coefficient and Youden's index were qualitatively compared to determine the best predictive model.
Results: Among the different models tested and presented, the one with the best reliability characteristics included the variables of cortical folding and curvatures as well as volumes of subcortical gray matter nuclei (caudate, pallidum, putamen, hippocampus, amygdala) and subcortical spaces (ventricles, vessels). The final model shows that at the demographic level, only the MMSE score has an impact on the prediction of AD and at the neuropsychiatric level, the symptoms of depression, apathy, delusions and aberrant motor behaviors are significant. In terms of specific structures, the curvatures involved were essentially anterior (frontal, insular, cingulate) and the folds more diffuse (frontal, cingulate, temporal). This model had a specificity of 99%, sensitivity of 98%, positive and negative predictive values of 98 and 99% respectively. Yule's Q index and Youden's index indicated strong relationships between the variables considered and the diagnosis of AD.
Conclusions: Comparison of models based on different structural imaging features shows that 1) Cortical curvature and folding features seem to be more specific and sensitive than subcortical features and other cortical factors

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such as cortical thicknesss or areas, 2) Neuropsychiatric symptoms have a significative implication even if these implication seems less important than MRI factors or MMSE score, 3) the better model is a combination of demographic, neuropsychiatric and MRI factors. Further studies would be needed to understand the correlates of these features with biomarkers of Alzheimer's neurodegeneration (amyloid and tau burden). These data are further complemented by the establishment of models to reliably distinguish cognitively normal subjects from Mild Cognitive Impairment patients.
Keywords: neuroimaging: structural**,** neuropsychiatry**,** dementia - Alzheimer's disease

43 Subjective Cognitive Decline and Negative Mood: Not One in the Same

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Objective: Subjective Cognitive Decline (SCD) is increasingly accepted as one of the earliest stages of Alzheimer's disease (AD). However, SCD commonly associates with symptoms of depression and anxiety but inconsistently with markers of AD such as cognition. These reported associations have led to the concern that SCD may simply reflect mood disturbance. Recent work has revealed a bidirectional temporal order for SCD and depressive symptoms, such that in some cases SCD precedes mood disturbance. Yet, when SCD presents concurrently with mood disturbance uncertainty remains as to whether these two conditions reflect the same underlying construct. The utility of SCD as a marker of preclinical AD is inherently limited until this is better understood. This study sought to examine the underlying factor structure of SCD and mood disturbance.

Participants and Methods: The sample included a total of 150 older adults (73% Non-Hispanic White, 22% Black and 5% Hispanic; mean age = 72.84 (SD = 7.17); mean education = 16.25 (SD = 2.40)). SCD was measured using a 20-item, age-anchored questionnaire surveying memory and other cognitive abilities (e.g., "Do you have difficulty remembering things people tell you compared to others your age?"). Depressive symptoms were assessed via the Geriatric Depression Scale. Anxiety was measured by the Beck Anxiety Scale. Individual items were coded as present or absent for SCD, depressive and anxiety symptoms. Bivariate correlations were conducted between SCD, depression and anxiety total scores. Three principal component analyses were conducted to examine the possible shared factor structure of: 1) SCD and depressive symptoms; 2) SCD and anxiety symptoms; and 3) SCD, anxiety and depressive symptoms. Factors were selected based on visual inspection of scree plots. Items with loadings >.3 in the rotated varimax solution were interpreted as belonging to one factor.
Results: SCD was associated with depressive symptoms ($r = .29$, $p < .001$, CI [.12, .46]) and anxiety symptoms ($r = .39$, $p < .001$, CI [.24, .53]). The factor solution for SCD and depression items revealed three factors with SCD items loading on the first two factors and depression items on the third. Similarly, the factor solution for SCD and anxiety revealed three factors with SCD loading on the first two factors, and anxiety on the third. Finally, the factor solution for the model with all items (SCD, depression and anxiety) produced 3 main factors. Whilst SCD items alone loaded on the first two factors, a combination of anxiety and depression items only loaded on the third factor.
Conclusions: Building on recent work disentangling SCD from mood disturbance, results supported an independent underlying structure for SCD versus negative mood states including symptoms of anxiety and depression in this cohort. Whilst overall raw scores of SCD, anxiety and depressive symptoms were significantly associated, this study showed that their underlying structure is not one in the same. Future studies are needed to further understand the etiology of mood symptoms in preclinical stages of AD, and to clarify the extent to which

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they increase or decrease the predictive utility of SCD for AD.
Keywords: anxiety**,** depression**,** memory complaints

44 Longitudinal Genetic and Environmental Relationships Between Two Alzheimer's Disease Neuroimaging Signatures

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Objective: Composite scores of MRI-based morphometry in brain regions associated with Alzheimer's disease (AD) pathology have been developed to distinguish between early AD-related atrophy and normal age-associated brain changes. These composite scores, commonly termed 'AD signatures,' are associated with progression to mild cognitive impairment (MCI) and AD symptom severity. Recent evidence suggests that AD signatures based on diffusion MRI measures (such as gray matter mean diffusivity) may serve as earlier predictors of AD-related changes compared to signatures based on structural MRI measures (such as cortical thickness). However, the genetic and environmental influences on AD signatures over time, as well as the temporal relationship between AD signatures derived from different modalities, remain unexplored.
Participants and Methods: We analyzed data from 736 men from three waves of the Vietnam Era Twin Study of Aging (VETSA) with repeated MRI assessments between the ages of 51 and 73 years. Primary measures included two AD signatures: a gray matter mean diffusivity (MD) signature and a cortical thickness/volume signature. Biometrical genetic analyses were used to examine genetic and environmental influences on the measures, as well as the phenotypic and genetic relationships between measures over 12 years.
Results: Phenotypic correlations indicated that MD signatures predicted thickness/volume signatures over a decade later, but thickness/volume signatures had a weak relationship with future MD signatures. Within each signature, genetic correlations across time were high (0.77-0.98), suggesting most of the same genes are influencing each signature across these three timepoints in midlife and early old age.
Conclusions: Findings suggest that the predictive utility of these AD signatures can change as a function of age or disease state, such that the MD signature may capture very early, AD-related changes that are later reflected in the thickness/volume signature. Overall, results highlight the utility of gray matter MD signatures as very early AD-related neuroimaging biomarkers.
Keywords: neuroimaging: structural**,** genetics**,** mild cognitive impairment

45 Higher levels of trait mindfulness are associated with less amyloid, tau, cognitive decline, and brain atrophy in preclinical Alzheimer's disease

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Objective: Mindfulness refers to the ability to engage in non-judgmental awareness of the present moment. This psychological trait is gaining increased attention in both scientific and general public settings, given its association with an array of health benefits. While psychological traits such as depression, anxiety, and neuroticism have been associated with increased risk for Alzheimer's disease (AD), the potential protective benefit of 'positive' psychological factors, such as mindfulness, remains to be explored. Here, we examined the relationship between mindfulness and markers of AD (i.e., amyloid, tau, cognitive decline, and neurodegeneration) in the preclinical phase of the disease.
Participants and Methods: Two hundred and sixty-one cognitively normal older adults, including 124 with amyloid and tau-PET scans, were included from the PREVENT-AD cohort. All participants completed the Five Facet Mindfulness Questionnaire and a comprehensive neuropsychological battery across multiple time points. Multivariate partial least squares (PLS) analyses were used to examine the relationships between different facets of mindfulness (Observing, Describing, Acting with Awareness, Nonjudgment, and Nonreactivity), AD pathology (i.e., amyloid and tau), and longitudinal cognitive decline. Two hundred and fifty nine of the participants also underwent T1 structural MRI scanning. Whole-brain voxel-based morphometry analyses were employed to examine associations between trait mindfulness and grey matter volume.
Results: Multivariate PLS analyses revealed higher levels of mindful nonjudgment and nonreactivity to be associated with less amyloid deposition in temporoparietal and frontal cortices. Higher levels of mindful acting with awareness, describing, nonjudgment and nonreactivity were also related to less tau deposition in medial and lateral temporal regions. Finally, higher levels of mindful nonjudgment and describing were associated with less decline on measures of global cognition, attention, immediate and delayed memory, and visuospatial function. These multivariate relationships remained significant when additional psychological (depression, anxiety, stress, perseverative thinking and personality traits) and demographic (age, sex, education and APOE status) variables were included in analyses. Using voxel-based morphometry, higher levels of mindful nonjudgment were associated with increased grey matter volume across regions of the default mode, salience, and executive control networks. This included cortical midline regions (i.e., medial prefrontal and posterior cingulate cortices), anterior insula, and dorsolateral prefrontal cortex.
Conclusions: Higher levels of trait mindfulness were associated with less amyloid and tau pathology and less cognitive decline in the preclinical phase of AD, with distinct combinations of mindfulness facets differentially related to each of the AD markers. Higher levels of mindful nonjudgment were also associated with increased grey matter volume in brain regions previously implicated in the practice of mindfulness. These findings suggest that, in addition to its other established health benefits, mindfulness may represent an independent psychological protective factor for AD. Moreover, this study provides empirical support for the potential utility of mindfulness interventions in early AD, which represents an area of significant ongoing international research interest.
Keywords: dementia - Alzheimer's disease

46 Case Report: Longitudinal Data Using In-Person and Teleneuropsychology Services in a Spanish-Speaking Patient with Autoimmune Limbic Encephalitis.

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Objective: The COVID-19 pandemic forced the neuropsychology field to embrace evaluations conducted via telehealth, even though the literature around its clinical applications and validity remained scarce. We present the clinical case of a patient with stable, non-reversible cognitive deficits evaluated in 2016 (in-person)

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and 2020 (teleneuropsychology, using video and audio). The aim of this project is to compare results from both neuropsychological assessments, in order to assess the validity and performance of follow-up teleneuropsychological evaluations compared to in-person assessments.
Participants and Methods: The patient was a 50-year-old, monolingual Spanish-speaking, Mexican female with 14 years of education who had lived in the U.S. since 2005. The patient reported having worked in retail for a few years as an adult in addition to working at home raising her children. She had an established diagnosis of Autoimmune Limbic Encephalitis since 2015. Both evaluations (2016 and 2020) were completed by an English-speaking provider with assistance of a certified interpreter who was also trained and serving as a psychometrician. Both evaluations utilized tests and norms aligned with the patient's background. At the time of the 2020 evaluation, she was independent for activities of daily living (ADLs) but required assistance for instrumental ADLs (IADLs).
Results: In the in-person evaluation from 2016, the patient demonstrated normal ability to learn and recall a word list with repetition, but with deficient retention. She demonstrated deficient learning and retention of episodic material and deficient learning and retention of visual constructional material. This was in spite of normal attention and working memory. Processing speed was also generally normal, including divided attention/set shifting speed. Confrontation naming and word generation speed were good as well. Visual spatial and visual constructional abilities were intact, and motor skills were normal. In the telehealth evaluation in 2020, the patient was found to have low average general fund of knowledge, personal remote memory was preserved, and she was oriented to person and place, and partially oriented to time. As during the 2016 evaluation, she demonstrated a flat learning curve with deficient learning and recall of visual and verbal information. Span of attention was low average to borderline deficient while working memory was average. Confrontation naming, word generation speed, and language comprehension were good. Visuospatial skills, executive functions, and motor functions were also preserved.
Conclusions: Despite non-standard administration of neuropsychological tests propelled by the COVID-19 pandemic's modification to delivery of healthcare services, the evaluation conducted via telehealth concluded with similar results to the in-person assessment rendered in 2016. Teleneuropsychological evaluations may be an appropriate and valid tool for follow-up care and monitoring of certain patients, even those from diverse linguistic backgrounds when culturally responsible considerations are taken.
Keywords: teleneuropsychology**,** cross-cultural issues**,** encephalitis

47 Machine learning models to predict the outcome of traumatic brain injury

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Objective: Approximately 1.7 million people sustain a Traumatic Brain Injury (TBI) annually (Levin, Shum, & Chan, 2014). Many researchers have agreed that the heterogeneity and complexity of TBI brings a myriad of difficulties in developing effective treatments (Saatman et al., 2008). Recent studies have attempted to use different Machine Learning (ML) algorithm to either predict the outcome or classify TBI and help clinicians develop appropriate treatments (Abdelrahman et al., 2020; Hale et al., 2018; Tunthanathip & Oearsakul, 2021). When making clinical decisions under multiple uncertainties, clinicians need to evaluate treatment and recovery progression better, and allocate treatment resources and opportunities more efficiently. The current study applied both k-nearest neighbor and Naïve Bayes models for their predictability of the functional outcomes of TBI.
Participants and Methods: The current study used publicly available data published at PLOS One journal. PLOS journals "require authors to make all data necessary to replicate their study's findings publicly available without restriction at the time of publication (PLOS ONE: Accelerating

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the Publication of Peer-Reviewed Science, 2021, para. 1).” The original multicentered study enrolled 586 acute TBI patients and collected diverse common data elements (TBI-CDEs) across the study population, including imaging, genetics, and clinical outcomes (Nielson et al., 2017). A subset of 145 complete data points was selected for the current study. This subset includes complete Marshall CT score, Rotterdam CT scores at intake, GOSE overall score at 3 months follow-up, and outcome measures at 6 months follow-up. The 6 months follow-up measures include WAIS PSI composite score, CVLT short delay cued recall standard score, and CVLT long delay cued recall standard score. If either of the three scores were below two standard deviations, the outcome was labeled as “Below Normal Range”, otherwise it was labeled as “Normal Range”.

After data splitting, 70% of the data were used for training the ML models and the remaining 30% were used for testing the ML models. The training set was used to build and train both k-nearest neighbor and Naive Bayes prediction model in R programming environment with Marshall CT score, Rotterdam CT scores, and GOSE overall score at 3 months as predictors for the 6 months outcome as either “Below Normal Range” or “Normal Range”. The ML models were tested for the predictive performances by the testing dataset.
Results: A confusion matrix was used for prediction analysis. The result showed moderate accuracy (77.9%; 95% CI [0.66 - 0.8654]) in predicting 6 months outcome for the Naïve Bay model with 90.8% specificity. However, the sensitivity was low at 12.5% and area under the curve (AUC) was 0.4699. The k-nearest neighbor model only had less than 50% in accuracy.
Conclusions: ML is an interdisciplinary field focused on tackling pattern recognition problems and building predictive models to make data-driven decisions (Lo et al., 2019). Applications of ML techniques have revolutionized a number of industries. ML algorithms have the potential to develop screening tools that predict functional outcomes of pathology and help with treatment decision making. The current study shows that the Naïve Bay model seems more promising than the k-nearest neighbor model in predicting TBI outcome, however, more extensive testing with other ML models and a larger dataset is needed.
Keywords: brain injury, technology, transdisciplinary research

48 Closing the Gap: Increasing Access to Feedback in Pediatric Neuropsychology Through Tele-Neuropsychology

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Objective: Telehealth utilization has increased in response to the coronavirus pandemic of 2019 (COVID-19) and has the potential to remove barriers to access, especially for patients in rural areas. Feedback is a crucial component of pediatric neuropsychology evaluations. Attendance and engagement from multiple caregivers, however, can be challenging to capture in a traditional in-person visit model and could benefit from telehealth services. While recent research has begun to explore the advantages of telehealth in pediatric neuropsychology, there are many unknowns left to explore. The current study aims to 1) characterize attendees of pediatric neuropsychology telehealth feedbacks, and 2) examine how tele-neuropsychology influences travel-related burden for families.
Participants and Methods: Retrospective chart reviews were completed for patients seen for outpatient evaluation through a pediatric neuropsychology clinic at an academic medical center in rural New England between July 2020 and June 2021. Patients (n=139) ranged between 5-24 years of age (m=12.78 years) and primary diagnoses include neurodevelopmental disorders (n=58), epilepsy (n=20), psychiatric disorders (n=16), genetic/metabolic disorders (n=15), congenital disorders (n=12), traumatic brain injuries (n=10), hematology/oncology (n=4), and other neurological conditions (n=4). Access to telehealth feedback was assessed via the number of total attendees (e.g., caregivers

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and care team members) present and their physical locations during the appointment. Travel time and financial costs (e.g., gas) saved by conducting feedback through telehealth versus a separate in-person appointment were also calculated. Descriptive statistics were used to characterize the appointments.
Results: Of the 139 feedbacks conducted via telehealth, 81 (58%) had one caregiver, 58 (42%) had two caregivers, and 3 (2%) included community team members. Telehealth allowed for attendance from a variety of locations (home, n=121; work, n=14; hospital, n=1; other, n=11) with individuals attending from up to three separate locations (one location, n=128; two locations, n=9; three locations, n=2). By using telehealth for feedback instead of traveling to the hospital, patients and their families saved an estimated average of $79.18 in fuel costs (141.4 round trip miles), and a total of 156.99 minutes of travel time.
Conclusions: In the current study, 42% of telehealth feedback appointments involved multiple family and community team members. Participants were able to join these visits from a variety of physical locations, a feature not possible with in-person feedback sessions. This included parents joining feedback from their place of business, allowing missed work time to be negligible, potentially reducing both financial and situational stress. Telehealth is a promising option for delivering pediatric neuropsychology feedback, providing a feasible and patient-centered way to close the gaps caused by transportation and financial barriers to care in rural areas. A hybrid model of in-person testing and telehealth feedback sessions may be a viable combination for the future of pediatric neuropsychological evaluation.
Keywords: teleneuropsychology**,** pediatric neuropsychology**,** neuropsychological assessment
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49 Evaluating the Use of Telephone-Based Neurocognitive Tests over 6-Month Follow-Up

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Objective: Extending research on technology-assisted remote neurocognitive assessment is a critical step towards improving access to neuropsychological care among underserved populations. The current study examines the use of a telephone-based interactive voice response (IVR) neurocognitive assessment among older adults over a 6-month period.
Participants and Methods: Participants were 107 community-dwelling older adults (aged 65-88 years) recruited from the Stanford/VA Alzheimer's Disease Center. Baseline cognitive status was characterized by Clinical Dementia Ratings: cognitively normal (N=36), mild cognitive impairment (N=37), and mild dementia (N=34). All participants completed telephone-based IVR neurocognitive assessments once every 4 weeks for 24 weeks, which included nine tasks: temporal orientation, alphabetic translation, digit-sequence learning, immediate word recognition, delayed word recognition, directed key-pressing, auditory spatial relations, semantic comprehension, and backwards digit span (see Mundt et al., 2007 for details). Linear mixed effects models examined changes over time on each task by cognitive status, covarying for demographics. Average performance over time on each task was compared by cognitive status group using one-way ANOVA. Intraindividual variability on each task over time was also examined by first calculating the means of the squared successive differences (MSSDs) for each person on each task, then comparing average MSSDs by cognitive status groups using one-way ANOVA.
Results: There was a significant time by group interaction on the delayed word recognition task such that the mild dementia group had a steeper decline over time compared to the cognitively normal group (b = -0.074, p = 0.001). The effect of time did not differ by cognitive group on any other task (ps > 0.05). Among the entire sample, practice effects (i.e., improvements in performance over time) were found for auditory

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spatial relations (b = 0.050, p < 0.001) and backwards digit span (b = 0.041, p = 0.001). Average performance on each task differed significantly by cognitive group such that the cognitively normal group performed better than both cognitively impaired groups on all tasks (ps < 0.05). The cognitively impaired groups also showed significantly greater intraindividual variability over time compared to the cognitively normal group on three tasks: orientation (ps < 0.002), immediate word recognition (ps < 0.01), and semantic comprehension (ps < 0.04).
Conclusions: Average performance on telephone-based IVR neurocognitive assessments appeared to differ in expected directions by cognitive status. Although intraindividual variability has been associated with cognitive status and is important to consider in repeated assessments over time, only three of the nine tasks demonstrated differences in intraindividual variability by cognitive group. Importantly, the delayed recognition task appeared to be sensitive to change over time among the mild dementia group. These results preliminarily support the use of telephone-based IVR assessments to monitor cognitive functioning over time. This telephone-based remote assessment technology may be particularly important for individuals with otherwise limited access to in-person clinical care (e.g., rural communities, low socioeconomic status).
Keywords: teleneuropsychology**,** aging disorders
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50 Effects of COVID-19 on Neuropsychological Test Selection for Repeat Evaluations in a VA Outpatient Setting using a Hybrid Teleneuropsychology Model

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Objective: This study sought to characterize how test selection for neuropsychological re-evaluations was affected by the COVID-19 pandemic in an outpatient VA setting by comparing individuals who were evaluated at two timepoints under standard conditions versus individuals whose second evaluation was accomplished with a hybrid telehealth model.
Participants and Methods: The COVID-era group consisted of 126 Veterans who were re-assessed at the outpatient Minneapolis VA clinic between July 2020 and March 2021 using a hybrid teleneuropsychology testing model (combination of in-person and virtual administration) and who had a previous outpatient evaluation at least one year earlier. The control group consisted of 96 Veterans whose re-evaluation took place between July 2019 and March 2020 under usual clinical conditions. All Veterans had initial evaluations at least one year prior to their re-evaluation. Neuropsychological test selection was characterized by entries in a clinical database. Frequencies of administered individual subtests and cognitive domains were characterized qualitatively by counts and quantitatively through chi-square tests to determine whether test-retest consistency differed between groups. Total number of tests within specific domains was assessed with two-way ANOVA.
Results: There was no difference in the frequency of administration for most tests in domains of attention/cognitive efficiency, basic visuospatial processes, language, list learning and memory, visuospatial learning and memory, motor functioning, select executive processes, or mood. Individuals re-tested during the COVID-19 era were administered fewer performance validity tests (F(1,223 = 19.431, p < .001). Those re-tested under the hybrid model were less likely to have received story memory (X^2(1, 162) = 13.9, p < .001), WAIS-IV Block Design (X^2(1, 89) = 26.6, p < .001), WAIS-IV Similarities (X^2(1, 184) = 9.8, p = .002), WAIS-IV Symbol Search (X^2(1, 57= 5.89, p = .02), or Wisconsin Card Sorting Test (either 64 or 128 version; X^2(1, 105) = 27.5 p < .001)on subsequent evaluation.

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Conclusions: The hybrid model did not change the frequency of re-testing across all commonly assessed domains and was largely consistent with practices pre-COVID. Some COVID-based administration changes reflected limited physical contact with stimuli (e.g., WAIS-IV Block Design, WCST), though domains of visuospatial processing and executive functioning were still regularly assessed with other common measures. Some tests less frequently administered under the hybrid model (e.g., WAIS-IV Similarities or Symbol Search, PVTs) require greater time demands and assess domains that are measured by other common tests, thus these results possibly reflect a shift toward more time efficient evaluation. The similarities between eras demonstrates that the adjustments to COVID-19 were generally sufficient to provide consistent re-evaluations. Differences in test administration may have limited the ability to differentiate decline in executive functioning or specific visuo-spatial processes. When conducting re-evaluations of patients with COVID-era baseline data, neuropsychologists should by mindful of including tests that may provide diagnostic value despite not being administered at baseline. Individuals with frontal-subcortical profiles may be prioritized for re-evaluation as loosening restrictions will allow for more thorough evaluations that could provide greater diagnostic clarity.

Keywords: teleneuropsychology, neuropsychological assessment

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51 Assessing Everyday Functioning in Young Adult Athletes Using the Goal-Control Framework: Relations Between the Virtual Kitchen Challenge (VKC) Paradigm, Cognition, and Lifetime Concussion History

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Objective: Difficulty performing everyday activities is a debilitating symptom of neurologic disease/injury. The Goal-Control Model of everyday activities, developed to account for functional impairments characteristic of dementia, posits that impairments in episodic memory and executive functioning are particularly important for everyday tasks and lead to dissociable error profiles in everyday task performance. However, the utility of this theory in accounting for everyday task performance in younger individuals with no-to-subtle cognitive difficulties has not been explored, in part due to a lack of sensitive measures for assessing everyday task performance. To address this gap, we examined associations between cognition and performance on a computerized measure of everyday activities in a sample of young adult athletes with and without a lifetime history of concussion.

Participants and Methods: 106 young adult athletes with and without a lifetime history of concussion completed the Virtual Kitchen Challenge (VKC), a non-immersive virtual-reality task developed in collaboration between neuropsychology and computer science teams in the US and Japan. Completion of the VKC required manipulating virtual objects on a touchscreen to prepare a breakfast and lunch under two conditions: an initial training trial in which participants received feedback about performance, followed by a test trial without feedback. Excluding a possible history of concussion, participants were free from neurologic injury/disease and were currently enrolled students and/or employed in the community. VKC performance scores included measures of efficiency (e.g., percent of time working on-screen, number of interactions with target and distractor objects). Cognitive testing included measures of episodic memory (Hopkins Verbal Learning Test-Revised) and executive functioning (NIH-EXAMINER subtasks). Paired t-tests compared performance between VKC training and test trials, correlations examined relations between VKC performance and cognitive tests, and ANOVAs examined

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associations between concussive history and VKC performance.
Results: As expected, participants performed the test trials more efficiently than the training trials, with fewer target [$t(79)=-7.2$, $p<.001$] and distractor interactions [$t(79)=-5.3$, $p<.001$]. Efficient performance (fewer target interactions) on the training trial was associated with stronger episodic memory ($r=-.4$, $p<.001$) and inhibition ($r=-.3$, $p=.02$), while efficient performance on the test trial was associated with stronger executive abilities (r's$>|.2|$, $p<.05$) but not episodic memory. Individuals with a history of three or more lifetime concussions were more likely to interact with distractor objects on the training trial than individuals with 1-2 or no prior concussions [$F(2,77)=4.6$, $p<.001$, post-hoc p's$<.05$].
Conclusions: The VKC is sensitive to subtle variations in cognition in a young, high-functioning sample, and the Goal-Control Model may be extended to subtle difficulties on everyday tasks. On everyday tasks that are new or unfamiliar, episodic memory abilities may be especially important for task performance when individuals may be relying on past memories of performing similar tasks and/or task instructions, whereas executive abilities may become more important as tasks become well-rehearsed. Interactions with distractor objects during novel tasks may be a marker associated with prior concussions, and future research should explore whether such interactions reflect a consequence of versus risk factor for head injuries.
Keywords: technology**,** concussion/ mild traumatic brain injury**,** everyday functioning
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52 Performance Validity Testing via Telehealth and Failure Rate After Mild Versus Moderate-to-Severe Traumatic Brain Injury: A Veterans Affairs TBI Model Systems Study

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Objective: To report on the failure rate on two well-established performance validity tests (PVTs) administered via telehealth in veterans and military personnel with traumatic brain injury (TBI) and to compare failure rates across TBI severity.
Participants and Methods: Secondary analysis of the Veterans Affairs TBI Model Systems (VA TBIMS) multicenter study of participants enrolled after performance validity testing was added to data collection (Data were collected between March 01 and September 30, 2020). TBI severity was characterized using the Glasgow Coma Score (GCS), time to follow commands (TFC) and duration of posttraumatic amnesia (PTA) abstracted from acute and rehabilitation medical records following standardized procedures (Lamberty et al., 2014). Participants classified as moderate-to-severe if GCS ≤ 12 or TFC ≥ 0 days or PTA duration ≥ 0 days (otherwise participants were classified as mild). PVTs included the forced choice total score from the 21-Item Test (Iverson, 1998) and Reliable Digit Span (Babikian et al., 2006). PVTs were administered alongside neuropsychological testing via telephone. Univariable models were conducted to examine the unadjusted effects of TBI severity on PVT performance with analysis of variance used to examine PVT indices as continuous outcomes and Fisher's exact tests to examine dichotomous outcomes (pass/fail) at selected cutoffs.
Results: Of 93 participants due for follow up, 88% were followed. However, 7% of those followed were unable to participant in testing due to deafness or because they were too severely cognitive impaired (e.g., prolonged disorders of consciousness) and 7% were missing PVT data. This resulted in a final sample 71 participants who were 98.6% male with an average age of 36 years (SD=13) with either mild TBI (28%) or moderate-to-severe TBI (72%). Time post-injury was M=43.7 months (SD=24.1). On the 21-Item Test, there was no statistically significant differences ($F(1,69)=0.85$; $p=0.360$, Cohen's $d=0.23$) between participants with mild (M=17.2; SD=4.2) versus moderate-to-severe TBI (M=16.4; SD=3.1). Also, there were no significant differences in failure rate between

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severity groups on all cutoffs examined (≤8, ≤9, ≤10, ≤11). On RDS, there was no statistically significant differences (F(1,69)=0.05; p=0.931, Cohen's d=0.05) between participants with mild (M=10.6; SD=3.1) versus moderate-to-severe TBI (M=10.5; SD=2.4). Also, there were no significant differences in failure rate between severity groups on all cutoffs examined (≤5, ≤6, ≤7, ≤8).
Conclusions: Conservative cut scores established in prior research performed similarly among mild and moderate-to-severe TBI subgroups. However, PVT failure rates were unacceptably high at more liberal cut scores. Findings provide preliminary support for the use of the 21-Item Test and RDS during neuropsychological assessment delivered via telehealth. Future research should cross-validate study findings vis-à-vis other PVT metrics and further ascertain equivalence across modality of administration.
Keywords: brain injury**,** teleneuropsychology**,** noncredible presentations
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53 Young, Tech Savvy, and Lonely: A Lifespan View of Social Media Use, Technology Barriers, and Loneliness during COVID-19

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Objective: Loneliness is associated with multiple negative health outcomes in clinical and healthy populations. Emerging research on the relation between social media and loneliness has been inconclusive and has limitedly examined the effects of social distancing measures tied to the emergence of SARS-Co-V-2 (COVID-19) in March 2020. We aimed to resolve the inconsistencies in the literature and gain insight into the role technology barriers play on social media use and loneliness across the adult lifespan. We hypothesized that (1) older people would report greater loneliness during COVID-19, (2) people who engaged in social media throughout the COVID-19 pandemic would report less loneliness, and (3) people who used social media less frequently during COVID-19 experienced more technology use barriers.
Participants and Methods: 2,935 participants recruited from across North America completed a series of online questionnaires as part of the Temple University Technology Use Across the Lifespan study. To address our hypotheses, responses from the UCLA Loneliness Scale, the Technology Barriers Questionnaire, and questions about social media use (e.g., Facebook, Twitter, Instagram, etc.) across a range of devices (e.g., computer, tablet, smartphone, etc.) were analyzed. Only participants who passed quality control measures were included in the final sample (n = 2,935; M age = 56.77; SD= 18.26; age range = 18 to 99).
Results: Contrary to our first hypothesis, a bivariate correlation showed a significant negative relation between age and loneliness ratings, as older adults reported less loneliness (r = .228, p < .001). Our second hypothesis was also not supported, as an independent sample t-test found no significant difference in loneliness between the group that used social media and the group that did not (p=.211). Consistent with the third hypothesis, participants who reported using less social media during COVID-19 also reported having more knowledge related technology barriers, compared to the group who reported more social media use (t = 5.725, p < .001). Exploratory analyses showed an association between older age and more technology barriers (r =.303, p < .001) as well as an association between greater loneliness and technology barriers (r = -.244, p < .001). There was no relation between use of technology for video calls and a very weak relation between more frequent texts/emails and greater loneliness (r = .059, p =.047).
Conclusions: Despite their more frequent engagement with social media and greater access to technology, younger adults reported greater loneliness than older adults during the COVID-19 pandemic. Future research should investigate whether these results generalize to clinical samples and persist after social distancing measures are lifted. Interventions to alleviate loneliness should address knowledge

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related technology barriers and examine how social media use patterns may be modified to increase social connectedness. Additionally, pilot intergenerational programs should be created through which younger adults gain insights from older adults regarding socialization and managing feelings of isolation.
Keywords: technology**,** aging (normal)**,** social processes

54 Relationship Between a Telephone-Based Cognitive Assessment and Lifestyle, Medical, and Cognitive Risk Factors in an Alzheimer's Prevention Registry

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Objective: Previous studies show that specific lifestyle behaviors (e.g., lack of exercise, poor diet, alcohol abuse), medical conditions, and subjective cognitive decline (SCD) are associated with poor cognitive function and are risk factors for dementia in older adults. The aim of the current study was to examine relationships between telephone-based cognitive performance and lifestyle factors, medical/ psychiatric history, and SCD in adults at heightened risk for Alzheimer's disease.
Participants and Methods: The current study included 643 participants *(M* age = 67.31; *SD* = 8.90) who enrolled in the Rhode Island Alzheimer's Prevention Registry. Participants were mostly non-Hispanic White (91%), female (77%) with a family history of dementia (73%) and an average of 16 (*SD*= 2.49) years of education. Hierarchical regression models examined relationships between self-reported lifestyle variables (i.e., exercise, smoking, alcohol abuse, diet), medical history (i.e., number of medical conditions, current psychiatric conditions, family history of dementia), SCD, and performances on the Minnesota Cognitive Acuity Screen (MCAS), a telephone-based cognitive screening test, previously shown to be sensitive to mild cognitive impairment (MCI). Average participant MCAS performance fell within the normal range (*M*= 57.88; *SD*= 5.54; 18.2% performed in the MCI range).
Results: The demographic model including participant years of education, sex, and age accounted for approximately 14% of the variance in total MCAS score (adjusted R^2 = .144*,* p < .001). The final model containing all clinical and demographic variables accounted for approximately 17% of the variance in MCAS scores (adjusted R^2 = .171*,* p < .001) and reflected a significant change in R^2. In addition to demographic variables, current exercise (β = .10, p =.009) and SCD (β = .14, p <.001) were independently associated with scores on the MCAS, suggesting that poorer cognitive performance was associated with increased worry about memory functioning, and decreased reports of current exercise. When subjective cognitive decline was divided into three groups by participant response (i.e., "yes, concerning;" "yes, not concerning;" "no"), and examined via an analysis of covariance, those who endorsed SCD with concern performed significantly worse than those who did not endorse SCD at all, or reported SCD without concern (p= <.001) on total MCAS score.
Conclusions: Results showed that performance on a telephone-based cognitive test was associated with exercise engagement and SCD, beyond the effects of education, sex, and age in a sample of adults without dementia. Family history of dementia, other lifestyle factors, and medical/psychiatric conditions were not associated with cognitive performance. These findings highlight the potential usefulness of a telephone-based cognitive assessment to track at-risk participants in Alzheimer's prevention registries and brain health cohort studies. Future work will follow this cohort to determine how well longitudinal changes in dementia risk factors and subjective cognitive concerns track with telephone-based cognition.
Keywords: teleneuropsychology**,** memory complaints**,** cognitive screening
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55 What Kind of Driver Are You? What You Think Versus What You Do: Discrepancies Between Self-Reported and Naturalistic Driving Behaviors

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Objective: Driving is a complex and risky everyday function that places high demands on cognition and awareness. Driving behaviors are often measured with self-report questionnaires, which may be inaccurate, and driver records, which only include major events (collisions, violations). Video telematics platforms provide opportunities to measure naturalistic driving behaviors in a more sensitive and accurate manner and to assess the accuracy of self-reported driving ability. However, there is limited knowledge about driving behaviors in healthy drivers across the adult lifespan. This study aimed to characterize naturalistic driving behaviors in healthy adults using video telematics, and to compare these metrics with self-rated driving ability to investigate driver awareness of driving behaviors.
Participants and Methods: 32 healthy adult drivers (ages 22-61, mean age=35; 69% women; at least 2 days of driving per week) were enrolled. Using the Driver Behavior Questionnaire (DBQ), participants rated their global driving ability from 0-100, with higher scores indicating better driving. They also reported their frequency of unsafe driving behaviors from 0 (never) to 5 (nearly all the time). Participants completed 28 days of naturalistic driving with the Lytx video telematics platform installed in their vehicle. Driving events were detected automatically using accelerometer, GPS, and video data, and driving behaviors during events were coded by driving risk analysts. Behaviors were assigned risk scores from 0 (no risk) to 10 (high risk) based on their likelihood of leading to a collision. For each participant, the following metrics were calculated: the number of unsafe driving events and the risk score both a) totaled across 28 days and b) per hour driven. We examined correlations of DBQ self-ratings with observed risk scores per hour driven.
Results: Average self-rated global driving ability was 83/100 (SD=11, range=60-100). Mean self-rated unsafe behavior frequency was “hardly ever” (M=0.81, SD=0.38, range=0.07-1.67). Participants drove for an average of 30 hours (SD=27) and 709 miles (SD=561). The mean number of unsafe driving events per participant was 47 total (SD=55, range=1-254) and 1.4 per hour driven (SD=1.0, range=0.1-3.6). The most common behaviors were speeding, rolling stop, cell phone use, seat belt nonuse/misuse, and unsafe following distance. Collisions and near-collisions were rare. The mean observed risk score was 197 total (SD=242; range=3-1085) and 5.9 per hour driven (SD=4.6, range=0.2-16.5). Observed risk score was not significantly correlated with self-ratings of either global driving ability (r=.18, p=.32) or unsafe behaviors (r=-.05, p=.77). Both effects were in the unexpected direction.
Conclusions: While self-ratings of driving ability are consistently favorable, naturalistic observation indicates a wide range of driving safety. Moreover, self-rated driving risk is not significantly related to observed driving risk and may even be inversely related. Results suggest that underestimation of driving risk is common among healthy adult drivers. Findings provide a methodological framework and normative naturalistic data that can be used to assess driving behaviors and awareness in clinical populations, particularly in neurologic disorders that cause both cognitive deficits and reduced awareness of deficits. This work may ultimately inform driving recommendations and the development of telematics-based driving interventions.
Keywords: driving, ecological validity, awareness
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56 Guidelines for the Practice of Teleneuropsychology in Latin America: Recommendations from the Latin American working Group for Teleneuropsychology

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Objective: Teleneuropsychology (teleNP) offers the potential to expand access to services for patients who are confined, have limited personal access to healthcare, or live in remote areas. The recent emergence of the COVID-19 pandemic has significantly accelerated the use of teleNP for cognitive assessments in Latin America. The main objective of these guidelines was to identify which procedures can be best adapted to the practice of teleNP and thereby facilitate health professional decision-making in Latin America.
Participants and Methods: Steps taken to develop the guidelines included (1) justification, scope, and objectives; (2) selection of the working group; (3) formulation of clinical questions; (4) evidence search and selection; (5) evidence evaluation and summary; and (6) formulation of recommendations. Levels of evidence were graded following the system developed by the Oxford Centre for Evidence-Based Medicine. Databases examined during the literature review included PubMed, WHO-IRIS, WHO and OPS-IRIS, IBCS, and LILACS.
Results: Experts reviewed 18400 titles and 422 abstracts and identified 19 articles meeting the criteria for level of evidence, categorization, and elaboration of recommendations. These guidelines provide information on the scope of teleNP, details on informed consent, strategies for improving assessment delivery, and levels of recommendation for specific neuropsychological tests. Furthermore, a recommendation regarding Latin American specific challenges and barriers for teleNP such as lack of computers and low connectivity in rural areas, low education, Isolated and aborigine populations, bilingualism in aborigine populations are provided.
Conclusions: There is currently sufficient evidence to support videoconferencing technology for remote neuropsychological assessments in the Latin American population. Challenges and barriers faced by neuropsychologists in Latin America are relevant

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and specific and will need to be addressed in the near future.
Keywords: teleneuropsychology

57 Teleneuropsychological Assessment with Youth with Neurodevelopmental Disorders: Challenges and Considerations

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Objective: The COVID-19 crisis has highlighted the need for Neuropsychologists to provide certain services virtually using teleneuropsychology (TNP). Research conducted on TNP assessments has demonstrated its usefulness, with only subtle differences in scores when compared to face-to-face (FTF) assessments. The vast majority of these studies, however, have taken place in a satellite clinic, where a technician can configure equipment and test stimuli. Due to social distancing requirements, an in-home assessment, without a technician, may be required. In addition, most studies conducted on the validity and reliability of TNP have focused on small samples of adult or geriatric patients and research is generally lacking on the application of TNP assessments to younger populations. Thus, the primary aim of the larger study is to determine whether TNP assessments administered in a child or adolescent's home produces results equivalent to a FTF assessment. This poster focuses on preliminary qualitative observations made during the administration of these assessments.
Participants and Methods: Students registered in a transition program for grade seven and eight students with neurodevelopmental conditions, who had undergone a FTF Psychoeducational Assessment just prior to the start of COVID, or who were waiting for a current FTF assessment, were invited to participate in a virtual assessment of approximately three hours of length. Virtual testing was completed by the participant via the participant's own computer, with the assessor located in a private office. Comprehensive cognitive and academic testing was administered using the Woodcock Johnson-Fourth edition (WJ-IV) and was supplemented with the use of a performance validity test (Memory Validity Profile: MVP). Required response forms were either mailed ahead to participants or dropped off at their home in a sealed envelope, and participants were provided with a postage paid envelope to return their completed response forms to the examiner. Of the 25 participants who completed virtual testing, the majority were male (17 males, 8 females) and ranged in age from 12 years, 1 month to 13 years, 11 months. Previous diagnoses included Learning Disabilities, Attention Deficit/Hyperactivity Disorder, and/or Autism Spectrum Disorder.
Results: Students tended to respond well to virtual testing, with all being sufficiently engaged and motivated to obtain a passing score on the MVP. However, common issues encountered when administering TNP assessments with this population were technological issues (lack of appropriate screen size, issues with sound quality), environmental challenges (lack of appropriate work space, distractions), personal factors (anxiety about being "on camera"), and difficulties maintaining standardized administration (difficulty knowing if participant was using tools, such as paper-and-pencil/calculator, student not adhering to directions to stop working on timed tasks).
Conclusions: TNP has allowed neuropsychologists to continue to provide clinical assessment during the period of COVID-19 restrictions. However, little to no research has investigated its equivalence to FTF assessments in children with neurodevelopmental conditions. If equivalent, TNP may be useful to assess youth living in remote and underserved settings. Preliminary findings, however, have raised some common challenges when administering TNP assessments to youth that may need to be considered to ensure valid results.
Keywords: teleneuropsychology**,** pediatric neuropsychology**,** assessment

58 Patients' Experience and Satisfaction with Teleneuropsychology: A Monolingual and Bilingual Spanish-Speaking Adult Sample

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Objective:
Objective: Telephone- and video-based neuropsychological assessment may be valid alternatives to in-person assessment (Appleman et al., 2021). These new modalities have been well-received by some patient groups including veterans and monolingual English-speaking older adults (Lacritz et al., 2020). To date, there is limited information regarding the validity of remote TeleNP in linguistically- and socioeconomically-diverse patients (Arias et al., 2020). While provider-specific barriers and benefits associated with providing teleneuropsychological (TeleNP) services to linguistically and socioeconomically -diverse patients have been examined, little is known about the acceptability of this modality among Spanish-Speaking patients (Stelmokas 2021). We present preliminary results from a study documenting patients' experience and satisfaction with TeleNP evaluations administered by bilingual and bicultural providers.
Participants and Methods: Participants and Methods: The sample comprises 11 adults who self-identified as Hispanic/Latina(o) and were evaluated at a major medical center in Boston, MA from May to August 2021. After completing a room-to-room TeleNP evaluation as part of routine clinical care, participants were invited to complete a post-assessment survey. Measures of central tendency, frequencies, and group differences were calculated from quantitative data using the R statistics package. Qualitative data was iteratively coded, sorted, and compared using a thematic analysis.
Results: Results: Respondents were predominantly female (82%) and monolingual Spanish-speaking (73%). Overall, 100% of the sample self-identified as Hispanic/Latina(o), and 86% reported their ethnicity as White. Mean age was of 63 (*SD* = 15.8) years, and the sample completed an average of 8.4 (*SD* = 5.0) years of education. In the year prior to the evaluation, the sample completed an average of 4 (*SD* = 3.5) medical/psychiatric visits and 1 (SD = 0.4) neuropsychological workup. All patients completed the current neuropsychological assessment visits via a hybrid (room-to-room) model, and only 23% reported having had a previous in-person neuropsychological evaluation. Eight out of 11 participants reported being satisfied with TeleNP, and there were no group differences in satisfaction between those who did (or did not) have a previous in-person assessment.
Conclusions: Conclusions: Preliminary results suggest that Hispanic/Latina(o) patients perceived TeleNP as a feasible approach for cognitive assessment. Participants valued the ability to connect with their providers and the scheduling flexibility this new modality provided. Upon completion of data collection, we will examine other aspects of their experience including ability to establish rapport, comfort with receiving technical support, and satisfaction with the clinical utility/value of the evaluation. Future research should focus on validating instruments to support this modality and on identifying populations that could most benefit from TeleNP services.
Keywords: language: second/foreign**,** multiculturalism**,** teleneuropsychology

59 The reliability of administering the Color-Word Interference Test and Oral Trail Making Test via videoconferencing technology

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Objective: In response to the COVID-19 pandemic, there has been a growing need for teleneuropsychology services, and research in this domain has rapidly expanded (Marra et al., 2020). We contribute to this literature by examining the reliability of speeded neuropsychological measures via videoconferencing technology. Specifically, we compared in-person and virtual administrations of the Trail Making Test (TMT) and Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference Test (CWIT).

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Participants and Methods: Our sample consisted of 10 males and 13 females (Age *M* = 49.07, *S.D.* = 13.48) from an ongoing observational study on Prion disease. In our sample, one individual had no Prion disease mutation, 14 individuals had a known Prion disease mutation, and eight individuals' mutation status was unknown. All participants had normal cognitive functioning at the time of assessment. All participants underwent both in-person and virtual visits with their virtual visit occurring approximately one to one-and-a-half years following their last in-person visit. Both the in-person and virtual visits consisted of the CWIT and TMT along with additional neuropsychological tests. For the TMT, subjects received the written TMT (wTMT) at the in-person visit and the oral TMT (oTMT) at the virtual visit.
Results: Paired samples t-tests, Pearson correlation, and intraclass correlation coefficients (ICC) were utilized to compare the test scores from the in-person and virtual visits. There was no statistically significant correlation between the oTMT-part A and wTMT-part A ($r(21)= .22$, $p = .31$); however, individuals performed faster on the oTMT-part A (*M* = 10.14, *SD* = 4.72, seconds) compared to the wTMT-part A (*M* = 21.92, *SD* = 6.88, seconds) ($t(22) = 7.60$, $p < .01$). While there was a moderate correlation between scores on the oTMT-part B and wTMT-part B (ICC = .57, $p < .01$), subjects performed worse on the oTMT-part B (*M* = -1.18, *SD* = 2.47, z-score) compared to the wTMT-part B (*M* = .66, *SD* = 1.49, z-score) ($t(22) = 4.68$, $p < .01$). Each condition of the CWIT showed strong correlations between the in-person and virtual scores (ICCs ranged from.79 to .94, *ps* < .01). However, there was a statistically significant difference between the virtual and in-person scores for the word reading condition as individuals were slower during the virtual visit (*M* = 9.74, *SD* = 3.29, scaled score) compared to the in-person visit (*M* = 10.43, *SD* = 3.09, scaled score) ($t(22) = 3.02$, $p = .01$).
Conclusions: Our results suggest the CWIT is reliable to administer virtually adding to the scant literature on its virtual administration. Our results also replicate past findings that the oTMT-part A is not appropriate as a substitute for the wTMT-part A (Kaemmerer et al., 2016). While we found a moderate correlation between the oTMT-part B and wTMT-part B replicating past research findings (e.g. Mrazik et al., 2010), individuals in our sample performed significantly worse on the oTMT-part B compared to the wTMT-part B. Accordingly, our results suggest that the oTMT-B is not fully analogous to the wTMT-B and future studies should be aware of this measure's limitations.
Keywords: teleneuropsychology**,** test reliability

60 The Clinical Utility of Teleneuropsychology Screening Evaluations in Assessing the Neurocognitive Status of Long-Term Pediatric Cancer Survivors

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Objective: The objective of this study was to determine the clinical utility of teleneuropsychology screening evaluations in assessing the neurocognitive status of pediatric cancer survivors, specifically to screen for late effects of treatment.
Participants and Methods: Thirteen pediatric cancer survivors (ages 5 to 21) participated in brief neuropsychological screening evaluations via teleheath to assess their neurocognitive status. Screening batteries generally included brief assessment of verbal and nonverbal intellectual abilities, verbal memory, working memory, processing speed, and executive functioning as well as parent- and/or self-report rating scales and a clinical interview. Results of each screening evaluation were analyzed to determine if the individual should be referred for comprehensive in-person neuropsychological evaluation. The Neuropsychological Impairment Rule (NRI; Beauchamp et al., 2015), which is defined as 2 or more scores falling 1.5 or more standard deviations below the mean, was used as an initial metric to assess areas of neurocognitive weakness. This metric was then considered in combination with reported concerns and testing limitations to determine if a more comprehensive neuropsychological

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evaluation was warranted in the upcoming 6 months.
Results: Of the 13 pediatric cancer survivors evaluated, 8 individuals did not demonstrate significant neurocognitive impairments on objective testing measures according to the NIR, and therefore additional testing during the upcoming 12 months was not recommended. Instead, these individuals generally performed within to above broad age expectations across measures administered, and many denied presenting concerns at the time of the screening evaluation. Conversely, the teleneuropsychology screening evaluation was not sufficient for 5 of the 13 survivors, who either required close interval monitoring or were referred for additional in-person testing during the upcoming 6 months. Of these 5 individuals, 3 demonstrated significant neurocognitive weaknesses, based on the NIR, in areas often associated with the late effects of treatment (i.e., working memory, processing speed, and executive functioning). The remaining 2 individuals who required additional in-person testing were referred due to objective and/or subjective concerns for significant learning difficulties in mathematics, which could not be fully assessed via the teleheath platform.
Conclusions: It is estimated that over 15,000 children and adolescents will be diagnosed with cancer in 2021. Fortunately, survival rates have greatly increased due to ongoing medical advances, and approximately 84% of pediatric patients survive five or more years (American Cancer Society, 2021). However, many of these individuals have been treated with powerful chemotherapy agents (i.e., methotrexate, vincristine, etc.) and/or radiation therapy, and are therefore vulnerable to late effects of treatment including neurocognitive deficits due to associated white matter changes. With the number of pediatric cancer survivors increasing, it is imperative to improve the efficiency of neuropsychological monitoring and evaluation of these individuals in order to provide adequate educational and therapeutic supports and thereby optimize survivors' functioning across settings. This study demonstrates that brief teleneuropsychology evaluations can be successfully used to efficiently evaluate the neurocognitive status of pediatric cancer survivors, many of whom may not require additional in-person testing. For those who do require comprehensive evaluation, this study demonstrated that telehealth screenings served as an effective tool to appropriately identify and refer pediatric cancer survivors for further testing when needed.
Keywords: teleneuropsychology**,** cancer**,** pediatric neuropsychology
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61 Brief Teleneuropsychological Assessment of Adults with Spinal Cord Injury: Feasibility and Acceptability

Najae Dixon[1], Ted Allaire[1], Kristian Manley[2], James Krause[2], Seth Warschausky[1], Michelle Meade[1]
[1]University of Michigan, Ann Arbor, MI, USA. [2]Medical University of South Carolina, Charleston, SC, USA

Objective: Recent developments in teleneuropsychology (teleNP) have the potential to address some of the accessibility barriers that contribute to health disparities for people with disabilities. Remote testing procedures can address the complexities of transportation for this population and teleNP testing often requires more universal test procedures that can minimize or by-pass typical manual dexterity and motor response demands. This ongoing study seeks to address gaps in the literature by developing a handsfree neuropsychological assessment battery and delivering this battery via telehealth to a sample of adults living with traumatic spinal cord injury (TSCI). Hypotheses: 1. This assessment battery will be feasible, as evidenced by ability of a representative sample of adults living with TSCI to complete the tests with minor and acceptable accommodations; 2. Participants with TSCI will rate this teleNP assessment experience as acceptable.
Participants and Methods: In this IRB-approved ongoing multisite, prospective study, eligibility included: English fluency; at least 18-years-old; adequate vision and hearing for participation; access to a device that could be used for the telehealth visit; and, history of TSCI.

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Participants (n=40) were age 24-70 (M=52, SD=11) years, 76.2% male, 38% with associate or bachelor's degree, and 42.8% with income <30K. Time since SCI was 24 (SD=12) years, and 52.9% had cervical level injury, 46.4% complete injury, and 5.8% concomitant traumatic brain injury. Instruments: Wide Range Achievement Test-4 (WRAT-4) Word Reading Subtest, California Verbal Learning Test – II (CVLT-2), Oral Trail Making Test (OTMT), Wechsler Adult Intelligence Scale-4 (WAIS-4) Digit Span Subtest, Wisconsin Card Sorting Test-64 (WCST), Delis-Kaplan Executive Function System (D-KEFS) Verbal Fluency Subtest, and Montreal Cognitive Assessment-Blind (MoCA-Blind). Assessments were administered using a HIPAA-compliant Zoom platform. Participants also rated their satisfaction with the virtual visit.
Results: Neuropsychological results largely fell within the average range with normal score distributions (Shapiro-Wilk's test), with the exception of WCST perseverative errors (p = .006), Digit Span total (p = .023), and OTMT B (p = .000). Differences between those with cervical versus noncervical level injuries did not differ, with the exception of Verbal Fluency category switching (Cervical M=10.05, SD=2.79; Nonsurgical M=12.76, SD=3.73, t(37)= -2.03, p=.013. Participants strongly endorsed (87%) overall satisfaction with the visit and 78.6% of participants rated themselves as comfortable with the Zoom platform and test instructions. However, 75.6% held concerns about their privacy during the assessment and 29.3% noted that they would not have participated in the study if the assessment was conducted in-person, primarily due to transportation difficulties.
Conclusions: Findings highlight the feasibility and acceptability of a teleNP battery in a sample of adults living with TSCI. The data suggest both adequate psychometric properties and overall participant satisfaction. Differences between those with cervical and non-cervical level injuries were minimal, supporting the accessibility of the teleNP battery. Concerns about privacy during telehealth visits differ from findings with recent nonTSCI outpatient clinic-based findings (Appleman et al, 2021) and require follow-up.
Keywords: spinal cord injury**,** teleneuropsychology

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62 TELE-NEUROPSYCHOLOGY in Argentina. Impact of COVID in the NEUROPSYCHOLOGICAL CLINIC. Perspective of patients and neuropsychologists.

MICAELA MARIA ARRUABARRENA, LUCIA CRIVELLI, MARIA EUGENIA MARTIN, ISMAEL LUIS CALANDRI, MARIA BELEN HELOU, CARLOS MARTINEZ, RICARDO FRANCISCO ALLEGRI
Fleni, Buenos Aires, Buenos Aires, Argentina

Objective: The objective of this work was to evaluate the degree of satisfaction with TNP, its acceptability and to identify advantages and disadvantages of its use, in patients and neuropsychologists
Participants and Methods: 41 patients with mild cognitive impairment were assessed and 35 neuropsychologists (from 6 different centers in Argentina) were surveyed. Neuropsychologists were sent a questionnaire by e-mail to evaluate their experience and level of satisfaction with TNP. Patients were cognitively evaluated by TNP and then completed a brief survey of satisfaction and preferences regarding the evaluation.
Results: TNP was accepted by both patients and practitioners. The results reflected a 91% degree of satisfaction and there were no differences between patients and professionals (p=0.112). 50% of the patients indicated no preference regarding the evaluation modality and 35.7% preferred the TNP. The main benefits identified related to TLN were the accessibility in remote areas (72.4%) and the comfort of the home (57.14%). 74.3% of the practitioners reported that the main difficulty is lack of familiarity with the technology and 60% consider the main difficulty is lack of control of the environment.
Conclusions: This study establishes that TNP cognitive evaluation has a high degree of acceptability both in practitioners and patients. The main obstacles identified by practitioners are related to connection problems and lack of

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familiarity with technology. The main advantages are linked to the possibility of accessing remote areas. The high degree of satisfaction suggests that this is a practice that will remain in force and will grow as part of the neuropsychological clinic beyond the pandemic context.
Keywords: teleneuropsychology**,** cognitive screening**,** cognitive reserve

LIVE Program Welcome
Co-Chairs: Lucette Cysique and Holly Miskey

9:45 - 10:00am
Wednesday, February 2, 2022

LIVE Plenary G: Culture, Education, Bilingualism and Neurocognitive Functioning

Presenter: Monica Rosselli

10:00 - 10:55am
Wednesday, February 2, 2022

Abstract & Learning Objectives:
Culture includes the ways of thinking, feeling, and behaving of a group of individuals. Several aspects of a culture have been identified. They are known to play an important role in neuropsychological assessment, including the values and meanings of the culture, the ways of knowing, and the conventions of communication. For instance, the relevance of the information presented on an item may not be the same in all cultures. Additionally, the pattern of cognitive abilities usually measured in neuropsychological tests represents, at least in their contents, learned abilities, which scores correlate with the subject's learning opportunities and contextual experiences. Therefore, culture will define the familiarity with the situations presented in neuropsychological evaluations and the cognitive strategies needed to succeed. Language is an identifying cultural characteristic that plays an instrumental role in cognition; world conceptualization depends upon language, and therefore, language experience may also influence performance on neuropsychological tests. Finally, length and quality of education have been identified as highly related to performance on neuropsychological testing. This presentation analyzes the importance of the above cultural variables in neurocognitive functioning, emphasizing the Hispanic/Latino population in the United States. As most of the members of this ethnic group are bilingual, the benefits and disadvantages associated with maintaining two active languages are presented, and the controversy about bilingualism as a builder of cognitive and brain reserve in aging is discussed.

Upon conclusion of this course, learners will be able to:
- Define culture and describe the identified aspects of culture that play a role in neuropsychological assessment
- Explain the relationships between bilingualism and the concept of brain and cognitive reserve
- List the clinical benefits of considering the individual's culture and education in neuropsychological assessments

LIVE Invited Symposium 4: Prenatal Exposures with Neuropsychological Consequences

Chair: Rebecca Bromley
Presenters: Claire D. Coles, Anne Wheeler, Laura Yates

11:00am - 12:30pm
Wednesday, February 2, 2022

Abstract & Learning Objectives:
Exposures in the womb to certain maternal illnesses, medications and recreational substances can have deleterious consequences for the developing fetal brain which leads to altered neuropsychological functioning profiles in childhood. This session will describe how such human teratogens can alter the development of the fetus and the principles which mediate the level of affect. Talks will include examples of a maternal illnesses (Zika Virus), a medication (Sodium Valproate) and a recreational exposure

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(Alcohol), which pose a risk to the developing fetal brain and result in neuropsychological difficulties. Important aspects of assessment and intervention with individuals with a history of such exposures will be discussed as will the importance of psychological expertise in this area of research.

Upon conclusion of this course, learners will be able to:
- Describe how certain exposures in the womb impact later child and adult neuropsychological functioning
- Assess the quality of the research evidence for a particular exposure
- Apply the key principles into your neuropsychology practice

Symposium 12: The Future of Neuropsychology: Applications of Innovative Technologies

11:00am - 12:30pm
Wednesday, February 2, 2022

11 The Future of Neuropsychology: Applications of Innovative Technologies

Chair

Michelle Chen
Rutgers Universty, New Brunswick, USA

Discussant

Michelle Chen
Rutgers University, New Brunswick, USA

The field of neuropsychology is experiencing a technology crisis. Most clinicians practice using inefficient and labor intensive methods that were developed a century ago. Although test items and normative data have been updated over time, the basic tools have not changed despite rapid advancement in technology. This problem became more apparent during the coronavirus disease 2019 (COVID-19) pandemic when clinicians struggled to adapt their practice in order to abide by social distancing guidelines. With increased computational power and availability of high dimensional data ("big data"), there is a push toward tailoring clinical care to the individual ("precision medicine"). The field of neuropsychology is in need of a major technological paradigm shift in order to remain relevant in the era of precision medicine. This symposium will focus on applications of innovative technologies in neuropsychological practice. Dr. Shifali Singh will start by introducing the limitations of traditional neuropsychological assessment, followed by recommendations of how digital technologies may be integrated into clinical practice. Then Dr. Michelle Chen will discuss the emerging field of digital phenotyping, which aims to objectively quantify real-life human behaviors through personal digital devices. She will present her work on monitoring how individuals type on their smartphone keyboards, which has the potential to provide moment-by-moment quantification of cognition in real life. PhD Candidate Samad Amini will report two ongoing digital health projects at the Framingham Heart Study (FHS): the digital clock drawing test using a digital pen and speech patterns from digital recordings of neuropsychological assessment. He will elaborate on the use of machine learning (i.e., artificial intelligence) methods to develop automated algorithms for detecting dementia. Finally, Dr. Silvana Costa will present on the applications of eye tracking technology in neurological populations. She will also discuss the advantages of creating "hands-free" neuropsychological tests using eye tracking, which have the potential to enhance the assessment of cognitive functions among individuals with significant motor impairment.
Keywords: technology**,** teleneuropsychology*,* assessment

180 Hybrid Neuropsychology: Integration of Digital Tools

Shifali Singh
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The COVID-19 pandemic has presented a unique set of challenges and opportunities in the ways neuropsychological evaluations are

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conducted. The initial inability to conduct traditional evaluations left neuropsychologists with the unprecedented task of determining how to modify existing paradigms while balancing the need to provide services and adhere to social distancing parameters. The current literature suggests that clinicians are modifying their evaluations based on the following models: 1) continuing to administer in-person evaluations; 2) discontinuing all evaluations due to issues related to standardization, test security, and patient-specific characteristics; 3) conducting virtual evaluations; and/or 4) adopting a hybrid model incorporating both traditional and technology-based modalities. Given the challenges with Models 1-3, along with the modifications in telehealth guidelines and insurance reimbursement rates, neuropsychologists are more poised than ever to solidify the implementation of a hybrid model that lasts beyond COVID-19. Therefore, we call for a more radical paradigm shift in the way neuropsychological assessments are conducted with the incorporation of digital technologies. This talk has the following aims: 1) address limitations in conducting traditional neuropsychological evaluations; 2) explore ways digital technologies may fill significant gaps in the assessment of cognitive functioning (such as creating more robust norms and increasing ecological validity); and 3) introduce ongoing work with Hybrid Neuropsychology, which provides a framework for the integration of digital tools in neuropsychological assessment.
Keywords: technology**,** teleneuropsychology**,** assessment

182 Digital Phenotyping of Cognition via Typing Dynamics Monitoring

Michelle H Chen
Rutgers University, New Brunswick, NJ, USA

Objective: Traditional neuropsychological assessment is time-consuming, only elucidates a snapshot of cognitive functioning at one time point, and takes place in an artificially controlled environment, which may not adequately capture the patient's everyday life difficulties. A promising solution to these limitations is to unobtrusively and continuously monitor cognition in the patients' daily lives through digital phenotyping. Digital phenotyping is an emerging area of research, which aims to objectively quantify real-life human behaviors through personal digital devices (e.g., smartphones, smartwatches). This talk will introduce BiAffect, a digital phenotyping platform that unobtrusively monitors how individuals type on their smartphones. BiAffect has the potential to provide a longitudinal assessment of real-life cognition with limited patient burden, which may supplement current clinical practices and greatly enhance patient care.
Participants and Methods: Two studies utilizing BiAffect in persons with multiple sclerosis (MS) will be reported. In the first study, 14 persons with MS and 7 healthy controls (HCs) downloaded the BiAffect application onto their personal smartphones. Typing data were collected automatically for six weeks without active engagement from the participants.
Results: Results showed that persons with MS exhibited significantly slower typing speed than HCs, and typing speed was significantly correlated with baseline performance on measures of processing speed, attention, and executive functions.
Conclusions: This study provides proof-of-concept evidence that typing dynamics may be used as a proxy for real-life cognitive functioning. However, since the observed associations between typing dynamics and traditional neuropsychological performance were cross-sectional, it did not take into account of real-time fluctuations in cognition often experienced by persons with MS. Thus, a second study was conducted to validate BiAffect's ability to predict real-time changes in cognition. In addition to monitoring typing dynamics, participants with MS were asked to complete smartphone versions of the Trail-Making Test and a Go and No Go task and report severity of various MS symptoms (e.g., mood disturbance, fatigue, pain) up to three times per day for three weeks. The goal was to examine real-time correspondences between typing dynamics and smartphone-based cognitive performance, as well as evaluating the effects of fluctuating MS symptoms on cognition in real time. Preliminary data for this ongoing study will be presented during this talk.

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Keywords: technology**,** teleneuropsychology**,** assessment

185 Automated Dementia Detection Using Artificial Intelligence

Samad Amini, Lifu Zhang, Boran Hao, Aman Gupta, Mengting Song, Cody Karjadi, Honghuang Lin, Vijaya B Kolachalama, Rhoda Au, Ioannis Paschalidis
Boston University, Boston, MA, USA

Objective: Current dementia screening metrics have limited sensitivity and specificity. Digital technologies now enable collection of high volume data using traditional measures, which may enhance sensitivity in detecting more subtle decline and specificity in differentiating among different possible neuropathologies. This talk will illustrate two automated screening tools for dementia detection, leveraging digital technologies and artificial intelligence techniques.
Participants and Methods: We used data from the Framingham Heart Study (FHS), which is a longitudinal, multiracial cohort study that has integrated digital technologies (i.e., substituting the traditional pen with a digital pen, digital voice recordings of neuropsychological examination). We applied machine learning methods to (i) images from the clock drawing test (CDT), which was completed by 3,263 cognitively intact subjects and 160 subjects with dementia using the digital pen; and (ii) digital voice recordings of 410 cognitively intact subjects and 287 subjects with dementia, which were transcribed using Google's automatic speech recognition. For both tasks, an automated dementia prediction tool was developed and validated using deep learning algorithms. A pre-trained Convolutional Neural Network and a Universal sentence encoder were utilized to process the images of the CDT and transcripts of the voice recordings, respectively. In addition, the participants' age and the education were integrated with these digital features into a logistic regression model to predict the likelihood of dementia diagnosis.
Results: We achieved 92% Area Under the precision-recall Curve (AUC) from the images of the CDT and 92.6% AUC from the digital voice recordings in dementia prediction.
Conclusions: We show the feasibility of two automated screening tools for dementia detection, using data that can be extracted from traditional neuropsychological assessment. These automatic screening tools have the potential to be more accessible and cost-effective which are critical for low-resourced health care environments.
Keywords: technology**,** dementia - Alzheimer's disease**,** assessment

187 Use of Eye Tracker Technologies in Neurological Populations

Silvana L Costa
Kessler Foundation, East Hanover, NJ, USA

A major challenge faced when examining cognitive functions in individuals with neurological disorders is that many of the commonly used cognitive tests involve motor inputs, such as written response or the use of a keyboard. This limits the utility and validity of the tests in individuals with multiple sclerosis, stroke, spinal cord injury, and other disorders, who often have some form of upper limb impairment. Therefore, development of motor-free ("hands-free") tasks are needed to ensure accurate assessment of cognitive functions, which is now possible with eye tracking technology. This talk will summarize the current state of research utilizing eye tracking in neurological populations and possibilities of using eye tracking technology to assess cognitive functions.

Patterns in eye movements are increasingly investigated as "biomarkers" for neurological dysfunction. There is a volume of research investigating eye movement abnormalities associated with concussion. With eye tracker technology, it is possible to assess the moment-by-moment processes occurring while participants execute a task. Additionally, eye trackers have been used in human-computer interfaces, which can enhance communication and mobility among individuals with significant motor impairment, such as those with amyotrophic lateral sclerosis.

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Eye-tracking technology may be used to create "hands-free" neuropsychological tests, and individuals may be able to perform visual tasks using eye movements instead of their hands. This will allow clinicians to more accurately assess individuals with upper limb impairment. Using eye-tracking technology to assess cognitive functions has several advantages: 1) it is a hands-free methodology, thus accessible to all individuals with neurological pathologies independent of upper limb motor ability; 2) it is non-invasive and is well tolerated by individuals with disabilities, 3) it has minimal secondary effects, the most common of which is mild fatigue, similar to reading/using a computer for a long period of time; 4) besides the initial investment in the eye tracker, it is an inexpensive technology and does not require a dedicated space (thus feasible in hospitals); and 5) it provides more granular information than what can be obtained from traditional neuropsychological assessment, such as moment-by-moment processes while participants execute a visual task and quantification of eye movement kinematics.
Keywords: technology**,** assessment**,** motor function

Symposium 13: Show Me The Money: Grantsmanship for the Early Career Neuropsychologist

11:00am - 12:30pm
Wednesday, February 2, 2022

9 Show Me The Money: Grantsmanship for the Early Career Neuropsychologist

Chair

Shanna Cooper
VA San Diego | Coastal Neuropsych | UC San Diego, San Diego, USA

Discussant

Preeti Sunderaraman
Boston University, Boston, USA

The process of applying for grants can be a time consuming and often unsuccessful process for many scientists, particularly at the early career stage. Although obtaining grants is largely a requirement for research scientists at most institutions, many early career researchers are never formally trained in grantsmanship. This educational symposium, which is directed toward early career scientists, will seek to, first, demystify the process of applying for grants through (1) the NIH (i.e., K-series and R-series) and (2) VHA (i.e., CDA-2 and Merit). Second, we seek to discuss common problems and pitfalls in applying for and managing a grant while balancing other professional and personal aspects that often occur in one's early career. This session aims to set up and provide space for an interactive question-and-answer period, with panelists and attendees collaborating to share information that has led to successful grants at the early career stage.
Keywords: neuropsychological assessment

681 Navigating National Institutes of Health Research Career Development Awards as an Early Career Investigator

Benjamin L. Brett
Medical College of Wisconsin, Milwaukee, WI, USA

Objective: National Institutes of Health (NIH) Career Development Awards are beneficial to early career clinician-scientists, as they allow for continued research training and development toward establishing an independent research program. Creating a proposal can be challenging due to the applicant's often limited experience with the process and the need to balance training and research activities. This presentation will offer recommendations in these areas, with a particular focus on K23 and K99/R00 Awards.
Participants and Methods: Information from this presentation will be based on the presenter's personal experience with a K23 Award, contributions from other K-Award recipients, interviews with Program Officers from different Institutes at the NIH (i.e., National Institute on Aging and National Institute of Neurological Disorders and Stroke), and published resources.
Results: Recommendations will be provided across four categories: 1) timeline for

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constructing the proposal (contacting the program officer, reaching out to potential mentors, duration of time dedicated to each section); 2) developing a balanced training plan that builds on previous work/expertise and identifies new areas for development; 3) building a team of mentors, collaborators and consultants that compliment each other and reflect the training plan and research activities; 4) formulating training plans and research activities in the context of career development that reflects larger career goals and objectives (i.e., leveraging training and research activities to increase competitiveness for NIH Research Grant Program Awards, such as R01 or R21 Awards).
Conclusions: The offered recommendations are intended to aid early career clinician-scientists in the development of K-Award applications, which can serve as one pathway toward becoming an independently funded clinician scientist.
Keywords: writing

685 Keys to Planning and Writing Effective VA Career Development Awards

J.Cobb Scott
University of Pennsylvania, Philadelphia, PA, USA. orporal Michael J. Crescenz (Philadelphia, VAMC), Philadelphia, PA, USA

Objective: VA Career Development Awards (CDA) are important funding mechanisms for early career scientists, but potential candidates often find the process of applying for them confusing and overwhelming. This presentation will attempt to clearly outline the process for planning and writing an effective grant for VA Career Development Awards.
Participants and Methods: This presentation will cover the aim of the CDA program, practical aspects of the application and review process, the criteria that comprise review of a CDA, candidate qualifications, letter of intent, working with a program officer, and all components of the application (budget, career plan, mentoring plan, specific aims, research plan, mentor letters, letters of recommendation). Throughout a review of these components, the presentation will focus on effective structure of each component, rhetorical patterns of successful applications, and tools to help applicants tailor their writing to align with review criteria. Finally, the presentation will discuss strategies for transitioning the CDA to a VA Merit Award to establish a sustainable funding path.
Results: .
Conclusions: This presentation seeks to detail and demystify the process of applying for VA CDAs for early career neuropsychology scientists. Attendees will have a clear outline of this process to facilitate planning, writing, and executing CDA applications. Such knowledge can help early career neuropsychologists launch an independent research career and obtain stable and sustainable funding to support their work.
Keywords: writing

687 Walking the Tightrope of Balancing Personal and Professional Life

Andrea Weinstein
University of Pittsburgh, Pittsburgh, PA, USA

Objective: Imbalance between personal and professional aspects of life can lead to burnout, particularly for the early career scientist. Burnout is even more of a threat for scientists who identify with one or more traditionally marginalized groups. It is imperative to set boundaries around what is truly necessary and/or urgent in order to prevent mental and physical exhaustion, otherwise this exhaustion will that deplete the happiness found in professional and social contexts.
Participants and Methods: This presentation will discuss subjective, anecdotal, and objective evidence on finding and maintaining balance on the tightrope of academic life. Empirical work on reducing/avoiding burn out will be reviewed and strategies will be provided. Additionally, personal factors will be discussed alongside applying for, obtaining, and managing grants as an early career scientist.
Results: .
Conclusions: This presentation seeks to normalize oft undiscussed anxieties present for

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early career scientists, and aims to lend fodder for the extended question and answer period for this proposed symposium.
Keywords: writing

694 Finding Foundation Funding

Emma Rhodes
University of Pennsylvania Frontotemporal Degeneration Center, Philadelphia, PA, USA

Objective: Foundations are an additional mechanism for funding for the early career scientist. Successful applications, however, tend to require a slightly different approach than most other funding sources.
Participants and Methods: This presentation will discuss: 1) processes for finding foundation funding; 2) highlighting the foundation's current goals in the submission, 3) writing for a non-scientific audience; 4) updating the foundation on progress after receipt of award.
Results: .
Conclusions: This brief presentation will discuss take a birdseye approach in covering frequent pitfalls and problems that are often present in foundation applications.
Keywords: writing

Paper Session 17: Aging 2

11:00am - 12:30pm
Wednesday, February 2, 2022

1 Socioeconomic Status, Biological Aging, and Memory in a Diverse National Sample of Older US Men and Women

Justina F Avila-Rieger, Indira C Turney, Jet M. J. Vonk, Precious Esie, Dominika Seblova, Vanessa R Weir, Daniel W Belsky, Jennifer J Manly
Columbia University Irving Medical Center, New York, NY, USA

Objective: Exposure to socioeconomic disadvantage is associated with early-onset cognitive aging. Biological aging, the progressive loss of system integrity that occurs as we age is proposed as a modifiable process mediating this health inequality. We examined whether socioeconomic disparities in cognitive aging in older adults is explained by accelerated biological aging similarly across race/ethnicity and sex/gender.
Participants and Methods: We used data from 3,997 adults aged 50-100 in the U.S. Health and Retirement Study DNA-methylation sub-study. Socioeconomic status (SES) was measured from years of education and household wealth at baseline. The extent and pace of biological aging were quantified using three DNA-methylation measures: PhenoAge, GrimAge, and DunedinPoAm. Cognitive aging was measured from repeated longitudinal assessments of immediate and delayed word recall. Latent growth curve modeling estimated participants' level of memory performance and rate of decline over 2-11 follow-up assessments spanning 2-20 years. Multiple-group models were estimated to assess whether the relationship between SES and memory trajectories was mediated by biological aging across racial/ethnic by sex/gender subgroups.
Results: Older adults with lower SES had lower memory performance, faster decline and exhibited accelerated biological aging (SES effect size associations ranged from .08 to .41). Accelerated biological aging was associated with decreased memory performance and faster memory decline (effect-size range .03 to .23). SES-biological aging associations were strongest for White men and women and weakest for Latinx women. The relationship between biological aging measures and memory was weaker for Black participants compared with White and Latinx people. In mediation analysis, biological aging accounted for 4-27% of the SES-memory gradient in White participants. There was little evidence of mediation in Black or Latinx participants.
Conclusions: Among a national sample of older adults, DNA-methylation measures of biological aging were variably associated with memory trajectories and SES across White, Black, and Latinx older adults. These results challenge the assumption that DNA-methylation biomarkers of aging that were developed in primarily White people can equivalently quantify aging

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processes affecting cognition in Black and Latinx older adults.
Keywords: diversity**,** cognitive functioning**,** minority issues

2 Childhood SES and Age-Related Brain Health in Racially/Ethnically Diverse Older Adults

Shawn X Crowley[1], Indira C Turney[2], Justina Avila-Rieger[2], Kacie Deters[3], Ketlyne Sol[4], Shellie-Anne Levy[5], Mirella Diaz-Santos[6], Franchesca Arias[7], Carmen Carrion[8], Tanisha G. Hill-Jarrett[9], Luis Medina[10], Sarah Tom[2], Rebecca Melrose[6], Richard Jones[11], Nicole Schupf[2], Richard Mayeux[2], Adam M. Brickman[2], Jennifer J. Manly[2]
[1]Morehouse School of Medicine, Atlanta, GA, USA. [2]Columbia University Medical Center, New York City, NY, USA. [3]University of California San Diego, San Diego, CA, USA. [4]University of Michigan, Ann Arbor, MI, USA. [5]University of Florida, Tampa, FL, USA. [6]University of California, Los Angeles, Los Angeles, CA, USA. [7]Beth Israel Deaconess Medical Center, Boston, MA, USA. [8]Yale University School of Medicine, New Haven, CT, USA. [9]University of South Florida, Tampa, FL, USA. [10]University of Houston, Houston, TX, USA. [11]Brown University, Providence, RI, USA

Objective: Childhood socioeconomic status (CSES) is a multifaceted construct that molds our environment in early life. CSES dictates everything from our access to healthcare to nutrition in infancy and childhood. Studies link socioeconomic disadvantage in childhood to a greater risk for dementia in late life. For example, participants from lower CSES backgrounds exhibit smaller brain volume, altered brain function, and are more likely to have dementia in later life than people from high CSES backgrounds. These studies have started a critical discourse on the link between CSES and age-related brain health. However, many of these studies included predominantly non-Latinx White participants and have neglected to examine this link in more diverse populations.The purpose of this study was to investigate whether CSES moderates the relationship between age and MRI markers of brain health, and to determine whether CSES moderates this relationship differently across race/ethnicity groups.
Participants and Methods: Participants were 924 racially/ethnically diverse older adults drawn from the Washington Heights Inwood Columbia Aging Project, who received MRI scans (mean age=75.2 (SD=6.5) years; 234 non-Latinx White, 325 non-Latinx Black, 365 Latinx; 61% women). We used general linear models to examine the relationship of age to MRI markers of neurodegeneration (cortical thickness in AD signature regions) and cerebrovascular disease (white matter hyperintensity volume; WMH) and to determine whether CSES moderated this relationship. We did this in the full sample and in groups stratified by race/ethnicity. CSES was a composite factor score that included number of siblings, and parents' education & occupation. Tertials were made based on the distribution of the factor scores and labeled low, medium, and high.
Results: First, in the full sample, older participants had greater WMH volume and lower cortical thickness than younger participants, Black and Latinx participants had lower cortical thickness, and Black participants had greater WMH, compared to White participants. Also in the full sample, there was no main effect of CSES on WMH or cortical thickness. There were no interactions between age and CSES in the full sample – in other words, the relationship between age and WMH did not vary across CSES levels. There were no interactions between age and CSES when cortical thickness was used as the outcome.

Next, we tested interactions between age and CSES in race/ethnicity stratified models. Among older White participants, there was an interaction between age and CSES, such that age had a diminished effect on cortical thickness among those with high CSES compared to those with low (B=-0.006, CI=-0.015, 0.004) and medium (B=-0.006, CI=-0.011, -0.001) CSES. However, higher CSES did not buffer the effect of age on cortical thickness among Black and Latinx participants. There were no interactions between age and CSES in race stratified models using WMH as the outcome
Conclusions: These results suggest that CSES may be more relevant for cortical thickness

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because of early brain development, but less relevant for WMH because they are accumulated in later life. Higher CSES buffered age-related neurodegeneration in White participants, but not in Black and Latinx people. Possible explanations for effect modification by race/ethnicity are multifaceted, so future work should dissect the individual CSES factors that were included in our combined factor score.
Keywords: dementia - Alzheimer's disease**,** aging (normal)

3 Sex Differences in the Relationship between Perceived Stress and Cognitive Trajectories

Emily W. Paolillo, Michelle You, Eva Gontrum, Joel H. Kramer, Kaitlin B. Casaletto
UCSF Memory and Aging Center, San Francisco, CA, USA

Objective: Chronic stress adversely affects cognitive functioning. Sex differences in this relationship have been found in rodents such that females are more resilient to stress; however, few studies have examined this among humans. This longitudinal study examined sex differences in the relationship between perceived stress and cognitive functioning over time among functionally normal older adults. We hypothesized that higher perceived stress would relate to steeper cognitive declines and that this relationship would be stronger among men. To explore contribution of inflammatory processes, we additionally examined whether perceived stress related to inflammatory marker trajectories.
Participants and Methods: Participants included 274 functionally normal older adults enrolled in the UC San Francisco Memory and Aging Center's brain aging study (baseline age: M=70.7, SD=7.2; 58% women; Clinical Dementia Rating=0). All participants completed at least 2 study visits (total years follow up: M=6.82, SD=3.99) during which they completed an annual neurocognitive battery and self-report measures (i.e., Perceived Stress Scale [PSS], Geriatric Depression Scale [GDS]). Composite z-scores were calculated for cognitive domains of memory, executive functioning, and processing speed. Two robust plasma-based markers of inflammation (i.e., interleukin 6 [IL-6] and tumor necrosis factor alpha [TNF-α]) were collected via blood draw at ≥2 visits in a subset of 147 participants. Inflammatory marker values were log-transformed. Linear mixed effects models examined the interaction between average PSS score (i.e., averaged within persons across visits), sex, and time (i.e., years since baseline) on each cognitive domain, covarying for average age, education, and average GDS. Linear mixed effects models also examined the interaction between average PSS score, sex, and time on inflammatory markers. Person-specific random intercepts and a random effect of time were specified.
Results: There was a significant interaction between average PSS score, sex, and time on executive functioning (p=0.012) such that among men only, higher average PSS scores were associated with steeper declines in executive functioning (b=-0.004, SE=0.001, p<0.001). Although the three-way interaction was not significant for processing speed, sex-stratified analyses showed that the relationship between average PSS score and processing speed over time demonstrated larger effects among men (b=0.005, SE=0.003, p=0.076) than women (b=0.001, SE=0.003, p=0.571). There were no sex differences in the relationship between average PSS score and memory trajectories. Among the subset of 147 participants with inflammatory marker data, there was a significant interaction between average PSS score, sex, and time on IL-6 (p=0.043) such that higher average PSS was associated with steeper increases in IL-6 over time in men (b=0.004, SE=0.002, p=0.043), but not women (p=0.749). There were no sex differences in the relationship between average PSS score and TNF-α trajectories.
Conclusions: Results are consistent with animal models suggesting men are more vulnerable to the negative effects of stress during cognitive aging. Our data demonstrating executive and processing speed specific effects, as well as inflammatory associations implicate possible immuno-vascular mechanisms underlying a protective effect among women. Future work is needed to better understand hormonal, chromosomal, and other biological differences that may underlie the attenuated

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association between stress and cognitive decline among older postmenopausal women.
Keywords: aging (normal)

4 Neighborhood Variability in Cognitive Function

Cheyenne V Parson[1,2], Dominika Seblova[1], Joan A Casey[1], Erin R Kulick[3], Adam M Brickman[1], Karen A Dorsman[4], Richard P Mayeux[1], Jennifer J Manly[1]
[1]Columbia University, New York, NY, USA. [2]Washington University in St. Louis, St. Louis, MO, USA. [3]Temple University, Philadelphia, PA, USA. [4]The University of Texas Southwestern Medical Center, Dallas, TX, USA

Objective: Low neighborhood-level socioeconomic status (SES) correlates with poorer health outcomes. These outcomes carry into late-life health. Previous literature suggests that people who live in lower SES neighborhoods obtain lower scores on cognitive tests. In this study, we hypothesized that an individual's residential neighborhood, including all aspects of a neighborhood's built and natural environment, contributes to cognitive function. Additionally, we hypothesized that cognitive function would be explained by neighborhood, even after controlling for individual-level demographic and socioeconomic factors.
Participants and Methods: Baseline tests of memory (n=5162), language (n=4868), visuospatial abilities (n=5109), and perceptual speed (n=3038) were analyzed in participants from the Washington Heights Inwood Columbia Aging Project cohort residing in Northern Manhattan, New York (mean age: 75.7 years). Composite scores were generated for tests within each cognitive domain, and all were Z-scored. We excluded people with prevalent dementia at baseline, and people who were missing covariate data. We used census block groups (n=366) as proxies for neighborhood. The data were analyzed using the GLIMMIX procedure in SAS. We fit two multilevel linear models: Model 1 adjusted only for age, and Model 2 adjusted for age, gender, childhood socioeconomic status, years of education, occupation, language, and recruitment cohort (1992, 1999, or 2009). The outcome of interest is the variation in each cognitive outcome attributable to the census block that participants reside.
Results: Our sample self-identified as Hispanic (43.0%, n=2261), Non-Hispanic Black (30.6%, n=1607), or Non-Hispanic White (25.1%, n=1320). Most of our sample were women (67.1%, n=3527), and the average amount of education was 10.3 years. There was substantial variability in cognition depending on census block group: composite scores varied in memory (range: -0.88, 1.84), language (range: -1.29, 1.66), visuospatial ability (range: -1.72, 1.42), and perceptual speed (range: -2.04, 1.82). Including random intercept for each census block group improved the model fit in Models 1 and 2. In Model 1, there was substantial variance at the block-group level for language (30.3%), visuospatial abilities (19.2%), perceptual speed (15.4%), and memory (8.4%). Accounting for individual variables in Model 2 substantially decreased the variation attributed to block groups for language (3.5%), visuospatial abilities (2.7%), perceptual speed (2.4%), and memory (1.2%).
Conclusions: In a cohort of older, cognitively healthy participants, census block group explained a substantial portion of cognitive test performance variability, especially for language measures, but this effect was much less pronounced when accounting for individual-level life-course demographic and socioeconomic covariates. Contrary to previous findings, our findings suggest that neighborhood factors may not significantly predict cognitive function after accounting for individual-level factors. Structural racism is a fundamental cause of both educational opportunities and residential segregation, so the covariates used in Model 2 may have over-adjusted and biased the estimates of neighborhood effects toward the null. Our findings highlight the importance of assessing both individual and neighborhood factors when characterizing contextual influences on later-life cognitive function.
Keywords: aging (normal)

5 Effect Modification of Discrimination on the Association of Changes in Inflammation with Cognition and White

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Matter Hyperintensity Burden Over Time in the Minority Aging Research Study

Elizabeth A Boots[1,2], Sue Leurgans[2], Douglas L Feinstein[1], Debra Fleischman[2], Konstantinos Arfanakis[2,3], Lisa L Barnes[2], Melissa Lamar[2]
[1]University of Illinois at Chicago, Chicago, IL, USA. [2]Rush Alzheimer's Disease Center, Chicago, IL, USA. [3]Illinois Institute of Technology, Chicago, IL, USA

Objective: Higher levels of inflammatory markers have been implicated in the pathogenic process of dementia including cognitive decline and higher white matter hyperintensity (WMH) burden. Further, many of these same inflammatory markers, including interleukin-6 (IL-6) and C-reactive protein (CRP), have been associated with culturally-relevant psychosocial stressors, such as discrimination, in older Black adults. Relatively few studies have investigated inflammation, brain-behavior, and discrimination in the same longitudinal study. We examined the associations between changes in inflammation and changes in cognition and WMH burden over time, and whether experiences of discrimination modify these relationships in older Black adults from the Minority Aging Research Study (MARS).
Participants and Methods: 117 older Black adults without known dementia at baseline (mean age=76 years; 84.4% female; mean education=15.23 years) completed blood draws, cognitive testing, MRI, and a discrimination questionnaire at two or more time points (mean follow-up: cognitive=5.9 years; MRI=2.6 years). Blood serum from two time points was assayed using highly-sensitive multiplexed sandwich ELISA for IL-6, CRP, and tumor necrosis factor-alpha and a two-point change score was created for each inflammatory marker. Raw scores from 19 neuropsychological tests were converted to z-scores and combined to create a global cognitive functioning composite and five cognitive domain scores (episodic memory, semantic memory, working memory, visuospatial ability, perceptual speed). WMHs were segmented from T1-weighted and T2-FLAIR images using in-house software. The Williams Everyday Discrimination Scale quantified self-reported experiences of discrimination. Linear mixed effects regression models examined associations between our 3 inflammatory change scores (separately) and change in cognition (global and the 5 domain scores, separately) and WMH burden adjusting for age, sex, education, cardiovascular disease risk factors, body mass index, statin and anti-inflammatory medication use, thyroid disorders, depression, time-in-study, and interactions of each of these variables with time. To determine whether discrimination modified these results, we repeated the analyses while adding individual inflammatory marker*discrimination interaction terms and their three-way interaction with time to the core models.
Results: In fully-adjusted models, there were no significant associations between any of our inflammatory change scores and cognition or WMH burden over time. Discrimination did, however, modify the association between CRP and cognitive change such that participants with increasing change in CRP across two time points coupled with higher levels of discrimination at baseline demonstrated steeper declines in perceptual speed over time (estimate=-0.0002, SE=.001, p=.0273).
Conclusions: While change in inflammatory markers did not predict longitudinal change in cognition or WMH burden over time in older Black adults, the combined impact of increasing CRP and higher levels of discrimination did predict faster rates of decline in perceptual speed. Thus, considering the combined effect of inflammation and culturally-relevant psychosocial stressors in longitudinal studies of older Black adults may be an important combination for identifying risk of cognitive decline in this minoritized population.
Keywords: diversity**,** aging (normal)**,** neuroimaging: structural

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6 Reproductive Health Span and Time Since Menopause are Associated with Inflammation and Cognition in Typically-Aging Women

Harli E Grant[1], Lauren Goldberger[1], Laura Pritschet[2], Emily Jacobs[2], Joel H Kramer[1], Kaitlin B Casaletto[1]

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Objective: More than two-thirds of Alzheimer's disease cases in the United States are women, yet how biological sex contributes to cognitive aging remains unknown. During the transition to menopause, women experience >90% reduction in 17b-estradiol levels, a neuromodulatory hormone that supports brain structure and function. Studies suggest that female brains undergo reorganization during the transition to menopause, often starting in the early to mid-50's. Sex hormones have also been shown to be protective for chronic inflammation, a putative risk factor for Alzheimer's disease and other neurodegenerative diseases. Here, we examined how reproductive health span (RHS) and time since menopause (TSM), which may reflect estrogen exposure, related to peripheral inflammatory markers (IL-6, TNF-a, MDC, and MCP-1) and neurobehavioral health in postmenopausal women.
Participants and Methods: 88 functionally-intact postmenopausal women (age M=70.19, CDR=0) underwent cognitive testing, brain MRI, a blood draw, and completed a reproductive health history questionnaire. RHS was calculated as the difference between age at menarche and final menstrual period (menopause). TSM was calculated as the number of years since menopause at the time of the research visit. Inflammation was assessed using peripheral inflammatory markers IL-6, TNF-a, MDC, and MCP-1. Cognition included domain scores reflecting executive functioning, episodic memory, and language (animal fluency). MRI assessments included total grey matter volume (GMV) and white matter volumes (WMV). Linear regression models were used to test associations between the reproductive health variables. Further, we explored interactions between reproductive health and APOE-e4 status. All analyses adjusted for age and education.
Results: Longer TSM was associated with higher plasma levels of IL-6, TNF-a, and MDC (B=0.31 to 0.42, ps<0.05). Similarly, shorter RHS related to higher MDC (B=-0.29, p=0.01); relationships with IL-6 and TNF-a did not reach significance (B=-0.16 to -0.17, ps<.11). Neither TSM nor RHS significantly related to MCP-1. Longer TSM and shorter RHS related to poorer executive functions (B=-0.50 to 0.26, ps<0.01), and poorer language related to longer TSM (B=-0.35, p=0.04) but did not reach significance with RHS (B=0.20, p=0.07). Neither related to memory. Both reproductive health variables related more strongly with WMV (B=-0.29 to 0.22, ps <.12) than GMV, but neither reached statistical significance. There was a significant interaction between APOE-4 and IL-6, in which the beneficial relationship between shorter TSM and longer RHS on IL-6 was attenuated in APOE-e4 carriers (B=-1.11 to 1.06, ps<.04). No other interactions were found.
Conclusions: Reproductive aging may play a role in observed sex differences in cognitive aging. Females with longer reproductive spans and less time since menopause had lower levels of inflammatory markers and better executive and language functioning. APOE-e4 significantly attenuated the relationship between both reproductive health variables and IL-6. More research is needed to examine potential protective effects of reproductive hormones in mid-life to further understand the unique biological mechanisms of sex-based differences in cognitive aging and the relationship between reproductive health, chronic inflammation, and brain health outcomes in females.
Keywords: aging (normal)

Paper Session 18: Oncology

11:00am - 12:30pm
Wednesday, February 2, 2022

1 Biomarkers of Cognitive Sequelae in Breast Cancer Patients Throughout Chemotherapy: a Systematic Review

Gwen Schroyen[1,2,3], Julie Vissers[3], Michelle Melis[1,2,3], Ann Smeets[2,4,5], Céline R. Gillebert[1,6], Jurgen Lemiere[2,4,7], Stefan Sunaert[1,3,8], Sabine Deprez[1,2,3], Charlotte Sleurs[1,2,4]
[1]Leuven Brain Institute, KU Leuven, Leuven, Belgium. [2]Leuven Cancer Institute, KU Leuven, Leuven, Belgium. [3]Department of Imaging and Pathology, KU Leuven, Leuven, Belgium.

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Objective: Cancer-related cognitive impairment is broadly reported, with a wide range (17-78%) of patients being affected, mainly in domains of memory, attention, psychomotor speed and executive functioning. Additionally, cancer treatment can induce alterations in fluid- and neuroimaging-based markers, known to associate with cognitive scores in other populations. However, an overview of the predictive value of these markers for cognition is lacking for breast cancer survivors.
Participants and Methods: This systematic review summarized studies of the last decade evaluating changes in fluid markers as well as the association between fluid- or structural neuroimaging markers and cognition, after chemotherapy for primary breast cancer, following PRISMA guidelines and based on the PubMed database.
Results: Forty-four studies were included. Our review showed that blood-based biomarkers are affected in patients with breast cancer over the course of a chemotherapeutic treatment, persisting up to 20 years post-therapy. Associations were found between cognitive functioning and 1) blood markers (mainly inflammatory, blood cells/proteins) during, shortly-, or years post-chemotherapy and 2) white and grey matter parameters in frontal, temporal and parietal brain-regions months up until years post-chemotherapy. Preliminary evidence exists for epigenetic and metabolic changes being associated with cognition, only after chemotherapy. Finally, cerebrospinal fluid or neuronal integrity markers were not or rarely reported, respectively.
Conclusions: This review demonstrated time-dependent associations between specific fluid-based and structural brain imaging markers with cognitive impairment in breast cancer patients. We suggest structural brain changes, inflammatory markers and blood/cells proteins to potentially provide more insights into individual susceptibility to cognitive decline at any timepoint, while the allostatic load markers of blood/brain metabolism, neuronal integrity or epigenetics could be more robust indicators of long-term cognitive effects of chemotherapy. Especially for evaluating long-term associations, blood markers could provide for a more easily accessible alternative or add-on marker to neuroimaging. However, the time-dependency of these associations needs to be clarified further to provide the required information on potential future therapeutic targets.
Keywords: neurotoxicity**,** chemotherapy**,** neuroimaging: structural

2 Hypogonadism and Neurocognitive Outcomes in Long-Term Survivors of Childhood Cancer: A Report From the St. Jude Lifetime Cohort (SJLIFE) Study

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Objective: Few studies have assessed contributions of hypogonadism to neurocognitive outcomes in childhood cancer survivors. We sought to explore associations between primary or central hypogonadism and neurocognitive impairment in a large cohort of systematically assessed survivors.
Participants and Methods: Participants included 3,628 childhood cancer survivors (47.6% female; mean [SD] current age 35.7 [10.9] years; 8.7 [5.6] years at diagnosis) in the St. Jude Lifetime Cohort Study who participated in clinical evaluation including neurocognitive testing to assess intelligence, academics, attention, memory, processing speed and executive function. Hypogonadism was classified as **central** (Males: luteinizing hormone [LH] ≤9.85 mIU/mL AND total testosterone <250 ng/dL; Females: Follicle-stimulating hormone [FSH] ≤11.2 mIU/mL AND estradiol ≤17 pg/mL)

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or **primary** (Males: LH ≥9.85 mIU/mL AND Total testosterone <250 ng/dL; Females: FSH ≥30 mIU/mL AND estradiol ≤17 pg/mL). Neurocognitive scores were transformed to age-adjusted z-scores using national norms and impairment was defined as having a z-score below the 10th percentile. Chi-squared tests were used to identify neurocognitive measures that demonstrated a higher prevalence of impairment than expected (10%), adjusted for false discovery rate. Multivariable Poisson regression was used to examine differences in impairment between eugonadal (normal gonadal function) and hypogonadal survivors, adjusted for race, age at diagnosis, chronic conditions, and treatment exposures. All analyses were stratified by sex.
Results: Among hypogonadal females (n = 335), a significantly higher proportion were impaired than eugonadal survivors in global cognition (verbal reasoning 22.0% vs. 16.5%, respectively, P=0.023; non-verbal reasoning 17.4% vs. 10.5%, P=0.002), processing speed (Trails A 19.1% vs 10.5%, P<0.001; Symbol Search 20.6% vs 12.8%, P=0.039; Digit Symbol 25.8% vs 13.3%, P<0.001), attention (CPT omissions 17.9% vs 12.7%, P=0.045), academics (word reading 11.6% vs 6.7%, P=0.009) and executive function (Trails B 29.6% vs 22.5%, P=0.028; verbal fluency 24.7% vs 18.9%, P=0.039). Similarly, hypogonadal males (n = 325) were significantly more likely to be impaired in attention (CPT perseveration 20.1% vs 14.4%, P=0.045; CPT Hit reaction time 17.6% vs 11.6%, P=0.029), processing speed (trails A 21.3% vs 15.3%, P=0.016; coding 31.3% vs 23.7%, P=0.016), memory (CVLT Total recall 22.7% vs 16.5%, P=0.015; CVLT short-delay free recall 22.0% vs 16.7%, P=0.033; CVLT long-delay free recall 27.8% vs 20.1, P=0.008; visual selective reminding 38.6% vs 27.5%, P=0.002), and executive function (verbal fluency 32.6% vs 23.7%, P=0.003). In multivariable models, attention (CPT Hit reaction time relative risk [RR] 1.82, 95% confidence interval [CI] 1.31, 2.55), academic achievement (word reading: RR 1.55 CI 1.04-2.31), and processing speed (coding RR 1.37 CI 1.06-1.75) were associated with hypogonadism in females. After adjusting for treatment exposures, associations between hypogonadism and cognitive impairment were no longer significant in males. Cranial irradiation and cardiopulmonary and neurologic conditions explained much of the elevated rates of impairment in males.
Conclusions: Hypogonadal survivors may be more likely to experience neurocognitive impairment than eugonadal survivors. However, other chronic conditions and treatment exposures were also associated with impairment suggesting contributions of multiple pathways to neurocognitive outcomes and multiple targets for interventions to improve neurocognitive function in this population.
Keywords: cognitive functioning**,** endocrine disorders**,** cancer

3 Late Neurocognitive Decline in Adult Survivors of Childhood Cancer: A Report from the St. Jude Lifetime Cohort Study

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Objective: While studies have examined neurocognitive change from treatment to long-term follow-up in childhood cancer survivors, progressive or late-onset decline during adulthood has not been previously reported. This longitudinal study aimed to examine neurocognitive decline in aging adult survivors of childhood acute lymphoblastic leukemia (ALL).
Participants and Methods: 730 long-term survivors of ALL (50.1% female; mean [SD] age at diagnosis 6.6 [4.4] years; age at first assessment 30.7 [8.1] years; time between first and last assessment 6.0 [2.0] years) completed ≥2 neuropsychological assessments (WAIS-IV, CVLT-II, WJ-III, CPT-II, Grooved Pegboard, Trail Making, COWA) as part of the St. Jude Lifetime Cohort Study. Neurocognitive performance was converted to age-adjusted z-scores using published normative data. Standard errors of the measures were used to generate 95% confidence intervals (CI) around first assessment scores, and clinically and

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statistically significant neurocognitive decline was defined as a follow-up score below the lower CI. Modified Poisson regression analysis was used to examine associations between treatment (cranial radiation therapy [CRT]; none/<20Gy/≥20Gy, and cumulative dose of chemotherapy) and decline among those unimpaired at initial testing (defined as a score >10th percentile of normative data). Covariates included age at diagnosis, age at initial testing, time between initial and last assessment, initial neurocognitive score, sex, and relapse/second malignancy.
Results: Across neurocognitive outcomes, between 11.8% (n=78; Letter-Word Identification) and 30.1% (n=185; CPT Reaction Time) of survivors who were unimpaired at initial testing demonstrated significant decline at follow-up. Among those unimpaired at initial testing, older age at initial evaluation was associated with lower risk of decline on CVLT Short-Delay Free Recall (RR=0.94 per year, 95%CI 0.91-0.98), with no significant effects of sex or age at diagnosis (p's>0.05). CRT was associated with elevated risk of decline in a dose-dependent manner compared to no CRT for Letter-Word Identification (<20Gy RR=1.96, 95%CI 1.11-3.46; ≥20Gy RR=2.09, 95%CI 1.16-3.77), Trails A (<20Gy RR=2.21, 95%CI 1.01-4.85; ≥20Gy RR=3.88, 95%CI 1.82-8.29), and Trails B (<20Gy RR=2.72, 95%CI 1.36-5.42; ≥20Gy RR=3.05, 95%CI 1.53-6.10). Significant interactions between CRT and time from initial to follow-up testing were found for Grooved Pegboard (p=0.04), CPT Commissions (p=0.001) and Digit Span Backward (p=0.02). For Grooved Pegboard, the ≥20Gy CRT group showed a higher risk of decline over time compared to the no CRT group (RR=1.39, 95%CI 1.08-1.80), with no significant differences between the other CRT groups. The <20Gy CRT group demonstrated a lower risk of decline over time on CPT Commissions compared to the no CRT group (RR=0.73, 95%CI 0.62-0.87) and the ≥20Gy CRT group (RR=0.81, 95%CI 0.68-0.97). On Digit Span Backward, the <20Gy CRT group demonstrated a higher risk of decline over time compared to the no CRT group (RR=1.40, 95%CI 1.11-1.77) and the ≥20Gy CRT group (RR=1.37, 95%CI 1.04-1.79).
Conclusions: In survivors of childhood ALL who were on average 25 years post-diagnosis, late-onset neurocognitive decline was common and associated with CRT dose. This finding suggests the need for continued monitoring of neurocognitive function throughout survivors' lives if CRT was administered, even for those who do not demonstrate problems decades after diagnosis.
Keywords: neurocognition**,** cancer**,** aging disorders

4 Graph Analysis of Structural Brain Networks and Associations with Core Cognitive Constructs in Pediatric Brain Tumor Survivors

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Objective: Research has found altered brain network connectivity in pediatric brain tumor survivors (PBTS). Efficient brain networks are characterized by a balance of integration and segregation of processing to facilitate cognitive functions. Three core cognitive constructs have been identified as particularly important for broad outcomes in PBTS: attention, working memory, and processing speed. We examined whether these three constructs are related to structural brain network integration and segregation in PBTS and healthy controls. Based on prior research, we would expect integration and segregation to be lower in PBTS, for processing speed to be significantly associated with a measure of integration, working memory with segregation, and attention with both integration and segregation.
Participants and Methods: 37 adolescent and young adult PBTS and 39 healthy controls (mean age=23, SD=5.0) completed neuropsychological assessment and MRI. Digit Span Forward (DSF) measured attention, Auditory Consonant Trigrams (ACT) measured working memory, and the Oral Symbol Digit Modalities Test (OSDMT) measured processing speed. The Neurological Predictor Scale (NPS) quantified neurological risk in PBTS. Fractional anisotropy (FA) was computed using deterministic tractography, graph nodes were

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defined using the Automated Anatomical Labeling Atlas, and edges were the average FA between two nodes. Proportional thresholding was set to the average network density (τ=0.28) and a more conservative threshold (τ=0.20) was utilized for comparison. Graph metrics were then calculated: global efficiency (GE), a measure of integration, reflects the topological distance between two given nodes such that shorter distances imply higher efficiency . Clustering coefficient (CC) measures segregation by quantifying the degree of local communication among neighboring nodes. T-tests and Pearson correlations were conducted.
Results: PBTS demonstrated lower GE and CC values at a density τ=0.28, but only GE was different in the more conservative graph (τ=0.20). PBTS performed more poorly on measures of attention, working memory, and processing speed. At both thresholds, GE was positively associated with OSDMT and DSF (*r*=0.24-0.36), as hypothesized. Similarly, CC was positively related to ACT and DSF at both thresholds (*r*=0.25-0.29). Finally, GE and CC were negatively related to the NPS in both graphs (*r* = 0.364-0.586).
Conclusions: The PBTS in our sample demonstrate lower efficiency and clustering throughout the brain compared to healthy controls, though this finding was most robust for GE. As predicted, a measure of network integration/efficiency (GE) was related to processing speed and attention, consistent with the theory that these functions are reliant on the efficient integration of distributed and parallel brain processes. Similarly, a measure of network segregation (CC) was related to working memory and attention, reflecting a role for more localized processing in these functions. These findings did not change appreciably when calculated in a sparser graph with more stringent criteria for edges. Finally, GE and CC were both robustly negatively related to the NPS, suggesting PBTS with greater neurological risk demonstrate larger differences in the brain network. Future work should explore whether these brain network characteristics predict core cognitive outcomes above and beyond other known predictors (e.g., radiation therapy) to continue to improve identification of at-risk patients.

Keywords: brain tumor**,** neuroimaging: structural connectivity**,** cognitive functioning

5 Neurocognitive Impairment, Neurobehavioral Sequelae, Fatigue, Sleep Disturbance, and Depressive Symptoms in Patients with Newly Diagnosed Glioblastoma

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Objective: Glioblastoma (GBM) is the most common malignant brain tumor in adults, with poor survival rates and neurological sequelae that negatively affect quality of life. We investigated the prevalence of neurocognitive impairment, neurobehavioral sequelae, fatigue, sleep disturbance, and depressive symptoms in newly diagnosed GBM patients. We also examined whether neurobehavioral sequelae, fatigue, sleep, and depressive symptoms influence neurocognitive performance.
Participants and Methods: This study was part of a prospective, inception cohort, single-arm exercise intervention study in which GBM patients were assessed prior to chemoradiation (baseline) and 3-, 6-, 12-, and 18- months later, or until tumor progression. Here, we present the baseline data from this study. Forty-five GBM patients (mean age = 54.7, SD=12.5; 73% male) completed validated objective tests of verbal memory (Hopkins Verbal Learning Test-Revised (HVLT-R)), executive function (Trail Making Test (TMT)), and speeded lexical fluency (Controlled Oral Word Association (COWA)), and self-report measures of neurobehavioral sequelae (Frontal Systems Behavior Scale), fatigue (Fatigue Symptom Inventory), sleep disturbance (Pittsburgh Sleep Quality Index), and depressive symptoms (Hospital Anxiety and Depression

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Scale). In accordance with the International Cancer and Cognition Task Force guidelines, patients with at least 2 test *z*-scores < -1.5 or one test *z*-score < -2.0 were classified as having neurocognitive impairment. Frequency of impairment on each test was defined as the number of patients with scores at or below a *z*-score of -1.5 or above clinical cut-offs on self-report measures. A Global Deficit Score was derived by weighting the number and severity of below average scores in the test battery; *z*-scores >-1.5 were coded as 0, *z*-scores <-1.5 and >-2.0 were coded as 1, and *z*-score <-2.0 were coded as 2 and then averaged to create one score.
Results: Despite average estimates of premorbid IQ (Wechsler Test of Adult Reading; mean = 107.1, SD = 7.4), GBM patients scored significantly lower on all neurocognitive tests than normative samples, with 34 (76%) exhibiting neurocognitive impairment. Specifically, 53% displayed deficits in memory (HVLT-R Delayed Recall), 51% in executive functions (TMT B), 42% in learning (HVLT-R Total), 41% in verbal fluency (COWA), and 24% in attention (TMT A). A substantial proportion reported elevated neurobehavioral sequelae (27%), fatigue (57%), sleep disturbance (70%), and depressive symptoms (32%).
The Global Deficit Score was univariately associated with fatigue (b=0.067, *p*=0.100), depression (HADS; b=0.054, *p*=0.026), apathy (FrSBe; b=0.009, *p*=0.100), and self-reported executive dysfunction (FrSBe; b=0.009, *p*=0.086), which were subsequently entered in a multivariate analysis. In the backward selection linear multivariate regression analysis, only depression remained significantly related to the Global Deficit Score, explaining 11.3% of the variance, $F(1, 42) = 5.327$, $p=.026$, AIC = 63.7403, RMSE=0.4773.
Conclusions: Our findings underscore that GBM patients are vulnerable to adverse sequelae including neurocognitive impairment, neurobehavioral sequelae, fatigue, sleep disturbance and depressive symptoms early in the course of the disease. Those with increased depressive symptoms are even more likely to experience neurocognitive deficits, highlighting the need for early identification and treatment of depression in this population.

Keywords: cancer, brain tumor

6 Assessing Learning and Memory Among Patients with Pediatric Brain Tumor (PBT): A Comparison of Measures

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Objective: Deficits in memory can occur in patients with pediatric brain tumor (PBT) due to tumor location, medical complications, and treatment-related late effects following chemotherapy and/or irradiation. The *California Verbal Learning Test-Children's Version* (*CVLT-C*), a rote verbal learning and memory measure, has been a staple in pediatric neuropsychological batteries since published in 1994. More recently published (2015), the *Child and Adolescent Memory Profile* (*ChAMP*) also includes rote verbal learning and memory subtests, though contains fewer learning trials (three versus five) and does not assess interference, cued recall, or retrieval patterns. The main objective of this study was to compare these tools to investigate whether the briefer *ChAMP* similarly identifies learning and memory concerns following diagnosis and treatment for PBT.
Participants and Methods: 120 patients with PBT ages 5-16 ($\bar{x}$=10.89 years, *SD*=3.22), were administered the *ChAMP* (n=72) or *CVLT-C* (n=48). The sample was split evenly (50%) for sex, though was primarily Latinx (48%), followed by Caucasian (29%), Asian American (9%), Black (7%), and Other. There were no differences between measures related to sex, χ^2 (1, *N*=120)=0.56, *p*=.456, or ethnicity, χ^2 (4, *N*=120)=2.28, *p*=.685. Three constructs were analyzed using standardized scores: rote verbal learning (*ChAMP Lists, CVLT-C Total Trials 1-5*); long term retrieval (*ChAMP Lists Delayed, CVLT-C Long-Delay Free Recall*); and recognition (*ChAMP Lists Recognition, CVLT-C Discriminability*). Z-scores were computed and controlled for age differences. Three lower-end recognition outliers among patients administered the *CVLT-C*

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(identified using a 2.2 multiplier for increased validity) were removed prior to analyses.
Results: Levene's test for equality of variances was found to be violated across learning and long term retrieval trials ($p \leq .002$), suggesting larger spread in retrieval scores in the *CVLT-C* group. Therefore, Welch's *t*-tests were used to detect differences in performance between patients administered the *ChAMP* and *CVLT-C.* Analyses did not reach statistical significance for rote verbal learning, $t(78)=0.28$, $p=.600$, long term retrieval, $t(74)=0.71$, $p=.401$, or recognition, $t(108)=0.48$, $p=.490$, even after controlling for age differences. Both measures indicated significant downward shifts in retrieval from the normative mean, with scores approximately 1/2 (*ChAMP*) to 2/3 (*CVLT-C) SD* below the mean across learning, $t(118)=-5.33$, $p<.001$, and long term retrieval trials, $t(113)=-5.30$, $p<.001$. Scores on recognition trials did not differ significantly from the normative mean, $t(109)=-0.61$, $p=.544$.
Conclusions: There were no significant differences in performance between the *ChAMP* and *CVLT-C,* suggesting both measures similarly assess learning and memory among patients with PBT. Given the *ChAMP* is less demanding in terms of time and effort (which is important in populations with higher risk of fatigue) and utilizes more updated and representative normative data (also important given ethnic/racial biases within many traditional neuropsychological assessment tools), this study supports the *ChAMP* as a useful tool to evaluate learning and memory within this population. These findings are consistent with recent literature examining the utility of the *ChAMP* within other pediatric conditions, such as epilepsy and traumatic brain injury. Additional research is needed to further explore these findings.
Keywords: pediatric neuropsychology**,** brain tumor**,** memory complaints

Poster Session 03: Executive Functions| Language | Neglect | TBI

11:00am - 12:00pm
Wednesday, February 2, 2022

01 Why are Performance-Based and Rating-Based Measures of Executive Function Poorly Correlated? An Exploration of Age-Related Effects

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Objective: Performance-based tests, informant ratings, clinical interviewing, and behavioral observation are used in clinical practice to evaluated executive function (EF). However, a growing body of evidence suggests these methods are poorly correlated. EF development follows a non-linear pattern of increasing differentiation from early childhood to adolescence from a unitary construct to dissociable components of working memory, inhibition, and shifting. These developmental changes in EF may partially account for the poor relationship between performance- and rating-based measures of EF. We sought to understand age-related effects on the relation between EF assessment methods, hypothesizing the correlation between performance-based and rating-based measures would be small to moderate, and that better congruence between methods would be found in younger compared to older participant groups.
Participants and Methods: We conducted a retrospective chart review of 61 children (mean age 11.46) referred for neuropsychological evaluation at a university-based clinic. Participants completed measures of intelligence (WISC-IV/WISC-V) and EF (DKEFS), while informants (caregivers and teachers) completed a rating-based measure of EF (BRIEF/BRIEF-2). Partial correlations (controlling for IQ and processing speed) were used to examine the relation between assessment methods and between raters, while Fisher's *r* to *z* transformation (using caregiver ratings) was used to examine differences in the magnitude of correlation between assessment methods across age groups (ages 8-12 and 13-16). Independent samples *t*-tests were used to examine mean differences in raw scores across three age groups (ages 8-10, 11-13, and 14-16).

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Results: Controlling for overall IQ, correlations between performance- and rating-based EF measures were broadly small to medium (*r*s ranged from -.50 to .71). A measure of shifting was significantly positively related to teacher ratings of behavioral and emotional regulation EF (r = .71, p = .031). No other significant correlations were found. No significant correlations between caregiver and teacher ratings were found (*r*s ranged from -.03 to .26). Fisher's *r* to *z* transformation revealed significant differences in the magnitude of correlation between assessment methods when comparing younger and older groups, with results broadly suggesting stronger negative correlations among performance-based and caregiver ratings of EF in older participants compared to younger participants. Similarly, analysis of mean raw scores changes on performance-based measures across age groups revealed significantly improved performance on measures of inhibition and shifting from ages 8-10 to ages 11-13, with no significant differences between ages 11-13 and 14-16.
Conclusions: Consistent with hypotheses and previous research, performance- and rating-based measures of EF were poorly correlated. Similarly, caregiver and teacher ratings were poorly correlated. Novel to this study is the finding that the magnitude of correlation between assessment methods varied across age groups. In addition, greater raw score improvements were found in younger compared to older groups on task-based EF measures, suggesting greater changes in EF performance from early to middle childhood compared to adolescence. Although additional research is needed, our results suggest that non-linear changes in EF component processes across development may partially account for the poor correlation between EF assessment methods—an important consideration for the use and interpretation of EF assessment measures in clinical practice.
Keywords: executive functions**,** assessment**,** pediatric neuropsychology
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02 Does Children's Performance in Orthographic and Semantic Verbal Fluency Correlate Differently with Linguistic and Executive Abilities?

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Objective: This study aims to verify the relations among orthographic verbal fluency (OFV) and semantic verbal fluency (SVF) performance with children's executive functions (EF; processing speed, verbal and visuospatial working memory, cognitive flexibility, and inhibition), verbal and visuospatial short-term memory and phonemic awareness. We also aim to analyze which of these variables best predicts the performance in OVF and SVF. We expect this study contributes to the unclear literature about the relationships of OVF, SVF, language abilities and other EF.
Participants and Methods: The sample consisted of 356 children from 7 to 11 years old (M = 9.01; SD = .93), 50.7% girls, from 3rd (37.5%), 4th (49.9%) and 5th (12.6%) grades attending public schools of two Brazilian capitals. We assessed the children in phonemic awareness, verbal and visuospatial working memory and EF abilities. Pearson correlation and multiple linear regression analysis (Stepwise method) were performed. The OSF and SVF were the dependent variables and the other neuropsychological abilities were the independent variables. We considered Z scores of all variables based on the age of the participants.
Results: The performance in the OVF and SVF correlated with all variables analyzed; however, the pattern of the correlations was somewhat different. The OVF correlation coefficients were higher for phonemic awareness and verbal and visuospatial working memory than those of SVF. In contrast, the SVF correlation coefficients were higher for other EF (inhibition and flexibility) than those of OVF. In the regression analysis, visuospatial (Beta = .21) and verbal (Beta = .14) working memory, verbal short-term memory (Beta = .14) and processing speed (response

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time; Beta = -.11) performed a model that predicted 13.1% of the OVF performance. The performance in a switching task (response time; Beta = -.53), a total score of cognitive flexibility (Beta = .33), and visuospatial working memory (Beta = .14) performed a model that predicted 9.2% of the SVF performance.
Conclusions: Verbal fluency appears to involve multiple domains of neuropsychological functioning such as EF (working memory, cognitive flexibility and inhibition), language ability (phonemic awareness), and processing speed, even though OVF and SVF seem to differ in their association with these abilities. Impairments in OVF may be associated with problems in language, EF, or both, whereas impairments in SVF may be more associated with EF deficits, particularly in cognitive flexibility and visuospatial working memory.
Keywords: verbal abilities**,** executive functions**,** working memory

03 Neuroticism Moderates Effect of Expressive Suppression on Executive Functioning in Community-Dwelling Older Adults

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Objective: Self-reported and experimentally manipulated expressive suppression (ES), an emotion regulation strategy in which the outward expression of emotion is deliberately inhibited (Butler et al., 2003; Gross, 1998), have been negatively associated with executive functioning (EF) performance (Baumeister, 2002; Baumeister et al., 2007; Franchow & Suchy, 2017; Niermeyer et al., 2019; Szczygiel & Maruszewski, 2015). However, past research has not assessed for individual-level factors that may be associated with greater negative impact of experimentally manipulated ES on subsequent EF performance. Neuroticism is associated with a proneness to experience negative emotions in general and in response to stressors (McCrae & Costa, 1985, 1996). Given that ES use does not reduce one's internal experience of emotion (Brans et al., 2013; Gross & Levenson, 1993; Gross & Levenson, 1997), it is reasonable to believe that individuals with higher neuroticism may be more susceptible to the negative impacts of ES use on EF. Accordingly, the aim of this study was to re-analyze data from a previously published study (Franchow & Suchy, 2017) to determine the impact of neuroticism, above and beyond other personality traits and recent and trait ES use, on EF performance following experimental manipulation of ES.
Participants and Methods: 79 non-demented community-dwelling older adults (*M* age = 68.7, 70% female) completed EF measures from the Delis-Kaplan Executive Function System (DKEFS) before and after experimental manipulation of ES. The suppression group consisted of 38 participants (*M* age = 68.4; 79% female) and the control group of 41 participants (*M* age = 68.9; 63% female). Participants also completed the Burden of State Emotion Regulation Questionnaire (B-SERQ) assessing recent ES, the Emotion Regulation Questionnaire (ERQ) assessing trait ES, and the NEO Personality Inventory (NEO) assessing big-five personality traits.
Results: A series of hierarchical linear regressions were run in which EF practice effects were regressed onto experimental condition, recent and trait ES, NEO personality factors, and demographics. Suppressors showed an attenuated EF (B = -0.40, p =.014) practice effect compared to controls after accounting for demographics, consistent with previous findings reported from this dataset. Neither recent (B = .007, p = .57) nor trait ES (B = .01, p = .57) were significant predictors of the EF practice effect when added to the model. A significant interaction emerged between neuroticism and experimental condition when added to the model along with other NEO personality factors. As hypothesized, higher neuroticism was associated with greater attenuation of the EF practice effect for suppressors (B = .02, p = .047) but not for controls (B = -0.001, p = .93). The addition of the interaction term to the model significantly improved EF practice effect estimation ($F(1)$ = 4.16, ΔR^2 = .05, p = .047).
Conclusions: Results suggest that a single instance of ES use can temporarily diminish EF abilities, irrespective of recent and trait ES levels. Importantly, results also indicate that

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individuals with higher neuroticism may be more prone to EF lapses in response to ES use than individuals with lower neuroticism.
Keywords: executive functions**,** emotional processes**,** personality

04 Low-Income Dual Language Learners' Executive Function and Language Usage During Preschool Parent-Child Book Sharing

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Objective: Psychologists have long theorized the development of language is important for the development of self-regulatory skills such as executive function (EF; e.g., Vygotsky, 1962; Zelazo, 1999). During the preschool period, book sharing is a major activity through which parents and children exchange complex language. Indeed, child book-related language complexity has been observed as positively associated with EF (e.g., Friend & Bates, 2014). Cognitive distance, which concerns the cognitive demand required to engage with a given idea, has been underexplored as an aspect of language complexity (Sigel, 1993). Furthermore, previous research is limited by a lack of ethnic/linguistic diversity among study samples, which has constrained the generalizability of findings. Research that has included diverse samples has frequently compared low-income dual language learners (DLLs) with middle-income, monolingual children, making it difficult to delineate the effects of socioeconomic status, cultural factors, and language variables. To help fill this gap, the present study aimed to test relations between child book-sharing language cognitive demand and inhibitory control (IC) / cognitive flexibility (CF) among a sample of low-income Chinese American (CA) and Mexican American (MA) preschool-age DLLs.
Participants and Methods: Eighty-eight preschool children (45 MA, 43 CA, 58% girls, age = 38-68 months, M_{age} = 54.27, SD_{age} = 7.08) and their parents ($M_{per\ capita\ income}$ = \$5,226, $SD_{per\ capita\ income}$ = \$3,676) participated in the present study. Book-sharing language was elicited using *Frog, Where are You?* (Mayer, 1969), a wordless picture book commonly used in the extant literature. Using the book, parents told stories and invited child contributions in the typical home language (English, Cantonese, Mandarin, or Spanish). An adapted version of Luo and Tamis-LeMonda's (2017) cognitive distancing coding scheme was used to code parent/child language (Cohen's kappa = .77). The present analyses specifically examined referential (low cognitive demand, referring to pictured content's visible features), behavioral (moderate cognitive demand, referring to the actions of story characters), and inferential (high cognitive demand, involving abstract inferences about unobservable story content) child statements. The Silly Sounds Stroop task and Something's the Same task were used to measure IC and CF respectively (Willoughby et al., 2010).
Results: Covariates for testing associations between child narrative variables and EF were first identified using correlation analyses. Due to missing data, final Ns for main analyses were 73 (IC) 78 (CF). A general linear model analysis revealed a unique, positive association between the number of child behavioral statements and CF (β = .27, p = .006) controlling for age, cultural group, and generation status ($F(5,72)$ = 9.01, p < .001).
Conclusions: Findings are consistent with previous research showing positive associations between child EF and differing measures/aspects of language complexity. Future research should test the observed effect's direction and whether it is causal. Book-sharing is already recognized as a low-cost intervention to strengthen child language and reading skills (Manz et al., 2010). The present study raises the possibility that cognitive distancing language may assist EF development among low-income DLLs, who are at higher risk of negative outcomes including educational underachievement.
Keywords: executive functions**,** language**,** child development (normal)
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05 Associations of Pre-Adolescent Circulating Endocannabinoid Concentrations with Cognitive and Behavioral Executive Functioning Measures: Preliminary Data from the ABCD Study

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Objective: The CNS endocannabinoid (eCB) system is comprised of cannabinoid-1 (CB1) receptors which are densely distributed throughout the prefrontal cortex, parietal cortex, and subcortical limbic system and endogenous ligands, the eCBs N-arachidonoylethanolamine (AEA) and 2-arachdionoylglycerol (2-AG). Preclinical studies demonstrate a relationship between CB1 signaling and executive functioning (EF) (i.e., cognitive flexibility and set-shifting). In addition, female adults exhibited variability in cognitive flexibility and control (i.e., Wisconsin Card Sorting Task and Stroop) predicted by serum eCB concentrations. As EF develops principally throughout childhood and adolescence, and given that the eCB signaling system undergoes maturation in adolescence, we sought to examine the associations between circulating concentrations of AEA and 2-AG and cognitive and behavioral measures of EF in 10 to 12-year-olds who are enrolled in the Adolescent Brain Cognitive Development (ABCD) study.
Participants and Methods: 110 participants (aged 10-12) completed the two-year follow-up of the ABCD study and participated in a pilot eCB sub-study (PI: Lisdahl) in which concentrations of circulating AEA and 2-AG were determined in serum using mass spectrometry. Participants were given Flanker and Pattern Comparison Processing as part of the NIH toolbox, along with self-report Behavioral Avoidance/Inhibition (BIS/BAS) and impulsivity behaviors (UPPS-P for Children) scales. Multiple linear regressions were used to determine the associations between AEA and 2-AG concentrations and age-corrected Flanker and Pattern Comparison, along with select subscales of the BIS/BAS and UPPS-P while controlling for sex; and models were re-run while controlling for factors known to affect circulating AEA and 2-AG concentrations (i.e., pain levels, recent exercise, last mealtime, and stress).
Results: AEA concentrations were positively associated with Pattern Comparison scores ($p<0.05$). 2-AG concentrations were not related to Pattern Comparison scores, and neither AEA nor 2-AG were related to Flanker performance. AEA and 2-AG concentrations were not significantly related to subscales of the BIS/BAS and UPPS-P. Adding in co-variates known to affect eCB concentrations into the models did not alter findings.
Conclusions: Higher circulating concentrations of the endocannabinoid, AEA, were associated with faster cognitive processing speed yet neither AEA nor 2-AG were associated with cognitive control. In addition, circulating eCB concentrations were unrelated to behavioral measures of EF in pre-adolescence. As EF development continues to refine well into adolescence, it is possible that eCB concentrations will demonstrate more robust associations in early to late adolescence (i.e., ages 14-19). Additionally, it is hypothesized that different EF tasks such as Card Sort and List Sort would yield more robust associations, as Wisconsin Card Sorting performance was shown previously to be significantly related to both 2-AG and AEA in adult samples. Continuous evaluation of eCB concentrations throughout adolescence would yield novel and promising data to investigate the influence of the endocannabinoid signaling system on the neurocognitive development of EF and prefrontal cortical function.
Keywords: adolescence**,** executive functions**,** neurotransmitter systems
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06 The Relationships Between Physical Activity, VO2 max, Cognition, and Brain Volume Differ by Inflammation Level in an Older Adult Cohort

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Objective: Examine the relationships between objective daily physical activity and VO2 max on executive function, processing speed, and brain volume, and how these relationships differ by high or low levels of inflammation.
Participants and Methods: Fifty-four non-demented, community-dwelling participants (mean age= 66.3±6.77 years, age range: 55-80, 69% female) were recruited in the Los Angeles area. Cognitive test performance, physical health measures, blood-based biomarkers, and brain MRI scans were collected. Executive functioning was measured using the Flanker Task reaction time (RT) (congruent - incongruent trials) and Trail Making Test time to completion (Switching condition). Processing speed was measured using the Flanker Task RT (congruent trials). Objective physical activity was measured for an average of 30.25 days with GENEActiv tri-axis wrist accelerometers using moderate-medium physical activity bouts defined as ≥5 continuous minutes of physical activity at 80% threshold. Cardiorespiratory health was measured using VO2 max (maximum rate of oxygen consumption during incremental exercise) via the single-stage treadmill walking test. Baseline MRI scans were collected on a 3T Siemens Prisma scanner, and T1-weighted images were analyzed to obtain brain volumes of the caudal middle frontal, superior frontal, and superior parietal regions. Inflammatory markers C-Reactive Protein (CRP) and Interleukin-6 (IL-6) were measured from blood samples and stratified via high-low median split in separate analyses. Multivariable regressions were conducted using SPSS v27, controlling for age and total intracranial volume (for brain volume analyses).
Results: *Cognition.* In the low CRP group, higher VO2 max was associated with better executive function (Flanker incongruent-congruent RT, p=.06). In the high CRP group, greater levels of physical activity were associated with faster processing speed (Flanker congruent RT, p=.04). In the low IL-6 group, greater levels of physical activity were associated with faster processing speed (Flanker congruent RT, p=.06). No significant associations were observed in the high IL-6 group or with the Trail Making Test.
Brain. Across all participants, higher VO2 max was associated with larger right superior frontal volume (p=.01) and larger right superior parietal volume (p=.04). In the high CRP group, higher VO2 max was associated with larger right superior frontal volume (p=.03). In the high CRP and high IL-6 groups, greater levels of physical activity were associated with larger left superior frontal volume (p=.01; p=.03, respectively). No associations with caudal middle frontal cortex or in the low inflammation groups were observed.
Conclusions: These results provide evidence that physical activity and cardiorespiratory health are associated with cognition and brain volumes in an older adult cohort. In support of a complex role of inflammation, these relationships differ based on high or low inflammation levels. While physical activity and VO2 max were associated with executive function and processing speed in low inflammation groups, an association between physical activity, VO2max, cognition, and brain volumes in the high inflammation group were also observed, which provide supportive evidence that inflammation may at times confer protective effects. Future longitudinal studies are needed to clarify how inflammation impacts the relationship between healthy lifestyles, cognition and brain health.
Keywords: aging (normal), neuroimaging: structural, brain function

07 Data-Driven Subtypes of Executive Function in a Transdiagnostic Pediatric Sample

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Objective: Executive function (EF) refers to goal-oriented regulation of thoughts, emotions, and behaviors. EF impairment is seen across neurodevelopmental and psychiatric populations. Additionally, executive dysfunction impedes the development of adaptive functioning that extend to poor adult outcomes. Remediation of executive dysfunction is hindered by the considerable heterogeneity of EF skills within and between diagnostic groups. The present study aims to identify distinct patterns of EF problems within a transdiagnostic sample of children based on caregiver-report.
Participants and Methods: A clinically recruited group of 165 participants, ages 8-14, were included in the study. Participants had one or more diagnoses including Attention-Deficit Hyperactivity Disorder (n=105), Autism Spectrum Disorder (n=77), as well as a variety of anxiety (n=44), mood (n=16), and learning (n=21) disorders. EF was measured using the parent-report form of the Behavior Rating Inventory of Executive Functioning (BRIEF-2), which produces a Global Executive Composite (GEC), indices for behavioral, emotional, and cognitive regulation as well as nine EF subdomain scores (Inhibit, Self-Monitor, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Task-Monitor, Organization of Materials). Latent profile analysis was applied to the nine subdomains for each participant to identify subgroups of similar EF patterns. Subgroups were compared on demographic, diagnostic, and adaptive variables (Vineland-II).
Results: Latent profile analysis of the EF subdomains revealed four distinct subgroups. Subgroups were distinguished by: minimal (S1), severe (S4) EF problems, and relatively greater problems with cognitive regulation (S2) or behavior and emotion regulation (S3). Each subgroup included participants with different diagnoses. The subgroups did not differ in age, gender, or IQ (p's>0.3). Subgroup membership significantly related to adaptive functioning (p's< 0.04). S1 (n=28) showed adaptive skills that were within normal limits. S4 (n=52) was characterized by below average adaptive functioning across domains. S2 (n=34) and S3 (n=51) evidenced similar levels of global adaptive skills but S2 showed worse adaptive skills in the Communication domain while S3 had worse adaptive skills in the Socialization domain.
Conclusions: We identified four EF subtypes within a mixed clinical sample that were distinguished by differences in EF pattern and level of executive dysfunction. As previously described, the severity of executive dysfunction (as illustrated by S4 and S1) relates to adaptive functioning. Differences in EF pattern, from S2 and S3, emphasizes heterogeneity within executive dysfunction and its real-world implications. This further implicates the importance of considering EF profiles for outcome prediction and treatment planning.
Keywords: child development disorders**,** executive functions**,** adaptive functioning

08 Executive Function in Complete and Partial Agenesis of the Corpus Callosum

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Objective: Agenesis of the corpus callosum (AgCC) is a congenital brain malformation characterized by an anatomical malformation involving either complete or partial absence of the corpus callosum. AgCC is associated with a range of cognitive and behavioral deficits, including mild to moderate deficits in everyday executive dysfunction (Mangum et al., 2021). Currently, little is known about potential behavioral differences between complete and partial AgCC, and the contribution of a partially present callosum to cognitive processing. Comparisons of cognition and behavior in people with complete vs. partial AgCC have offered inconsistent findings. Several studies have reported relatively worse performance in individuals with complete AgCC in learning and memory (Erickson et al., 2014) and social processing (Paul et al., 2003). Likewise, on lab-based measures of executive functioning, such as processing speed, inhibition, and cognitive flexibility, participants with complete AgCC performed worse on average than participants

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with partial AgCC, but group comparisons were not statistically significant (Marco et al., 2012). Using data reported by Magnum et al., (2021), this study compared everyday executive functioning in adults with partial and complete AgCC, using informant-reported ratings on the Behavior Rating Inventory of Executive Function - Adult (BRIEF-A). Based on results from the aforementioned studies, it was predicted that BRIEF scores would be more typical in the partial AgCC group, but the complete and partial AgCC groups would not differ significantly in direct comparison.
Participants and Methods: For 36 individuals with AgCC (23 complete, 13 partial), we acquired BRIEF-A ratings from informants (i.e., close family members). The BRIEF-A is composed of 75 items that are summed into nine clinical scales which are further grouped into two composite indices (Behavioral Regulation Index, BRI and Metacognition Index, MI). Analyses were conducted on age-referenced T-scores.
Results: Comparison to the normative mean (50) revealed deficits on both BRI and MI in the complete AgCC group (BRI: M(SD) = x(y), $t(22) = 2.16$, $p = .04$; MI: M(SD) = x(y), $t(22) = 3.15$, $p = .01$) and deficits on MI in the partial AgCC group, (BRI: M(SD) = x(y), $t(12) = 1.63$, $p = .13$; MI: M(SD) = x(y), $t(12) = 2.56$, $p = .03$). However, only MI deficits in the complete AgCC group remained significant following Bonferroni-correction. Scores on both indices suggested slightly worse daily executive functioning in the partial AgCC group, but the group difference was not significant in a 2-group x 2-index repeated measures ANOVA ($F(1,34) = .087$, $p = .769$, $\eta_p^2 = .003$).
Conclusions: Difficulties with daily executive functioning in AgCC do exist as supported by close informants (Mangum et al., 2021). Although complete AgCC group showed greater deficiency than the partial AgCC group in both BRI and MI, the group difference was not statistically significant. These results do not suggest that some degree of callosal connectivity can ameliorate the deficits in executive function.
Keywords: corpus callosum, executive functions, congenital disorders

09 Attention and Executive Functions in a Clinical Sample of Children, Adolescents, and Young Adults with Attention-Deficit/Hyperactivity Disorder (ADHD) and Mood Disorders

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Objective: Deficits in attention and executive functions (EF) are paramount in Attention-Deficit/Hyperactivity Disorder (ADHD), and concentration difficulties occur in mood disorders. Studies found EF difficulties in adults with mood disorders; however, findings in children, adolescents, and young adults are inconsistent. This study investigated attention and EF in children, adolescents, and young adults with ADHD and mood disorders. It was hypothesized individuals with comorbid ADHD and mood disorders would have greater difficulty with attention and EF compared to those with either disorder alone.
Participants and Methods: Comprehensive neuropsychological evaluations in an outpatient medical center were completed for 224 individuals (139 males) ages 4-25 years old (M=12.0,SD=4.3). Individuals with ADHD (inattentive, hyperactive/impulsive, and combined) and/or mood disorder (e.g., major depressive disorder, generalized anxiety disorder, social anxiety disorder) were categorized into three groups: “ADHD,” “Mood,” and “ADHD+Mood.” Other diagnoses were excluded.
IQ was measured using the WISC, WAIS, and WPPSI. Measures of attention and EF included the Conners’ Continuous Performance Test (CPT); Delis-Kaplan Executive Function System Verbal Fluency, Color Word, Tower, and Trail Making Tests; Trails A and B; Wisconsin Card Sorting Test; and parent questionnaires including the Behavior Rating Inventory of Executive Function (BRIEF) and the Behavior Assessment System for Children (BASC). One-way ANOVAs and χ^2 tests were conducted to determine group differences across demographics and measures. Groups differed on age ($F(2,221)=26.763$,$p<.001$; ADHD: M=10.4,SD=3.9, MOOD: M=14.8,SD=3.5, ADHD+MOOD: M:=12.1,SD=3.9), which was not

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believed to affect results, as measures are age-normed. Groups did not differ on gender, race, or ethnicity.
Results: Full-Scale IQ, verbal comprehension, and nonverbal intellectual abilities did not differ among groups (p>.05). Group differences trended toward significance for working memory (F(2,211)=2.50,p=.085; Mood: M=105.8,SD=14.4; ADHD+Mood: M=103.6,SD=14.9; ADHD: M=101.2,SD=11.0) and processing speed (F(2,211)=3.02,p=.051; Mood: M=100.9,SD=15.6; ADHD: M=97.3,SD=12.7; ADHD+Mood: M=94.4,SD=14.4).
CPT omissions had significant group differences (F(2,184)=5.80,p=.0036; Mood: M=50.6,SD=9.5; ADHD+Mood: M=53.0,SD=12.1; ADHD: M=57.3,SD=13.5). Reaction time also varied significantly (F(2,184)=4.28,p=.016; Mood: M=47.5,SD=11.2; ADHD: M=52.7,SD=11.9; ADHD+Mood: M=53.2,SD=12.4).
BASC scores (Hyperactivity: F(2,192)=7.45,p=.000767; Attention: F(2,192)=6.77,p=.00144) were mildly elevated for the ADHD+Mood group (Hyperactivity: M=62.1,SD=11.6, Attention: M=65.0,SD=7.5) and the ADHD group (Hyperactivity: M=60.8,SD=13.7, Attention: M=64.2,SD=7.4). Scores for the Mood group were average (Hyperactivity: M=53.4,SD=10.9, Attention: M=59.4,SD=11.2).
There were no significant group differences on objective measures of EF. Parent-rated general executive control on the BRIEF showed significant differences (F(2,198)=5.77,p=.00366; ADHD+Mood: M=68.2,SD=8.8; ADHD: M=63.4,SD=9.0; Mood: M=61.8,SD=10.8).
Conclusions: The hypothesis individuals with ADHD and comorbid mood disorder would have greater difficulty than either disorder alone was supported for parent-reported measures of attention, hyperactivity, and EF, and preliminary evidence was apparent for processing speed. For working memory and an objective inattention measure, those with ADHD had the most difficulty, followed by individuals with ADHD and mood disorder and mood disorder alone, suggesting mood disorder may be protective in these areas.
Contrary to the initial hypothesis, no differences among groups were found on objective measures of EF. This may suggest similar levels of EF deficits in individuals with ADHD and mood disorders; this should be investigated further with inclusion of typically developing and clinical controls.
Keywords: attention deficit hyperactivity disorder**,** mood disorders**,** executive functions
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10 Informant and Self-Reported Ratings of the Frontal Systems Behavior Scale in Brain Tumor Survivors and Healthy Controls

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Objective: Extant literature on survivor insight into their executive functioning is inconsistent, with some work finding informant-report and self-report concordance, and others the opposite. Discrepancies between informant and self-report consistency may reflect variability in survivor introspection, informant awareness of survivors' experiences, and differences in measurement constructs. This project aims to examine self-report and informant-report of executive functioning in long-term survivors of pediatric cerebellar brain tumor and healthy controls.
Participants and Methods: Participants include 31 survivors (51.6 % female; M_{age}=23.8, SD = 5.1) and 58 controls (53.4% female; M_{age}=22.5, SD=4.4). The Frontal Systems Behavior Scale (FrSBe) self and informant questionnaires were administered. The FrSBe is a 46-item questionnaire developed to assess apathy, disinhibition, and executive dysfunction in adult neurological populations. Criteria for controls included the absence of current psychopathology as evaluated with the Structured Clinical Interview for DSM-IV-TR Axis 1 and the absence of a psychiatric disorder. Informants were individuals knowledgeable of the participant's daily living skills for at least the past year. Chi-square tests were used to compare the percentage of participants with clinically elevated scores. Independent samples t-tests were used to compare groups subscale

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scores. Odds ratio and Cohen's d were calculated as measures of effect size, respectively. Linear regression tested for association between self and informant scores. **Results:** More survivors were clinically elevated compared to controls on informant reported executive dysfunction (OR=13.68, 95% CI: 1.56, 119.64) and disinhibition (OR=4.40, 95% CI: 1.02, 19.03). Yet, fewer survivors were clinically elevated compared to controls on self-reported disinhibition (3% versus 12% controls; OR=.13, 95% CI: .02, 1.03). Both groups evidenced comparably high levels of apathy elevations in both self and informant reports (e.g., controls: 17% of self-reported, and 22% of informant-reported scores). There were no significant differences in survivor subscales between informants and self-reports. In controls, self-report scores were greater than informant scores on the disinhibition (p<.001, d= 0.89) and executive dysfunction p<.001, d=0.94). Linear regressions revealed positive relationships for self and informant ratings on the disinhibition (p=.005, r^2=13%) and apathy (p<.001, r^2=21%) subscales for controls. The relationship for executive dysfunction was non-significant. For survivors, positive relationships were seen for all subscales: executive dysfunction (p=.023, r^2=13%), disinhibition (p=.028, r^2=16%), and apathy (p=.005, r^2=25%). **Conclusions:** Results reveal significant associations between survivor self and informant scores on all three FrSBe subscales. Interestingly, we saw a less consistent relationship between healthy young adult controls and their informants. Also, unexpectedly, about 20% of the control sample had clinically elevated apathy FrSBe scores despite rigorous exclusion criteria for current psychopathology. Less consistency between informants and participants for controls may be due to informant type. More survivor informants were parents, and more control informants were roommates. The relationship between roommates may be less developed or nuanced than long-term parent-child relationships, resulting in different observations and attributions of participant behavior. This study emphasizes the complementary information provided by informant- and self-report when evaluating executive functioning in healthy young adults and brain tumor survivors.

Keywords: brain tumor, neuropsychological assessment, executive functions

11 Environmental Predictors of Children's Executive Functioning Development

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Objective: Executive functioning (EF) is foundational to children's development of daily functioning and academic skills. EF abilities develop through childhood, but this development can be impacted by a number of psychosocial and environmental influences, such as SES, parent mental health, and caregiving environment. Using longitudinal data from the Health Outcome and Measures of the Environment (HOME) Study, a prospective pregnancy and birth cohort study, we examined if socioeconomic status, maternal mental health, maternal intellectual functioning, and childhood caregiving environment were significant predictors of children's EF development. **Participants and Methods:** We analyzed EF data of 271 children (male=119, female=152; White, non-Hispanic=160), assessed up to five times using the parent-rated Behavior Rating Inventory of Executive Function (BRIEF) from age 3 to 12 years. Socioeconomic status was assessed using family income. Maternal mental health was assessed using the Symptom Checklist-90-Revised and the Conners' Adult ADHD Rating Scales. Maternal intellectual functioning was assessed using the Wechsler Abbreviated Scale of Intelligence. Lastly, childhood caregiving environment was assessed using the Home Observation for Measurement of the Environment Inventory.

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Results: We identified four distinct developmental trajectory groups: (1) children consistently impaired across the study period ('consistently impaired', *n*=36), (2) children with descending levels of impairment over time ('descending impairment', *n*=75), (3) children with ascending levels of impairment over time ('ascending impairment', *n*=27), and (4) children with levels of EF functioning consistently within normal limits over time ('consistently not impaired', *n*=133). The 'ascending impairment' trajectory is particularly concerning. Children in this group exhibited BRIEF composite scores that increased by approximately two standard deviations from early childhood to early adolescence, indicating substantial worsening of EF. Among children who demonstrate ascending levels of EF impairment from early childhood through early adolescence, higher levels of maternal ADHD and relational frustration appear to be risk factors. In contrast, higher family income may serve as a protective factor for these children, delaying impairment onset.
Conclusions: Importantly, the identified possible risk and protective factors may exert both direct and indirect effects on children's EF development. These results indicate that differences in maternal factors are associated with different patterns of EF development through childhood into early adolescence.
Keywords: executive functions**,** child development (normal)

12 The relationship between age, intra-individual variability, and executive functioning in youth age 8 to 17

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Objective: Intra-individual variability (IIV) reflects the variability in performance among tests within a single testing session. For adults, IIV has been linked to age-related cognitive declines and presence of and severity of progression in neurological conditions. In healthy pediatric samples, previous research has shown that IIV decreases from ages 8 to 17 (Roalf et al., 2014). Nevertheless, there has been little investigation of the cognitive mechanisms associated with IIV for pediatrics. Thus, the current study investigated these mechanisms for reductions in IIV with increased age by testing whether aspects of executive functioning mediated the relationship between age and IIV in a community sample of children and adolescents.
Participants and Methods: Participants were 248 individuals aged 8 to 17 from Nathan Kline Institute's Rockland Sample (Nooner et al., 2012). Participants were excluded if they endorsed conditions associated with cognitive impairment (e.g., brain injury) or acute psychiatric symptoms treated with psychotropic medications. IIV was calculated based on standardized scores from tests assessing various cognitive abilities with the Penn Computerized Neurocognitive Battery (Gur, et al., 2010). Separate IIV scores were calculated for accuracy and reaction time (RT) with higher scores indicating greater variability. Executive functioning was assessed with the Delis-Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2001). Specifically, Letter Number Sequencing response time scores represented executive switching ability, Color Word Interference Inhibition response time scores represented inhibition abilities, and Tower Total Achievement scores represented problem-solving. Parallel mediation models tested (Hayes (2018) PROCESS with Bootstrapping) the direct (relationship between age and IIV) and indirect effects (mediation of age and IIV by executive functioning performance). Two models were tested given there were two dependent variables, IIV accuracy and IIV RT.
Results: Pearson correlations revealed that age was negatively correlated with IIV accuracy (r = -.37, p = .00) and IIV RT (r = -.38, p = .00). In the mediation model predicting IIV accuracy, the direct effect between age and IIV was not significant, 95% CI [-.02,.01], but the indirect effect between age and IIV with executive switching as a mediator was significant, 95%*CI (-.02, -.01).* As age increased, executive switching scores were lower (faster performance), 95% CI (-11.65, -7.70) and lower switching scores were associated with lower IIV accuracy, 95% CI (.01, .002). Thus, higher age was associated with a decrease in IIV accuracy

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via executive switching ability. In the mediation model predicting IIV RT, the direct effect between age and IIV was not significant, 95%CI (-.01,.03). The indirect effect between age and IIV with executive switching was significant, 95% *CI (-.04, -.01)* with higher age associated with a decrease in IIV RT via executive switching ability. The other mediators tested (inhibition and problem-solving) were not found to significantly mediate the relationship between age and IIV measures.
Conclusions: Results suggest that the aspect of executive functioning involving the ability to switch between task goals accounts for the pattern of decrease in IIV with increased age in a community sample of children and teenagers.
Keywords: child development (normal), pediatric neuropsychology, cognitive control

13 Examining Methods of Executive Ability from Trail Making Test Part B in Monolingual and Bilingual Persons with Traumatic Brain Injury

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Objective: We investigated three different measures of executive ability derived from the Trail Making Test part B (TMT-B) in monolingual and bilingual healthy comparison (HC) and persons with traumatic brain injury (TBI).

Participants and Methods: The sample consisted of 32 acute TBI (ATBI; 16 English-monolinguals & 16 English and other language bilinguals), 30 chronic TBI (CTBI; 12 English-monolinguals & 18 English and other language bilinguals), and 51 HC (24 English-monolinguals & 27 English and other language bilinguals) adults. Participants were administered both TMT part A (TMT-A) and TMT-B, and total time for completion was recorded and converted into adjusted-demographic T-scores. A series of ANOVAs were conducted to evaluate group differences in executive abilities. Executive measures included the TMT-B T-score, the T-score raw difference between TMT-A and TMT-B (TMT-BA), and the difference between a predicted TMT-B T-score (TMT-BP) and the obtained TMT-B T-score (TMT-BBP). Pearson's correlations between TMT-B, TMT-BA, and TMT-BBP and other executive functioning tests [i.e., Stroop Color Word Test-Color Word (SCWT-CW), design fluency filled dots, empty dots, and switching dots, letter fluency and animal naming] were evaluated.
Results: Results revealed the HC group outperformed the ATBI group on the TMT-B and TMT-BBP executive ability measures derived from TMT-B, p's<.05, η_{ps}^2 =.08-.12. Next, we found the bilingual group outperformed the monolingual group on TMT-BA executive ability measure, p=.024, η_p^2 =.05. On the other hand, the monolingual group outperformed the bilingual group on TMT-BBP executive ability measure, p=.047, η_p^2 =.04. No interactions were found in any executive ability measure. Pearson's correlations revealed the bilingual ATBI group TMT-B executive ability correlated with design fluency empty dots performance; meanwhile, TMT-BBP executive ability correlated with SCWT-CW performance, r's=.58-.77, p's<.05. Next, the monolingual CTBI group TMT-BBP executive ability correlated with SCWT-CW performance, r=.59, p=.044. The bilingual CTBI group both TMT-B and TMT-BBP executive abilities correlated with all executive functioning tests except SCWT-CW performance, r's=.47-.67, p's<.05. Additionally, the monolingual HC group TMT-B executive ability correlated with design fluency empty dots and switching dots performance, r's=.45-.46, p's<.05. Finally, the bilingual CTBI group TMT-BBP executive ability correlated with letter

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fluency and design fluency empty dots performance, r's=.39-.44, p's<.05.
Conclusions: Our data revealed the HC group outperformed the ATBI on several TMT executive ability measures; meanwhile, the CTBI group performed the same as the ATBI and the HC groups. Furthermore, the bilingual group demonstrated better TMT-BA executive ability than the monolingual group, but worse executive ability on TMT-BBP. In our bilingual TBI sample compared to their counterparts, more TMT variables (i.e., TMT-B, TMT-BBP) correlated with executive functioning measures which suggest that they are likely better measures of executive ability than TMT-BA. Future studies with larger sample sizes using a bilingual TBI sample should examine if different TMT variables correlate with executive functioning if participants learn to speak English as a first language compared to second.
Keywords: traumatic brain injury**,** executive functions
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14 Profiles of Neurobiological and Cognitive Processes Among Low-income, Urban youth

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Objective: Children's neurobiological and cognitive processes are associated with a range of psychological symptoms and outcomes (multifinality), suggesting heterogeneity in risk and resilience and developmental pathways associated with these processes. Low-income, urban youth may be one such population to consider in terms of risk and resilience, as their environments are characterized by elevated rates of physical and psychosocial stressors. Identifying more homogeneous profiles during middle childhood may be advantageous as neurobiological and cognitive processes may be more malleable and responsive to intervention during this developmental period. The present study sought to identify neurobiological and cognitive profiles of low income, urban youth and to examine whether profiles differ in contextual processes and conduct problems.
Participants and Methods: Participants were 104 children (M=9.93±1.22 years; 50% male; 96% African American, 4% Latinx) who resided in neighborhoods with elevated rates of poverty and crime. Three constructs were considered in a latent profile analysis (LPA): limbic system/orbitofrontal cortical functioning (indexed by youth-completed Facial Expression Labeling Task [FELT] and Emotional Interrupt [EI] tasks), autonomic nervous system reactivity (indexed by youth pre-ejection period and respiratory sinus arrhythmia), and dorsolateral prefrontal cortical functioning (indexed by Stockings of Cambridge [SOC] planning task and caregiver-reported Behavior Rating Inventory of Executive Function [BRIEF]). Profiles were validated with three types of variables assessed using multiple informants: peer processes, conduct problems, and neighborhood factors.
Results: The LPA indicated that a 4-profile model best fit the data based on a variety of fit indices (BIC, AIC, BLRT, entropy) and conceptual considerations. These 4 profiles were (1) Average (AV, n=49), characterized by scores within 0.50 *SD*s from the sample means; (2) High executive functioning (EF)/FELT (EF, n=9), characterized by elevated EF and emotion recognition; (3) EI/good BRIEF (EI, n=36), characterized by above average emotion processing and caregiver-reported EF; and (4) SOC/poor BRIEF (SOC, n=10), characterized by elevated scores on the planning task, but poor caregiver-reported EF. Among youth in the EF profile, all informants indicated low levels of conduct, peer, and neighborhood problems. Youth in the EI profile also demonstrated low levels of aggression and conduct problems, but elevated neighborhood danger and self-reported bullying. Across informants, the AV and SOC profiles reported elevated conduct problems and exposure to community violence compared to the EF and EI profiles. The AV and SOC profiles differed very little across variables.
Conclusions: This study is the first to consider profiles of neurobiological and cognitive processes among urban youth. Importantly, these profiles may indicate specific opportunities for assessment and identification of those most vulnerable to developing negative sequelae.

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Elevated orbitofrontal cortical and dorsolateral prefrontal cortical functioning may attenuate effects of contextual disadvantage. Further, youth profiles demonstrating average to low EF coupled with increased rates of community violence exposure and conduct problems may be more likely to experience psychosocial difficulties. As such, these youth may benefit from targeted interventions to improve mental health outcomes and social functioning.
Keywords: executive functions**,** child development (normal)**,** social processes
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15 Practice Makes Perfect? The Effects of Long-Term Mindfulness Practice on Mind-Wandering

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Objective: Multiple studies indicate that *mindfulness* is an effective way to reduce off-task thinking, also known as *mind-wandering*. Previous research suggests that short-term mindfulness meditation is effective for reducing mind-wandering as measured by improved performance on continuous performance tasks (CPTs) and probe-based experience-sampling. However, there are currently no systematic reviews summarizing how long-term meditation practice impacts mind-wandering, and whether this effect differs from short-term meditation studies of novice meditators. The present review sought to address this gap, summarizing the effects of long-term mindfulness experience on mind-wandering and comparing these results to research on short-term mindfulness meditation.
Participants and Methods: Peer-reviewed correlational and experimental studies were included; however, studies were excluded if mind-wandering or mindfulness was only measured using neuroimaging. All studies included individuals who regularly practiced mindfulness meditation over a long period of time (>1 year or >7900 hours). Our final sample included *n* = 6 studies.
Results: All studies reported at least one significant relationship. Included studies measured mind-wandering using self-report (*n* = 5), probe-sampling (*n* = 1), and a CPT (*n* = 1). The results of this review are largely consistent with research on short-term meditation, but with some exceptions. Probe-caught mind-wandering was reduced in long-term meditators. In 80% of studies, experienced meditators self-reported significantly less mind-wandering relative to non-meditators and less experienced meditators, suggesting that cumulative meditation experience can result in greater mind-wandering reductions. However, Cardeña et al. (2015) did not find significant relationship between mindfulness and CPT performance in long-term meditators. They found that while some reaction times were faster for experienced meditators, there was no difference between the two groups in terms of commission errors.
Conclusions: Overall, more research is needed to determine if long-term meditation actually affects behavioral measures of mind-wandering, or if it simply increases the practitioner's perception of focused attention. Implications of these results are considered as well as ideas for future research.
Keywords: attention**,** awareness
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16 The Relationship Between Dietary Habits, Nutrition Knowledge, and Self-Reported Executive Functioning Abilities

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Objective: Diets high in glucose and/or saturated fats have been associated with poor performance on tasks of attention, memory, and executive functioning (Smith, 2015; Francis et al., 2014; Mahoney et. al, 2005; Meikle et al., 2005). Research also has suggested a bi-directional relationship may exist between executive functioning and dietary habits. Inhibitory control and planning abilities were found to significantly predict fruit and vegetable consumption in obese adults (Wyckoff et al., 2017). The purpose of the current study

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was to examine the relationship between dietary habits, nutrition knowledge and self-reported executive functioning abilities in a sample of healthy adults.
Participants and Methods: There were 102 healthy adults included in the current study who were fluent in English and ranged in age between 26-45 years with no history of eating disorder, metabolic disease, neurological disorder and were not currently adhering to dietary restrictions or weight management diet. In the current study, 70.6% participants were between the ages of 26-29 years with 78.4% of the participants identifying as female and 68.6% of the participants identifying as White. Highest level of education ranged from Associate's to Doctorate degrees with 44.1% of the participants reporting having at least a Master's and 37.3% having at least a Bachelor's degree, and 86.3% of participants reported residing in the United States. Through an online survey platform, participants completed the KomPAN Dietary Habits and Nutrition Beliefs Questionnaire (Jezewska-Zychowicz et al., 2017) and the Behavior Rating Inventory of Executive Function– Adult Version (BRIEF-A) (Roth et al., 2005).
Results: The current study sample reported executive functioning abilities within the average range across all nine individual clinical scales on the BRIEF-A, on the Behavior Regulation Index (BRI) and Metacognition Index (MI), and for the overall Global Executive Composite score (GEC), which indicated no concerns about executive functioning in the clinical impairment range (all T scores < 65). Analyses revealed significant positive correlations between greater consumption of a non-healthy diet and difficulties with overall executive functioning (GEC) and behavior regulation (BRI) and with specific abilities of inhibition, emotional control, self-monitoring, and task initiation. A greater consumption of a healthy diet was significantly associated with less task initiation difficulties. Results also found that greater nutrition knowledge was significantly associated with a greater consumption of a healthy diet, but no relationships were found between nutrition knowledge and consumption of a non-healthy diet. Additionally, participants with good nutrition knowledge endorsed less difficulty with organization of materials than those with sufficient nutrition knowledge.
Conclusions: The current study found that consumption of a relatively poorer, non-healthy diet in a healthy adult population was associated with self-reported weaknesses in executive functioning, which is consistent with previous studies examining links between executive functioning and diet. Results also suggested that better skills in initiating behaviors and organizing information was associated with consumption of a healthy diet. Overall, the study found that learning and having more knowledge about nutrition can contribute to people making healthy dietary choices but that other factors, such as executive functioning abilities, also play a significant role in people's dietary choices.
Keywords: everyday functioning**,** executive functions**,** inhibitory control
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17 Voxel-Based Lesion Behavior Mapping in Patients with Resected Brain Tumors: A Pilot Study

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Objective: Only 30% of persons diagnosed with anaplastic astrocytoma and 5.6% of persons with glioblastoma live for up to five years (Ostrom, 2018). Thus, quality of life is a primary focus of patient care and cancer research. Additionally, the presence of soft neurological signs has traditionally been associated with frontal dysfunction and negatively associated with quality of life. While so-called "*frontal signs"* can arise from damage outside the frontal lobes, such phenomena have been difficult to examine systematically. The current study

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examined the influence of brain tumor location on frontal signs using a standardized neurobehavioral examination (NBE) and voxel-based lesion symptom mapping (VLSM). Such research can be used for early identification of patients who could benefit from behavioral interventions that can improve quality of life.
Participants and Methods: A retrospective observational cohort of 38 de novo patients (M age = 55.65, range 18-80) underwent brain tumor resections between 2017 and 2021 at the West Virginia University Cancer Institute. All patients underwent post-surgical MRI, and resection cavities were segmented using 3DSlicer. Participants completed a standardized NBE within three months of surgical resection to quantify fronto-executive dysfunction (i.e., frontal signs). Voxel-based lesion symptom mapping was then employed to assess the impact of lesion location on fronto-executive dysfunction. Correction for multiple comparisons was achieved using false discovery rate (FDR)-corrected $p < 0.05$ threshold and permutation testing. Significant lesion-symptom maps were overlaid on resting state network and tractography reconstructions to better characterize potential network disruption associated with frontal signs.
Results: Individuals with resection cavities in the right medial frontal/anterior cingulate and left anterior temporal lobe displayed greater fronto-executive dysfunction relative to individuals with resection cavities elsewhere (FDR corrected $p < .05$). These regions overlapped with prominent white matter tracts, including the left anterior portions of the inferior, middle, and superior gyri, right superior frontal gyrus, and the right anterior cingulate at the cortical level. At the subcortical level, they overlapped with the cingulum, corpus callosum, and uncinate fasciculus. These regions were primarily associated with the default mode network.
Conclusions: Both frontal and non-frontal lesions can contribute to the presence of frontal signs in patients with brain tumors post-resection. Outside of the frontal lobes, only lesions in the left anterior temporal lobe were associated with increased frontal signs. This association may be explained by damage to the uncinate fasciculus and disruption of the default mode network. Because the presence of frontal signs is negatively correlated with quality of life, this study provides steps towards identifying factors that could help early identification of patients that may benefit from targeted behavioral treatments.
Keywords: brain tumor**,** cognitive functioning
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18 The Relationship Between Adverse Childhood Experiences and Executive Functioning in an Inpatient Adolescent Population

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Objective: Adverse Childhood Experiences (ACEs) have a significant role in an individual's physiological and psychological health. Individuals who have experienced ACEs are at higher risk for developing chronic health conditions, such as obesity, hypertension, and heart disease (Felitti et al.,1998) and psychological symptoms, such as depression, anxiety, and suicidality (Choi, DiNitto, Marti, & Segal, 2017). Research has also shown that ACEs affect many aspects of cognition, including intelligence, memory, and learning (Barkley, 2011). Several studies have illustrated the impact of childhood and adult trauma on executive functioning; however, there is limited research examining associations between ACEs and executive functioning. The purpose of the present study was to explore the relationship between ACEs and performance on measures of executive functioning in an inpatient adolescent population.
Participants and Methods: The current study utilized data collected as part of an ongoing, larger research study conducted at Butler Hospital examining neuropsychological profiles of an adolescent psychiatric inpatient population. The current study sample was comprised of adolescent patients who received neuropsychological testing during their inpatient stay at Butler Hospital and consented or had a parent/guardian consent to having their

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neuropsychological data included in the larger research study. Assessment data in the current study included the Center for Youth Wellness ACE Questionnaire (CYW ACE-Q), the Wechsler Abbreviated Scale of Intelligence, 2nd edition (WASI-II), Trail Making Test Parts A and B, and the Stroop Color Word Test (SCWT). There were 110 adolescents included in the current study who ranged in age from 13 to 21 years, with a mean age of 15.9 years (*SD* = 1.9) and had completed grades 6 to 12th grade or beyond, with a mode completed education level of 10th grade.
Results: The adolescent inpatient study sample reported approximately 6.28 (*SD* = 4.23) ACEs on the CYW ACE-Q and performed within the average range on measures of intellectual and executive functioning. Analyses revealed no significant relationships between number of ACEs and performance on measures of executive functioning with correlation coefficients ranging from weak (-.12 to .12) to zero. The current study sample was also divided into three groups based on total CYW ACE-Q scores. Performance on measures of intelligence and executive functioning were intact and within the average range across all three groups with no significant differences in performance on intellectual and executive functioning measures between CYW ACE-Q score groups.
Conclusions: The current study is one of the first studies to specifically examine associations between ACEs and executive functioning. No significant relationships were found between ACEs and executive functioning. However, results of the current study revealed that executive functioning abilities were intact in the adolescent inpatient study sample who had experienced ACEs, which is a positive and promising cognitive indication. Additional research is still needed to have a more comprehensive understanding of how ACEs may or may not impact the development of and different domains of executive functioning.
Keywords: executive functions

19 Associations Between Personality Traits and Subjective and Objective Measures of Executive Function

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Objective: In recent years, there has been increased interest in the relationship between personality and neuropsychological performance, specifically executive functioning (EF). EF is regulated by the frontal lobes and comprised of a number of interrelated yet separate domains such as cognitive flexibility, planning, working memory, and inhibitory control. EF and personality are often associated with the same brain regions; thus, it seems logical to assume that individual differences in EF could be related to differences in personality. Prior research has indeed demonstrated a relationship between EF and personality; however, this relationship has primarily been explored by examining individual personality traits and individual EF tasks or domains as opposed to looking at both the Five-Factor Model (FFM) and EF globally. Additionally, much of the existing literature supporting an EF and personality link was conducted with individuals with personality disorder diagnoses. The present study seeks to expand the existing literature by examining the relationship between personality and both subjective and objective measures of EF in a sample of healthy young adults.
Participants and Methods: All participants were university students from the Bronx, NY (*N* = 218, Female = 68.8%, *M* Age = 20.5, *SD* = 1.97). Personality was measured with the 50-item International Personality Item Pool (IPIP-50) and subscales were calculated based on the Five Factor Model (conscientiousness, agreeableness, neuroticism, extraversion, and openness/intellect).Subjective EF was assessed using the Behavior Rating Inventory of Executive Functioning - Adult Version Global Executive Composite (BRIEF-A-GEC). Objective EF was assessed using the Trail Making Test Part B (TMTB), and Conditions 3 and 4 of the Delis-Kaplan Executive Function System Color-Word Interference Test (D-KEFS-CWIT) which measure inhibition and inhibition/switching, respectively.
Results: A series of linear regression models were calculated to examine the effect of IPIP

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FFM personality factors on subjective and objective measures of EF. After controlling for gender, the BRIEF-A-GEC was associated with both conscientiousness (F (2, 187) = 14.66, p < .001, R^2 = .14; β = -.370, p < .001) and neuroticism (F (2, 188) = 5.24, p = .006, R^2 = .053; β = .235, p = .002). IPIP FFM personality factors were not associated with the objective measures of EF included in the model (completion time on TMTB, D-KEFS-CWIT Condition 3, and D-KEFS-CWIT Condition 4; Standardized β Range = -.092-.084, p's < .05).

Conclusions: Our analyses indicated that personality traits in healthy young adults are related to self-reported EF; yet, contrary to our hypotheses, unrelated to objective evidence on two common measures of EF, the TMTB and D-KEFS-CWIT. The results suggest that the relationship between personality and EF may not be captured by objective evidence from neuropsychological tests and that research looking to further explore the relationship between personality and EF should include both subjective and objective measures of EF. Given that personality and EF are both associated with important outcomes such as health behaviors, criminality, and dementia onset, future research with older adults and with individuals with known executive dysfunction (e.g., individuals with ADHD) is needed to fully understand their relationship.

Keywords: executive functions**,** personality

20 Subdimensions of Mood Symptoms and Cognitive Performance in Healthy Young Adults

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Objective: Mood and anxiety symptoms are associated with cognitive impairments across the lifespan. Young adults are often overlooked in this area of research despite facing frequent academic and social challenges that require intact mental health and cognitive abilities. Moreover, studies suggest that subdimensions of depression have different cognitive correlates, but such relationships remain unclear in nonclinical populations. The present study examined the associations between depressive and anxiety symptoms and cognitive performance, with a focus on executive functions (EF), in a healthy young adult sample. We hypothesized that greater mood and anxiety symptoms are associated with worse EF performance.

Participants and Methods: University participants in Bronx, NY [N = 218; M age = 20.5 (SD = 1.97); female = 68.8%] completed the Beck Depression Inventory-II (BDI-II) and Beck Anxiety Inventory (BAI). EF was assessed with the Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference Test (C-WIT), a modified Stroop task that measures both inhibition and cognitive switching. D-KEFS C-WIT baseline conditions 1, color-naming, and 2, word-reading, were included in the study to establish specificity of the findings. D-KEFS C-WIT conditions 1 and 2 were combined to assess attention and processing speed (APS-combined), and conditions 3 and 4 were combined to assess EF (EF-combined). Individual condition raw scores were also examined for associations with mood and anxiety symptoms. Total scores and the subscales of BDI-II (cognitive, affective, and somatic) and BAI (cognitive and somatic) were analyzed to examine subdimensions of depressive and anxiety symptoms.

Results: Covariate analyses did not find demographic variables (gender, age, education, and race/ethnicity) related to BDI-II or BAI measures. Pearson's correlation tests were conducted to evaluate the relationships between depressive and anxiety symptoms and cognitive performance. EF-combined was significantly associated with BDI-II affective subscale (r = .19, p = .007), but not with cognitive (r = .13, p = .06) or somatic (r = .11, p = .13) subscales. Individual D-KEFS C-WIT condition raw scores showed similar findings as APS- and EF-combined scores. BDI-II affective subscale was significantly correlated with inhibitory control condition (r = .17, p = .01) and inhibitory control + switching condition (r = .16, p = .02). However, contrary to study hypothesis, BDI-II total score was not significantly correlated with APS-

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combined (r = .03, p = .68) or EF-combined (r = .08, p = .26). No other BDI-II subscale scores had significant correlations with individual raw scores. Associations with BAI measures were analyzed but nonsignificant.
Conclusions: Our results suggest that in healthy young adults, the affective dimension of depressive symptoms is related to inhibitory control and mental flexibility. However, we did not see this relationship with measures of processing speed and attention. Contrary to our hypothesis, anxiety symptoms were not related to cognitive performance. This finding indicates the importance of evaluating the subdimensions of depression when assessing executive dysfunction as part of a neuropsychological battery. It also suggests that affective depressive symptoms may be related to poorer inhibitory control and mental flexibility, even in healthy young adults.
Keywords: depression**,** inhibitory control**,** executive functions

21 Outcomes of an Online Caregiver Executive Functioning Video Suite for Children with EF Difficulties

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Objective: ADHD and ASD are both neurodevelopmental disorders associated with challenges in executive functioning (EF), which is linked to important outcomes in adulthood, including mental and physical health and employment. Poor generalization of learned skills to real world settings has limited the effectiveness of EF treatments. School-based interventions can address this problem, but reinforcement at home remains a challenge. The present study aims to better understand the outcomes of a brief caregiver training on basic executive functioning skills. The caregiver training included 12 short videos (e.g., animations, expert and caregiver interviews) that describe supporting and modeling positive EF skills for their children.
Participants and Methods: Participants included caregivers (N = 75) of children with symptoms consistent with ASD and/or ADHD and flexibility or planning/organization problems. Caregivers were primarily female (90.7%) and had an average age of 41.37 years (SD = 6.26). Their children were between the ages of 8 and 11 years (M = 9.73, SD =.96). Caregivers reported their child's observed EF through 2 global executive function questions, which assess the degree of interference from child EF behaviors at home and frequency of EF difficulties on a 10-point Likert scale; higher scores indicate greater EF problems. Caregiver strain was assessed through the Caregiver Strain Questionnaire-Short Form 7, a 7-item questionnaire assessing child-related caregiver strain through a 6-point Likert scale; higher composite scores indicate greater strain. Change scores were calculated between pre- and post-EF training for child EF interference, child EF frequency, and caregiver strain. Pearson Correlations were used to evaluate the relationship between change in caregiver strain, change in EF interference, and change in EF frequency. Paired t-tests were used to compare pre- to post outcome scores to evaluate the magnitude of the training's effect.
Results: Results indicate significant reduction in both interference of child EF problems (t = 2.507, p < .05) and their frequency (t = 4.482, p < .001), with small to medium effect sizes (Cohen's d's: .291-.496). Caregivers reported that child-related strain diminished (t = 3.798, p < .05, Cohen's d = .291). Change in EF interference and frequency were both significantly correlated with change in caregiver strain (r's: .377-.427, p's $\leq$ .001).
Conclusions: Caregivers report modest reductions in the interference and frequency of child executive functioning difficulties and reductions in caregiver strain following a brief video-based caregiver training program. Reduction in child EF difficulties related to reductions in caregiver strain. These findings

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suggest even a brief, online, and asynchronous caregiver training in EF supports may be effective in improving both caregiver and child outcomes. All outcomes were measured based on caregiver-report and there was no control condition, thus these are preliminary findings that require replication in a randomized controlled trial. They nonetheless raise the possibility that low-cost, highly accessible caregiver training tools may yield important benefits for a common and potent childhood difficulty.

Keywords: autism spectrum disorder**,** attention deficit hyperactivity disorder**,** treatment outcome

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22 I Think, Therefore I Deliberate: Higher Need for Cognition is Associated with Increased Response Time on Computerized Executive Functioning Tasks

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Objective: Need for Cognition (NFC) is a personality trait related to enjoyment of effortful mentation. NFC has been found to have a moderate association with fluid intelligence. This study evaluated increased time engagement on test items as a possible mechanism for that relationship.

Participants and Methods: A sample of 147 healthy undergraduate participants [mean age 19.61 years (*SD=3.65*), range 17-46 years old; mean education 12.40 years (*SD=.74*); 70.3% female; 62.0% Caucasian, 29.6% African American, 4.9% Asian] completed the Need for Cognition Scale (NFCS), Berlin Numeracy Test (BNT), and Bivalent Shape Task (BST) as part of a larger cognitive battery. BNT and BST were administered using Psychology Experiment Building Language (PEBL) software. The variables of interest for BNT and BST were average time engaged per test item and correct response.

Results: A significant positive association was found between higher NFCS score and longer average response time on BNT items (r = .198, p < .05). NFCS score was also negatively correlated with BST “congruent” subtest correct responses (r = -.174, p < .05) that are simplistic problems but was positively correlated with BST “mixed” subtest response time (r= .168, p < .05), which are difficult items.

Conclusions: Individuals who reported that they tend to enjoy thinking (i.e., higher NFC) took longer on average per item on tests of number estimation and response inhibition. Higher NFC was also associated with fewer correct responses on a test involving matching a single target in both shape and color. Personality traits related to motivation may influence performance on untimed neuropsychological tests by increasing the amount of time and engagement on cognitively demanding items but may counterintuitively result in worse performance on simple or boring test items. Further research is needed to explicate the interaction between personality, motivation, and item-level factors that account for individual differences in cognitive performance.

Keywords: computerized neuropsychological testing**,** reaction time**,** motivation

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23 Mexican Mood Symptomatology and Acculturation Impacts Lexical Retrieval Performance

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Objective: The Córdoba Naming Test (CNT) is a confrontation naming test. Research shows that Mexicans that reside in México (MRM) outperform Mexicans residing in the United States (MRUS) on the CNT and report higher Spanish acculturation levels. However, to our knowledge, there is no study that has investigated if depression or anxiety symptomatology correlates with acculturation and CNT performance. We examined the relationship between anxiety and depression symptomatology and acculturation on CNT performance on a Mexican population.
Participants and Methods: The sample consisted of 22 MRM, 11 MRUS, and 10 Mexican-Americans residing in the U.S. (MARUS). We used the Hospital Anxiety and Depression Scale (HADS) to evaluate depression and anxiety symptomatology and the Abbreviated Multidimensional Acculturation Scale (AMAS) to evaluate acculturation. All participants completed the CNT, HADS and the AMAS subscales in Spanish (i.e., English language, U.S. identity, U.S. competency, Spanish language, Latino competency, & Latino identity). An ANOVA, using a demographically-adjusted T-score was used to evaluate CNT performance; meanwhile, ANCOVAs, controlling for age and education, were used to evaluate acculturation on the AMAS subscales, and depression and anxiety symptomatology. Finally, Pearson's correlations were used to evaluate the influence of acculturation, depression and anxiety symptomatology on Mexican groups' CNT performance.
Results: We found that the MRM and MRUS groups outperformed the MARUS group on the CNT, $p=.000$, $\eta p^2=.50$. Next, on the AMAS subscales, we found the MRUS and the MARUS groups reported better English language, U.S. identity, and U.S. competency abilities compared to the MRM group, $p's<.05$, $\eta p^2=.47$-$.77$. Furthermore, the MRUS group reported better Spanish language abilities compared to the MRM and MARUS groups, $p=.008$, $\eta p^2=.23$. Additionally, results showed the MRM and MRUS reported better Latino competency compared to the MARUS group, $p=.007$, $\eta p^2=.23$. Regarding depression and anxiety symptomatology, we found MRM reported higher depression symptomatology compared to the MRUS and MARUS groups, $p=.001$, $\eta p^2=.31$; meanwhile, the MRM and MARUS groups reported higher anxiety symptomatology compared to the MRUS group, $p=.012$, $\eta p^2=.21$. Pearson's correlations revealed the MRM group's CNT performance correlated with Spanish language, Latino competency, and depression symptomatology, $r's=-.50$ to $.60$, $p's<.05$. Meanwhile, the MRUS group's CNT performance did not correlate with any of the AMAS subscales or anxiety or depression symptomatology. Finally, the MARUS group's CNT performance correlated with U.S. identity and anxiety symptomatology, $r's=-.61$ to $.81$, $p's<.05$.
Conclusions: As expected, the MRM and MRUS groups outperformed the MARUS group on the CNT, but did not report better Spanish acculturation traits. Next, we found the MRM group reported higher depression and anxiety symptomatology compared to their counterparts; furthermore, their depression symptomatology impacted their CNT performance. Our data suggests that while MRM individuals are more acculturated to their Spanish heritage compared to MARUS, their higher level of anxiety and depression symptomatology can be influencing other cognitive abilities besides lexical retrieval. Future investigations with a larger sample size should examine if depression and anxiety symptomatology influence additional cognitive abilities (e.g., memory) in MRM compared to their Mexican counterparts that reside in the United States.
Keywords: acculturation**,** anxiety**,** depression
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24 Expressive and Receptive Language Profiles of Adolescents in Prostitution

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Objective: Historically, adolescents involved in prostitution were considered delinquents and criminals, whereas more recently, they have been categorized as victims. This extreme type of categorization is a part of the dualistic fallacy within criminology. Depending on the perspective taken, these adolescents are treated as either offenders deserving punishment or victims needing rescue. Current research supports the idea of a spectrum within this dichotomy, yet much of the legislation and supportive services for this population are based on these extreme perspectives of dualistic fallacy. Consequently, many of these adolescents involved in prostitution have been placed in the juvenile correction system or on witness protection holds until they testify against their pimp or trafficker, an expectation that would require the adolescent to have strong verbalization skills. Given the overrepresentation of children with language deficits in the juvenile offender population and the associated rate of higher externalizing behavior, it is likely that a number of children involved in prostitution may also have language disorders; however, little is known about the language profile of these young people.
Participants and Methods: This study utilized archival data gathered from comprehensive neuropsychological evaluations conducted at a community mental health clinic. The sample included 24 adolescents (23 female and 1 transgender transitioning from male to female) involved in prostitution between the ages of 12 and 17. Out of the 24 participants, 8 self-identified as African American, 6 as Latina, 5 as Caucasian, and 5 as biracial. The adolescents were from a nationally recognized residential facility in California that provides advocacy, education, and mental health support for children involved in prostitution. They were referred in order to assist with placement and educational/ vocational planning; thus, these adolescents expressed a desire to be evaluated so that they could better understand their learning style. This study's aim was to develop a language profile of this unique population by examining these adolescents' performance on subtests from the Clinical Evaluation of Language Fundamentals (CELF- 4 and 5) and Woodcock Johnson Tests of Achievement and Oral Language (WJ-III and WJ-IV), as well caregiver's and self-report responses on the Achenbach checklists (Child Behavior Checklist (CBCL), Teacher Report Form (TRF) and Youth Self-Report Form (YSF).
Results: In comparison to the normative sample, adolescents in prostitution had statically significant lower receptive and expressive language scores, as well as higher externalizing behavior scores. The study also found lower receptive language scores than expressive language scores, and a correlation between teachers' reports of higher externalizing behavior scores and lower expressive language scores, even when co-varying for IQ.
Conclusions: These findings may have significant implications regarding the use of neuropsychological profiles to help inform legislation and legal proceedings, as it may be counterintuitive to continue common practices, such as detaining children and young adults in prostitution until they verbally testify against their pimp (Children of the Night, 2020; Lee, 2016, 2019). These adolescents do not have intact receptive or expressive language skills, much less the rather advanced skills necessary for navigating the linguistic complexity of judicial hearings and legal terminology.
Keywords: adolescence**,** language
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26 Estimating Baseline Functioning when Language is a Complication: Exploring Primary Progressive Aphasia and English as a Second Language

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Objective: Baseline estimation is an important component of neuropsychological assessment when an intraindividual approach is taken, as it often is in clinical cases, where the question is "has decline occurred?" When intelligence quotients (IQ) obtained before disease or injury are known, these are utilized; however, access to that information is rarely available. Instead, proxies for IQ are required. Several quantitative measures have been developed for this task

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including tests of increasingly difficult irregular-word reading; for example, the Wechsler Test or Adult Reading (WTAR). Such tests could be problematic in situations where language is a presenting concern. In conditions where language loss is part of the disease process, the score could capture both baseline factors and functional loss due to pathology. If English is an individual's second language (ESL), the score would include baseline factors, English fluency, and exposure to the words in the test. In either case, the resulting score could be an underestimate given those confounding variables.
One alternative method to estimate baseline functioning transforms qualitative demographic data into quantitative data and provides a weighted equation to obtain an estimated IQ. One example of a demographically based method, the Barona equation, denotes values for age, sex, race, education, occupation, and geographic region.
Comparisons of these and other methods of estimating baseline functioning exist in the literature; this study will compare two specific methods (WTAR and Barona) in two situations where language is a presenting factor: Primary Progressive Aphasia (PPA) and ESL.
Participants and Methods: A sample of 5 individuals with PPA and a different sample of 7 individuals with ESL were recruited from a longitudinal study of Neurodegenerative Diseases. All obtained WTAR scores and had information sufficient to provide a Barona estimate.
Results: In both PPA and ESL cases, the WTAR score was consistently lower than the Barona. In PPA cases, the scores were lower by 10 points or more. In the ESL cases, there was variability in the size of the difference. For both groups, there was not a statistically significant difference between the cases' WTAR scores and Barona estimate.
Conclusions: There is a need for caution when word-reading tests are used as proxies for baseline IQ in cases where language is a complication, including when PPA is in the differential diagnosis or ESL is a factor. Word reading scores were consistently lower than expected given education/occupation data and the results of the Barona equation. However, clinicians can feel somewhat confident in their use of either the reading test or demographic based calculations. Future research could increase participant size, potentially with diverse populations, and with recently developed tools.
Keywords: premorbid functioning**,** aphasia**,** language: second/foreign

27 The impact of temperament on communication development in term and preterm infants

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Objective: Research suggests that temperament is related to communication development but has focused on toddlers and older children. Existing infancy studies have focused on benefits of higher surgency/positive emotionality and regulation/orienting on communication, neglecting the role of negative emotionality and the preterm population. Toddlers with negative emotionality may encourage less social interaction, limiting their access to communication opportunities; however, negative emotionality has predicted larger vocabularies at 12 months, perhaps due to increased maternal attention. This study evaluated the relation between infant temperament at six months and communication at 12 months. Hypotheses included: 1) higher surgency and regulatory capacity would predict higher communication, and 2) higher negative emotionality and lower regulatory capacity would predict poorer communication. Differences by term status were examined.
Participants and Methods: A diverse sample of 571 caregivers of term (N=331) and preterm (N=240) infants from the PediaTrac™ longitudinal, multi-site study completed the Infant Behavior Questionnaire (IBQ) to assess temperament at 6 months, and the Communication and Symbolic Behavior Scales (CSBS; speech, social, symbolic) and the Social/Communication/Cognition (SCG) domain of PediaTrac™ to evaluate communication at 12 months. Dependent variables were analyzed

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longitudinally via linear modeling. Data was stratified by term status and covariates sex (M=298), maternal age (M_{age}=30.1) and education (48.7% college/postgraduate degree) were examined.
Results: In the pooled sample, there were positive correlations between 6 month IBQ surgency/positive affectivity and 12 month CSBS (speech [r=.33, p<.001], social [r=.35, p<.001], symbolic [r=.27, p<.001]), between regulatory capacity and the CSBS (speech [r=.17, p<.01], social [r=.20, p<.001], symbolic [r=.16, p<.01]), and between surgency/positive affectivity (r=.55, p<.001) and regulatory capacity (r=.38, p<.01) and PediaTrac SCG. No significant relation existed between negative affectivity and CSBS or SCG. Higher surgency predicted higher 12 month CSBS speech and symbolic scores (p's<.001; model R^2=.09, .06, respectively). Higher surgency, female sex, and greater gestational age predicted higher CSBS social scores (p's≤.02; model R^2=.15). Higher surgency and regulation, female sex, greater gestational age, and higher maternal education predicted 12 month SCG (p's<.05; model R^2=.36). Stratified by term status, being female predicted higher CSBS social, speech, and symbolic scores in preterm infants (p's<.008; models R^2=.13, R^2=.08; R^2=.05, respectively), and higher surgency predicted CSBS social, speech, and symbolic scores in term infants ($p's$<.001; model R^2=.18, R^2=.12, R^2=.10, respectively). Surgency, regulatory capacity, and being female predicted SCG scores in preterm infants, while surgency, higher maternal education, and younger maternal age predicted SCG scores in term infants, both models accounting for 37% of outcome ($p's$<.05).
Conclusions: Investigations suggest a transactional relation between temperament and communication, though demographic predictors may vary based on prematurity. Positive infant temperament at 6 months promotes communication acquisition at 12 months. Unexpectedly, negative affectivity affords no benefit or risk to communication development, and regulatory capacity only predicts SCG in preterm infants. Being female and having higher regulatory capacity influenced communication in preterm infants, while surgency and sociodemographic predictors affected communication in term infants. To our knowledge, this study is one of the first to examine both temperamental and demographic predictors of infant communication in a large term/preterm cohort.
Keywords: language: development**,** prematurity**,** child development (normal)
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28 The Effect of Language Experience and Gender on Verbal Fluency Test Performance in Young Adults

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Objective: To analyze the effect of Language experience and Gender in verbal fluency (VF) test performance (Category and Phonemic). We hypothesized a significant effect of Language Group (Spanish-English Bilinguals vs. English Monolinguals) with monolinguals outperforming Spanish-English bilinguals on the phonemic test but similar performance on Category Fluency. We anticipated that Gender would not influence Phonemic Fluency scores, but men would perform better than women on Category Fluency.
Participants and Methods: Fifty-eight undergraduate students (14 males) were divided into two groups: monolinguals (n = 26) and late Spanish-English bilinguals (n = 32), whose native language was Spanish and had acquired English as a second language at seven years of age or older (MAoA = 10.5, SD = 4.83). The Gender groups were similar in age and education while the Language groups were similar in education, but Monolinguals were older than Bilinguals.
Results: The analyses included 2 levels of Language Group (Monolinguals and Bilinguals), 2 levels of Gender (Males and Females), and 4 VF tasks (Animals, and letters F, A, and S) in English.
The effects of Language Group, F (1,54) = 4.73, p = .03, ηp2 = .08, and Gender, F (1,54) = 5.51, p = .02, ηp2 = .09, were significant. Monolinguals produced more words than

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Bilinguals and Males more words than Females. There was a significant effect of task, F (3,52) = 47.49, p < .001, ηp2 = .73. Post hoc analyses revealed significant differences between all VF categories, except between the letters F and S. A similar 2X2X4 Multivariate GLM analysis was performed within the bilingual group. The effect of Gender and all its interactions were not significant. The effect of Language was significant, F (1,30) = 6.83, p = .01, ηp2 = .19. Participants produced more words in English than in Spanish. The effect of VF was also significant, F (3,28) = 31.13, p < .001, ηp2 = .77 with more words for the animal than the letter categories. The Language X task interaction was significant, F (3,28) = 1.95, p < .001, ηp2 = .54, with higher scores in English than in Spanish for all categories except for the letter F, where they produced more words in Spanish than in English.

Conclusions: The results support our hypothesis that Monolinguals would produce more words than Bilinguals in English. However, we observed significant language effects across all categories, suggesting that the level of difficulty of VF tasks in English and Spanish is not equivalent. Our gender hypothesis was not fully supported since males outperformed females on the Category Fluency task and in all phonological categories except for the letter S, where females surpassed males. Contrary to what could be expected in late bilinguals, participants produced more words in English than in Spanish for all categories except for the letter F, where they produced more words in Spanish than in English. Limitations of this study include the small sample size; the unbalance distribution of males and females, and the absence of a Spanish monolingual group.

Keywords: verbal abilities**,** language**,** bilingualism/multilingualism

29 The associations between sleep disturbance and language difficulties in Down syndrome

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Objective: Sleep abnormalities are common in youth with Down syndrome (DS). There is a growing body of work suggesting that individuals with DS who experience sleep challenges have increased cognitive and behavioral difficulties. Frequent arousals and poor sleep quality have been associated with decreased cognitive flexibility and overall function, as well as memory and language challenges. Language difficulties are indeed a central concern for this population, as these challenges are often the most apparent and striking. Specifically, individuals with DS show a profile of language difficulties characterized by greater impairments in structural (e.g., non-social) than pragmatic (e.g., social) language. Despite robust evidence that increased sleep abnormalities are associated with language, the relations between sleep disturbance and the nature of social and non-social language difficulties (i.e. the language profile) have not been examined.

Participants and Methods: The current study seeks to evaluate a measure of sleep abnormalities, the Pediatric Sleep Questionnaire (PSQ), alongside a measure of structural and pragmatic language skills, the Children's Communication Checklist – 2nd Edition (CCC-2), with the goal of revealing nuances underlying the relationship between sleep and language use in the DS population. We hypothesize more language difficulties in children with DS with sleep atypicalities as measured by the PSQ. 27 individuals with DS (M_{AGE}=10.7, SD_{AGE} =2.6, Pct_{FEMALE}=51.7%) participated in the study. Caregivers of participants completed the PSQ and CCC-2. The CCC-2 is comprised of 4 structural and 4 pragmatic language scales that were averaged to create structural and pragmatic language skills composites. The standard cutoff score of .33 was applied to PSQ scores to identify participants with suspected sleep-related breathing disorders (SRBD; N_{ABOVE}=10).

Results: A 2 (Sleep group: above v. below PSQ cutoff) x 2 (CCC-composite: structural v. pragmatic) mixed measures ANOVA was used to evaluate differential language profiles for youth with and without suspected SRBD. There

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was no significant interaction between group and composite (Wilks' Lambda= .95, $F(1,25)=1.36$, $p=.26$, partial $\eta^2=.05$). There was a substantial main effect for composite (Wilks' Lambda=.32, $F(1,25)=52.56$, $p<.001$, partial $\eta^2=.68$), with both groups showing higher pragmatic than structural language scores. The main effect comparing the sleep group approached significance ($F(1,25)=3.28$, $p=.082$, partial $\eta^2=.12$) such that those with suspected SRBD performed worse overall. To explore this relationship further, continuous regression analyses were completed for each CCC-2 composite score. A bivariate regression analysis indicated that sleep abnormalities accounted for 8.4% of the variance in structural language skills, though this relationship did not reach statistical significance ($\beta=-.29$, $R^2=.084$, $F(1,25)=2.29$, $p=.14$). In contrast, sleep abnormalities accounted for 24.6% of the variance in pragmatic language skills ($\beta=-.49$, $R^2=.246$, $F(1,25)=8.14$, $p=.009$).

Conclusions: These results reinforce prior findings that sleep abnormalities are adversely associated with functional communication in youth with DS. Moreover, these results add to the literature and suggest that sleep abnormalities are particularly associated with pragmatic language. This is especially of note because pragmatic skills are known as a relative strength in the DS population.

Keywords: language**,** sleep**,** child development disorders

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30 Relationship Between Visual Working Memory and Verbal Fluency in Undergraduate Deaf Sign Language Users

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Objective: Bimodal bilingualism develops in deaf individuals learning English in the United States (for lip-reading and literacy purposes) and American Sign Language (ASL), which results in a different but parallel, structural representation of language and other cognitive functions in deaf ASL users due to separate input and output neural circuits associated with each language (Emmorey, et al., 2002). Working memory, in particular, is a component of executive functioning (EF) which has been reported as being potentially organized differently in the deaf signing population (Morales, Calvo & Bialystok, 2012). In hearing adult populations, working memory and verbal fluency are positively correlated (Rende, Romberg, & Miyake, 2002); however, it is unclear if the same relationship exists in the deaf ASL users. The current study examined relationships between visual working memory and verbal fluency in undergraduate pre-lingual deaf ASL users.

Participants and Methods: The current study utilized data collected for a larger research study conducted at Gallaudet University examining literacy in undergraduate pre-lingual deaf sign language users. The current study sample comprised of 43 participants who completed neuropsychological testing as part of the larger research study, specifically the Wechsler Abbreviated Scale of Intelligence, 2nd edition (WASI-II), Wechsler Memory Scale 4th edition (WMS-IV) Symbol Span, and the Delis-Kaplan Executive Function System (D-KEFS) Verbal Fluency Test. The study sample mean age was 22 years 7 months (SD = 3.68), and the WASI-II Full Scale IQ mean score was in the average range with no significant discrepancy between verbal and nonverbal performance. The majority of the sample reported idiopathic or unknown type of hearing loss (n=30; 69.8%) with 25.6% (n=11) reporting sensorineural hearing loss. The best communication method was ASL for 88.4% (n=38,) of the study sample. ASL was the primary household language during childhood for 58.1% and a combination of ASL and spoken English was the childhood primary household language for 28% of the study sample.

Results: Performance was in the average range on the WMS-IV Symbol Span (mean T-score=47.23, SD=8.30). The study sample performed in the low average range on D-KEFS Letter Fluency (mean T-score=36.63, SD=10.29) and Category Fluency (mean T-score=34.98, SD=13.88) and in the average range on

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Category Switching (mean T-score=40.33, SD=13.96) compared to normative data based on same-age, hearing populations. No significant correlations were found, but multiple correlation coefficients examining associations between visual working memory and verbal fluency were almost zero.
Conclusions: Significant associations between visual working memory and verbal fluency were not found, but results suggested that further research should examine if these domains develop discretely or have a curvilinear relationship in pre-lingual deaf sign language users. An additional compelling observation was the limitation of current neuropsychological conventions for evaluating deaf sign language users. The ability to reliably assess verbal fluency and other cognitive abilities in a valid manner for sign language users is a critical need that should be the focus of future research along with a greater understanding of cognition for better conceptualization of cognitive strengths and needs of deaf individuals.
Keywords: language: development**,** working memory**,** assessment
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31 Narrowing of Semantic Scope in Narrative Production in Post-Stroke Aphasia

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Objective: Aphasia has historically been regarded as a disorder of impaired linguistic access to intact semantic representations. For example, people with aphasia (PWA) might have difficulty saying “apple” but would have no problems demonstrating non-verbal knowledge of apples (e.g., eating an apple, sorting apples with other fruits). Recent studies have cast doubt on this fundamental assumption within aphasiology. Paradoxically, recent studies have shown that PWA do appear to experience nonverbal semantic impairments, especially under high executive loads. The nature of these semantic impairments remains unclear.
Our understanding of semantic impairment in aphasia was shaped by experimental paradigms using single words or objects. Much remains to be learned about how impairment at the word level reverberates through higher order elements of language. This is especially true for narrative production (e.g., “tell me about your day”), an essential skill for human communication.
We investigated semantic relationships between words in the running narratives of PWA vs. age-matched controls. We specifically focused on the distinction between thematic (e.g., dog-leash) vs. taxonomic (e.g., dog-wolf) semantic distance as language unfolds. We hypothesized that PWA experience a restricted ‘tunnel’ focus compromising lexical and topical diversity during storytelling. This narrow focus will result in low thematic distance for PWA.
Participants and Methods: We extracted narrative transcriptions from PWA (N=216) and neurotypical controls (N=201) from AphasiaBank. Narratives were elicited from a standard set of story prompts (e.g., Cinderella). We imported all narratives into R and subjected each to a custom processing pipeline with the goal of automatically transforming and splitting long strings of text (e.g., “The doctor visited the patient”) into vectors of lemmatized content words. This processing pipeline yielded all ordered pairs of content words within each participant’s narrative (e.g., doctor-visit, visit-patient, etc.).
We derived feature-based (taxonomic) distance for each word pair by computing Euclidean distance via a 15-dimension semantic space (e.g., color, sound, disgust). We derived thematic distance for each word pair using the GloVe cosine similarity metric. We transformed each of these distance metrics to a standard unitless scale (0-1) so that the cosine and Euclidean distance metrics could be directly compared. We eliminated outliers by participant and prompt by applying minimum thresholds to the number of words produced.
Results: PWA showed lower inter-word thematic (M = 0.142 ± 0.002) and taxonomic (0.163 ± 0.001) distance relative to controls

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(thematic: 0.164 ± 0.001; taxonomic: 0.174 ± 0.001; both *p*s < 10^{-13}). Additionally, the relationship between thematic and taxonomic semantic distance was stronger for PWA, who demonstrated a stronger positive correlation (*r* = 0.46) between taxonomic and thematic semantic distance measures than controls (*r* = 0.32). These results indicate that PWA exhibit constrained thematic and taxonomic semantics during narrative production.
Conclusions: We applied a novel set of natural language processing methods to analyze thematic and taxonomic semantic transitions between thousands of words, offering an unprecedented glimpse into how people with aphasia organize semantic flow. Specifically, PWA narratives are more semantically constrained than controls.
Keywords: aphasia**,** semantic processing**,** language: aphasia

32 Examining Sequential Effects on Oral Reading Response Time and Accuracy in Older Adults and People with Aphasia

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Objective: The order of item types affects response times in oral word reading tasks (Kinoshita & Lupker, 2007; Taylor & Lupker, 2001). Some researchers attribute these sequential effects to “response homogenization,” suggesting that readers subconsciously control speed, not process (Lupker et al., 1997). Other studies suggest that readers dynamically control the reading process depending on the word type, and that switching between processes slows response times (Reynolds & Besner, 2005). These studies have been designed within Dual Route frameworks that deemphasize the role of semantics in reading aloud (Coltheart et al., 1993, 2001) and therefore have not examined sequential effects of semantic content. Prior studies have also not investigated sequential effects on accuracy, which could not be explained by response homogenization. We first replicate sequential effects of response time in older controls using a mixed-block word reading task. We then examine sequential effects on reading accuracy in people with aphasia and matched older controls using the same task, allowing simultaneous examination of sequential effects of multiple word features.
Participants and Methods: Participants were 41 people with a history of aphasia post left-hemisphere stroke and 51 controls matched on age and education. Both groups read aloud 200 monosyllabic words crossed factorially on frequency (high/low), regularity (regular/irregular), and imageability (high/low). Items were ordered such that each item type was preceded by each other item type the same number of times. A series of 12 linear mixed effects models examined effects of (1) preceding item response time and accuracy and (2) preceding item frequency, regularity, and imageability on both (a) current item response time (in controls) and (b) current item accuracy (in each group). Models using current item accuracy as the dependent variable individually examined reading of high frequency regular, low frequency regular, high frequency irregular, and low frequency irregular words.
Results: Controls read words more quickly when preceded by a word that was read accurately or quickly (prior accuracy: P <.001, unstandardized beta=-135.83, 95% CI=-203.39 - -68.28; prior response time: P <.001, unstandardized beta=0.24, 95% CI=0.21-0.26). Low frequency irregular words were read more accurately by both controls and patients if preceded by a low imageability word rather than a high imageability word (Controls: Z=-2.26, P=.02, OR=0.30, 95% CI=0.11-0.85; Patients: Z=-2.38, P=.02, OR=0.48, 95% CI=0.26-0.87). There was no significant interaction of preceding imageability with current imageability. Patients also more accurately read high frequency regular words when preceded by an irregular word rather than a regular word (Z=-2.13, P=.033, OR= 0.60, 95% CI=0.37-0.96).
Conclusions: Our results suggest that both response time homogenization and

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dynamic process-switching account for sequential effects in reading, with the former affecting response times and the latter affecting accuracy. Specifically, residual semantic activation from a highly imageable prior trial interferes with correct reading of low frequency irregular words, consistent with models suggesting semantic reliance in reading these words (Plaut et al., 1996). The preceding regularity effect on high frequency regular words requires further investigation. Sequential effects should be considered when designing oral word reading tasks for clinical assessment.

Keywords: language: aphasia**,** aphasia**,** reaction time

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33 Burden Negatively Impacts Attention in Caregivers of Persons with TBI

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Objective: Increased levels of stress-related symptoms, such as burden, in informal caregivers places them at a higher risk for late life cognitive decline. The research on the interactions between caregiver burden, psychological health, and cognitive function mainly focuses on caregivers of persons with dementia. This necessitates addressing the gap of knowledge pertaining to stress-related cognitive function in caregivers of persons with traumatic brain injury (TBI). The present study aims to explore the relationship between burden and cognitive function in caregivers of persons with TBI.

Participants and Methods: Thirty-two caregivers of persons with TBI (91% female; 91% married; 47% with at least a bachelor's degree; mean age = 50.97 ± 16.05 years) were assessed at the VA Palo Alto Health Care System in Palo Alto, CA. The main predictor included burden (Zarit Burden Inventory) as the stress-based symptom. Potential covariates included age as well as measures of psychological health, such as depression (Center for Epidemiological Studies- Depression Scale), vigilance (Vigilance Scale), and worry (Penn State Worry Questionnaire). Primary outcomes were drawn from the Rey Auditory Verbal Learning Task (RAVLT). These included attention (RAVLT Trial 1), learning (RAVLT Trials 1-5), and memory (RAVLT Delayed Recall Trial). Learning and memory scores were summed to create a learning and memory composite score. Analyses included a correlation matrix for covariate identification and linear regressions.

Results: The correlation matrix revealed that none of the potential covariates (i.e., age, depression, vigilance, worry) were significantly associated with either predictors or outcomes, thus were excluded from the main analyses. The linear regression results indicated that burden accounted for 46% of the variance within attention ($p < 0.01$; $t = -2.82$; $CI = [-0.27, -0.04]$). Burden was not significantly associated with learning and memory.

Conclusions: Burden was found to negatively impact attention. This identifies burden as a significant psychological factor related to cognitive function in caregivers of persons with TBI. Short-term implications of having impaired attention can include a decline in other cognitive domains. Although these results are looking at the short-term cognitive outcomes, they also have long-term implications. Current longitudinal research results on the effects of caregiver burden on cognitive functioning are mixed, with little research investigating the role of burden on cognitive functioning in caregivers of persons with TBI. Additional research to evaluate the impact of burden on attention, specifically in caregivers of persons with TBI, could assist providers in implementing preventative interventions to improve attention and maintain healthy cognitive functioning. Addressing and preventing burden in caregivers of persons with TBI is important for both the caregiver's and care recipient's cognitive and psychological well-being.

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Keywords: caregiver burden**,** attention**,** cognitive functioning

34 A Prospection Intervention Engenders Greater Episodic Specificity

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Objective: Prospection involves imagining future events and is linked to healthy functioning across a variety of domains, such as behavioral engagement, planning, emotion regulation, goal pursuit, problem-solving, and mood. Deficits in prospection are observed in different forms of psychopathology with a large body of research showing that people with depression generate less episodically specific prospections than healthy adults. Episodic specificity is an important component of prospection and is associated with better functioning. This study sought to determine if combining a prospection intervention with an empirically supported behavioral activation intervention would increase episodic specificity in a non-depressed sample. We hypothesized that the combination of these interventions would enhance episodic specificity, thereby increasing behavioral engagement over and above behavioral activation alone. Given the clinical utility of behavioral activation for depression, prospection may be a clinically useful motivator for behavioral activation in clinical populations.
Participants and Methods: Fifty-four undergraduate psychology students who were not currently experiencing depression took part in the experiment for course credit. Participants were placed into one of two instructional groups (standard behavioral activation treatment - BA group – or behavioral activation treatment plus prospection - BAP group). Participants in each group choose two activities that they wanted to participate in over the following week. Both groups typed about engaging in each activity for 3 minutes. Prior to typing about each activity, participants in the BAP group engaged in prospection (i.e., they were instructed to imagine engaging in their chosen activities in as much detail as possible). Participants completed the BDI-II, Subjective Well-Being Scale, Vividness Scale, and Behavioral Activation for Depression Scale (BADS).
Results: Participants in each group choose two activities that they wanted to participate in over the following week. The activities are referred to as Activity 1 and Activity 2. In support of our hypothesis, the experimental group (BAP) generated significantly more episodic details (M = 13.19, SD = 5.758) for activity one than the control group (BA) (M = 10.30, SD = 4.268); t (52) = 2.094, p = .041), d = 0.507. The same was true for activity two (BAP, M = 14.04, SD = 4.686; BA group, M = 10.30, SD = 4.427; t (52) = 3.015, p = .004, d = 0.82). Contrary to our hypothesis, the interaction was not supported, meaning that we did not find significant differences in behavior engagement between groups.
Conclusions: Results of this study suggest that the addition of a prospection intervention to an empirically supported behavioral activation intervention engenders greater episodic specificity. Further development of this intervention is warranted to enhance behavioral engagement in populations with prospection deficits through the generation of more episodically specific prospections. The implications of these findings are particularly significant for populations that have prospection deficits who might be more likely to experience enhanced behavioral engagement, planning, emotion regulation, goal pursuit, problem-solving, and mood if able to generate more episodically specific prospections.
Keywords: visual imagery**,** everyday functioning
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35 Predictors of Social Participation Outcome After Rehabilitation for Traumatic Brain Injury

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Objective: The French-Canadian MPAI-4 questionnaire (FC-MPAI-4) (Guerrette & McKerral, 2021; McKerral et al., 2014) assesses functional outcome and social participation of adults after traumatic brain injury (TBI). In fact, social participation, such as return to work and community integration, is one of many objectives in the rehabilitation of patients with TBI. Studies on predictors of social participation specific to a French-Canadian population where there is free universal access to inpatient and outpatient rehabilitation services following TBI are scarce. Our objective was thus to assess the ability of pre-injury, injury-related, and post-injury variables in predicting social participation outcome after TBI.
Participants and Methods: Participants (*N* = 372) were adults consecutively admitted in rehabilitation after a mild, moderate or severe TBI between 2016 and 2020, and for which a FC-MPAI-4 measure was obtained at start and end of rehabilitation. Sociodemographic and clinical characteristics were collected from medical files and rehabilitation databases to predict social participation outcomes (measured in terms of FC-MPAI-4 Participation subscale score at discharge from outpatient rehabilitation). Multiple regressions were used to investigate the value of each variable in the prediction of social participation outcome. Analyses were carried out separately for patients who received inpatient and outpatient rehabilitation, and for patients who only received outpatient services.
Results: For the inpatient-outpatient rehabilitation path, three variables (years of education prior to injury, FC-MPAI-4 Abilities and Adjustment subscale scores at rehabilitation intake) were found to significantly predict social participation outcome, with the overall regression model accounting for 49% of the variance of the FC-MPAI-4 Participation score. For the outpatient rehabilitation path, five variables (premorbid hypertension and prior psychiatric diagnosis, total hours of indirect interventions received, FC-MPAI-4 Abilities and Adjustment scores at rehabilitation intake) significantly predicted social participation outcome, with the overall regression model accounting for 47% of the variance.
Conclusions: In a French-Canadian rehabilitation context, multiple premorbid and post-injury variables (but not injury-related variables) appear to be significantly involved in predicting social participation. Predictors also vary depending on the type of rehabilitation services received (inpatient-outpatient or outpatient only). The predictive value of those variables could help clinicians in identifying patients who are at risk of showing poorer social participation at discharge from outpatient rehabilitation, and influence intervention approaches put forward with these individuals.
Keywords: traumatic brain injury
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36 Not so Gentle in to that Good Night: Linking High-Risk Behavior and Neurotrauma

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Objective: Existing research demonstrates that age, substance use, and injury mechanisms interact and impact the incidence of traumatic brain injury (TBI) across the lifespan, with younger males carrying elevated risk for moderate-severe TBI (msTBI), contrasting with their female counterparts who may present with milder forms of TBI. While specific injury contexts may prompt legal authority intervention for these patients, little is known regarding clinical characteristics of these individuals.
Participants and Methods: Drawing from an existing registry (Pennsylvania Trauma Outcome Study), recording hospital data from trauma centers across the state (1986-2019), we characterized demographics, injury mechanisms, and pre-existing conditions (PECs; conditions present prior to admission) for 2,538 adults suffering TBI (17.6% msTBI), 2.7% of the database) discharged to a 'Legal Authority' (jail). Of these TBI patients, 11.6% were injured in prison (8% msTBI).
Results: TBI patients discharged to jail, but not injured in prison were 93% male, 49% Black,

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Asian, or Other race, mean age = 35 years (±11.9), 41% legally intoxicated on admission, 36% injured overnight (10PM-5AM), and most likely to be injured in motor vehicle accidents (MVAs), fights/brawls, or falls, which persisted for msTBI patients as well, contrasting with TBI patients not discharged to jail (62% male, 15% Black, Asian, or Other race, mean age = 53 years (±23), 30% legally intoxicated, 26% injured overnight). TBI patients injured in prison were 96% male, 41% Black, Asian, or Other race, mean age = 40 years (±13.8), 15% injured overnight, and most frequently injured in fights/brawls, falls, or assault with blunt object. The most frequently endorsed PECs for the TBI cohort not injured in prison were substance use disorder (29%) and psychiatric diagnoses (20%), and one-third of TBI patients injured in prison endorsed psychiatric PECs. Furthermore, 10% of all TBI patients discharged to jail reported prior hospital admissions for trauma. Alcohol intoxication did not confer risk for msTBI over mild TBI, χ^2 (1, 1512) = 1.4, p = .2, but was associated with more MVAs compared to fights/brawls and falls together, χ^2 (1, 982) = 126.5, p < .001, φ = .4, and for these MVAs to transpire overnight (χ^2 (1, 982) = 30.9, p < .001, φ = .2). The overnight timeframe did not impact injury mechanism for patients injured in prison, χ^2 (1, 152) = 1.1, p = .3.
Conclusions: Younger males, with Black patients (45%) notably over-represented, appear to be at increased risk for injury contexts prompting discharge to jail compared to their female counterparts. In combination with psychiatric and substance use PECs, this may reduce chances for these patients to participate in research due to restrictive inclusion criteria, diminishing opportunities to understand the impact of high-risk behavior resulting in TBI and risk factors for repetitive neurotrauma. This not only impacts recovery and rehabilitation efforts, but also creates challenges facing intervention science regarding reproducibility of findings and TBI detection within this under-represented and at-risk population aging with a complex and chronic injury history.
Keywords: traumatic brain injury**,** minority issues**,** inclusion
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37 Performance on Brief Cognitive Screener and its Relationship with Discharge Destination in Traumatic Brain Injury Patients

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Objective: To determine if performance on brief cognitive screener, Galveston Orientation and Amnesia Test (GOAT) for patients with traumatic brain injury (TBI) is associated with discharge destination.
Participants and Methods: This study retrospectively analyzed data from patients admitted to an acute care hospital due to a confirmed TBI. Data from 79 patients (age range: 18-98 years) with TBIs of varying severity (GCS range: 3–15) and with confirmed head injury (per emergency department report) were available for analysis. Cognitive impairment was assessed with the Galveston Orientation Amnesia Test (GOAT) during acute hospital admission.
Patients were grouped based on discharge location (i.e., Home without 24/7 care vs. institution, rehabilitation or 24/7 care at home). Univariate analysis was utilized to determine if there was an association between discharge disposition and GOAT score during acute recovery when controlling for demographics and GCS score. Logistic regression was also used to determine if TBI severity (i.e., GCS score), cognitive impairment (i.e., GOAT score), or demographics (i.e., age, education) could predict discharge disposition.
Results: Contingency analyses (i.e., Chi-Square) revealed significant differences in terms of the racial composition of the groups (X2(3, n=78)=10.5, p=0.0015); Among patient discharged home without supervision, there were relatively fewer white patients, and a higher number of Latino and Asian individuals. Results of non-parametric testing indicated those who were discharged home were significantly younger (U=1026.0, p=0.007) and had fewer years of education (U=682.0,

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p=0.009) compared to individuals discharged to a supervised care setting. Those discharged home scored significantly higher (i.e., better) on the GOAT (U= 477.5, p=0.003). GCS scores on admission did not differ significantly between groups. Univariate Analysis (i.e., ANCOVA) controlling for age, education, and GCS score at hospital admission revealed a significant association between GOAT total score and discharge disposition (F,(4)=5.3, p=0.001); those who were discharged home without supervision scored significantly higher (i.e., better) on the GOAT compared to patients discharged to supervised care settings. Using age, education, GCS score and GOAT scores as potential predictors of discharge disposition, a forward hierarchical logistic regression indicated that discharge to a supervised care setting was positively associated with years of education (B=0.33, p=0.002, OR=1.39) and negatively associated with GOAT total scores (B=-0.43, p=0.002, OR=0.96). This model accurately predicted discharge disposition in 76% of cases (X2(2, n=63)=20.8, p<0.001).
Conclusions: This study confirmed that GOAT scores during acute hospitalization following TBI are associated with discharge disposition and may be useful in predicting level of supervision needed following post-acute care. Results of our predictive model suggest a 4% increase in likelihood of being discharged home without supervision for each additional point earned on the GOAT during the acute care period. As such, clinicians may wish to consider administration of the GOAT during the acute-phase.
One unexpected finding was identification of years of education as a predictor of discharge disposition. Considering the differences in racial makeup between the groups in this study, we hypothesize that years of education instead reflected a proxy for latent differences between the groups (e.g., socioeconomic status, healthcare literacy/access, etc.) in that those possessing more of said latent trait were more likely to discharge to supervised care settings.
Keywords: brain injury**,** traumatic brain injury**,** concussion/ mild traumatic brain injury
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38 A Systematic Review of Heart Rate Variability Biofeedback Treatment Following Traumatic Brain Injury

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Objective: Autonomic nervous system dysregulation is increasingly identified as a consequence of traumatic brain injury. Heart rate variability is a specific and cost-effective measure of autonomic nervous system functioning, with studies suggesting decreased heart rate variability following moderate-to-severe traumatic brain injury. Heart rate variability biofeedback treatment may improve post-traumatic brain injury autonomic nervous system functioning and, potentially, cognitive functioning. A systematic evidence-based understanding of the effectiveness and limitations of heart rate variability biofeedback training is needed to summarize the state of the literature and provide future research directions. The current systematic review had three aims: 1.) determine the evidence available for the use of heart rate variability biofeedback in treating traumatic brain injury; 2.) understand the connection between heart rate variability biofeedback and neurocognitive functioning following traumatic brain injury; 3.) examine whether heart rate variability biofeedback was associated with a reduction in clinical and physical symptoms.
Participants and Methods: We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Systematic literature searches were conducted in August of 2020 on PsycINFO, MEDLINE, Embase, CINAHL, and SPORTDiscus. Articles were included if participants experienced mild, moderate or severe traumatic brain injury; provided data on heart rate variability; used heart rate variability biofeedback as a primary form of treatment;

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were peer-reviewed; and were available in English. Two raters coded articles with discrepancies adjudicated by a third rater. Articles were rated for quality using standardized quality assessment measures.
Results: Seven papers met inclusion criteria: two case studies, two pre-post intervention designs, one retrospective study, and one case-control study. Only one study utilized a control group or sham intervention. Sample sizes were modest ranging from one to sixty participants (mean=14.7, SD=20.8). Four studies included neuropsychological functioning as an outcome measure; one study included a measure of life satisfaction. On average, participants completed fourteen sessions of heart rate variability biofeedback (mean=14.4, SD=12.5, range=1 to 40). All studies showed significant increases in heart rate variability for both frequency-domain (LF, HF, LF:HF ratio) and time-domain measures (SDNN, pNN50, rMSSD). Four studies showed improved executive functioning and one study showed improved life satisfaction. All studies showed improvements in mood and physical symptoms (e.g., headaches, sleep), which positively correlated with improved heart rate variability measures. Regarding the rigor of the studies, primary methodological biases included lack of control or sham comparison, lack of randomization, and lack of blinding of assessors. On average, studies had five of twelve indicators of bias (SD = 2.06), suggesting overall poor-to-fair study quality.
Conclusions: The literature on heart rate variability biofeedback and traumatic brain injury remains in the early stages, and conclusions on effectiveness are unclear and may be biased. That said, findings to date suggest heart rate variability biofeedback may be a useful measure for clinical recovery following traumatic brain injury. Study results were positive with gains in autonomic control, mood, executive functioning and quality of life. Larger controlled trials are warranted to more clearly determine the effectiveness of heart rate variability biofeedback following traumatic brain injury.
Keywords: traumatic brain injury**,** treatment outcome
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39 History of Traumatic Brain Injury Predicts Criminality in Individuals who are Incarcerated

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Objective: Prior research has demonstrated those who have experienced a traumatic brain injury (TBI) are more likely to become incarcerated. Evidence suggests the cognitive and psychological sequelae (e.g., increased irritability, externalizing symptoms, psychiatric conditions) are related to an increased risk for engaging in criminal activity. However, few large studies of this relationship have been conducted in the United States, and most prior studies have investigated primarily male samples, who have a greater likelihood of experiencing externalizing symptoms following a TBI compared to women. Additionally, prior studies have used a combination of assessment methods to document TBI history (e.g., medical records, self-report). The goal of our study is to clarify the connection between TBI history and severity with criminal activity using a validated structured interview in a large sample of both male and female persons currently incarcerated in prison. Additionally, we examined whether a history of TBI increased risk for recidivism, examining how the severity of injury influenced outcomes.
Participants and Methods: We examined 1,432 individuals incarcerated in medium-security institutions in the state of Wisconsin, including 1032 males and 391 females, of whom 59% had a history of TBI. TBI history was assessed using a modified version of the Ohio State University TBI Identification. TBI severity was determined using the DSM-5 criteria (length of loss of consciousness, post-traumatic amnesia, experience of neurological symptoms at the time of injury). Criminal data was taken from public court documents in the state of Wisconsin.
Results: Across the entire sample, a history of any TBI was associated with greater number of convicted crimes. This connection was stronger for nonviolent compared to violent crimes. Within

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our model, women with a TBI committed more crimes than women with no TBI history, but this same effect was not found for men.
Conclusions: Our results clarify the connection between history of TBI and criminal activity. In our large sample of both male and female individuals who are incarcerated, we found those with a history of any TBI committed more crimes than those who did not, although when broken down by gender, this effect only appeared within women. Understanding how a history TBI impacts those who are incarcerated will improve both treatment outcomes and has significant criminal justice implications.
Keywords: traumatic brain injury**,** forensic neuropsychology
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40 Encoding, Consolidation, and Retrieval Performances in Monolingual and Bilingual Traumatic Brian Injury Survivors

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Objective: Traumatic brain injury (TBI) often results in verbal memory deficits. The Item Specific Deficit Approach (ISDA) has been used to characterize memory process deficits associated with TBI and other neurological conditions. The ISDA is an item analytic method that can be applied to clinical list learning tests. The ISDA has repeatedly shown that TBI-related verbal memory impairment was primary due to encoding deficits, consistent with experimental studies of memory in TBI. In addition to TBI, linguistic factors (e.g., bilingualism) are also known to impact memory and other cognitive performances. We examined the impact of TBI and bilingualism on verbal memory encoding, consolidation, and retrieval. We predicted that the healthy comparison (HC) group would demonstrate better encoding, consolidation, and retrieval scores relative to TBI participants, and that monolingual participants would score higher than bilingual participants on measures of encoding, consolidation, and retrieval.
Participants and Methods: The sample consisted of 37 persons with acute TBI (ATBI; 25 English monolingual &12 English-Spanish bilingual), 25 persons with chronic TBI (CTBI; 13 English monolingual & 12 English-Spanish bilingual), and 54 HC (27 English monolingual & 27 English-Spanish bilingual) participants. Participants with ATBI were tested 6 months post-injury and CTBI participants were tested 12 months or more post-injury. Indices of encoding, consolidation, and retrieval were obtained via the ISDA as applied to the California Verbal Learning Test, Second Edition (CVLT-II). Data were analyzed via a series of ANCOVAs, controlling for age. All participants passed performance validity testing.
Results: The groups were matched, with the exception of age (HCs were younger than the ATBI and CTBI groups). We found that the ATBI group showed greater encoding, $p=.001$, $\eta p^2=.11$, consolidation, $p=.005$, $\eta p^2=.09$, and retrieval deficits, $p=.005$, $\eta p^2=.09$ compared to the HC group. Furthermore, the CTBI group demonstrated greater consolidation deficits compared to the HC group, $p=.005$, $\eta p^2=.09$. Next, we found an interaction where the monolingual CTBI group showed more consolidation deficits compared to the bilingual CTBI group. Also, the bilingual HC group showed greater consolidation deficits compared to the monolingual HC group, $p=.013$, $\eta p^2=.08$.
Conclusions: As expected, the TBI groups showed worse memory process abilities than the HC group. Specifically, the ATBI group demonstrated greater encoding and retrieval deficits than the HC group, while the CTBI group had worse consolidation than the HC group. Results also showed worse memory deficits as measured by the ISDA compared to bilingual CTBI participants. Prior research has indicated bilingualism as a potential neuroprotective factor in other clinical populations (e.g., dementia).

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Further research is needed with a larger sample size to evaluate different bilingual English and other language groups' (e.g., French-English bilinguals, English-Mandarin bilinguals) performance on encoding, consolidation, and retrieval.

Keywords: traumatic brain injury**,** memory complaints

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41 Bilingualism and Verbal Fluency in Traumatic Brain Injury

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Objective: Traumatic brain injury (TBI) survivors frequently demonstrate deficits in executive function relative to healthy adults. Phonemic (letter) and semantic (category) fluency are language-based measures of executive. Verbal fluency performance components including provide additional insight into language based executive function. We evaluated letter fluency, switching, and clustering monolingual (English) and bilingual (English plus another language) individuals with traumatic brain injury. We predicted that individuals with TBI will underperform compared to healthy comparison (HC) participants and that bilingual groups [i.e., English as a first language (EFL), English as a second language (ESL)] would underperform compared to the English monolingual group in the executive functioning tests.
Participants and Methods: Our sample consisted of 69 persons with TBI (33 English monolingual; 18 EFL bilingual; 18 ESL bilingual) and 63 HC (26 English monolingual; 12 EFL bilingual; 25 ESL bilingual) participants. The bilingual groups spoke English and another language (e.g., Spanish). Adjusted demographic T-scores from the Delis-Kaplan Executive Function System were used to examine letter and semantic; meanwhile, Troyer (2000) calculations were used to examine letter and semantic clustering and switching performances. All participants passed performance validity testing.
Results: ANOVAs revealed the HC group outperformed the TBI group on letter fluency, letter switching, semantic fluency, and semantic switching on demographically adjusted T-scores (ps<.05, ηp^2=.04-.10). Next, the English monolingual group underperformed compared to both bilingual groups in letter clustering (p=.010, ηp^2 =.07). Finally, a letter fluency interaction emerged where the English monolingual TBI group underperformed compared to EFL TBI group; English monolingual TBI underperformed compared to the ESL TBI group; and the ESL HC group underperformed compared to the English monolingual HC group (p=.042, ηp^2=.05).
Conclusions: As expected, the HC group outperformed the TBI group in all measured dependent variables except for letter and semantic clustering. We also found that both TBI bilingual groups outperformed the monolingual group on letter fluency performance. This suggests greater language based executive reserve in bilingual English speakers in contrast to monolingual English speakers. A possible explanation is bilingual language use results in more resilient language related neural networks that may be related to better recovery in some persons with TBI. Future work should confirm this finding, determine if brain-behavior associations support the benefits of bilingualism in language base executive ability after brain injury, and to determine if there are subgroup differences in verbal fluency performances among bilingual individuals with TBI (e.g.,

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English as a first language vs. English as a second language, etc.).
Keywords: traumatic brain injury**,** executive functions
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42 Speeded Attention, Bilingualism, and Functional Outcome Following TBI

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Objective: Traumatic brain injury (TBI)is associated with reduced attentional speed and functional declines. Previous work has shown that reduced processing speed is primary to poor functional outcomes in TBI. We examined the relationship between speeded attention, bilingualism, and functional outcome in persons with TBI.
Participants and Methods: The sample consisted of 42 persons with acute TBI (ATBI; 23 monolingual & 19 English and other language bilingual), 30 persons with chronic TBI (CTBI; 12 monolingual & 18 bilingual) and 45 healthy comparison participants [HC; 18 monolingual (English) & 27 bilingual (English and another language)]. The Trail Making Test Part A (TMT-A), Symbol Digit Modalities Test (SDMT oral (SDMT-O) & SDMT written and oral trials (SDMT-Wand SDMT-O, respectively), and Stroop Color Word Test [word (Stroop-W) and color (Stroop-C) trials] were employed to assess speeded attention. The Mayo Portland Adaptability Inventory (MPAI-4) was used to examine functional outcome. Data were evaluated with ANOVA.
Results: Results showed that HC group outperformed both TBI groups on Stroop-C and SDMT-W, p's<.05, ηp^2=.12-.20. The HC group outperformed the ATBI group on TMT-A, p=.003, ηp^2=.12. Also, the HC and CTBI demonstrated superior performances on the SDMT-O in contrast to the ATBI group, p=.000, ηp^2=.15. Additionally, interactions emerged where the monolingual ATBI participants outperformed the bilingual ATBI participants on the SDMT-W, SDMT-O, and SCWT-C and the bilingual CTBI participants outperformed their counterparts on the SDMT-W, SDMT-O, and SCWT-C, p's<.05, ηps^2=.10-.28. As expected, the HC group reported better functional abilities compared to both TBI groups, p's<.05, ηp^2=.11 to 18. Also, bilingual speakers reported better participation and total functional outcome compared to monolingual speakers, p's<.05, ηp^2 =.04. Pearson's correlations revealed monolingual ATBIs SDMT-W and SDMT-O performances correlated with functional outcomes, r=-.57 to -.43, p's<.05. Furthermore, bilingual ATBIs' SDMT-W and SDMT-O performances correlated with functional outcomes, r=-.57 to -.43, p's<.05. Finally, monolingual HCs' SCWT-C performance correlated with adjustment functional outcomes, r=.47, p=.049.
Conclusions: As expected, the HC group outperformed the TBI groups on measures of speeded attention and demonstrated superior functional abilities. Also, the CTBI group showed some better performances in contrast to the ATBI, as expected, although the CTBI and HC groups were statistically equivalent on some measures of speeded attention. Monolingual participants with ATBI outperformed their counterparts on measures of speeded attention. In contrast, bilingual participants with CTBI outperformed their counterparts on such measures. This finding suggests that improved early outcome from brain injury may be observed in monolingual English users with TBI, but, ultimately, bilingual TBI survivors show

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better speeded attention outcomes. That said, our data were cross-sectional with regard to TBI. Longitudinal analyses would be needed to confirm the possible long-term benefit to speeded attention in bilingual persons with TBI. Also, better powered studies could better show any potential influence of language use on the relationship between speeding processing and functional outcome in TBI.

Keywords: traumatic brain injury**,** bilingualism/multilingualism**,** language

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43 The Influence of Mood on Cognitive Performances in Retired Football Players

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Objective: Traumatic brain injury (TBI) results in cognitive impairment. This is no different for those who suffer TBI from sports-related injuries. Deficits in attention and executive function is common in TBI regardless of etiology. Depression and anxiety have been suggested to influence cognitive performances in persons with TBI. We examined mood symptoms (anxiety & depression, measured by the Hospital Anxiety and Depression Scale; HADS) and tests of attention and executive ability [Symbol Digit Modalities Test (SDMT) & Trail Making Test (TMT)] in persons with moderate-to-severe TBI unrelated to sport performance, TBI related to contact sports (TBI-CS; retired football players), and healthy comparison (HC) participants. We hypothesized the HC group would outperform the TBI and TBI-CS groups on the SDMT and TMT. Furthermore, we expected abnormal anxiety and depression symptomatology would impact the TBI and TBI-CS groups' SDMT and TMT scores.

Participants and Methods: The sample consisted of 53 persons with moderate-to-severe TBI, 65 TBI-CS, and 30 HC participants. Groups were compared on demographically adjusted T-scores on the SDMT (oral and written trials, SDMT-O and SDMT-W, respectively), and TMT (parts A and B, TMT-A and TMT-B, respectively). SDMT-O, SDMT-A, and TMT-A measure attention and TMT-B assesses executive function. We also evaluated group differences in mood as assessed by the HADS (anxious and depressive symptoms, HADS-A and HADS-D, respectively). In addition, we determined associations between mood and cognitive performances. Data analysis included ANOVA, ANCOVA, and Pearson's correlations.

Results: The groups were generally matched, but the TBI-CS group was older than the other groups. The TBI group demonstrated deficits on demographically adjusted SDMT and TMT scores, $p's$<.05, ηps^2=.09-.21, compared to the TBI-CS and HC participants. ANCOVAs, controlling for age, revealed that the TBI-CS group reported more depressive and anxious symptomatology in contrast to TBI and HC participants, p=.002, ηp^2 =.08 and p=.000, ηp^2=.18, respectively. Pearson's correlations revealed inverse correlations between mood and TMT-B scores (HADS-D, r=-.34 and HADS-A, r= -.26). TMT-B is a measure of executive ability. On the other hand, Finally, in the TBI group, anxiety symptomatology was significantly correlated with TMT-A performance, r=.31.

Conclusions: As expected, the HC group outperformed both TBI groups on tests of attention and executive ability. TBI-CS participants displayed more symptoms of anxiety and depression compared to persons with TBI. Our data suggests differential associations

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between mood and cognition in the TBI subgroups. Specifically, s anxiety and depression symptoms were related to executive function in the TBI-CS group, while anxiety symptoms were related to attention in the TBI group. Future studies should examine potential mood and cognitive differences between various TBI subgroups in greater detail.
Keywords: traumatic brain injury**,** sports-related neuropsychology**,** executive functions
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44 The Association of Perceived Workload and Episodic Memory in Traumatic Brain Injury

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Objective: Previous research has shown that persons with traumatic brain injury (TBI) suffer from episodic memory impairment. Additionally, we have shown that self-reported workload correlates with neuropsychological test performances and that estimates of workload provide additional information regarding cognitive outcomes in TBI. We examined workload and episodic memory in survivors of TBI.
Participants and Methods: The sample consisted of 39 TBI survivors and 53 healthy comparison (HC) participants. Demographically adjusted T-scores were used to examine California Verbal Learning Test, Second Edition assess verbal episodic recall. The Brief Visuospatial Memory Test-Revised (BVMT-R) was used to measure nonverbal/visual episodic recall. Workload was assessed by the NASA Task Load Index (NASA-TLX). ANCOVAS, controlling for age, were used to examine group differences.
Results: ANOVAs revealed the HC group outperformed the TBI group in immediate and delayed recall of verbal information, $p's<.05$, $np's^2=.08$-$.10$; meanwhile, no significant differences were found between groups on the BVMT-R performances. Regarding the NASA-TLX, the TBI group perceived immediate recall on the CVLT-II to be more frustrating compared to the HC group, $p=.016$, $np^2=.06$. Also, the TBI group reported higher levels of perceived effort compared to the HC group with regard to CVLT-II long delayed free recall, $p's<.05$, $np's^2=.04$-$.08$. Also, despite no group differences on the BVMT-R, TBI participants indicated higher overall workload compared to the HC group related to the immediate and delayed non-verbal recall, $p's<.05$, $np's^2=.03$-$.09$.
Conclusions: As expected, the persons with TBI reported higher workload on episodic memory tasks. Our data suggests TBI survivors' not only exhibit memory deficits, but they perceive them. Also, they may even have subjective judgments of memory difficulty on task in which they prom in the normal range. It is unclear if this might be due to overgeneralization or subtle, ipsative changes.
Keywords: traumatic brain injury**,** memory: normal
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45 Obstructive Sleep Apnea Severity and Cognitive Outcome in Acute Moderate/Severe TBI: A TBI Model Systems Study

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Objective: There is an unusually high comorbidity between traumatic brain injury (TBI) and obstructive sleep apnea (OSA), a sleep disorder characterized by recurrent interruption of breathing (i.e., apnea) or decreased airflow (i.e., hypopnea) due to repeated episodes of upper airway collapse. In post-acute and mild TBI samples, OSA is associated with worse cognitive, psychological, and functional outcomes. This is the first study to examine the relationship between polysomnography-classified OSA severity and cognitive outcome in acute, well-characterized moderate/severe TBI.
Participants and Methods: The current study is a secondary analysis leveraging data from a clinical trial (NCT03033901) and TBI Model Systems. Fifty-nine inpatients with moderate/severe TBI were assessed across five civilian hospitals at one-month post-injury (M=32.3 days, SD=10). Ages ranged from 16-86 (M=50 years, SD=18) and participants were mostly male (71%), white (66%), and high-school educated (M=12.9 years, SD=3). Participants underwent overnight, Level 1 polysomnography interpreted by a board-certified sleep medicine physician using American Academy of Sleep Medicine guidelines. OSA severity was measured using the polysomnography-derived Apnea-Hypopnea Index (AHI), Arousal Index, and lowest oxygen desaturation (Nadir). Participants also completed the Brief Test of Adult Cognition by Telephone (BTACT) in-person, which contains 6 cognitive subtests. Demographically-corrected (i.e., age, gender, and education) BTACT Verbal Memory, Executive Function, and Global indices were used as the primary cognitive outcomes. For those who were unable to complete any component of the BTACT due to degree of neurocognitive impairment (n=9), lowest scores were imputed. None of the sample had received continuous positive airway pressure (CPAP) treatment at the time of cognitive assessment.
Results: Based on Total AHI, 24% of the sample had no OSA (AHI=0-4.9), 32% had mild OSA (AHI=5-14.9), 19% had moderate OSA (AHI=15-29.9), and 25% had severe OSA (AHI= ≥30). Separate linear regression models were used to examine the relationship between the three variables examining OSA severity and the three cognitive outcomes, adjusting for TBI severity [Glasgow Coma Scale (GCS)] in each model. After controlling for age, gender, education, and GCS, no indices of sleep disturbance (AHI, Arousal Index, nor Nadir) were significantly related to any of the three BTACT cognitive indices (all p>.05). Only GCS significantly predicted BTACT Global (β=.097, p=.019), Verbal Memory (β=.061, p=.027), and Executive Function (β=.092, p=.031) indices.
Conclusions: Given that TBI is a major public health concern, it is critical to identify modifiable risk factors as a point of intervention for improving cognitive and functional outcomes. OSA is a particularly salient risk factor to examine given that successful treatment of OSA with CPAP is associated with improved cognitive function and reversal of white matter abnormalities in the general population. Results from the current analyses confirm that OSA is prevalent in acute moderate/severe TBI; however, severity of OSA was unrelated to concurrently assessed verbal memory and executive function at one-month post-injury. Limitations include sample size and use of global cognitive indices, which may have been less sensitive than individual subtests. Future studies should also examine the impact of OSA severity and disease duration on other cognitive domains and at subsequent periods post-injury.
Keywords: cognitive functioning**,** traumatic brain injury**,** sleep disorders
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46 The Role of Depressive Symptoms on Perceived Workload of Verbal and Design Fluency in a TBI Sample

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Objective: Depressive symptoms are common in cases of traumatic brain injury (TBI). Also, depression is frequently associated with poor functional outcomes. Depressive symptoms are thought to reduce cognitive function, and subjective assessments of cognitive ability. In 2018, our group conditionally validated the NASA Task Load Index (NASA-TLX) for use with a neuropsychological test of executive ability. The current study aimed to examine the impact of perceived workload and depression symptomology on executive ability in TBI. We expected the TBI participants to display executive deficits in contrast to healthy comparison participants. We also expected TBI participants to report higher levels of workload and depressive symptoms compared to the HC group.
Participants and Methods: The sample consisted of 40 participants with TBI and 56 HC participants. Depressive symptoms were measured using the Hospital Anxiety and Depression Scale. Workload was determined via the NASA-TLX. Executive function was assessed by the verbal fluency (VF) and design fluency (DF) measures from the Delis–Kaplan Executive Function System. Study data were evaluated via ANOVA, ANCOVA, and Pearson correlations.
Results: Groups were generally well-matched on demographic variables, although the TBI group was older on average than the HC group. The HC group outperformed the TBI group on both VF (p=.001, ηp2=.11) and DF (p=.000, ηp2=.12). The groups significantly differed on the depressive symptoms, with the TBI group reporting higher levels of depression (p=.028, ηp2=.05). We found the TBI group reported significantly higher levels of workload related to both fluency tasks (p's<.05, ηps2=.05-.08). Pearson correlation showed the HC group depression symptomology was positively correlated with VF physical demand, frustration, and overall subjective workload (r's=.30-.52, p's<.05). Furthermore, the HC group depression symptomology was positively correlated with DF physical demand, frustration, and overall subjective workload (r's=.29-.48, p's<.05). Finally, the TBI group depression symptomology was negatively correlated with VF temporal demand, effort, and overall subjective workload and DF temporal demand (r's=-.43 to -.32, p's<.05).
Conclusions: As expected, the TBI group underperformed on both fluency/executive tasks compared to their HC counterparts. Also, as expected, the TBI group had a higher depression symptomology and perceived workloads compared to the HC group. Interestingly, higher levels of depression seemed to affect perceived workloads on the NASA-TLX in the HC group, but had an opposite effect in the TBI group. This suggests that depressive symptoms are influencing fluency tasks and perceived workload in persons with moderate-to-severe TBI. Further investigation is needed if depression influences cognition in persons with mild TBI or just moderate-to-severe TBI survivors.
Keywords: traumatic brain injury**,** verbal abilities**,** anxiety
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47 Perceived Workload on Boston Naming Test and Hooper Visual Organization Test in Latinx and Caucasians with Traumatic Brain Injury

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Objective: Research shows that persons with traumatic brain injury (TBI) demonstrate cognitive deficits. Also, it has been found that non-Latinx Caucasians outperformed individuals from ethnic diverse backgrounds on cognitive tasks. In 2018, our group conditionally validated the NASA Task Load Index (NASA-TLX) for use with a neuropsychological test of executive ability. Additionally, we have shown that self-reported workload correlates with neuropsychological test performances and that estimates of workload provide additional information regarding cognitive outcomes in TBI. Furthermore, Latinx Caucasian participants perceived a higher workload compared to non-Latinx Caucasian participants on cognitive tasks.We assessed perceived workload (via the NASA-TLX) on the Boston Naming Task (BNT) and Hooper Visual Organization Test (HVOT) in Latinx Caucasian and non-Latinx Caucasian participants with and without TBI. It was hypothesized the healthy comparison group would outperform the TBI group and the non-Latinx Caucasian group would outperform the Latinx Caucasian group on the BNT and HVOT tasks. We also expected the TBI group to report a higher perceived workload compared to the healthy comparison group and the Latinx group to report a higher perceived workload compared to the Caucasian group on the BNT and HVOT. **Participants and Methods:** The sample consisted of 34 persons with TBI (12 Latinx Caucasian & 22 non-Latinx Caucasians) and 43 healthy comparison (20 Latinx Caucasian & 23 non-Latinx Caucasians) participants. Persons with TBI were tested six months or more post-injury. The perceived workload was assessed by NASA-TLX. A series of ANCOVAs, controlling for age, were used to evaluate group differences on the BNT, HVOT, and perceived workloads. **Results:** Both groups were demographically matched except for age (i.e., the TBI group was older compared to the healthy comparison group). ANCOVAs revealed the healthy comparison group outperformed the TBI group on the BNT, p=.048, ηp^2=.05. Furthermore, results revealed the non-Latinx Caucasian group outperformed the Latinx Caucasian group on the BNT, p=.002, ηp^2=.13. The Latinx Caucasian group perceived higher levels of frustration, p=.033, ηp^2=.06, and effort, p=.038, ηp^2=.06, compared to the non-Latinx Caucasian group on the BNT. However, on the HVOT we found interactions where the non-Latinx Caucasian TBI group reported higher levels of mental demand, temporal demand, and overall subjective workload compared to the Latinx Caucasian TBI group; the Latinx Caucasian healthy comparison group reported higher levels of mental demand, temporal demand, and overall subjective workload compared to the non-Latinx Caucasian healthy comparison group, p's<.05, ηp^2=.10-.12. **Conclusions:** The results showed that TBI and Latinx Caucasian groups underperformed on the BNT compared to their counterparts. In addition, our Latinx Caucasian sample reported higher perceived workloads (i.e., frustration and effort) compared to the non-Latinx Caucasian sample. Our data suggests that non-Latinx Caucasian persons with TBI had higher levels of perceived workload on the BNT compared to the Latinx Caucasian persons with TBI. Future studies with a larger sample size should examine if other factors (e.g., depression) influence the relationship between TBI, ethnicity, BNT and HVOT performance, and perceived workload.

Keywords: language**,** traumatic brain injury

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48 Metacognitive Accuracy Predicts Self-Reported Measures of Quality of Life Following Traumatic Brain Injury

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Objective: Metacognition is the ability to observe, monitor, and make judgements about one's own cognitive status. The impact of metacognitive functioning on quality of life (QoL) is described in several neuropsychiatric conditions. Most studies show that metacognitive performance is positively correlated with key drivers of post-morbid QoL, including self-efficacy, social and occupational engagement, and response to rehabilitation. Yet,

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some reports indicate that those with better metacognitive functioning endorse more struggles with daily living and greater self-stigma, leading to worse QoL. While metacognition and QoL are both adversely affected by traumatic brain injury (TBI), the relationship between them after TBI is not fully understood. The purpose of this study is to determine the degree to which metacognitive accuracy predicts QoL in individuals with TBI. Links between metacognitive accuracy and different areas of post-injury QoL are also evaluated.
Participants and Methods: 18 participants with moderate-to-severe TBI completed a stimulus-response task in which they were required to correctly discriminate emotions expressed by pictures of faces and provide metacognitive retrospective confidence judgments on a Likert scale following each response. Calibration between participants' response accuracy and confidence judgement accuracy was assessed using type 2 signal detection theory analysis in order to generate a value of metacognitive accuracy, called meta-*d′*. Participants also completed the Quality of Life After Brain Injury (QOLIBRI) questionnaire, a 37-item survey that queries satisfaction with functioning after TBI in the following areas: cognition, self-esteem, autonomy, social relationships, emotions, and physical limitations. Linear regressions were performed to determine the relationships between participants' meta-*d′* values and their total and subscale QOLIBRI scores.
Results: Participants had an average meta-*d′* value of 0.237 (σ = 0.538) and an average total QOLIBRI score of 63.401 (σ = 17.609). Higher meta-*d′* values, indicative of better metacognitive accuracy, significantly predicted lower total QOLIBRI scores, or worse QoL ($ß$ = -0.495, p = 0.037). Additionally, higher meta-*d′* values significantly predicted lower scores on the cognition and physical limitations subscales ($ß$ = -0.542, p = 0.020; $ß$ = -0.693, p = 0.001, respectively).
Conclusions: The results of this study establish evidence of a connection between metacognition and QoL following TBI; specifically, an inverse relationship was found between metacognitive performance and QoL. One explanation for this seemingly paradoxical interaction asserts that individuals with TBI who possess better metacognitive insight are more sensitive to and bothered by injury-related cognitive impairments, leading to lower self-reported QoL. The particular relationship observed between metacognitive accuracy and the cognitive subscale of the QOLIBRI lends credence to this hypothesis, although more research is warranted. Further work must investigate the mechanisms specific to TBI by which metacognition influences QoL. The clinical significance of TBI-induced metacognitive changes and their effects on treatment must also be understood in order to help improve survivors' satisfaction with life once they exit rehabilitative care.
Keywords: metacognition**,** quality of life**,** traumatic brain injury
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49 Functional Outcome in Chronic Traumatic Brain Injury: Goal Attainment in Rehabilitation

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Objective: Individuals with TBI experience variable sequelae and treatment needs across the acute, post-acute, and chronic stages after injury. It is estimated that 40% of individuals with a moderate to severe TBI will live with long-term disability. The lifetime direct and indirect costs of TBI are estimated to exceed $70 billion. This is a significant public health concern, and the patterns of recovery and decline in chronic TBI are important to study. Thus, the aims of the current study are to identify the premorbid, injury-related, and cognitive predictors of individuals with chronic TBI's goal attainment in rehabilitation.
Participants and Methods: 70 individuals with chronic TBI (mean time since injury = 26.48 years, SD = 12.37) participating in day/residential rehabilitation treatment were examined. On average, the sample was 52.01 years old (SD = 11.83 years), with 13.06 years

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of education (SD = 2.11), white (83%), and male (60%). 84% sustained a TBI with loss of consciousness. Goal attainment was measured with Goal Attainment Scaling.
Results: Results of the study suggest that Speech Therapy goal attainment is predicted by time since injury ($F(2, 26) = 5.46$, $p = .01$, R^2=.30). Occupational Therapy goal attainment was not predicted by premorbid or injury-related variables, but was predicted by judgment ability (NAB Judgment; $F(1, 22) = 4.17$, $p = .05$), R^2=.16). Finally, Physical Therapy goal attainment was not predicted by premorbid, injury-related, or cognitive variables. Sleep quality was strongly related to overall goal attainment (Pittsburgh Sleep Quality Index; $r = -.89$, p=.003).
Conclusions: Findings reflect that individuals with chronic TBI continue to make incremental functional gains when enrolled in day and residential rehabilitation. However, many individuals with chronic TBI are not able to access such long-term rigorous treatment for myriad reasons, including financial limitations, lack of insurance coverage, absence of programs in their area, or simply lack of knowledge of such treatment programs. In fact, results of a longitudinal study of individuals with moderate to severe TBI suggested that women and individuals with premorbid employment are more likely to access healthcare services in general, including after sustaining a TBI. Results of another study suggested that males who are racial/ethnic minorities and have Medicare/Medicaid (rather than commercial insurance) tend to have poorer cognitive and motor trajectories after TBI. This represents a significant public health issue and potential avenue for psychologists and other providers to engage with policymakers to generate more equitable access to these necessary services. Additionally, results of the current study suggest that neuropsychological assessment can assist speech, occupational, and physical therapists in identifying specific functions of which they should be aware when generating goals for their patients with chronic TBI to maximize attainment. Treatment for sleep problems is one particular avenue for additional intervention to enable functional gains. Future research should replicate these findings, as they can aid in treatment planning for individuals with chronic TBI, inform recommendations made in earlier stages, and help set expectations for individuals with TBI and their caregivers at all stages.
Keywords: traumatic brain injury**,** treatment outcome

50 Rehabilitation of executive functions in frontal traumatic brain injury: case report

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Objective: Design, apply and evaluate a neuropsychological intervention program in a patient with severe frontal traumatic brain injury.
Participants and Methods: The participant was a male patient, 43 years old, right-handed, with unfinished high school education. 6 years ago, he suffered a car accident resulting in a strong frontal trauma, while he was on workday. The participant is currently retired. The study was divided in three stages. The first one included the elaboration of a patient clinical history with information from one family member and the patient and carry on a complete neuropsychological evaluation applying the Integrated Program of Neuropsychological Exploration, Barcelona Test, the Battery of Executive Functions and Frontal Lobes BANFE-2, the five-digit test, Columbia Card Task and the Tower of London. Additionally, were applied the Beck inventory of anxiety and depression, and the Lawton and Brody index of instrumental activities of daily living and, finally the Barthel Index. Second stage included the design and implementation of a neuropsychological rehabilitation program which was structured in two areas (language and executive functions), with 28 sessions, twice a week and an approximate duration of 50-60 minutes. This

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program had the active participation of the primary caregiver. Also was applied the Goal Attainment Scaling (GAS) to qualitative evaluate the main purposes proposed by the patient. Finally, once the rehabilitation program was finished, the third stage was entered, which consisted of evaluating the effectiveness of the program by applying all the tests again.
Results: The initial neuropsychological evaluation showed problems in expressive language and executive functioning, mainly in planning, cognitive flexibility, inhibition and working memory. Those problems interfered with the proper development of daily activities, preventing them from being carried out properly and limiting their personal development. The final evaluation, after the neuropsychological intervention, presented improvements in expressive language, working memory and flexibility as well as in emotional aspects. Finally, through the GAS scale, it was possible to show progress in terms of independence from daily activities, such as cooking on your own and tidying up your room.
Conclusions: Neuropsychological rehabilitation is important as it facilitates cognitive recovery and reincorporation to patient daily life. Likewise, it is substantial to involve the primary caregiver in the rehabilitation process, since the cognitive and emotional aspects of both are incorporated, reducing the uncertainty and pain by the loss of health and life as they known it before the trauma. Motivation and participation promote feedback where both parties interact (patient and caregiver), communicate, and know each other in their new situation. The incorporation of the cognitive, emotional and functional aspects to the rehabilitation process allows to attend to the patient in a more comprehensive way.
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Keywords: brain injury**,** executive functions**,** cognitive rehabilitation
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51 Pain Related to Perceived and Objective Cognitive Function after Moderate to Severe Traumatic Brain Injury

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Objective: Chronic pain following traumatic brain injury (TBI) is frequently endorsed. Independently, pain and TBI each are understood to be related to cognitive impairment; however, there is a relative dearth of investigations regarding cognitive impairment associated with TBI-related pain. To date, studies that have conducted such investigations have produced somewhat incongruous results. Additionally, self-perception of a person's cognitive functioning after injury may significantly affect quality of life; however, it is unknown whether the experience of pain may alter this perception. The present investigation seeks to elucidate how pain secondary to TBI may be related to neuropsychological functioning and subjective expectations of cognition after a moderate to severe traumatic brain injury.
Participants and Methods: Adults with a history of moderate to severe traumatic brain injury (n=19) participated in the study. Participants completed a comprehensive neuropsychological battery which evaluated various domains of cognitive function including: processing speed, working memory, and executive function. Presence of pain and its relation to TBI were measured from a self-report modified Injury Perception Questionnaire (mIPQ-R-TBI), and perceived cognitive ability was determined from self-report on the Quality of Life after Brain Injury (QOLIBRI) questionnaire. Mood was assessed using the State Trait Anxiety Inventory (STAI) and Chicago Multiscale Depression Inventory (CMDI). Partial Pearson correlations were conducted to investigate the relationships among TBI-related pain, neuropsychological functioning, and perceived cognitive ability, taking psychiatric distress into account. A hierarchical regression analysis was also performed to determine the extent to which pain secondary to brain injury independently predicted perceived cognitive ability while

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controlling for age, education, anxiety, and depression.
Results: Results from the partial correlation analyses indicated that a moderate relationship exists between TBI-related pain and performance on measures of processing speed and executive function (Trail Making Test (TMT) A: r = 0.713, *p* = 0.009; TMT B: r = 0.718, *p* = 0.008; SDMT: r = 0.668, *p* = 0.018). A moderate relationship with semantic fluency also trended toward significance (r = 0.558, *p* = 0.059). Pain secondary to brain injury was not associated with perceived cognitive ability in this sample (Unstandardized ß = -42.728, *p* = 0.800).
Conclusions: The results showed that endorsement of TBI-related pain was significantly related to better performance on tests of executive function and processing speed. Executive functioning and processing speed have been shown to be domains affected by pain in previous studies, but the direction of the relationship found in this study was unexpected. One possible explanation is that individuals experiencing pain may have developed compensatory executive and processing skills. Additionally, pain was not found to be a significant predictor of perceived cognitive ability. It is possible that deficits in self-awareness present after TBI may contribute to biased perceptions of cognitive abilities that are incongruent with reports of TBI-related pain. These findings and future work in this area may help clinicians make more informed interpretations when considering the influence of pain on cognitive assessment after TBI.
Keywords: brain injury**,** chronic pain**,** neuropsychological assessment
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52 Perceived Financial Vulnerability among People with a History of Moderate to Severe Traumatic Brain Injury

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Objective: Research among older adults has demonstrated that psychosocial aspects of financial decision making contribute to vulnerability to exploitation. Our research seeks to examine the reliability and psychological correlates of a 6-item scale of perceived financial vulnerability (PFV) among people with a history of moderate to severe traumatic brain injury (TBI), a population similarly at-risk for negative financial outcomes.
Participants and Methods: Participants (N = 51) were administered a PFV scale as part of a long-term follow-up study of TBI. Cronbach's α was used to assess reliability. Correlational analyses were conducted between demographics, measures of mood, life satisfaction, household finances, and self-reported health. An independent samples t-test was conducted to compare PFV between participants who reported interpersonal conflicts related to finances in the past 6 months.
Results: Participants were primarily male (80.4 %), African-American (52.9 %), and middle aged (M = 53.4, SD = 17.0) with an average of 13 years of education. The scale had good internal consistency (α = .81) and the mean was 9.02 (SD = 3.1). PFV was significantly correlated with the PHQ-9 (*r* = .42, *p* = .004) and GAD-7 (*r* = .38, *p* = .009). It was correlated with self-reported health (*r* = -.37, *p* = .009) but not life satisfaction. PFV was correlated with household income (*r* = -.31, *p* = .03) but not employment status or personal income. It was not correlated with demographics. People who reported conflict about finances in the past 6 months (N = 7) had significantly higher PFV scores (M = 12.7, SD = 3.5) than those who did not (M = 8.43, SD = 2.62), *t*(49) = 3.8, *p* < .001.
Conclusions: The construct of PFV appears to be valid and reliable for use with people with a history of moderate to severe TBI. Our results are consistent with research demonstrating that mental and physical health, social relationships, and financial resources contribute to financial vulnerability. In the context of TBI, PFV may be a useful addition to cognitive and financial skills assessments to identify psychosocial risk factors for financial exploitation or poor financial decision making.

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Keywords: traumatic brain injury**,** self-report
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53 Injury Severity Predicts Social Competence and Degradation of White Matter Fiber Tracts Associated with Social Cognition in Children with Traumatic Brain Injury

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Objective: Children with TBI often experience social cognitive deficits, possibly due to damage in white matter tracts that support social cognition. This study explored variations in white matter microstructure as they relate to social competence in children with complicated-mild/moderate TBI (mTBI), severe TBI (sTBI), or orthopedic injury (OI).
Participants and Methods: Participants included 10 children with severe TBI (M_{age}=10.9, n_{male}=5, $M_{TimeSinceInjury}$=4.05mo), 18 children with complicated-mild/moderate TBI (M_{age}=12.4, n_{male}=14, $M_{TimeSinceInjury}$=3.95mo), and 24 children with OI (M_{age}=11.7, n_{male}=16, $M_{TimeSinceInjury}$=3.99mo) recruited from a large midwestern children's hospital. Parents completed the Child Behavior Checklist (CBCL) and the Adaptive Behavior Assessment System 3 (ABAS-3) while children completed a 64-direction DTI in a Siemens 3T scanner. White matter integrity was quantified via FSL's (v6.0.4) Tract-Based Spatial Statistics (TBSS) and ENIGMA ROI segmentation. TBSS yielded fractional anisotropy (FA) for the right and left cingulum, superior longitudinal (SLF), uncinate (UF), and inferior fronto-occipital fasciculi (IFOF), and fornix which were then imported into SPSS (v26) for analysis.
Results: One-way ANOVA revealed a significant group difference in the ABAS-3 Social Composite (F(2,44)=4.97, p≤.01). Specifically, children with sTBI were rated as having worse social adaptive skills than children with OI (M_{OI}=106.7, M_{sev}=89.8, t(44)=3.13, p≤.005) or mTBI (M_{mod}=102.76, t(44)=2.33, p≤.05). Separate ANOVA revealed group differences in FA for the right cingulum (F(2,49)=3.57, p≤.05), fornix (F(2,49)=3.08, p≤.05), and left UF (F(2,49)=3.53, p≤.05), each indicating degradation of white matter in children with sTBI. Right cingulum FA was higher in children with OI than children with sTBI (M_{OI}=.63, M_{sev}=.59, t(49)=2, p≤.05) and higher in children with mTBI than children with sTBI (M_{mod}=.64, t(49)=2.66, p≤.01). Fornix FA was higher in children with OI than children with sTBI (M_{OI}=.60, M_{sev}=.55, t(49)=2.2, p≤.05). Fornix FA was also higher in children with mTBI than children with sTBI (M_{mod}=.61, t(49)=2.66, p≤.01). Left UF FA was higher in children with mTBI than in children with sTBI (M_{OI}=.59, M_{sev}=.54, t(49)=2.56, p≤.01). Within groups, correlations revealed significant positive associations between the CBCL Social Competence subscale and FA in the fornix (r(51)=.31, p≤.05), left cingulum (r(51)=.34, p≤.05), right and left SLF (r(51)=.38, p≤.001; r(51)=.34, p≤.05), and right and left UF (r(51)=.50, p≤.001, r(51)=.38, p≤.001). Positive associations were also found between the ABAS-3 Social Composite and FA in the right UF (r(51)=.29, p≤.05).
Conclusions: Results suggest a dose-response relationship between TBI severity and social competence. Likewise, increases in TBI severity were associated with white matter microstructure degradation, which was also associated with lower scores on measures of social competence. These findings suggest that damage to white matter tracts implicated in social cognition may contribute to deficits in the real-world social capabilities of children with TBI.
Keywords: traumatic brain injury**,** child brain injury**,** social cognition

54 Characterizing the Relationship Between Executive Functioning and

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Social/Emotional Behaviors Following a Severe Pediatric Traumatic Brain Injury

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Objective: Traumatic brain injury (TBI) is the most common cause of acquired disability and one of the leading sources of morbidity and mortality in children and adolescents. Children who sustain a TBI during the critical stage of skills acquisition may be faced with significant disruptions to their development. Executive function (EF) and psychosocial difficulties among children and adolescents following TBI have been found to be a major concern for caregivers, as they may have detrimental effects on a child's long-term adaptation, skill acquisition and peer interaction. Significant impairments in EF have been found after TBI, although the relative impact of impairments within each domain of executive functioning and the degree to which they affect social, emotional and behavioral functioning remains unclear.
Participants and Methods: The Approaches and Decisions for Acute Pediatric TBI (ADAPT) trial was an observational cohort study to compare the effectiveness of standard therapies in clinical use and how they impact outcomes. In this data set, 256 patients aged 1 to 18 years with severe TBI (GCS $\leq$ 8 after resuscitation) who had an intracranial pressure (ICP) monitor placed as part of their routine care were assessed 12 months post injury. The BRIEF/BRIEF-P and CBCL were administered to caregivers by a site neuropsychologist or technician trained in the administration of these measures. The current secondary analysis examines the relationship between EF and psychosocial functioning in this sample, as well as models for relative contribution of executive functioning deficits as well as demographic factors and injury characteristics to social-emotional and behavioral concerns.
Results: Z-test statistics relative to population norms revealed children with TBI demonstrated impaired EF (caregiver-reported BRIEF scores) in every subdomain (all $p<.001$) except Organization of Materials ($p<.950$), with the largest effect size noted in subdomains of Inhibition (Cohen's d =.79) and Working Memory (d = 1.19). Smaller but still significant effect sizes were also noted on the CBCL for both externalizing (d =.26) and internalizing (d =.33) symptoms (both $p <.001$). A multivariate regression with independent variables of gender, age, mechanism of injury, severity of injury, and BRIEF Behavior Regulation and Metacognition indices demonstrated large effect sizes in separate models for both dependent variables of internalizing $F(6, 211)= 35.958$, $p<.001$, adj. R^2=49% and externalizing behaviors $F(6, 211)= 64.701$, $p<.001$, adj.R^2=64%.
Conclusions: As expected, executive functioning difficulties following TBI were common in this pediatric sample, as were emotional and behavioral concerns to a lesser extent. Furthermore, those with greater impairments in behavior regulation as measured by the BRIEF are likely to exhibit both internalizing and externalizing behaviors following a TBI. The results of this study are essential in advocating for the implementation of strategies and goals for successfully treating impairments in executive functioning as a mechanism by which social-emotional concerns within the pediatric TBI population may potentially be alleviated. Interventions targeting inhibition, flexibility and emotional modulation may be beneficial when delivered early in the recovery process. Limitations of the study include the restriction of the sample (severe TBI requiring placement of an ICP monitor) and inability to determine causality.
Keywords: executive functions**,** emotional processes**,** brain injury
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55 Psychosocial Risk in Pediatric TBI: Reliability of the Psychosocial Assessment Tool

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Objective: Pediatric traumatic brain injury (TBI) is a leading cause of death and disability in children. Previous studies link greater childhood adversity to poorer neurobehavioral outcomes after TBI. However, a reliable clinical or research tool to comprehensively measure adversity in children with TBI is lacking. The Psychosocial Assessment Tool (PAT) is a caregiver-report measure of psychosocial risk in pediatric patients. The PAT has demonstrated reliability and validity in various pediatric populations, including cancer, sickle cell disease, irritable bowel disease, and headache, but has not yet been studied in TBI. We evaluated the reliability of the PAT in a sample of children with TBI and characterized their psychosocial risk relative to children with orthopedic injuries (OI).
Participants and Methods: Children aged 3-18 years who were hospitalized overnight for complicated mild to severe TBI (n=96) or OI (n=36) participated in a longitudinal observational study. Caregivers completed the PAT at the time of injury (baseline) and 6-months post-injury. We compared injury groups on the total PAT scores at 6-months using *t*-tests. We also compared the PAT scores from baseline to 6-months within the TBI group using a paired *t*-test. We categorized participants into the Pediatric Psychosocial Preventative Health Model (PPPHM) tri-level risk system based on total scores. We compared the TBI and OI groups on their risk levels at 6-months using a chi-square test. Lastly, we used the Kuder-Richardson Formula 20 and Pearson's correlation coefficient to examine internal consistency and test-retest reliability, respectively, within the TBI group.
Results: There were no significant group differences in PAT total scores (TBI=0.85±0.81; OI=0.59±0.49; t=1.56; p=0.123; Cohen's d=0.37) or risk level distributions (TBI [universal risk n=35, targeted risk n=9, clinical risk n=5]; OI [universal risk n=25, targeted risk n=2, clinical risk n=1]; χ^2=3.307; p=0.191; Cramer's V=0.21) at 6-months. There were also no significant differences between the TBI PAT scores from baseline (0.78±0.57) to 6-months (t=1.06; p=0.297; Cohen's d=0.19). Internal consistency was strong for the total PAT score (KR-20=0.83) and moderate-strong for all subscale scores (KR-20=0.66-0.81), except family structure (KR-20=0.51) and family beliefs (KR-20=0.39), which were weak. Test-retest reliability was strong (r=0.87; p<0.001) between the PAT scores at baseline and 6-months within the TBI group.
Conclusions: The results show small, non-significant differences between TBI and OI PAT scores and risk level distributions 6-months post-injury. The results require replication in larger samples to better assess the effect that injury group may have on psychosocial risk. With demonstrated internal consistency and test-retest reliability, the PAT is a reliable clinical and research tool to characterize psychosocial risk in pediatric TBI. Upon testing its validity against other established measures related to adversity in a larger sample, the PAT can be used to identify children with TBI at risk for psychosocial problems.
Keywords: traumatic brain injury**,** child brain injury**,** test reliability

56 Regional Cortical Thickness Correlates of Intellectual Abilities Differ in Children with Traumatic Brain Injury vs. Orthopedic Injury

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Objective: A decline in intellectual functioning (IQ) is often observed following more severe forms of traumatic brain injury (TBI) and is a useful index for long-term outcome. Identifying brain correlates of IQ can serve to inform developmental trajectories of behavior in this population. Using magnetic resonance imaging

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(MRI), we examined the relationship between intellectual abilities and patterns of cortical thickness in children with TBI and orthopedic injury (OI) in the chronic phase of injury recovery.
Participants and Methods: Participants were 47 children with OI and 59 children with TBI, with TBI severity ranging from complicated-mild to severe. Age ranged from 8-14 years old, with an average age of 10.47 years, and an injury-to-test range of approximately 1-5 years. The groups did not differ in age or sex. The intellectual estimate (FSIQ-2) was derived from a two-form (Vocabulary and Matrix Reasoning subtests) Wechsler Abbreviated Scale of Intelligence (WASI). MRI data were processed using the FreeSurfer toolkit and harmonized across data collection sites using ComBat procedures, while holding demographic features (i.e., sex, SES), TBI status, and FSIQ-2 constant. Separate general linear models per group (TBI and OI) were analyzed with all significant results withstanding correction for multiple comparisons.
Results: Intellectual performance was better ($p < 0.001$) in the OI group (FSIQ-2 = 110.81) compared to the TBI group (FSIQ-2 = 99.81). In children with OI, bi-hemispheric regions, including right precentral gyrus and precuneus and left occipital areas, were related to IQ, such that higher IQ was associated with thicker cortex in these regions. In contrast, only cortical thickness in the right precentral gyrus positively related to IQ in children with TBI. A significant interaction effect was found in the left occipital lobe, indicating that the correlation between IQ and cortical thickness differed between groups in that region.
Conclusions: TBI-altered cortical associations with IQ may reflect direct injury effects and/or adaption in cortical thickness and intellectual functioning. A longitudinal study is needed to account for normal developmental changes and to investigate how cortical thickness and intellectual functioning change over time following TBI. Improved understanding of how TBI-related cortical thickness alterations relate to cognitive outcome could lead to improved predictions of outcome following brain injury.
Keywords: intellectual functioning**,** traumatic brain injury**,** neuroimaging: structural

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57 Diurnal Salivary Alpha-Amylase and Behavioral Outcomes in Children with Traumatic Injuries

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Objective: Despite the high occurrence of psychological health issues following traumatic injury, little is known about the impact traumatic injuries on the body's physiological stress response and whether these changes in the biological stress systems are related to post-traumatic changes in psychological health. The sympathetic branch of the ANS responds rapidly to stressful situations and activates the body's fight or flight reactions via the release of catecholamines. Stress-related increase in noradrenergic activity can be observed peripherally in the sympathetic nervous system through salivary alpha-amylase (sAA), which rises and falls quickly in response to either physical or psychological stress.
Participants and Methods: In this prospective, longitudinal study, diurnal profiles of sAA were collected in children with traumatic brain injury (TBI, n=65), extracranial injury (EI, n=31) and noninjured children (n=45) an average of 7 weeks after injury or enrollment in the study. To assess diurnal sAA values, samples were collected four times a day on two consecutive school days: at awakening, 30 minutes after awakening, after school, and at bedtime. sAA values at each timepoint were averaged across days. Reliability of collection time was assessed using electronic surveillance and daily diaries. Unreliable samples were removed from the analyses.
The Child Behavior Checklist (CBCL), which assesses internalizing and externalizing behaviors, was administered at the baseline visit to obtain ratings of children's behavior prior to the injury. Parents also completed the CBCL at 6 months post injury to assess post-injury behavioral problems. As pubertal development

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may influence sAA values, Pubertal status was self-reported at the 7 week visit using the Pubertal Development Scale (PDS) Controlling for preinjury behavior ratings, general linear models evaluated the influence of group (TBI, EI, control). sAA values at different times during the day, pubertal status, and the group x sAA interaction on internalizing and externalizing behavior problem ratings obtained 6 months after injury.
Results: For internalizing scores, there were no significant group x sAA interactions in any of the models. Bedtime sAA was significantly related to post injury CBCL internalizing, with higher sAA associated with higher internalizing scores. For externalizing scores, there was a significant three way interaction of preinjury CBCL externalizing scores, bedtime sAA, and group (p=.005). Higher sAA at bedtime was associated with higher externalizing scores for the two injury groups relative to the control group, especially for children with elevated externalizing scores prior to injury.
Conclusions: Given that sAA is a marker for the sympatho-adrenal-medullary component of the autonomic nervous system, these findings suggest that increased autonomic activity at bedtime may be related to internalizing and externalizing behavioral dysregulation. For injured children, those who had higher pre-injury externalizing behaviors were more likely to have worse behavior after the injury if they also had high bedtime sAA. Our findings implicate bedtime sAA as a potential mechanism of biological vulnerability for poorer adjustment, particularly in children experiencing traumatic injury.
Keywords: child brain injury**,** traumatic brain injury

58 Racial, Health Insurance, and Urban-Rural Disparities in Rehabilitation Utilization and Unmet Needs Among Pediatric Patients with Traumatic Brain Injury (TBI)

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Objective: Traumatic brain injury (TBI) in children is associated with physical, cognitive, and emotional difficulties. Functional outcomes can be improved through outpatient rehabilitation. Fewer than 50% of children hospitalized for TBI receive outpatient rehabilitation services within their first-year post-injury; many of these children have unmet or unrecognized healthcare needs. Past studies suggest disparities in outpatient rehabilitation service utilization based on age, insurance status, and geographic location, with younger, publicly insured, and rural children less likely to receive services. We report rates of rehabilitation service utilization, and examine whether there are racial, health insurance, or urban-rural disparities in rehabilitation utilization and caregiver-reported unmet needs among children hospitalized for TBI at the UPMC Children's Hospital of Pittsburgh (CHP).
Participants and Methods: Participants 3-18 years of age were drawn from a longitudinal observational study of children who sustained a complicated mild to severe TBI. Caregivers completed a structured interview about their child's use of outpatient physical, occupational, or speech/language therapies, or behavioral health or neuropsychological services, as well as unmet physical, cognitive, and emotional needs at 6- and 12-months post-injury. Rehabilitation service use and unmet needs were compared among White and Non-White children, privately and publicly insured children, and children living in rural and urban counties using ANOVA and binary logistic regression, adjusting for TBI severity, via lowest post-resuscitation Glasgow Coma Scale (GCS) score, as indicated.
Results: Eighty-one percent of patients identified as White and 18.1% identified as Non-White (n=83). Fifty-six percent were privately insured, 39.8% were publicly insured, and 3.6% did not report insurance status and were, therefore, excluded from analysis. Fifty-five percent lived in urban, and 44.6% in rural, counties. Nine percent of patients went to an inpatient rehabilitation unit post-injury. Forty-seven percent received at least one outpatient rehabilitation service (PT, OT, SLT, counseling or neuropsych eval) at 6 months and 53.9% at 12 months. Thirteen percent had at least one

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unmet need at 6 months and 21.1% at 12 months. TBI severity was associated with inpatient rehabilitation and receipt of neuropsychological evaluation at 6- and 12-months; therefore, we adjusted for TBI severity in corresponding models. Privately insured children (28.6%) were more likely to receive a neuropsychological evaluation at 6 months compared to publicly insured children (3.85%; [*b*=-2.548, s.e.=1.145, *p*=0.026]). There were no other statistically significant differences by race, insurance type, or rurality in rehabilitation utilization or unmet needs at 6- or 12-months post-injury.
Conclusions: Rates of rehabilitation utilization and unmet need were relatively consistent with those reported in previous literature. Little evidence was found for statistically significant disparities in this small sample of children hospitalized for TBI at CHP. Examining these questions in larger, geographically diverse samples is crucial to better understanding disparities in rehabilitation service use and unmet need among children with TBI, as service access may be less equitable in other geographic and sociocultural settings The results suggest insurance type may be a significant barrier to accessing healthcare services; thus targeting publicly insured groups may be the first step for clinicians in identifying children at greatest risk for unmet rehabilitation needs after TBI.
Keywords: traumatic brain injury
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59 Cortical Thickness and Subcortical Volume Does Not Mediate Sex Differences in Visuospatial Processing

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Objective: Sex differences in visuospatial processing have been consistently reported over the past century, with males typically performing better than females. However, to date the mechanisms behind these differences are poorly understood. This study evaluated in a large normative sample if sex differences in cortical thickness or volume could explain sex differences in visuospatial processing.
Participants and Methods: We evaluated neuroanatomic and visuospatial performance data from 1100 participants enrolled in the Human Connectome Project Young Adult Database (503 males, 597 females, ages 21-35 years).
Results: Males performed significantly better than females on the Variable Short Penn Line Orientation Test (VSPLOT; Moore et al., 2015), a computerized adaptation of the Judgment of Line Orientation test. We next evaluated if measures of cortical thickness (28 regions) or cortical volume (68 regions) derived via FreeSurfer mediated the relationship between sex and VSPLOT performance. Mediation analyses were conducted with 10,000 bootstrap resampling controlling for covariates intracranial volume, education, handedness, and age.
Conclusions: After FDR correction for multiple comparisons, no regions' thickness or volume significantly mediated the observed sex difference in VSPLOT performance. External environmental and other biological factors may be mediating this relationship.
Keywords: neuropsychological assessment**,** visuospatial functions**,** neuroimaging: structural
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60 The Reliability and Validity of a Novel Mental Rotation Task

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Objective: Few visuospatial perception tests exist, especially those that assess mental

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rotation abilities. Among available measures, the Judgment of Line Orientation Test (JLO) is the most widely used (c.f. Calamia et al., 2011). However, evidence suggests mental rotation tests (MRT) are more specifically related to the right parietal lobe, especially the intraparietal sulcus, than more visuospatial perception tasks (Harris et al., 2013). Despite their potential utility, few clinical MRTs are available (Quinn & Liben, 2008). To address this limitation, a novel MRT was developed. The Puzzle Piece Rotation Test (PPRT) is a 15-item test that requires approximately seven minutes to administer. The present study establishes the initial psychometric properties of the PPRT based on healthy undergraduate students across a variety of academic majors including psychology, engineering, and physics.
Participants and Methods: A neuropsychological battery was administered to 64 healthy individuals. Of these individuals, 33 majored in psychology and 31 majored within the physical sciences (e.g., engineering, chemistry, physics). The sample included 16 males and 48 females. Established visuospatial tests such as the Judgment of Line Orientation test (JLO) and the Vandenberg and Kuse Mental Rotation Test (MRT) were administered to establish the PPRT's convergent validity. Tests of verbal reasoning including the Boston Naming Test (BNT), were administered to establish the divergent validity of the PPRT. In addition, measures of affective functioning, premorbid intelligence, and attention and working memory were administered.
Results: The PPRT achieved acceptable split-half reliability (r = .85). Individuals with academic majors within the physical sciences outperformed psychology majors on the PPRT (t = -3.39, p = .001, *95%CI* = -3.38, -.87). Regarding convergent validity, the PPRT achieved significant correlations with measures of visuospatial ability including the JLO (r = .64, p < .001) and the MRT (r =.59, p < .001). With respect to divergent validity, the PPRT achieved nonsignificant correlations with measures of verbal reasoning skills (r's < .25). The PPRT also achieved nonsignificant correlations with measures of affective functioning, premorbid intelligence, and attention and working memory (r's < .28).
Conclusions: The PPRT appears to possess satisfactory reliability and construct validity. The PPRT holds promise as a novel measure of visuospatial ability. Its clinical utility remains unaddressed, and should become the focus of future investigations.
Keywords: visuospatial functions**,** parietal lobes**,** test development

61 Age Cohort Moderates the Relationship Between Visuospatial Intellectual Functioning and Recall for Meal Preparation in Virtual Reality

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Objective: Virtual reality (VR) technology may provide neuropsychologists with a means of measuring everyday functioning with greater ecological validity. Little extant research has investigated how verbal and visuospatial intellectual abilities may impact young adults' and older adults' performance on VR-based tasks. The purpose of this study was to investigate age cohort as a moderator between both verbal and visuospatial intellectual abilities and delayed recall on the Virtual Kitchen Protocol (VKP), a VR-based measure of memory functioning for meal preparation tasks.
Participants and Methods: Young adults (n = 41; age range 18-26, M = 18.85, SD = 1.57) and older adults (n = 41; age range 60-90, M = 72.37, SD = 8.08) completed a test battery that included the VKP and the WAIS-IV Vocabulary (VC) and Block Design (BD) subtests.
Results: Bivariate correlations found that younger age cohort and BD were associated with higher VKP delayed recall, but VC was not. Likewise, in relation to VKP delayed recall, age cohort had a significant interaction with BD (p < .001) but not VC. At lower BD scores, young adults had higher delayed recall; however, older adults with higher BD scores outperformed their young adult counterparts.

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Conclusions: Age cohort moderated the relationship between WAIS-IV BD and VKP delayed recall. Higher visuospatial intellectual abilities appeared to disproportionately benefit older adults on recall of meal preparation tasks in virtual reality, possibly by allowing for greater encoding and retrieval of visuospatial information.
Keywords: aging (normal), visuospatial functions, memory: normal

62 Effect of vertical prism adaptation on line bisection judgments in a computerized landmark task

Aleksandra Mańkowska[1], Kenneth M. Heilman[2], Michał Harciarek[1]
[1]University of Gdańsk, Institute of Psychology, Division of Neuropsychology, Gdańsk, Poland. [2]University of Florida, Gainesville, USA

Objective: Traditional horizontal prism adaptation (PA) is a rehabilitation technique used to treat visuo-spatial inattention-neglect. However, PA may be also applied vertically, and there is evidence that such vertical PA impacts the functions of the dorsal or the ventral attentional stream. Therefore, vertically oriented PA may influence the judgments on spatial attention. For example, we have previously reported that the PA with upward and downward shifting lenses lead to significant aftereffect in vertical line bisection task. However, the influence of vertical PA on visual perception has not been investigated. Thus, the main purpose of this study is to learn how orienting spatial attention upwards or downwards by using PA with adaptation, might influence healthy participant's visual perception, as measured by computerized landmark task.
Participants and Methods: Ten right-handed healthy adults (age M=21.3) performed a landmark task before and after PA in three conditions of shifting lenses; down, up, control. In the landmark task we used 90 vertical lines, each centered on 23" touch screen. Each line had been prebisected at different distances. Of these 90 vertical lines, 10 were bisected in the center, 10 above or below the center at the following distances, 0.65, 1.25, 2.5, or 5%. The participants were instructed to press a lower or higher button if the bisection line was closer to the lower or upper end of the line. Further, the number of responses was counted. A perceptual bias in a certain direction was indicated by the difference between these two responses. This difference was computed such that a positive number refers to an upward bias.
Results: In preadaptation, there was an upward bias in the landmark task (M=0.60, SD=1.59). To assess the effect of vertical PA on landmark judgments we performed a repeated-measures ANOVA with condition (upward/downward/control) and pre- vs post adaptation as a between-subjects factor. This analysis revealed a main effect of the direction of PA, $F(2, 16) = 24.35$, $p < .001$ and a main effect of adaptation, $F(2, 16) = 409.6$, $p < .001$. Post-hoc comparisons revealed, however, that only adaptation in down-shifting lenses led to changes in visual perception of the pre-bisected lines in 1.25%, 0.65%, and 0 condition. Specifically, in comparison to pre-PA condition, after adaptation to the down-shifting prisms participants judged the presented lines as prebisected higher.
Conclusions: The results of this study indicated that only downward PA evoked a perceptual bias in visual space as measured by the landmark task. Whereas the mechanism inducing this perceptual bias is not fully known, it might be related to differences between the dorsal and ventral attentional streams. The downward PA might primarily lead to activation of the ventral visual stream, and thus our participants might have increased allocation of attention to superior altitudinal visual space. Thus, the magnitude or length of the upper half of a vertical line may appear enlarged, and bisection of the vertical line may be shifted further upwards. However, future research with neuroimaging techniques and more participants are needed to test this hypothesis.
Keywords: visuospatial functions, attention

Coffee Break

12:30 - 1:00pm
Wednesday, February 2, 2022

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LIVE Invited Symposium 1: Inclusive and Open Science to Improve Research

Chair: Neda Jahanshad
Presenters: Kristine J. Ajrouch, Carrie Esopenko, Miguel E. Rentería

1:00 - 2:25pm
Wednesday, February 2, 2022

Abstract & Learning Objectives:
In this symposium, we will have four talks designed to introduce ongoing research directions related to open science. We will give an overview of consortium efforts dedicated to defining internationally viable neuroimaging biomarkers and risk factors for brain disorders, with specific emphasis on the ongoing efforts within the ENIGMA consortium. We will highlight the multifaceted concepts related to “open science”, from pre-registration of project aims, to available workflows, algorithms, and data, to detailed methodology and accessible publications. We will discuss and give specific examples of how groups around the world have come together to participate in neuroscience research that not only boosts power for scientific discovery, but does so reliable and across many populations, including people from underrepresented groups and regions. We describe how these advances in inclusivity allow not only for researchers to find common neurological signatures across populations, but also empower population specific sources of variability.

Upon conclusion of this course, learners will be able to:
- Plan and design a multi-cohort neuroimaging study
- Recognize how to use open or shared data to improve statistical power, replicate findings and compare/generalize results to that of diverse populations
- Identify ways to use and contribute to open science

Symposium 07: The International Classification of Cognitive Disorders in Epilepsy (IC-CoDE)

1:00 - 2:25pm
Wednesday, February 2, 2022

18 The International Classification of Cognitive Disorders in Epilepsy (IC-CoDE)

Chair

Bruce Hermann
University of Wisconsin School of Medicine and Public Health, Madison WI, USA

Discussant

Alberto Fernandez
Universidad Católica de Córdoba, Córdoba, Argentina

Epilepsy, the 4th most common neurological disorder affecting 50 million people worldwide, is associated with significant cognitive, psychological and social consequences. Cognitive impairment is a particularly important comorbidity and in February 2020 representatives from the International League Against Epilepsy (ILAE) and the International Neuropsychological Society (INS) signed a Memorandum of Understanding (MOU) designed to facilitate and advance epilepsy-specific clinical, educational, and research efforts on a global scale. The first initiative from this MOU addresses the development of a taxonomy of neuropsychological impairment in adults with epilepsy.
Within the epilepsies there are established taxonomies for the classification of seizures and epileptic syndromes, their underlying neuropathologies (e.g., hippocampal sclerosis, cortical dysplasia), and consensus diagnostic criteria for psychogenic nonepileptic seizures and other important aspects of epilepsy. In some instances, existing taxonomies have been imported from other fields to epilepsy care and research, best exemplified by the application of

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the DSM and ICD for characterization of psychiatric diagnoses. These efforts have facilitated international communication and big-data science. In contrast, neuropsychology is characterized by within and across nation heterogeneity in assessment practices, definitions of impairment, and a cognitive taxonomy characterized by a broad and arguably nonspecific diagnostic system (e.g., DSM-5 minor and major neurocognitive disorder). In sum, there is an overreliance on tests, underutilization of cognitive diagnoses, and poor understanding of the underlying cognitive phenotypes of the epilepsies.
To address this, the International Classification of Cognitive Disorders in Epilepsy (IC-CoDE) initiative was launched. An international panel of neuropsychologists: a) conducted a critical review of existing and potential cognitive diagnostic taxonomies and related operational definitions of impairment potentially applicable to epilepsy, b) performed an audit of cognitive tests used across epilepsy centers, c) established a broad template of guiding assessment principles, and d) proposed a proof-of-principle cognitive diagnostic taxonomy.

This symposium will provide an overview of these efforts to develop a consensus-based classification system for cognitive disorders in epilepsy, international in scope, with broad applicability for clinical practice and research. First, Dr. Baxendale will review the rationale and process for developing the IC-CoDE and the relevance of this initiative to the international neuropsychology of epilepsy. Second, Dr. Busch will describe work from the ILAE Neuropsychology Task Force to examine the application of the IC-CoDE taxonomy to large cohorts of adults with epilepsy representing over 3,000 patients from geographically diverse regions of the U.S. and the U.K. Third, Ms. Reyes will discuss the potential impact of social health determinants including ethnicity on the IC-CoDE taxonomy. Finally, Dr. McDonald will discuss efforts to develop a large, international neuropsychology data registry for epilepsy using the *Enhancing NeuroImaging and Genetics through Meta-Analysis* (ENIGMA)-Epilepsy infrastructure developed for neuroimaging and relevant preliminary findings to date. Together, these presentations will provide compelling evidence for the utility of a common cognitive diagnostic taxonomy that can be used internationally to facilitate future research and patient care. The discussant, Dr. Alberto Fernandez, will overview the synergy between the ILAE, IC-CoDE and the INS Global Engagement Committee and the utility of model for similar efforts in other disorders.
Keywords: epilepsy / seizure disorders**,** psychometrics*,* cross-cultural issues

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551 Introducing the International Classification of Cognitive Disorders in Epilepsy: Establishing Neuropsychology at the Forefront of Clinical and Research Practice.

Sallie Baxendale
University College, London, United Kingdom

Objective: Most neurological conditions (e.g., multiple sclerosis, Alzheimer's Disease, vascular dementia, even Traumatic Brain Injury) are unified by common underlying processes within the brain, giving rise to a number of symptoms. Epilepsy is different in that the diagnosis is conferred on the basis of the unifying defining symptom, recurrent seizures. The abnormalities and pathologies that can result in seizures are multiple and varied and may be structurally apparent or cryptogenic, genetic or acquired. This makes epilepsy one of the most common neurological disorders worldwide and one the most common neurological comorbidities of other neurological conditions. It follows that people with epilepsy form an extremely heterogeneous population.
Participants and Methods: For the past two decades the International League against Epilepsy (ILAE) has been engaged in a global project to create clear classification systems to inform the clinical treatment of people with epilepsy and to ensure robust and reproducible research with this group. Achievements to date have been the publication of the practical clinical definition of epilepsy (Fisher et al, Epilepsia, 55(4):475–482, 2014), an operational classification of seizures types (Fisher et al, Epilepsia, 58(4):522–530, 2017) and a new

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classification of the epilepsies which reflects our current understanding of epilepsies based on seizure type, epilepsy type and epilepsy syndrome (Scheffer et al, Epilepsia, 58(4):512–521, 2017. It is now formally recognised that neuropsychological difficulties are a common core comorbidity of epilepsy. One of the key strategic goals of the ILAE is that neuropsychological difficulties should be operationalised to allow clear communication between clinicians and researchers working in different settings around the world. To this end the ILAE signed a Memorandum of Understanding with INS in 2020 for the two organisations to collaborate in working towards this goal. The International Classification of Cognitive Disorders in Epilepsy (IC CoDE) initiative is currently being developed in response to this need.
Results: This presentation will introduce the background to this project and the progress of the group to date. Any international classification poses significant challenges in harmonising practice, but these challenges are very significant for clinical neuropsychologists who work with a diverse range of tests in many different languages.
Conclusions: Approaches to these challenges will be discussed and it is hoped that this symposium will lead to fruitful discussions with respect to the best way forward to ensure that the IC CoDE will result in a classification system that will become a valuable global tool for neuropsychologists working in this field.
Keywords: epilepsy / seizure disorders**,** cross-cultural issues**,** psychometrics

552 Taxonomy of Cognitive Diagnoses in >3000 Patients with Temporal Lobe Epilepsy using IC-CoDE

Robyn Busch
Cleveland Clinic Lerner College of Medicine, Cleveland, Ohio, USA

Objective: To examine the base rate of cognitive impairment in adults with epilepsy across a wide range of individual neuropsychological measures and to apply the new IC-CoDE taxonomy to large, clinically diverse datasets in order to compare strengths and weaknesses of various approaches.
Participants and Methods: Clinical datasets containing demographic and disease variables and neuropsychological test scores from adults with temporal lobe epilepsy (TLE) were obtained from 6 independent epilepsy centers across the United States and United Kingdom (n=3,117; mean age=36.81, 89% White, 56% female). The base rate of impairment was calculated for each cognitive measure within the test battery across 5 cognitive domains (i.e., attention/processing speed, language, executive function, memory, and visuospatial) using both 1.5 and 1.0 SD cutoffs relative to demographically-adjusted norms. Then, the IC-CoDE taxonomy was applied in a subset of patients (n=1314; mean age=37.68, 88% White, 58% female) who completed 2 or more measures within at least 4 cognitive domains, and the base rate of cognitive phenotypes was examined.
Results: Using a 1.5 SD cutoff, cognitive impairments were most prevalent in the domains of language and memory, with impairments in naming observed in over 50% of patients and impairments in verbal learning/recall observed in over one-third. Deficits in executive function and attention/processing speed were also common, affecting up to 30% of patients, while visuospatial functions were least likely to be affected (10-20%). Application of the IC-CoDE taxonomy revealed an *Intact* cognitive profile in 47% of patients, *Single Domain* impairment in 29% of patients, and *Bi-Domain* impairment in 16% of patients. The most common *Single Domain* impairments were in language (48%) and memory (40%). A small subset of patients (8%) demonstrated *Generalized* impairment with impairment in 3 or more cognitive domains. While the same overall pattern was observed using a <1.0 SD cutoff to define impairment at the subtest level (i.e., language and memory most impaired domains), base rates of impairment were substantially higher (i.e., 9-13% higher across domains), and cognitive profiles shifted rather dramatically for the intact and generalized phenotypes (i.e., *Intact*=28%, *Single Domain*=29%, *Bi-Domain*=20%, *Generalized*=23%).
Conclusions: In the largest assembled cohort of adult patients with TLE to date, application of

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a consensus-based classification system for cognitive disorders in epilepsy (i.e., IC-CoDE) showed the primary single domain impairment to be in language followed by verbal memory. In addition, three primary cognitive phenotypes across domains (i.e., intact, focal deficit, generalized impairment) were confirmed. Base rates of cognitive impairment change rather substantially depending on the cutoff used to define impairment. The more stringent 1.5 SD cutoff is most consistent with base rates derived from data-driven approaches to classification and may be more appropriate to avoid overestimating cognitive impairment in adults with TLE. Importantly, this study demonstrates the feasibility of applying a consensus-based classification system for cognitive disorders in epilepsy that will have wide applicability for clinical practice and research internationally.
Keywords: epilepsy / seizure disorders**,** psychometrics**,** cross-cultural issues

553 Testing the Worldwide Applicability of the IC-CoDE: Cognitive Phenotypes inENIGMA-Epilepsy

Carrie R. McDonald
University of California, San Diego, San Diego, CA, USA

Objective: To leverage the infrastructure of a large international epilepsy neuroimaging resource (*Enhancing Neuroimaging and Genetics through Meta-Analysis*; ENIGMA-Epilepsy) to develop an international neuropsychology data registry for epilepsy, test the reproducibility of cognitive phenotypes worldwide, and determine their underlying neural signatures.
Participants and Methods: ENIGMA-Epilepsy has harmonized and analyzed structural MRI and diffusion-weighted imaging (dMRI) data on over 1,122 healthy controls and 1,027 people with epilepsy from 21 sites internationally [874 temporal lobe epilepsy, TLE; 182 genetic generalized epilepsy, GGE; 193 extratemporal epilepsy, ExE). Estimates of cortical thickness, subcortical volumetry, white matter microstructure, and network-based atrophy have been calculated for all patients, and imaging profiles have been derived from these measures within and across epilepsy syndromes. In our next phase, neuropsychological and clinical data will be aggregated across all ENIGMA sites, spanning nine countries and five languages. Using the cognitive domains and impairment cut-offs established through the IC-CoDE, patients will be classified into cognitive phenotypes. The association between IC-CoDE-derived phenotypes and imaging profiles will then be explored and the stability of the results will be tested across countries and languages. Unique clinical features and social determinants associated with each cognitive phenotype will also be investigated.
Results: Initial results from ENIGMA-Epilepsy have demonstrated the presence of shared and unique patterns of cortical, subcortical, and network atrophy across and within epilepsy syndromes (*Brain 2018, Brain 2020; Science Advances, 2021*). Across *all epilepsies*, fronto-central atrophy, including alterations in the body and genu of the corpus callosum, corona radiata, pre- and postcentral gyrus, and external capsule have been observed. In TLE, white and gray matter changes were widespread, but most pronounced in temporo-limbic regions and ipsilateral to the seizure focus. In GGE and ExE, atrophy patterns are less pronounced and primarily impact bilateral fronto-central regions. Despite some syndrome-specific findings, striking heterogeneity was observed across patients even within the *same* syndrome and this heterogeneity could not be explained by common clinical factors (i.e., age of onset, epilepsy duration). These findings complement our prior work identifying the presence of unique cognitive phenotypes within epilepsy syndromes that harbor distinct imaging characteristics (*Neurology, 2019; Epilepsia, 2019*), and highlight the problem of studying all patients within a syndrome in aggregate. The ENIGMA-Epilepsy database will provide a unique resource to determine whether these cognitive-imaging phenotypes are invariant to country, test battery, and languages.
Conclusions: Patients with common epilepsy syndromes show considerable heterogeneity in atrophy patterns, which may explain the cognitive heterogeneity described in our prior work. These findings suggest the likelihood that

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distinct cognitive phenotypes exist within epilepsy syndromes that could be universal, guide cognitive diagnostics, and have important implications for treatment planning. This will be systematically tested through an on-going and international collaborative effort of the INS, *International League Against Epilepsy* (ILAE), and ENIGMA-Epilepsy.

Keywords: epilepsy / seizure disorders**,** cross-cultural issues**,** psychometrics

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555 Cultural Considerations for the IC-CoDE: Implementing the Sociocultural Framework in the Diagnosis of Cognitive Disorders in Epilepsy

Anny Reyes
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Objective: Disparities in epilepsy diagnosis, treatment, and health outcomes have been previously reported and are of increasing concern. Social determinants of health (SDH) have been identified as key drivers of these epilepsy healthcare disparities but their impact on cognition still remains to be fully characterized. As such, we aim to identify the impact of important SDH and cultural factors on the new IC-CoDE taxonomy to minimize these existing disparities. To accomplish this, we first surveyed the neuropsychological and epilepsy literature to identify SDH and cultural factors that have been previously identified as important contributors to cognitive function and/or epilepsy outcomes. Second, we validated the IC-CoDE taxonomy on a sample of Spanish-speaking adults with temporal lobe epilepsy (TLE) to determine the cross-cultural application of the taxonomy.

Participants and Methods: Sixty-six Spanish-speaking patients (average age: 39 years; average education: 12 years) completed neuropsychological measures of memory, language, executive function, visuospatial functioning, and attention/processing speed as part of the Neuropsychological Screening Battery for Hispanics (NeSBHIS), which has been validated in patients with epilepsy. The base rate of impairment was calculated using several cutoffs: 1, 1.5, and 2 standard deviations (SD) below normative data. The IC-CoDE taxonomy was then applied and the base rate of cognitive phenotypes for each cutoff was compared to the original sample of 1314 English-speaking patients (average age: 38 years; average education: 14 years) with focal epilepsy for which the taxonomy was validated on.

Results: The 1SD cutoff classified ~90% of the sample as impaired (32% *Single Domain*; 15% *Bi-Domain*, 43% *Generalized* impairment). The 1.5SD cutoff classified ~67% of the sample as impaired (26% *Single Domain*; 17% *Bi-Domain*, 24% *Generalized* impairment). Finally, the 2SD cutoff classified ~50% of the sample as impaired (39% *Single Domain*; 14% *Bi-Domain*, 8% *Generalized* impairment). The 2SD cutoff yielded similar rates of cognitive phenotypes relative to the English-speaking sample, which was based on a 1.5SD cutoff (29% *Single Domain*; 14% *Bi-Domain*, 8% *Generalized* impairment). Overall, impairment was most prevalent in the domains of language and memory, similar to findings observed in the English-speaking sample.

Conclusions: These initial findings demonstrate that the IC-CoDE taxonomy can be applied to a culturally/linguistically diverse population; however, the cutoff for impairment must be carefully considered to decrease misclassification rates. In particular, using traditional impairment cut-offs of -1.0 or -1.5 may lead to over-classification of diverse populations as having generalized impairment. Furthermore, our Spanish-speaking sample had on average less years of education relative to the English-speaking sample, which could have impacted the classification. There are many factors that may explain the misclassification of cognitive disorders in culturally/linguistically diverse populations, including lack of representative normative data, liberal impairment cutoffs, and lack of culturally sensitive assessment tools. Furthermore, the impact of epilepsy on cognition must be carefully examined in the context of SDH, including access to care, health literacy, economic resources, health insurance coverage, language barriers, and trust in the healthcare system. Other factors such as quality of education, bilingualism, and acculturation must

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be considered in the application of the IC-CoDE taxonomy.
Keywords: epilepsy / seizure disorders**,** cross-cultural issues**,** psychometrics

995 Epilepsy-Associated Neurocognitive Disorders in onchocerciasis-endemic villages in Cameroon

Alfred K. Njamnshi
Brain Research Africa Initiative, Yaoundé, Cameroon. Yaoundé Central (Teaching) Hospital, Yaoundé, Cameroon. The University of Yaoundé, Yaoundé, Cameroon

Paper Session 07: Pediatric

1:00 - 2:25pm
Wednesday, February 2, 2022

1 Reduced Neural Synchrony in Children with Prenatal Zika Exposure

Karen Blackmon[1], Ahmet Omurtag[2], Thomas Thesen[3], Randall Waechter[4], Barbara Landon[4], Kemi S Burgen[4], Roberta Evans[5], Dennis Dlugos[6], Geetha Chari[7], A Desiree LaBeaud[8], Samah A Baki[9]
[1]Mayo Clinic, Jacksonville, FL, USA. [2]Nottingham Trent University, Nottingham, United Kingdom. [3]University of Houston Medical School, Houston, Texas, USA. [4]St George's University, St George's, Grenada. [5]Windward Islands Research and Education Foundation, St George's, Grenada. [6]Children's Hospital of Pennsylvania, Philadelphia, PA, USA. [7]7. SUNY Downstate Health Sciences University, New York, NY, USA. [8]Stanford University, Stanford, California, USA. [9]9. Biosignal Group Inc, Acton, MA, USA

Objective: Prenatal exposure to the Zika virus (ZIKV) increases risk of microcephaly and other more subtle malformations of cortical development. Neurodevelopmental delays are found in a large proportion of ZIKV-exposed children with microcephaly and in a much smaller proportion of normocephalic ZIKV-exposed children. The neurophysiological substrates for these delays remain unclear. In this study, we examined a quantitative electroencephalography (EEG) measure of inter-areal neural phase synchrony in 2-year-olds with and without prenatal ZIKV exposure to determine whether prenatal ZIKV exposure is associated with altered phase synchrony, which is believed to reflect large-scale integration of distributed neural activity.
Participants and Methods: Children were recruited from a longitudinal cohort of mother-child dyads who completed extensive serological and sociodemographic characterization during the 2016-2017 ZIKV outbreak in Grenada, West Indies. Maternal and child serum samples were assessed for ZIKV exposure with indirect IgG capture Enzyme-Linked Immunosorbent Assay (ELISA) and the pGOLD IgG immunoassay. We administered a structured interview and questionnaire set to primary caregivers to determine household socio-demographics and food security status. We assessed child anthropometrics using World Health Organization child growth standards. At least 20 minutes of EEG data were collected, using a standard 10-20 configuration *micro*EEG® (www.biosignalgroup.com) monitoring system, when the children were between the ages of 23 and 27 months. For each child, we calculated the phase locking value (PLV) as a measure of phase synchronization of EEG oscillations, averaged over all time windows, for each pair of channels, and for each frequency band. We compared the resulting values between ZIKV-exposed and unexposed children and examined group interactions between PLV and age.
Results: We obtained high quality EEG recordings in 39 exposed (21 boys/18 girls; 1 child with microcephaly) and 19 unexposed (11 boys/8 girls) children. There was no difference in age, head circumference, weight, height, or household food security between the groups. Whole-brain average PLV was lower in exposed compared to unexposed children. Age-associated global PLV increases (i.e., maturation effects) were also reduced in exposed compared to unexposed children. Group differences were most pronounced in electrode pairs reflecting intra-hemispheric (T5-F7, T5-F3, T6-F8, P4-F8) and inter-hemispheric

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(T5-F4, T5-F8, T5-P4, T6-F7, T6-F3, P4-F7) phase-synchronization in higher frequency bands (20-28 Hz). Maturation effects were greatest in electrode pairs reflecting intra-hemispheric (O2-T4) and inter-hemispheric (O1-C4, O1-T4, O2-F7, O2-T3) phase-synchronization in lower frequency bands (0-4 Hz).
Conclusions: Findings suggest that ZIKV-exposed children, the majority of whom were without clear neurological manifestations at birth, may nevertheless show reduced posterior to anterior phase synchrony. Reduced neural synchrony may serve as a marker of aberrant large-scale functional integration in ZIKV-exposed children and a possible predictor of later neurodevelopmental delays.
Keywords: infectious disease**,** in utero teratogen exposure**,** electroencephalography

2 Innate vs. Adaptive Immunity is Associated with Brain Structure and Neuropsychological Function in Pediatric Crohn's Disease

Christine Mrakotsky[1,2], Vanessa Mitsialis[1,2], Ally Eran[1], Anna Prohl[1], Michael Field[1], Simon Warfield[1,2], Scott Snapper[1,2]
[1]Boston Children's Hospital, Boston, MA, USA. [2]Harvard Medical School, Boston, MA, USA

Objective: Crohn's disease (CD) is a relapsing-remitting inflammatory disease of the intestine associated with a range of extra-intestinal systemic manifestations including those affecting the brain. Structural brain changes in gray and white matter and decreased cognitive performance have been found in adults with CD, although findings have been inconsistent, without immune mechanistic evaluation. We have shown similar effects for pediatric CD, with previously reported differences in cortical thickness. We here provide new data on immune gene transcriptomic analyses and associations with additional brain outcomes to include surface area and white matter tracts.
Participants and Methods: Sixty children age 10-15 years (19 CD_{Active}, 23 $CD_{Remission}$, 18 Healthy Controls) underwent one-time structural MRI, diffusion weighted imaging (DWI), neuropsychological assessment, disease severity rating and phlebotomy for immune gene expression. Cortical thickness, surface area and volume were analyzed with Freesurfer. White matter metrics (i.e. axial diffusivity, fractional anisotropy, isotropic free water) were obtained via diffusion compartment model, DIAMOND. Immune gene expression was assayed via multiplex array (Nanostring®). Analyses included group comparison, regression, gene set enrichment and gene set variance analyses via GeneOntology -and were adjusted for age, sex, race, ethnicity, SES, steroid and anti-TNF therapy.
Results: Compared to disease and healthy controls, CD_{Active} patients demonstrated widespread reduced cortical thickness (i.e. inferior, superior parietal, precuneus), cortical volume (i.e. superior frontal, insula), surface area (pars orbitalis, insula), subcortical volume (thalamus, hippocampus), and poorer verbal memory, mood, and fatigue, after adjusting for all covariates and FDR correction. Consistent structural differences were found for insula, cuneus, thalamus and a range of posterior brain regions. Across several white matter fiber tracts, we found an increased fraction of isotropic free water in extrafascicular space (reflecting neuroinflammation) and decreased axial diffusivity (a measure of axonal integrity). We further found upregulation of innate immunity-related genes and downregulation of adaptive immunity-related genes in CD_{Active} patients, with innate immune pathways (i.e. myeloid leukocyte mediated immunity) to be associated with smaller brain volumes, reduced thickness, increased free water, and worse fatigue, while adaptive immunity (i.e. T cell costimulation) was associated with larger volume and less fatigue. Verbal memory was associated with a network of single genes, and brain structures.
Conclusions: Gray and white matter is reduced in active pediatric CD, particularly in brain regions critical for cognition, emotional and pain processing, and autonomic control/immune regulation and this reduction is not explained by medical therapies. Importantly, we found inflammatory gene transcriptional signatures that correlate with reduced gray and white matter structures, increased neuroinflammation, poorer memory and mood during active disease. This

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association between immune genes, brain and behavior provides further insights in the immune mechanisms underlying brain manifestations of CD, and warrant further study.
Keywords: immune disorders**,** neuroimaging: structural**,** cognitive functioning

3 The Association Between Objective Sleep Quality and Neurocognitive Functioning in Pediatric Sickle Cell Disease

Tiffany D Tucker[1], Julie Trapani[1], Victoria Seghatol-Eslami[1], Karthik Reddy[1], Sarah McGilvray[1], Shreya Grandhi[1], Chien-Chien Lee[1], Ammar S Alishlash[2], Jeffrey Lebensburger[2], Smita Bhatia[2], Donna Murdaugh[1]
[1]The University of Alabama at Birmingham, Birmingham, Alabama, USA. [2]UAB School of Medicine, Birmingham, Alabama, USA

Objective: Sickle cell disease (SCD) is a hereditary red blood cell disorder affecting 1 in every 365 Black/African American births. Youth with SCD are at high risk for neurocognitive deficits. Frequent complications (e.g., vaso-occlusion, chronic anemia, silent cerebral infarcts, overt stroke) have a notable impact on brain physiology, thus influencing neurocognitive development. Poor sleep quality can have deleterious effect on neurocognitive function, but its role in SCD-related neurocognitive deficits is not known. Additionally, youth with SCD are at greater risk of living in areas of deprivation; low socioeconomic status (SES) is also associated with greater risk of sleep problems when compared to higher SES peers. This study aimed to assess the potential effects of poor sleep quality on neurocognitive function in youth with SCD.
Participants and Methods: A retrospective cohort of 27 youth with SCD (ages 6-17, 14 males; sickle cell anemia [93%], sickle cell beta plus thalassemia [7%]) participated in neuropsychological testing after undergoing polysomnography (PSG). Demographics and medical history were abstracted from medical records. Participants were excluded if they have a history of neurological disorder (stroke, seizures, or moyamoya disease) or prescribed psychotropic medication. The following measures of neurocognitive function were selected: The Wechsler Scales of Intelligence (WISC-V/WAIS-IV; verbal comprehension [VC], working memory [WM], and processing speed [PS]), Delis-Kaplan Executive Function System (D-KEFS; executive function [EF]), and BRIEF-2 and BASC-3 (parent-report of EF and internalizing/ externalizing behaviors). Two nighttime sleep parameters that affect sleep quality were abstracted from each patient's initial PSG; mean oxygen saturation (SpO2) and percent of time under 90% oxygen saturation (SpO2<90%). Socioeconomic disadvantage was measured by individual's neighborhood-level Area Deprivation Index (ADI), based on their US Census block group; scores range from 1 (least disadvantaged) to 10 (most disadvantaged). Multiple linear regression analyses were conducted for each neurocognitive domain (VC, WM, PS, EF) and parent-ratings and two nighttime sleep parameters. All analyses controlled for age at neuropsychological testing, the time between PSG and neuropsychological testing, and ADI.
Results: The mean ADI for our sample was 6.15 (SD=2.61), with 14.8% in the most disadvantaged group. ADI was not significantly correlated with sleep parameters. Results revealed that mean SpO2 significantly predicted VC (p=.012) and SpO2<90% significantly predicted WM (p=.003). Specifically, VC decreased by 2.37 standard points for every unit of decrease on average in mean SpO2 (β=2.37, p=.031). WM decreased by 1.46 standard points for each 1 percent increase in time spent under 90% oxygen saturation (β=-1.46, p=.030). Sleep parameters did not significantly predict EF, PS, or parent-reported executive or behavioral outcomes.
Conclusions: Results support poor sleep quality as a possible contributory factor for neurocognitive difficulties in youth with SCD given the vital role of normal oxygenation in brain development. Subsequent research should replicate these findings with increased sample size, as well as include investigation of neurobiological effects. In addition, studies should capture sleep activity in patient's customary environment to identify the influence of SES. Overall, identifying sleep needs in youth

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with SCD may promote sleep-targeted interventions as a modifiable factor to reduce neurocognitive deficits.
Keywords: sickle cell disease**,** sleep**,** neurocognition

4 The Role of Infant Sleep in the Relationship Between Cumulative Risk and Infant Social-Emotional Development

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Objective: Research indicates that social-emotional problems can present early in life and predict continued pathology, highlighting the importance of identifying early difficulties and risk factors for problematic social-emotional development (Bagner et al., 2012). Despite the need to target early difficulties, research has focused primarily on children preschool age or older. Our first aim was to extend the literature by examining the effect of risk on social-emotional functioning in 9- to 12-month-olds. Though some children will inevitably experience risk, not all at-risk children experience social-emotional problems. It is important to understand modifiable protective factors, such as sleep. Our second aim was to examine whether quality sleep, which could be targeted through intervention, would promote social-emotional functioning despite risk (Field, 2017).
Participants and Methods: The sample included 325 racially (30% Black, 55% White, 15% multiracial/other) and socioeconomically (43% below median income) diverse caregiver-infant dyads from the PediaTracTM multisite, longitudinal study. Data included caregiver-reported biological (i.e., gestational age, negative affectivity, postnatal medical complications), psychosocial (i.e., maternal depression, parenting stress, stressful life events), and demographic (i.e., household income, maternal education, marital status) risk. Sleep efficiency was measured using the Brief Infant Sleep Questionnaire (BISQ; 9 months) and sleep domain of PediaTracTM (9 and 12 months), an experimental tool that tracks development. Social-emotional problems were measured using the Brief Infant-Toddler Social Emotional Assessment Problem Scale (BITSEA; 12 months) and typical social-emotional functioning was measured using the social/communication/cognition (SCG) PediaTracTM domain (9 and 12 months). Correlational analyses examined relations between risk, sleep, and social-emotional functioning. Moderation analyses explored sleep as a moderator in the relationship between risk and social-emotional functioning.
Results: Higher cumulative risk was not associated with SCG scores, but was associated with higher BITSEA problem scores ($r = .30$, $p < .001$) and lower sleep efficiency measured by PediaTracTM (9 mo: $r = -.12$, $p < .05$; 12 mo: $r = -.20$, $p < .001$) and the BISQ ($r = .20$, $p < .01$). Additionally, higher BISQ sleep efficiency was associated with lower BITSEA problem scores ($r = .17$, $p < .05$). Concurrently, higher PediaTracTM sleep efficiency was associated with lower BITSEA problem scores ($r = .-19$, $p < .01$) and higher SCG scores at 12 months ($r = .12$, $p < .05$). When predicting social-emotional functioning, sleep efficiency was not a significant moderator. Instead, higher cumulative risk and infant sex (male) remained significant predictors of higher problem scores, while infant sex (male) was the only significant predictor of lower SCG scores (all $p < .05$).
Conclusions: Higher cumulative risk was associated with more problem behavior and lower sleep efficiency; however, typical social-emotional development was not associated with risk, suggesting resilience in developing these milestones. The relation between sleep efficiency and social-emotional outcomes indicates that children who fall asleep faster and wake less have better typical social-emotional development and fewer problem behaviors. The lack of moderation signifies that sleep may not be protective for high-risk infants, but instead could affect social-emotional functioning similarly for all infants. This finding suggests that interventions targeting sleep efficiency may promote healthy social-emotional functioning in all children, regardless of risk.

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Keywords: emotional processes, child development (normal), sleep

5 Efficacy of Computerized Cognitive Training for Cognitive Deficits in Neurofibromatosis Type 1: A Randomized Trial

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Objective: Cognitive deficits are common and impairing neurological manifestations of Neurofibromatosis Type 1 (NF1). Working memory (WM) is a particularly compelling target for intervention, given its critical role in the development of other cognitive and academic outcomes. Despite the significant negative impact of cognitive and behavioral deficits, few intervention studies have been conducted in patients with NF1. Cognitive training (CT) programs have increasingly been utilized to improve functioning in other populations, and Cogmed[RM] is the most widely used CT program for working memory (WM) deficit remediation. Thus, the current study aimed to examine the efficacy of a home-based, computerized CT program, Cogmed[RM], on improvements in working memory for youth with NF1 in a randomized, multi-site clinical trial.
Participants and Methods: One hundred and three children with NF1, age 8-16 years (M = 11.37 years, SD = 2.21) at four participating sites (50.5% Male, 78.6% Not Hispanic/Latino, 68.0% White, 14.6% on stimulant medication), were screened using a battery of neurocognitive tests and parent-completed questionnaires. The intervention phase included 80 children (77.7%) who demonstrated working memory abilities at least 1 SD below the mean or below their estimated IQ. These participants were stratified by stimulant medication use and randomized equally between two interventions: Cogmed[RM] (n = 40), or the active control, MobyMax, an online reading program (n = 40). Participants had up to 11 weeks to complete the intervention and returned for follow-up assessment within 2 weeks of finishing the CT program.
Results: The majority of participants (70%) who were randomized to Cogmed[RM] met the standard for treatment adherence, completing at least 20 out of 25 training blocks (M = 21). Cogmed[RM] appeared acceptable to families, with the majority of participants reporting that they enjoyed completing the cognitive training exercises “sometimes,” “often,” or “always.”. Additionally, the majority of parents (84.6%) reported being “somewhat” or “very” satisfied with their child’s participation in the program. Results indicate that participants randomized to Cogmed[RM] improved in Digit Span Backwards ($t(33) = -2.29$, $p = 0.028$) from pre- to post-intervention, and demonstrated significantly higher scores on Digit Span Backwards ($p = .025$) than participants randomized to MobyMax. However, intervention groups did not significantly differ ($p > 0.05$) on other key measurements of working memory (i.e., Digit Span Forward, Spatial Span Forward/Backward).
Conclusions: This computerized, home-based WM training program was acceptable, feasible, and enjoyable for children and adolescents with NF1 and may positively impact aspects of WM. Given this support for the acceptability and efficacy of Cogmed[RM], translation of this intervention into clinical practice may be warranted. Critically, however, future research should examine factors that promote adherence and contribute to the transfer of training-related gains to everyday functioning.
Keywords: neurofibromatosis, executive functions, working memory

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6 Exploration of a Multidimensional Outcomes Model for the Effectiveness of Pediatric Neuropsychological Evaluations: The Relationship Between Parent Satisfaction and Impact on Child Services

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Objective: There is increasing need to demonstrate the effectiveness of pediatric neuropsychological evaluations, although it is challenging to identify appropriate measures. Neuropsychologists typically see children on a time-limited basis, with long-term monitoring at lengthy intervals, if at all. The intent of the evaluation is often transitive, centering on accurate diagnosis and referral to next steps in care. As such, a child's functional outcome – impacted by time and factors outside the neuropsychologist's control – may not be reflective of the evaluation. Our group has developed a multidimensional outcomes model focusing on proximal variables instead, including 1) parent satisfaction, 2) changes in access to services, and 3) rate of implementation of recommendations. This study explores the first two of these, looking at relationships between parent satisfaction and access to services.
Participants and Methods: Parents of children who received neuropsychological evaluations in our clinic were recruited to complete an online survey 3 to 12 months after mailing of the report. This is an open project, with continued recruitment at a response rate of 58%. Sixty-four participants were included in the current study. Parents were emailed a link to the online tool, which includes the Parent Satisfaction Survey and Impact Questionnaire. The Parent Satisfaction Survey was modified from that developed by Bodin and colleagues (2007). It consists of 34 questions regarding parent/guardian perceptions of services their child received, generating four factors: General Satisfaction, Clinician Acceptance & Empathy, Provision of Help, and Facilities/Administrative Assistance. The Impact Questionnaire was designed per prior studies exploring changes in educational services following neuropsychological assessments (Waber et al, 2017). It asks parents whether their child's evaluation led to changes in school or emotional/ behavioral services, how their child's provider(s) responded to the report, and how helpful the neuropsychological evaluation was in service planning.
Results: On the Parent Satisfaction Survey, parents endorsed high rates of satisfaction with their child's neuropsychological evaluation across all factors. For example, on key items, 78% of parents reported being "very satisfied" with the evaluation overall, with similar rates of endorsement regarding the helpfulness of both the feedback session (81% "excellent") and the written report (84% "excellent"). On the Impact Questionnaire, 80% reported an increase in school services as a result of their child's evaluation, while 52% reported an increase in emotional/behavioral services. General Satisfaction was significantly predicted by impact on school services, including change in access and school provider response ($F[2,48] = 15.613$, $p = <001$, $r2 = .394$).
Conclusions: These findings provide initial data linking parent satisfaction to proximal "next steps" following pediatric neuropsychological evaluations, specifically school provider response and subsequent changes in school supports. Parents report increases in both school and emotional/behavioral services as a result of neuropsychological evaluations, albeit at a higher rate for the former. This school versus emotional/behavioral outcome differential is apparent in other studies from our project, suggesting parents – or neuropsychologists – may focus more on educational factors. While school outcomes are important to the perceived helpfulness of our evaluations, neuropsychologists are encouraged to highlight the relevance of emotional/behavioral interventions when indicated.
Keywords: pediatric neuropsychology

Paper Session 08: Assessment

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1:00 - 2:25pm
Wednesday, February 2, 2022

1 Why Bother with Base Rates? Limitations of Performance Validity Tests in Dementia Evaluations of Older Adults

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Objective: The American Academy of Clinical Neuropsychology (AACN) recently published an updated consensus statement on validity assessment reaffirming “the need to ensure valid responding in all cases” (Sweet et al., 2021, p. 15). Survey research suggests a 5% base rate of invalid performance in dementia evaluations (Martin & Schroeder, 2020). The present study applied Bayes’ theorem to examine the clinical utility of performance validity tests (PVTs) in older adults presenting for dementia evaluations in the context of an estimated 5% base rate of invalid performance. **Participants and Methods:** PVTs with reported sensitivities and specificities described in a recent systematic review of effort testing in dementia assessment of older adults were included in analyses (McGuire et al., 2019): Test of Memory Malingering (TOMM), Rey 15-Item Test, Medical Symptom Validity Test (MSVT), Nonverbal MSVT (NV-MSVT), the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Effort Index (EI), and RBANS Effort Scale (ES). Software developed by Crawford and colleagues (2009) was used to compute posterior probabilities. It was also used to generate illustrative parameters required for a positive (i.e., invalid) PVT result to produce a posterior probability of invalid performance greater than 50%. A survey- based, estimated 5% base rate of invalid performance was used in all analyses. **Results:** For PVTs included in the present study, posterior probabilities of an invalid performance based on a true positive PVT result (i.e., invalid performance identified as such), ranged from 7.3% to 60.3%; posterior probabilities of a false positive (i.e., valid performance identified as invalid), ranged from 39.7% to 92.7%. Conversely, posterior probabilities of a true negative (i.e., valid performance identified as such) ranged from 95.7% to 99.3%; posterior probabilities of a false negative (i.e., invalid performance identified as valid), ranged from 0.7% to 4.3%. To obtain a posterior probability of invalid performance in which the lower bound of the 95% credibility interval exceeded 50%, a PVT should show at least an 80% sensitivity and a 98% specificity based on a sample of at least 1,000 participants. **Conclusions:** Results of the present study call into question the clinical utility of PVT administration in dementia evaluations when a 5% base rate of invalid performance is assumed. Although a negative PVT result incrementally improves accuracy beyond reliance on the base rate in isolation, a positive PVT result does not sufficiently shift the posterior probability to conclude an invalid performance is present. Specifically, across the majority of PVTs examined, given a positive PVT result, the probability of valid performance far exceeded the probability of an invalid performance. Thus, if a patient fails a PVT, this result provides insufficient evidence to assume the patient’s performance was invalid. Our results set out proposed parameters for development of PVTs used in dementia assessments. Further research examining correlates of invalid performance among older adults presenting for dementia evaluations will clarify base rate estimates and potentially enhance the clinical utility of PVTs.
Keywords: validity (performance or symptom), psychometrics, aging disorders

2 The Influence of Conventional Versus Robust Norming on Cognitive Characterization and Differential Diagnosis of MCI and Dementia

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Objective: Accurate assessment of age-related cognitive impairment is crucial for appropriate and timely management. Conditions like mild cognitive impairment (MCI) and dementia are typically diagnosed via neuropsychological assessment, in which norm-referenced scores are used to evaluate cognitive performance. Current literature outlines various normative systems; however, question remains as to whether a particular norming approach is superior for cognitive characterization and diagnostic accuracy. To further explore this issue, we examined the impact of conventional versus robust normative approaches on cognitive characterization and differential diagnosis in individuals with MCI and dementia.
Participants and Methods: The sample included three groups derived from the National Alzheimer's Coordinating Center Uniform Data Set: 1) a conventional normative group (n = 4,273), diagnosed as cognitively unimpaired at baseline; 2) a robust normative group (n = 602), diagnosed as cognitively unimpaired across at least three repeat evaluations; and 3) a clinical validation group (n = 5,134), consisting of individuals diagnosed with MCI or dementia at baseline. Separate demographically adjusted z-scores derived from the conventional and robust normative groups were created for each cognitive test on the Uniform Data Set 3.0 Neuropsychological Battery and then used to examine cognitive characterization and clinical staging within the clinical validation group. Receiver operating characteristic (ROC) curves and areas under the curves (AUC) were calculated to measure overall classification accuracy of conventional and robust normative approaches.
Results: When compared to conventional norms, using robust norms provided a higher likelihood of low cognitive scores within both MCI and dementia groups. However, effect sizes for differentiation of MCI and dementia using a number of low scores approach were nearly identical when using robust versus conventional norms. Comparison of the diagnostic accuracy of the two approaches for distinguishing MCI from dementia suggested an advantage for conventional ($Z = 3.96$, $p < 0.001$), albeit unlikely to be clinically meaningful due to the extremely small size of differences (.81 for conventional versus .80 for robust).
Conclusions: In summary, these results propose that either normative approach is appropriate when differentiating between MCI and dementia using cognitive tests. Although the robust approach demonstrated increased likelihood of characterizing scores as low, neither approach showed a clear advantage in differentiating MCI from dementia. Further work investigating the impact of using conventional versus robust norms in practice will be crucial to inform clinical decision-making.
Keywords: mild cognitive impairment**,** dementia - Alzheimer's disease**,** normative data

3 External Context Predicts Subjective Cognitive Complaints

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Objective: Although subjective cognitive complaints (SCC) remain incompletely understood, they are weighed heavily in diagnoses and clinical decision making. Prior research suggests that SCCs are influenced by demographic and person-level factors, such as sex, IQ, and psychological distress, but minimal research has been conducted on exploring relations of SCCs and external factors. Because people typically experience greater cognitive difficulties on more demanding tasks, it is reasonable to expect that external factors, such as daily task demands, might also predict SCCs. The current study investigated whether self-reported memory difficulties (retrospective [RM] and prospective memory [PM]) were affected by contextual factors, including people's level of daily busyness, daily routines, and the COVID-19 pandemic and whether age moderated these relations.
Participants and Methods: 819 participants with a mean age of 57.46 years (range: 22-99 years) completed an online survey that included four questionnaires regarding their demographic information, memory complaints, busyness, daily routine, and influence of the pandemic. Multiple linear regressions were conducted to examine

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main effects and interactions of contextual factors and age on memory complaints. Significant interactions were post-hoc probed based on methods described in Holmbeck (2002).
Results: Age was significantly, negatively correlated with both PM and RM failures (PM *r* = -0.27; RM *r* = -0.23), such that older adults reported fewer memory failures. PM and RM failures also were significantly associated with busyness (*r* = 0.39; 0.38), routine (*r* = -0.15; -0.13), and the COVID-19 pandemic (r= 0.44; 0.50), indicating that people who reported more memory failures also were busier, had less routine in their daily activities, and were more affected by the pandemic. A multiple linear regression predicting PM failures showed the same main effects of age, busyness, routine, and the pandemic, with no significant interactions with age. A multiple regression predicting RM failures, showed a strong and significant main effect of busyness, but no main effect of age or routine. A significant age X pandemic influence interaction revealed that age was a moderating factor in the relationship between the influence of the pandemic and reported RM failures. Post-hoc probing revealed that the slopes for both older ($B = 4.37$, $p < 0.001$) and younger ($B = 6.57$, $p < 0.001$) ages were significantly different from zero and that the slope for the younger adults was steeper than that of the older adults.
Conclusions: Contrary to the cognitive aging literature showing older adults underperform relative to younger adults on objective, performance-based tests of episodic and prospective memory, younger adults self-reported more memory failures than older adults. Self-reported memory failures were strongly influenced by busyness and the influence of the pandemic, indicating that external factors influence SCCs even more than age, and potentially even more than cognitive ability. Interestingly, we found that younger adults appear to be more susceptible to self-reported RM failures when experiencing greater effects of the pandemic compared to older adults. These results underscore the limitations of clinical diagnoses and decisions based only on self-report and indicate that the contextual factors must be considered when interpreting self-reported memory complaints.

Keywords: self-report, memory complaints, metamemory

4 Demographically Adjusted Normative Study of Everyday Cognition in the ACTIVE Sample

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Objective: Functional impairment is a necessary criterion for Major Neurocognitive Disorder in DSM-5, but it is usually assessed subjectively via self or informant report. The goals of this project are (1) to provide demographically adjusted normative data for three performance-based tests of everyday cognition: The Everyday Problems Test (EPT), Observed Tasks of Daily Living (OTDL) and Timed Instrumental Activities of Daily Living (TIADL) and (2) to examine each test's relationship with traditional cognitive test scores and relevant self-report measures. Everyday cognitive assessments are thought to add ecologically valid measures of cognitive performance on real-world tasks, and thus they may fill an important gap in diagnostic neuropsychological evaluations and evaluations where functional abilities are the key variable of interest.
Participants and Methods: A sample of 2,767 Black (*n*=726) and White (*n*=2,041) older adults (aged 65-94) in the ACTIVE baseline sample were included in this study. First, normed scores were adjusted for age and education (linear & nonlinear relationships), sex/gender (female & male), and race (Black & White) using multiple fractional polynomial regressions. Second, an ordinal logistic regression was performed to predict participants' number of demographically adjusted low (<16th percentile) test scores, where more low tests might indicate broader impairment. Predictor variables included (1) psychosocial characteristics (co-residence status, attitudes about aging, and physical & mental health related QOL), (2) functional

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abilities (IADL frequency & difficulty, driving avoidance, and extent of mobility), and (3) traditional cognitive test scores (crystallized intelligence proxy, immediate memory, reasoning, visual attention, and processing speed). Full methodological information is available in our secondary data pre-registration (doi: 10.17605/OSF.IO/QXN2U).
Results: Our initial normative models accounted for 23%-38% of the variance in the three everyday cognition test scores, and adjusted scores were now unrelated to age, education, sex/gender, and race. The three demographically adjusted test scores fit extremely well on a single Everyday Cognition factor, which accounted for 31%-61% of the variance in the three demographically adjusted test scores (SRMR = .02, GFI =1, NFI, RFI, IFI, & TLI = .99, and RMSEA = .04). In the subsequent ordinal model, intellectual self-efficacy (OR = .76), concern about intellectual aging (.80), mental health related QOL (.57), immediate memory (.77), reasoning (.73), recognition vocabulary (.93), and digit-symbol substitution (.97) significantly lowered odds of having below expectation tests while physical health related QOL (1.40) and IADL performance limitations (1.03) significantly increased odds of having below expectation tests ($p < .001$).
Conclusions: Multiple fractional polynomial regressions proved extremely effective in producing normed scores of three everyday cognition tests which showed little to no relationship with age, education, sex/gender, and race. These demographically adjusted scores contained reliable variance which was shared among the three tests and not currently being captured by traditional cognitive test scores and relevant self-report measures. Persons with more widespread impairment on these tasks tended to show poorer cognitive, emotional and functional performance. Unexpected relationships (e.g., physical QOL, concerns about aging) are likely due to the partialling out of demographics and simultaneous controlling for other covariates. Future research will longitudinally examine the predictive validity of these everyday cognitive tasks.
Keywords: aging disorders**,** everyday functioning**,** activities of daily living

5 Estimates of Education Quality Reduce Race/Ethnicity Differences in MoCA Classification of Cognitive Impairment

Nicole D Evangelista[1], Jacob Fiala[1], Shellie-Anne Levy[1], Alexandra L Clark[2], Vanessa Dominguez[3], Kristin Calfee[1], Emily J Van Etten[4], Stacey Alvarez-Alvarado[1], Jessica N Kraft[1], Cheshire Hardcastle[1], Hanna K Hausman[1], Kailey G Langer[1], Andrew O'Shea[1], Alejandro Albizu[1], Emanuel M Boutzoukas[1], Pradyumna K Bharadwaj[4], Hyun Song[4], Samantha G Smith[4], Steven DeKosky[1], Georg A Hishaw[4], Samuel Wu[1], Eric S Porges[1], Gene E Alexander[4], Ronald Cohen[1], Michael Marsiske[1], Adam J Woods[1]
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Objective: The Montreal Cognitive Assessment (MoCA) is a widely accepted screening measure for cognitive impairment commonly used in clinical trials to determine study eligibility. However, the conventional MoCA cutoff score indicating mild cognitive impairment (MCI) may not accurately reflect the cognitive status of those belonging to particular racial/ethnic groups. Several prior studies have demonstrated that utilizing conventional MoCA cutoff scores as a study enrollment factor results in selection bias, ultimately obscuring our understanding of cognitive aging trajectories within diverse racial/ethnic groups. Milani et al., 2018 proposed new cutoff criteria for distinct race/ethnic groups and education levels to improve MCI diagnosis and inclusion. However, there remains a need to determine the MoCA's utility as a cognitive screening tool in historically marginalized groups. Therefore, we aimed to evaluate potential racial/ethnicity differences in cognitive impairment classification between conventional and cutoff criteria adjusted for race/ethnicity and years of education.
Participants and Methods: 489 older adults ages 65-89 completed the Wechsler Test of

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Adult Reading (WTAR) and the MoCA. Race/ethnicity was self-identification as Non-Hispanic Black (NHB; n=31), Hispanic (n=42), or Non-Hispanic White (NHW; n=416). Separate binary logistic regressions adjusting for age, sex, and years of education evaluated whether race/ethnicity predicted the probability of performing below conventional MoCA cognitive impairment cutoff criteria (total score < 26/30) and demographically corrected cutoff criteria stratified by race/ethnicity and education (Milani et al., 2018).
Results: Out of the total 489 older adults, 171 were classified as cognitively impaired due to performance below conventional MoCA cutoff (< 26), whereas 124 performed below demographically corrected cutoff criteria. Race/ethnicity significantly predicted the probability of performing below the conventional cutoff ($p < .001$). Specifically, relative to NHW (14.7%) or Hispanic (23.8%), NHB older adults had significantly greater probability of performing below the conventional cutoff (90.3%; NHB > NHW: $p < .001$; NHB > Hispanic: $p = .004$). Probabilities for Hispanic older adults were not significantly different from NHW older adults ($p = .240$). Demographically corrected cutoffs reduced the probability of performing below the cutoff as predicted by race/ethnicity. Specifically, relative to NHW (6.0%) or Hispanic (7.1%), NHB older adults had significantly greater probability of performing below the demographically corrected cutoffs (51.6%; NHB > NHW: $p < .001$; NHB > H: $p = .039$). Only the NHB (64.5%) > NHW (19.2%) difference in probability of performing below conventional cutoffs remained significant after adjusting for WTAR score ($p = .021$). There were no significant race/ethnicity differences in probability of performing below the demographically adjusted cutoffs after adjusting for WTAR score (p's > 0.05).
Conclusions: Results confirm racial/ethnic differences in MCI classification when applying conventional and demographically corrected MoCA cutoff criteria. However, after adjusting for WTAR score, race/ethnicity group differences in MCI classification were reduced. Results suggest that adjustment for one sociocultural factor (e.g., reading ability as proxy for education quality) substantially reduced the magnitude of race/ethnicity differences in MCI classification. Future adjustment for additional measures of social determinants of health beyond race/ethnicity and years of education may further promote accurate diagnosis and inclusive research practices.
Keywords: cognitive screening**,** diversity**,** aging disorders

6 The Structure of Attention

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Objective: There are fewer than expected studies that test models regarding the structure of attention, particularly in children, and fewer still that use a confirmatory model-comparison approach. The Mirsky (1999) model is most commonly assessed, but some measures used in that model more familiarly tap domains such as working memory (Digit Span) or processing speed (Symbol Search). The Chun et al. (2011) framework distinguishes external from internal attention, and this framework has overlap with other attention models (e.g., Posner, 2007; Dennis et al., 2008). We sought to (and expected to) structurally distinguish this external versus internal dichotomy via factor analyses. We also included behavioral attention as a further distinguishable factor, and contrasted attention against factors of working memory and processing speed, as well as against methods factors.
Participants and Methods: We included 212 students in middle school. All were Hispanic, with many struggling readers, many current or former English learners, and most of whom were eligible for lunch assistance. There were 27 measures from 6 domains in total. Domains included Internal Attention (e.g., mind wandering, 5 measures total); External Attention (e.g., visual search and visual attention span, 7 measures total), Combined Internal/External (e.g., continuous performance task, 5 measures total); Behavioral Attention (e.g., teacher ratings, 4 measures total) – those 4 factors were contrasted against factors of Working Memory (4 measures of WISC-5) and Processing Speed (2 measures of WISC-5). Theoretical models distinguishing Internal versus External Attention

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were expected to show better fit than a unitary, or methodological models. We utilized confirmatory factor analytic modeling.
Results: The unitary model fit poorly ($\chi^2(54)$ = 707.34, CFI = .357; RMSEA = .239), as expected. Theoretical models showed improvement, but nonetheless had poor absolute fit (e.g., $\chi^2(53)$ = 412.48, CFI = .646; RMSEA = .179), which was contrary to expectation. Instead, and surprisingly, models that separated measures solely on the basis of methods factors had excellent fit (e.g., $\chi^2(290)$ = 360.28, CFI = .971; RMSEA = .034).
Conclusions: Present results that separate attention aspects only on the basis of methodology are inconsistent with the relatively thin literature on the structure of attention. Sample characteristics and choice of indicator measures are possible explanations, but these are insufficient. More generally, the present work may not be comparable to prior studies, as it focused on confirmatory techniques, included comparison to alternative models, and employed stringent tests of the theoretical boundaries of attention. Results highlight the need to use caution in conceptualizing "attention" too broadly, as well as along common theoretical dichotomies or trichotomies. Instead, results stress the need to consider the varieties of attention in a more discrete and consistent manner to better understand its role in key outcomes for children.
Keywords: attention**,** working memory**,** cognitive processing

Early Career Award Presentation
Presenter: Porrselvi Ammaiappan Palanisamy
Technology for Resource Optimization: TAM Battery, a Neuropsychological Patient Management System

1:00 - 2:25pm
Wednesday, February 2, 2022

As neuropsychology is expanding across the world, there is increasing awareness that testing in the most proficient language is crucial for sensitivity of an assessment. Although neuropsychologists are working with their counterparts in other countries, there is a dearth of assessments available in respective native languages.
In Tamil Nadu as well as the rest of India, like in many other parts of the world, the very few neuropsychologists are concentrated in the Tier 1 cities leaving a void in access to evidence based healthcare for significant sections of populations.
In addition to these limitations, the lack of insurance coverage for neuropsychology or rehabilitation makes neuropsychological assessment or management a dispensable option for them. So, in a busy clinic with limited time and space, the neuropsychologist must assess, interpret, give feedback and recommendations for meagre charges through private pay, and hence cannot afford a interpreter, a psychometrician, or an assistant. These are some of the deficiencies in resources that TAM Battery addresses by harnessing the advantages of technology. It is a secure patient management system with a comprehensive neuropsychological assessment with 16 stand-alone tests that can be chosen as per requirements, 9 of them newly developed, and covers all the usual cognitive domains as well as a quick screen, a measure of pre-morbid functioning, performance validity, and supplementary questionnaires and checklists for examining mood, quality of life, activities of daily living checklists, and medical/cognitive history. It is clinician friendly and allows for retesting, baseline comparison and reporting with automatic norm comparison.
There is user-friendly provision for addition of more languages that the test battery can be administered in after appropriate linguistic translation and validation. This is essential for multilingual cultures like India and can facilitate cross-cultural research. Other technology driven resource optimization enabled by TAM Battery are- tele-evaluation, computer assisted test administration with improved standardization, semi-automated scoring, zero prep time and paperless that requires no physical space for storage. It is dynamically normed to facilitate updated population derived norms that removes the need for a single large study that will demand research funds and resources that are not readily available.
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Poster Session 06: MCI | Aging | Memory | Psychopharm

1:00 - 2:00pm
Wednesday, February 2, 2022

1 Machine Learning Identifies Neurocognitive Measures as Most Predictive Modality of Functional Decline in Older Adults

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The Ohio State University, Columbus, OH, USA

Objective: The ability to carry out instrumental activities of daily living, such as paying bills, remembering appointments, and shopping alone decreases with age, yet there are remarkable individual differences in the rate of decline among older adults. Understanding variables associated with decline in instrumental activities of daily living is critical to providing appropriate intervention to prolong independence. In the present study, we used machine learning techniques, both classification and regression algorithms, to understand modalities and variables that best predicted functional decline in older adults.
Participants and Methods: The sample included 398 deeply-characterized older adults (mean age = 71.4 years) from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Participants were diagnosed with either normal cognition (N=128) or mild cognitive impairment (N=270). Support vector machine classification (SVM) algorithms and support vector regression (SVR) algorithms were used to identify the most predictive modality from five different data modality types (demographics, structural MRI, fluorodeoxyglucose-PET, neurocognitive, and genetic/fluid-based biomarkers). In addition, variable selection identified individual variables across all modalities that best predicted functional decline in a testing sample.
Results: Of the five modalities examined, neurocognitive measures demonstrated the best accuracy in predicting functional decline using both SVM (accuracy=74.2%; area under the curve=0.77) and SVR (RMSE=3.26). Other modalities were much less predictive (area under the curve<0.67; RMSE>3.70). The individual variables with the greatest discriminatory ability for predicting functional decline included partner report of language in the Everyday Cognition questionnaire, the ADAS13, and activity of the left angular gyrus using fluorodeoxyglucose-PET. These three variables collectively explained 32% of the total variance in functional decline.
Conclusions: Taken together, the machine learning models identified neurocognitive measures as the most predictive modality of functional decline. Further, two of the three most predictive variables were in this modality. These novel markers may be involved in the processing, retrieval, and conceptual integration of semantic information and which predict functional decline two years after assessment. These findings may be used to explore the clinical utility of the Everyday Cognition as a non-invasive, cost and time effective tool to predict future functional decline.
Keywords: everyday functioning**,** activities of daily living**,** aging disorders

2 Principal Component Analysis of Neuropsychological Test Data and Relationship to Age in the SIU Longitudinal Cognitive Aging Study.

Madison G. Hollinshead[1], Albert Botchway[1], Gabriella L. Weybright[1], Ronald F. Zec[2], Thomas A. Ala[2], Erin R. Hascup[2], M. Rebecca Hoffman[3], Amber Fifer[1], Kathleen E. Schmidt[4], Mehul A. Trivedi[5]
[1]Center for Clinical Research, SIU School of Medicine, Springfield, Illinois, USA. [2]Department of Neurology, SIU School of Medcine, Springfield, Illinois, USA. [3]Center for Family and Community Medcine, Alton, Illinois, USA. [4]Department of Psychology, Carbondale, Illinois, USA. [5]Department of Psychiatry, SIU School of Medicine, Springfield, Illinois, USA

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Objective: Principal Component Analysis (PCA) is a data reduction technique in which multiple cognitive test measures are reduced to component scores, which are made up of measures that are both conceptually and statistically related to one another, in order to decrease the possibility of Type 1 errors. Previous research has also demonstrated that cognitive component scores are more sensitive to disease states and treatment effects that the individual test measures, and are more highly correlated with biomarkers in many neurological and psychiatric conditions. In the present study, we used PCA as a data-driven approach to determine the component structure of the neuropsychological test battery that is being administered to cognitively-normal (predominantly) older adults in the SIU Longitudinal Cognitive Aging Study (LCAS). We also sought to examine the influence of age on the component scores after controlling for gender and education.
Participants and Methods: We included data from 943 participants who were enrolled in the SIU LCAS as controls. The vast majority of the cohort was White/Non-Hispanic (98.9%) and female (72.4%). Participants had a mean age of 67 years and a mean education of 14 years. All participants were administered a comprehensive battery of neuropsychological tests including measures of language, learning/memory, visuospatial skills, processing speed, and executive function. We excluded participants who met the diagnostic criteria for MCI, dementia, and/or other neurological or psychiatric conditions at baseline as well as individuals who developed MCI, dementia, or neurological impairment within three consecutive study visits, which resulted in the final sample size of 943 participants who were included in the analysis. The PCA was completed using an orthogonal (varimax) rotation with Kaiser normalization. Raw scores were transformed into standardized z-scores with a mean of 0 and standard deviation of 1. Timed measures (Trail Making Test and Stroop Test) where worse performance is measured as longer time to complete were reverse coded to match the other measures where high scores reflected better performance.
Results: The four-component model was chosen because it explained the most variance (63.9%). The four components were speed/cognitive flexibility, visuospatial skills, word list learning/memory, and story memory. The three-component model explained 58.3% of the variance with story memory and word list learning/memory grouping onto the same component. Linear regression analysis demonstrated that increasing age was associated with decreased component scores for all four components after controlling for gender and education. The strongest relationship was between age and the speed/cognitive flexibility component.
Conclusions: The results of the present study are consistent with the previous research demonstrating that PCA can be used to reduce a large number of cognitive test measures into component scores. Our finding that increasing age was associated with reduced component scores after controlling for education and gender is consistent with previous findings in the literature. Future directions include using these cognitive component scores to examine the influence of risk factors for cognitive decline to mild cognitive impairment and Alzheimer's disease.
Keywords: aging (normal)**,** cognitive functioning**,** dementia - Alzheimer's disease

3 Higher Insulin Resistance Relates to Worse Cognition in Black Older Adults

Alyx L. Shepherd, Sarah J. Banks, Kacie D. Deters, Rachel A. Bernier
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Objective: Higher insulin resistance (IR) is a key mediator of prediabetes and diabetes which relates to abnormal insulin functioning and ineffective glucose metabolism. Furthermore, higher IR relates to increased risk of Alzheimer's disease and to poorer cognitive function. Several of these studies were conducted in women-only samples; however, sex differences in these associations are unclear. Evidence of a more adverse cardiovascular profile in diabetic women versus diabetic men and an association between prediabetes poorer cognitive function in women with mild cognitive impairment (MCI) but

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not in men with MCI suggests that women may be more susceptible to the negative impact of metabolic risk factors. However, the majority of this research has been conducted among the White community and much less is known about the relationship between IR and cognitive function in Black older adults. There is an increased prevalence of AD and diabetes among Black individuals compared to White individuals making this a critical knowledge gap. We determined whether higher IR relates to worse cognitive functioning specifically among Black older adults and whether this relationship is stronger in women.
Participants and Methods: This study included 1,024 (57.0% women; mean age=73.4 years [SD=2.9 years]) cognitively normal older Black adults from the community-based Health, Aging, and Body Composition (Health ABC) study who underwent fasting blood draw and cognitive testing. The Health ABC study is a prospective study of community-dwelling older adults living in Memphis, TN, or Pittsburgh, PA. IR was defined as fasting plasma glucose (mmol/l) times fasting serum insulin (mU/l) divided by 22.5. Cognitive measures included the Digit Symbol Substitution Test (DSS), a measure of processing speed, and the Modified Mini-Mental Status Exam (3MS), a measure of global cognition. We used linear regression models to examine whether there was an association between IR and cognitive functioning after controlling for relevant demographic variables (age and education) and whether this relationship was modified by sex/gender.
Results: Black women had significantly lower education ($p<.001$), higher IR ($p=.012$), better DSS performance ($p<.001$), and better 3MS performance ($p<.001$) compared to Black men but did not differ in age ($p=.810$). There was no significant sex by IR interaction on DSS ($\beta=0.00$, $p=.988$) or 3MS ($\beta = -0.14$, $p = .177$). Rather, higher IR is related to poorer DSS ($\beta=-0.09$, , $p=.003$) and 3MS performance $\beta = -0.08$, $p = .014$) regardless of sex/gender.
Conclusions: Results demonstrate that the negative association between IR and cognitive function that has been previously found in mostly predominantly White samples generalizes to cognitively normal older Black adults. This relationship was not modified by sex. These findings highlight the importance of addressing IR as a risk factor for cognitive impairment among older Black individuals that is potentially modifiable (e.g., via diet/food/healthcare access). A person's metabolic health is heavily influenced by social determinants of health, like food security, which can be driven by different factors like income, accessibility, and culture. Therefore, these findings validate the importance of future examinations of diet/food access as modifiers of IR. Future studies should examine this relationship longitudinally and among Black individuals across the AD continuum.
Keywords: cognitive functioning**,** aging (normal)**,** dementia - Alzheimer's disease
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4 Social Interaction as a Functional Marker of Cognitive Decline in Older Adults

Molly Split, Kathryn N. Devlin, Maria T. Schultheis
Drexel University, Philadelphia, PA, USA

Objective: Age-related cognitive decline and associated risk of dementia is a severe public health concern. Researchers have identified early biological markers of dementia, but these markers are costly and often inaccessible. There is a need to improve the identification of early signs of cognitive and behavioral decline associated with dementia and to maximize the generalizability of clinical tools. Social and behavioral changes are core features of dementia symptomology and may be more accessible and less costly to measure than biomarkers; yet there are minimal tools currently available to assess early signs of these changes. Given that these changes can appear well before other symptoms and biomarkers, a reliable and feasible tool for assessing these symptoms is warranted. The current study created a novel self-report measure, entitled the Cognitive Assessment of Social Interaction (CASI), and examined its preliminary psychometric properties in a sample of healthy older adults.

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Participants and Methods: The CASI contains 33 items rated on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree.” Questions target social behaviors that may involve the demand of cognitive processes, such as “I generally avoid complex or unfamiliar topics during conversation.” Items are summed for a total score (up to 165), with higher scores denoting greater difficulty. 126 healthy adults submitted responses via Amazon’s Mechanical Turk platform. All individuals completed the CASI and the Frontal Systems of Behavior (FrSBe) “After” ratings. Participants ranged from 50 to 77 years old (M = 56.8, SD 6.47). The CASI’s internal consistency and overall factor structure were assessed using Cronbach’s alpha and an exploratory factor analysis (EFA), respectively. Preliminary convergent validity of the CASI factors was evaluated by conducting Pearson correlations with FrSBe subscales (Apathy, Executive Dysfunction, Disinhibition).
Results: Cronbach’s alpha suggested strong internal consistency (α = 0.959) for all 33 items. EFA using varimax orthogonal rotation with manual extraction supported a two-factor model representing the following constructs: Cognitive Demand/Working Memory (CD/WM; 21 items) and Behavioral Monitoring (BM; 11 items). One item did not load onto either factor. All factor loadings were greater than .4. Both factors were significantly associated with all three FrSBe subscales. The relationship between CD/WM and the FrSBe subscales was strongest for the executive dysfunction (r =.652, p < .001) and apathy subscales (r =.649, p < .001), followed by the disinhibition subscale (r =.583, p < .001). The relationship between BM and the FrSBe subscales was strongest for the disinhibition subscale (r =.702, p < .001), followed by the executive dysfunction (r =.687, p < .001) and apathy subscales (r =.595, p < .001).
Conclusions: The CASI is a reliable clinical tool for identifying social interaction difficulties in older adults and demonstrates convergent validity with an established measure of frontal behavioral symptoms. Findings suggest that difficulties with executive functions, disinhibition, and apathy may contribute to poor cognition/working memory and behavioral monitoring during social situations. Future work will investigate the relationship of CASI scores with dementia biomarkers and with subtle cognitive decline to determine the CASI’s utility in the early detection of dementia.
Keywords: cognitive functioning, aging (normal), dementia - Alzheimer's disease

5 Serial Position Effects’ Prognostic Utility in Healthy Aging and Mild Cognitive Impairment: A Systematic Review

Melissa Pocsai[1], Aditya Kulkarni[1], Vivian Q Chu[1], Isabelle K Avildsen[1], Laura A Rabin[2], Joel Erblich[3], Nancy S Foldi[1]
[1]Queens College, CUNY, New York, NY, USA. [2]Brooklyn College, CUNY, New York, NY, USA. [3]Hunter College, CUNY, New York, NY, USA

Objective: A hallmark neuropsychological marker of Alzheimer’s Disease (AD) is early semantic degradation. Serial Position Effect (SPE) recall patterns from supraspan verbal list-learning tasks inform the cognitive mechanism of semantic processing. SPE measures show that deviation from the classic patterns of primacy, middle, and recency item recall (i.e., curvilinear “U-shaped” learning curve, and linear primacy progression recall over time) are sensitive discriminators of individuals who maintain healthy status versus those who develop disease from the Mild Cognitive Impairment (MCI) to AD process. Preferential encoding and recall of primacy items, in particular, is hypothesized to reflect deep semantic processing within the wordlist. Subsequent detection of change in primacy item learning and recall accuracy is thought to be most sensitive to very early stages of AD prior to overt disease detection. This investigation reviewed the measurement and utility of all three serial positions (primacy, middle, and recency) at learning and following a delay in preclinical populations.
Participants and Methods: We conducted a systematic database search in PubMed and PsycINFO on articles published through April 2021. These articles were screened and reviewed in accordance with the 2020 PRISMA statement. Studies were included if participants were: (a) ≥ 50 years-old, and (b) identified as cognitively intact or deemed as MCI at baseline.

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Then, studies were eligible for review if they indexed SPE performance and characterized cognitive profiles to predict future cognitive decline.
Results: This procedure led to the inclusion of 21 studies in the review. Studies were evaluated with differences in design, administration, and psychometric properties of list-learning tasks. Despite variability in SPE measurements, and heterogeneity in statistical reporting across studies, a robust synthesis and comparison of findings showed that SPEs provided a reliable and sensitive metric of subtle cognitive decline associated with pre-clinical AD, at times above and beyond traditional metrics of recall. Compared to healthy individuals, those with MCI show SPE marker profiles: relatively low primacy performance at learning, deteriorating primacy on delayed recall, and/or deteriorating recall of recency items over time from learning to delay. Importantly, delayed recall accuracy performance compared to learning recall accuracy performance was more indicative of SPE profiles associated with future decline.
Conclusions: Despite discrepancies in list-learning tasks and varied cohorts, SPE performance patterns provide effective identification of healthy adults who later convert to disease. These metrics provide an important cognitive marker of deteriorating semantic integrity, and reflect cognitive mechanisms underlying early disease detection and sensitivity to disease progression. This review motivates future integration of primacy item sensitivity and specificity performance at learning and progression over delayed recalls as a prognostic tool across diverse pre-clinical populations. We will corroborate these findings tracking cognitive deterioration in conjunction with AD-biomarker status. Lastly, in the promotion of open science, planned future research needs increased itemized cognitive data accessibility for statistical synthesis and meta-analysis of effect estimates of SPEs throughout the AD continuum.
Keywords: cognitive functioning**,** mild cognitive impairment**,** dementia - Alzheimer's disease
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6 Neuropsychological Correlates of the Shared Variance Between Everyday Functioning and Brain Volumetrics

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Objective: Given the multitude of non-cognitive factors that can contribute to difficulties with everyday functioning, examining the extent to which cognition is associated with brain-related changes in everyday functioning is critical to accurate characterization of cognitive disorders. In this study we aimed to identify the neuropsychological correlates of the shared variance between everyday functioning and pathological indicators of cognitive aging using brain volumetrics.
Participants and Methods: Participants were 600 adults age 55 and older without dementia (168 MCI; 432 cognitively normal) derived from the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS) who underwent neuropsychological testing, informant-reported everyday functioning, and brain MRI at baseline. The shared variance between everyday functioning and brain volumetrics (i.e., hippocampal volume, white matter hyperintensity volume) was extracted using the predicted value from multiple regression adjusting for age, sex, education, race/ethnicity, APOE ε4 status (carrier versus noncarrier), and intracranial volume. The shared variance was used as an indicator of pathological everyday functioning.
Results: Greater white matter hyperintensity volumes (p = .002) and smaller hippocampal volumes (p < .001) were significantly correlated with worse informant-rated everyday functioning. The pathological everyday functioning score was greater in individuals with MCI as compared to those with normal cognition (p < .001). Among individuals with MCI, delayed verbal memory (p = .009), category fluency (p = .020), and processing speed (p = .040) were significantly correlated with pathological functioning in

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multiple regression analysis. In the cognitively normal group, only auditory working memory (i.e., digit span backward; p = .02) significantly correlated with pathological functioning.
Conclusions: Even among individuals without clinical dementia, who by definition have only minimal functional difficulties, findings suggest that cognitive abilities are associated with brain-related everyday functioning. Extracting the shared variance between everyday functioning and brain volumetrics may help to identify early neurobehavioral indicators of pathological aging.
This work was supported by Grant R01 AG049810. The NACC database is funded by NIA/NIH Grant U24 AG072122.
Keywords: activities of daily living**,** neuroimaging: structural**,** mild cognitive impairment
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7 Explaining Informant-Rated IADLs in Individuals With and Without Cognitive Impairment in The Aging, Demographics, and Memory Study (ADAMS)

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Objective: Instrumental activities for daily living (IADLs) are essential for adults to maintain independence. Decline in IADLs is a major health cost and contributes to caregiver burden. By understanding
factors contributing to IADL completion in those with and without dementia, interventions can be developed to support older adults. We examined whether the relationship of collateral reported IADLs to: self-reported (SR) memory change, cognitive ability, and collateral-reported neuropsychiatric
symptoms was the same or different for older adults with and without cognitive impairment.
Participants and Methods: The present study represents a subset of participants from wave A of The Aging, Demographics, and Memory Study (ADAMS), which is part of the larger Health and Retirement Study. Analyses included 307 participants who were Non-cases (54.1% female; Mage=77.96,
SD=5.35; Meducation=11.53; 77.5% white, 13.0% Black/African American, 9.4% Hispanic) and 327 participants classified as mild cognitive impairment, mild ambiguous impairment, possible Alzheimer's disease, or probable Alzheimer's disease (Cases; 67.3% female; Mage =85.21,
SD=6.92; Meducation =9.28; 67.6% white, 22.0% Black/African
American, 10.4% Hispanic). Diagnostic categories were determined by a clinical team. IADLs were informant rated (0=no difficulty in any of 5 tasks to 5=difficulty in all 5). Participants rated SR cognitive decline of memory compared to two years prior on a five-point scale. Collateral-rated DSM depression symptom count (range=0-12), and the Neuropsychiatric Inventory (NPI) severity index (0-30) were also used. A relatively comprehensive cognitive battery was included.
Results: Given differences in age and education for Cases and Non-cases, we controlled for both variables in regression analyses. Regression showed that Case status moderated the relationship of IADLs to SR memory change (p<.001). IADL difficulty was related to increased SR memory change in Non-cases (r=.17, p=.007),
but decreased SR memory change in Cases (r=-.29; p<.001). Although regression did not show a moderation effect of Case status for the relationship of IADLs to either depression (p=.167) or NPI (p=.790), depression symptoms were positively related to IADL difficulty for Non-cases (r=.29; p<.001), but not Cases (r=.08; p=.23); NPI severity was related to IADLs for both Non-cases (r=.20; p=.001) and Cases (r=.38; p<.001). In Non-cases, there was little-to-no relationship between IADLs and cognitive functioning (rs=-.18 to .03),
while for Cases, there were several small to moderate correlations across all cognitive domains (rs=-.59 to .20). Several regressions were conducted and there were some significant interactions between cognitive tests and case status on IADL performance (e.g., MMSE x Case status, p<.001).
Conclusions: Factors related
to IADLs differed somewhat for Cases and Non-cases. Results suggest that older adults without

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dementia agreed about functional limitations with collaterals, while those with cognitive impairment may experience anosognosia and under-report the degree to which their cognition has changed. Difficulty completing IADLs in older adults with cognitive impairment can be better explained by the presence of cognitive impairment and neuropsychiatric symptoms, while difficulty completing IADLs in older adults without dementia was best explained by depressive symptoms and other neuropsychiatric concerns.
Keywords: activities of daily living**,** aging disorders**,** cognitive functioning

8 Predictors of Time to Nursing Home Placement Among Patients with Dementia in the National Alzheimer's Coordinating Center Database

Hudaisa Fatima, Jeff Schaffert, Linda S Hynan, Christian LoBue, Allison Parker, Jessica Helphrey, Will Goette, Laura Lacritz, John Hart, C. Munro Cullum
University of Texas Southwestern Medical Center, Dallas, Texas, USA

Objective: Nursing home placement (NHP) is often required for patients with dementia and identifying prognostic indicators of time to NHP may inform the early planning of future needs. Prior research has suggested NHP to be multi-factorial, including demographic variables, level of cognitive impairment, disease duration, medical comorbidities, neuropsychiatric symptoms, and loss of mobility. However, no study has examined these characteristics together in a predictive model. Our goal in this retrospective analysis was to identify factors that are most predictive of time to NHP.
Participants and Methods: Data from 6746 participants (M_{age}=73.03, SD=9.20) with a diagnosis of dementia (n=5086) or MCI (n=1660) at study entry who progressed to dementia were analyzed. NHP was defined as participants moving from independent living into an assisted or skilled nursing facility. A forward entry Cox proportional hazards model was used to examine baseline characteristics that predicted time to NHP, which was calculated in days from initial visit to placement in assisted/skilled nursing facility. Sixteen possible predictors were identified from the literature, including demographics [age, education, sex, race (White/non-White), ethnicity (Hispanic/non-Hispanic)], cognitive symptom duration (years from onset to dementia diagnosis), cognitive impairment (MMSE), Functional Activities Questionnaire (FAQ) score, motor symptom severity [Unified Parkinson's Disease Rating Scale (UPDRS-Part III)], cardiovascular health [modified-Cardiovascular Risk Factors, Aging and Incidence of Dementia (CAIDE) risk score], years of smoking, Neuropsychiatric Inventory-Questionnaire (NPI-Q) score, hearing impairment, the number of prescription medications, presence of urinary/fecal incontinence, and current alcohol use disorder. For participants without NHP/death before NHP, time from the initial visit to the last follow-up visit was utilized.
Results: Average time to NHP for participants entering nursing homes (n=1292) was 1393.96 days (SD= 831.77). The model found that 11 of 16 predictors were statistically significant (χ^2=737.76, p < .001, R^2=0.094). The strongest predictor of days to NHP, ranked by entry into the forward model, was FAQ total score (Exp[b] =1.054, p < .001). For each additional point increase on the FAQ, the hazard for NHP increased by 5.4%. Other predictors, ordered by strength, were Non-Hispanic ethnicity (Exp[b]=2.551, p < .001), followed by White race (Exp[b]=2.086, p < .001), older age (Exp[b]=1.021, p < .001), MMSE (Exp[b]=1.040, p < .001), female sex (Exp[b]=1.312, p < .001), NPI-Q severity (Exp[b]=1.024, p < .001), greater motor/mobility impairment (Exp[b]=1.010, p = .001), more years of education (Exp[b]=1.031, p = .001), and shorter cognitive symptom duration (Exp[b]=1.028, p = .004).
Conclusions: Our findings suggest that functional decline, non-Hispanic ethnicity, Caucasian race, and age were the strongest predictors of shorter time to NHP. Additional contributors include cognitive impairment, neuropsychiatric symptoms, motor symptom severity, education, and time from symptom onset. Additional investigation is required into sociocultural factors and/or disparities that can affect the utilization of long-term care facilities in different racial/ethnic groups. Future research

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may employ more sophisticated modeling to calculate risk indices in the presence of these characteristics and approximate the number of days to NHP.
Keywords: assessment**,** planning**,** memory complaints
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9 Neuropsychological Profiles of Time to Conversion from Mild Cognitive Impairment to Alzheimer's Disease

Allison N Parker, Shawn M. McClintock, Trung Nguyen, Linda Hynan, Heidi Rossetti, C. M Cullum
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Objective: Mild Cognitive Impairment (MCI) is a risk state for the development of Alzheimer's disease syndrome (AD), though individual outcomes vary. Accurately predicting which patients with MCI are likely to develop AD and how long they have until the onset of dementia could provide both patients and their families sufficient time to prepare for the onset of functional impairment. Because there are a number of cognitive domains implicated in the development of AD, multiple neuropsychological tests are likely required to adequately predict prognosis. The present study aimed to determine if baseline neuropsychological profiles could distinguish between patients based on time to conversion from MCI to AD.
Participants and Methods: Participants (n=223) diagnosed with MCI by consensus, minimum 50 years of age (M_{age}=74.2, SD=7.9), and at least one follow-up visit ($M_{YearsFollowed}$=3.9, SD=1.8) were selected from the Texas Alzheimer's Research and Care Consortium (TARCC) database and divided into the following groups based on time to conversion from MCI to AD: sooner converters (SC, under 3 years), later converters (LC, 3+ years), and non-converters (NC, no conversion during study participation; $M_{YearsFollowed}$=3.8, SD=1.8). Profile analysis was utilized to compare patterns of neuropsychological performance across conversion groups using multiple neuropsychological measures, controlling for age.
Results: Distinct neuropsychological profiles were detected across the conversion groups (F=21.89, *p<.001)*). Post-hoc ANOVAs and Bonferroni comparisons found that in comparison to the NC group, the SC group completed Trail Making Test B (TMT-B) 44.54 seconds more slowly ($CI_{95\%}$=18.93, 70.15), recalled 4.82 ($CI_{95\%}$=3.40, 6.23) fewer words, earned 14.39 ($CI_{95\%}$=8.23, 20.55) fewer points on WMS III Visual Reproduction delayed recall (VRII), and 1.29 ($CI_{95\%}$=.54, 2.04) fewer points on the MMSE. In contrast, only word list immediate recall ($M_{Difference}$=2.70, $CI_{95\%}$=.53, 4.88) distinguished the SC group from the LC group. None of the tests examined significantly differed between later converters and non-converters.
Conclusions: Memory measures and TMT-B appeared to be most informative to identify those who are likely to maintain an MCI diagnosis and those who may convert to clinical AD within three years. The findings were more limited regarding later converters but suggest that verbal memory performance best distinguished sooner converters from later converters. Future studies are recommended to determine if different neuropsychological measures can clarify neuropsychological profiles of those who later develop dementia.
Keywords: mild cognitive impairment**,** dementia - Alzheimer's disease**,** planning

10 Anosognosia: Our ongoing lack of awareness

Aya Haneda, Christopher Krause, Maureen Lacy
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Objective: Anosognosia or lack of awareness of deficits, has been associated with Alzheimer's disease, Frontal Temporal Dementia, Parkinson etc. (Amanzio et al 2020). Debate continues on whether this reflects an early or later symptom in a degenerative disease process (Bsatin et al 2021) or whether it reflects frontal or temporal network disruption (Cosentino et al 2020). In a

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recent review, Amanzio and colleagues (2020) noted executive dysfunction associated with reduced self-awareness across neurologic diseases. Based on this review, in the current study it was hypothesized that anosognosia will be correlated with executive dysfunction rather than dementia severity or memory impairment regardless of degenerative disease process.
Participants and Methods: This retrospective study examined memory (Hopkins Verbal Learning Test-Revised Delayed recall trial), executive (Trail Making Test-B) and global/stage impairment (Mini-Mental Status Examination) performances along with self- and collateral reports on an anosognosia questionnaire (AQD: Anosognosia Questionnaire in Dementia; Migliorelli et al 1995) in 73 older adults (>65) referred to a University based Medical Center's Memory Clinic. Patients had a mean age 73.2 (SD = 10.73), with mean 13.8 (SD = 2.88) years of education, and average premorbid intellectual ability (WRAT 4 SS Mean = 98.35, SD = 16.73). An "anosognosia score" was defined as the difference between the patient's and collateral's report of impairment (AQD-D). Means and standard deviations were correlated and correlations were conducted via SPSS-26.
Results: MMSE mean = 25.4 (SD= 3.58); HVLT-Delayed Mean = 29.79 (SD= 9.39); TMT B Mean = 34.42 (SD= 13.18) AQD self-report mean was 20.23 (SD = 14.01), Collateral Mean = 22.47 AQD (SD= 15.04) Difference Mean (AQD-D) = -2.23 (SD= 17.13). AQD-D was not significantly correlated with severity of impairment (MMSE p=0.865) or executive mental flexibility (TMT-B p=0.128), but significantly correlated with memory performance (HVLT Delay p=0.004).
Conclusions: A 2020 review identified only 11 rigorous studies examining Anosognosia despite its association with prediction of future decline, disruptive behavior, limitations in activities of daily living, failure to use compensatory strategies, tendency to adopt dangerous behavior, and caregiver stress (Spaletta et al., 2012; Tagai et al., 2020). The scant current literature, including functional imaging studies, indicates frontal disruption underpinning anosognosia, yet our study suggests a relationship between memory loss and temporal dysfunction. This finding will be discussed in the context of the Cognitive Awareness Model (Mograbi and Morris, 2014) which proposes mnemonic and executive forms of anosognosia. We will also discuss limitations in assessing anosognosia and suggestions for future directions.
Keywords: activities of daily living**,** aging disorders**,** neuropsychological assessment

11 The Associations Between Primacy and Subjective Everyday Cognitive Functioning are Task-Dependent

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Objective: Subjective difficulties in everyday activities in healthy older adults is associated with conversion from MCI to dementia. However, many studies report only modest associations between subjective difficulties and objective cognitive functioning. At least part of this discrepancy may be related to the use of total scores when analyzing data from cognitive testing. Alternatively, serial position effects (i.e., analyzing the specific locations from which word-list items are recalled) can improve prediction of later cognitive decline beyond total scores and may represent a more subtle marker of cognitive impairment. Therefore, the goal of this study was to determine whether analyzing primacy performance (i.e., words recalled at the beginning of a word-list) would add significant variance above and beyond total scores in the relationship with subjective everyday functioning.
Participants and Methods: Participants were 86 older adults (69.8% female, mean age of 71.62 years (*SD* = 7.20), range: 56-89 years). Participants completed the Rey Auditory Verbal Learning Test (RAVLT), the California Verbal Learning Test, Third Edition (CVLT3), and the Everyday Cognition (ECog) scale. Participants also completed other neuropsychological measures.
Results: Primacy performance on the learning trials of the RAVLT explained significant variance above and beyond demographic information, questionnaires assessing emotional

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status, and total learning and memory scores in the associations with ECog scores ($p < .001$). However, primacy performance on the learning trials from the CVLT3 did not explain significant variance above other predictors in the associations with ECog scores ($p > .05$).
Conclusions: The current study suggests that, by adding unique variance above and beyond total memory scores, examining primacy performance on the learning trials of the RAVLT may help to explain some of the discrepancy found between subjective measures of everyday functioning and objective measures of cognitive functioning. However, this finding did not replicate for the CVLT3. Therefore, it is possible that at least some of the discrepancy between subjective and objective performance may be related to specific aspects of the memory assessments (e.g., whether a test is designed to allow for strategies such as semantic clustering).
Keywords: activities of daily living**,** memory complaints

12 Procedural Learning, Declarative Learning, and Working Memory as Predictors for Memory Compensation Training Efficiency in Persons with Amnestic Mild Cognitive Impairment

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Objective: Persons with amnestic Mild Cognitive Impairment (MCI) are at risk for experiencing changes in their daily functioning due to their memory impairment. The Memory Support System, a compensatory calendaring system, was developed to support functional independence in persons with amnestic MCI. A previous study showed that the achieved training stage by the end of Memory Support System training is predictive of the continued use of the Memory Support System at six, 12 and 18 months post-training. Specifically, persons with amnestic MCI who were in the more advanced training stages by the end of training were more likely to continue to use the calendaring system post-training. These findings highlight the importance of initial learning of the Memory Support System. The current study aimed to examine which memory systems are leveraged during Memory Support System training by assessing if procedural learning, declarative learning, and working memory were predictive of learning efficiency of the Memory Support System in persons with amnestic MCI.
Participants and Methods: Fifty-nine persons with amnestic MCI completed the intervention and all memory measures. The intervention consisted of nine sessions of Memory Support System training in a two-week period. The Serial Reaction Time Test and Mirror Tracing Test (MTT) were used to assess procedural learning, the Rey Auditory Verbal Learning Test (AVLT) was used to assess verbal declarative learning, and the CogState was used to assess visual declarative learning and working memory. Linear regression models were conducted to assess if procedural learning, declarative learning, and working memory were associated with Memory Support System learning efficiency. Years of education and age were entered as covariates.
Results: Results showed associations between both verbal and non-verbal declarative learning and Memory Support System learning efficiency, with medium-to-large effect sizes (AVLT LOT: $\eta^2 = 0.082$, $p = 0.013$; AVLT Delay: $\eta^2 = 0.091$, $p = 0.009$, CogState One Card: $\eta^2 = 0.099$, $p = 0.009$). Further, better learning on the MTT was associated with better Memory Support System learning efficiency ($\eta^2 = 0.142$, $p=0.02$) while there was no association between other measures of procedural learning and Memory Support System learning efficiency ($p > 0.05$). There was no association between working memory and Memory Support System learning efficiency (CogState One Back $\eta^2 = 0.000$, $p = 0.862$). This pattern of results remained robust regardless of whether or not we controlled for global cognition (as measured by the Dementia Rating Scale-2).
Conclusions: The current study showed that declarative learning was predictive of the learning efficiency of a compensatory system in persons with amnestic MCI, while results were inconsistent or not significant for procedural

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learning and working memory. These findings are suggestive that success in teaching compensatory tools like the Memory Support System will be greater if the intervention is offered in the early MCI or pre-MCI stage. This is consistent with the general emphasis in the field to intervene as early as possible in MCI. Future studies should assess if additional teaching strategies or more training sessions would facilitate learning of the MSS in those with more advanced MCI.
Keywords: memory training**,** cognitive rehabilitation**,** memory disorders
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13 Neural Changes and Neuropsychiatric Symptoms in Amnestic Mild Cognitive Impairment

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Objective: Depressive symptoms and apathy are common in amnestic mild cognitive impairment (aMCI) and are associated with increased risk of conversion to Alzheimer's disease (AD). The shared neuropathological model of neuropsychiatric symptoms (NPS) in AD suggests that symptoms of depression and apathy represent noncognitive manifestations of neuropathological changes. Neurodegeneration in aMCI occurs in areas of the brain that support emotion regulation, including the limbic system and prefrontal control regions. Depression and apathy in aMCI have been linked to atrophy in the limbic system and prefrontal cortex and reduced connectivity in resting-state networks. However, it is not yet established whether neural changes in emotion centers in the brain predict symptoms of depression and apathy in persons with aMCI, or whether neural changes in the limbic system and prefrontal cortex are associated with higher risk of conversion from aMCI to AD. The current study utilized longitudinal clinical and neuroimaging data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) to determine whether change in neural structure and function in emotion centers predicted symptoms of depression and apathy in aMCI and conversion to AD.
Participants and Methods: Participants were 563 subjects from the ADNI database that were diagnosed with normal cognition (CN) or mild cognitive impairment (MCI) at enrollment (*n* = 224 CN; *n* = 339 MCI), and who had at least two study timepoints with imaging data (Mdn visits = 5). Participants enrolled in ADNI undergo an initial screening assessment, during which demographic, clinical, medical, and neuropsychological information is collected. Participants also undergo a baseline 3T fMRI within two weeks of the initial screening visit. Subsequent study visits are conducted at every six months from baseline. Depressive symptoms were assessed with the Geriatric Depression Scale (GDS) and apathy was assessed with the Neuropsychiatric Inventory Questionnaire (NPI-Q). Structural and functional MRI data used in the current study were derived from standardized imaging datasets.
Results: Multilevel longitudinal structural equation models determined associations between neural changes, neuropsychiatric symptoms, and progression of disease. Cortical volume in emotion centers in the brain decreased over time, with faster atrophy in the MCI group compared to the CN group. The slope of change in neural markers was not associated with the slope of change in depressive symptoms or with the presence versus absence of apathy. There was partial evidence for neural markers predicting later symptoms of depression and apathy. Apathy, slope of change in depressive symptoms, and speed of atrophy in the amygdala and cingulate cortex predicted progression of disease.
Conclusions: Results provide preliminary support for the shared neuropathological model of NPS in aMCI, although certain findings may suggest a more complex relationship between neural changes and depressive symptoms. Early neuropathological changes in emotion circuitry may serve as prognostic markers for persons with aMCI.
Keywords: apathy**,** depression**,** mild cognitive impairment
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14 Factors Affecting Mental Health Trajectories in Partners of MCI Patients

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Objective: Long-term caregiving for patients with Mild Cognitive Impairment (pwMCI) can impact adjustment and depressive symptoms, anxiety level, and burden in a negative or positive direction. However, there is limited research on the factors that might affect the path of changes in caregivers' mental conditions. Therefore, this study aimed to explore the longitudinal effects of partners' demographics and their perceived functional decline in family members on their mental health trajectories.
Participants and Methods: Using latent growth curve models with time varying and invariant covariates, we examined the association of caregiver age, gender, and years of education along with the speed of changes in the Everyday Cognition (ECog) and the Functional Activity Questionnaire (FAQ) scores on measures of caregiver adjustment in 474 pwMCI and their partners from the Healthy Action to Benefit Independence & Thinking® Program (HABIT). Assessments of depressive symptoms, anxiety level, and functional abilities were administered at baseline, 3-month, 6-month, and one-year follow-ups.
Results: Female caregivers reported higher initial anxiety compared to their male counterparts (b=1.43, p=.05). Partner age was negatively related to initial anxiety (b=-.07, p=.004) and depression (b=-.07, p=.031). Partners with higher education level reported lower initial depression (b=-.43, p=.001) and anxiety (b=-.21, p=.012). None of the factors was related to the slope of change in anxiety or depression.
Conclusions: Partners' mental health improved marginally over the course of one year. Among them, the ones who were older, male, and highly educated appeared to report lower depression and anxiety at baseline. However, neither demographic nor perceived functional decline affected the trajectories of anxiety or depression. More research is warranted to identify long-term risk factors for mental health problems in partners of pwMCI.
Keywords: caregiver burden**,** mood disorders**,** demographic effects on test performance

15 Background Music and Recognition Memory in Amnestic Mild Cognitive Impairment

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Objective: Recent evidence in healthy older adults indicates that exposure to music (as background) may improve performance while people are learning new information and/or retrieving stored information. Surprisingly, there is no available evidence that background music may also work for people with memory deficits, such as Alzheimer's disease (AD) or Mild Cognitive Impairment (MCI).
The main aim of this project is to investigate whether background music acts as a memory enhancer in people with MCI. Additionally, the role of music preferences, emotional valence and the pleasantness of music are investigated, as shown to be key factors for determining the music-induced benefits on cognitive performance.
Participants and Methods: Two experiments were conducted with two different groups of 20 participants with amnestic MCI. Participants underwent a neuropsychological assessment and performed a face memory task (encoding and delayed recognition).

During the encoding phase, unfamiliar faces were displayed and participants made a gender judgement task and asked to encode the faces. During the recognition phase, participants were

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asked to judge whether the faces were 'old' (presented during the encoding phase) or 'new'. Participants performed the task twice, in one condition with background music and in the other without music.
In Experiment 1 the music as background was played only during the encoding phase and in Experiment 2 the music was played during both encoding and recognition. We used low-arousal music ('Adagio' by Johann Sebastian Bach) in both experiments and the arousal values were collected from an independent group of participants.
Additionally, music preferences were collected with the Barcelona Music Reward Questionnaire (BMRQ) (Mas-Herrero, Marco-Pallares, Lorenzo-Seva, Zatorre, & Rodriguez-Fornells, 2013) and mood changes assessed with the scale for Mood Assessment (EVEA, Sanz, 2001).
Results: In both experiments background music did not improve the participant's memory performance as compared to silence (Experiment 1: music d'= .82, silence d'= .88, p= .71; Experiment 2: music d'= .85, silence d'= .77, p= .39).
Nevertheless, we found that the magnitude of the music-induced effects on memory was modulated by individual factors. First, the more the music was rated as happy the higher was the music-induced benefit on memory (r= .37, p=. 05). Second, the dimension 'music seeking' was positively correlated with the number of hits in the music condition (r= .61, p< .01) but not in the silence condition (r= .19, p= .40).
Conclusions: The results suggest that background music modulates memory performance when individual factors are taken into account. Further research is needed to investigate the role of music preferences, arousal, and emotions as mediator factors for the music-induced benefits on cognition in MCI.
Keywords: memory disorders**,** cognitive rehabilitation

16 Discerning the Impact of COVID-19 on Cognitive Decline in the Elderly: A Case Series Investigation

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Objective: Since the coronavirus disease 2019 (COVID-19) was declared a pandemic by the World Health Organization in 2020, the short- and long-term implications of the disease on cognition remain a critical area of investigation. While preliminary research has shown that diagnosis and "recovery" from COVID-19 has been associated with impairment in attention, learning, memory, and executive functioning, these studies have not exclusively examined individuals aged 65 and over who are at elevated risk for cognitive decline. Studies have shown the negative implications of quarantine on physical health and well-being in individuals aged 60 and over (Di Santo et al., 2020), as well as rapid cognitive decline in patients with existing mild cognitive impairment and dementia during this time of isolation (Ismail et al., 2021). The current case series aims to further this burgeoning area of research in individuals vulnerable to cognitive decline by examining neurocognitive profiles of elderly individuals (65+) presenting with cognitive complaints following diagnosis of COVID-19 within the setting of outpatient neuropsychological evaluation.
Participants and Methods: Participants of this case series included three elderly individuals (70-81 years-old) who were seen for clinical neuropsychological evaluation for cognitive decline following diagnosis of COVID-19. Cognitive complaints following COVID-19 included word finding issues, forgetfulness, slowed processing speed, and general sense of "fogginess" or reduced mental "sharpness." Participants underwent clinical interview and participated in comprehensive clinical neuropsychological evaluation 3-7 months following diagnosis of COVID-19. Participants' medical history is notable for cerebrovascular risk factors, including diabetes mellitus (type 2), hypertension, and hyperlipidemia.
Results: One participant who reported new onset of cognitive symptoms following COVID-19 and contracted COVID-19 twice (less than 2 months between respective diagnoses) showed reduced performances on tasks of visual attention/processing speed, executive functioning, and language. Two participants who were currently employed and acknowledged some minor cognitive changes prior to diagnosis

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of COVID-19 exhibited performances consistent with estimates of premorbid ability. One of these participants endorsed clinically elevated symptoms of anxiety and depression, in addition to several lingering symptoms of COVID-19.
Conclusions: The case series shows that elderly individuals who present with new onset of cognitive concerns following diagnosis of COVID-19 may be at increased risk for cognitive decline. These findings highlight the potential impact of COVID-19 disease severity on cognition, as the individual diagnosed with cognitive impairment had contracted the disease on two occasions within a two-month period. The well-established role of protective factors on cognition is evident in the current case series, as two participants with subjective concerns of cognitive change pre-COVID-19 diagnosis (but without impairment on objective measures) were engaged in physical and mentally stimulating activities and maintained employment. Additionally, this case series emphasizes the importance of emotional well-being and lingering symptoms of COVID-19 in case conceptualization, as these factors can contribute to reduced cognitive efficiency. Future research should investigate timing of cognitive symptom presentation as it relates to COVID-19 diagnosis, as this may help to elucidate whether cognitive symptoms were part of an existing neurodegenerative disease process.
Keywords: cognitive functioning**,** mild cognitive impairment**,** neurocognition
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17 Factors predicting adherence to behavioral interventions in participants with amnestic Mild Cognitive Impairment (aMCI)

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Objective: Behavioral interventions in early cognitive decline are currently one of the most promising approaches to delay the onset of dementia. The aim of this study was to examine factors that could predict adherence to different behavioral interventions in participants with amnestic Mild Cognitive Impairment (aMCI) accompanied by study partners.
Participants and Methods: Fifty-two dyads of a person with aMCI and their study partner enrolled in the Physical Exercise And Cognitive Engagement Outcomes for Mild Cognitive Disorder (PEACEOFMND) study were included in this analysis. At enrollment, participants were randomized to one of three behavioral interventions: Computerized cognitive training (BrainHQ; n=20), yoga (n=14) or wellness education (n=18). Participants also received memory compensation training with a memory support system (MSS) and support group. Initially, the assigned intervention was administered for 1 hour across 10 days. Subsequently, participants continued their assigned intervention for 24 weeks. Adherence was assessed based on the following criteria: ≥40 hours of training on BrainHQ, ≥150 minutes of yoga per week, and 18 of 24 wellness logs completed. A binary logistic regression was performed to measure factors that could predict adherence to the randomized behavioral interventions. Age, education, type of study partner, depression (CES-D), Clinical Dementia Rating (CDR) scores, Functional Activities Questionnaire (FAQ) scores and MSS compensation training use were included as predictors in the model.
Results: For the binary regression, the use of MSS predicted adherence to the combined randomized behavioral interventions [OR=0.02, p=0.01]. Participants that used a MSS had 98% higher probability of being adherent to the randomized behavioral interventions. None of the other factors predicted adherence to the combined interventions.
Conclusions: The use of calendar as a memory support system is an important tool that may improve the odds of adherence to interventions in participants with aMCI. However, the observed association might simply be a reflection that some people are more adherent to all program components compared to others. Either way, understanding adherence is critical

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in our efforts at improving behavioral interventions to reduce cognitive decline.
Keywords: mild cognitive impairment**,** memory training
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18 Examining Heterogeneity in Depression Symptoms in Those with MCI: A Factor Mixture Modeling Approach

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Objective: Late-Life depression has been shown to be associated with both cognitive and functional decline in older adults with mild cognitive impairment (MCI). However, it has remained understudied if specific depression symptoms or combinations of symptoms vary in this association. The current study aimed to examine heterogeneity of depression symptoms in MCI and to investigate if cognition and function varied as a function of the type of symptoms endorsed.
Participants and Methods: Older adult participants (*N* = 3838), classified as having MCI by the National Alzheimer's Coordinating Center, were examined. Depression was measured via the Geriatric Depression Scale. Cognitive and functional outcomes included measures of everyday function (Functional Activities Questionnaire-Informant), executive function (Trail Making Test B), and episodic memory (Logical Memory-Recall). Exploratory factor analysis followed by factor mixture modeling was used to examine latent population heterogeneity of depression symptoms and to examine possible group differences in cognition and functioning.
Results: A five-class, two-factor model of depression was chosen based on model fit and previous literature on depression heterogeneity in older adults (BIC = 39306.03, AIC = 39055.93). The five classes were: moderately depressed (5%), low life satisfaction (6%), low/non-depressed (50%), highly depressed (3%), and somatic symptoms (35%). In terms of everyday function, the highly depressed class had the highest reported impairment (*m* = 6.33), while the low life satisfaction (*m* = 2.28) and non-depressed (*m* = 2.42) classes had the least reported impairment. In terms of executive function, the highly depressed class again had the worst performance (*m* = 160.64) while the low life satisfaction (*m* = 128.22) and non-depressed (*m* = 123.58) classes had the best performance. The highly depressed, moderately depressed, and purely somatic symptom classes significantly differed, such that they had significantly worse everyday and executive function, compared to the low life satisfaction and non-depressed classes (all $p < .05$). Classes did not significantly differ in terms of memory.
Conclusions: There is significant heterogeneity in depression symptoms in older adults with MCI. Depression symptoms significantly impact the everyday and executive function of those with MCI. Specifically, our results suggest that individuals reporting moderate to high levels of depression and somatic symptoms (e.g. low energy) may be at the greatest risk for cognitive and functional decline. Clinicians should pay particular attention to which depression symptoms patients are reporting to aid with early detection of risk for cognitive decline.
Keywords: mild cognitive impairment**,** depression
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19 Pupillary Responses During HVLT Learning Trials Differentially Predicts Retention in Cognitively Normal Older Adults and Individuals with MCI

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Objective: Recent evidence suggests that pupillary responses during cognitive tasks may be a novel biomarker of early risk for mild cognitive impairment (MCI) and Alzheimer's disease (AD). Greater pupil dilation during cognitive tasks, indicative of greater effort, may appear prior to frank impairments on these tasks in those at risk for AD (Granholm et al. 2017). Verbal learning tests such as the Hopkins Verbal Learning Test- Revised (HVLT) have been utilized as a reliable indicator of episodic memory impairment in preclinical AD, MCI, and AD dementia (Bondi et al. 1994, 1999; Grober & Kawas, 1997). Variables available from the HVLT include learning across trials and percent retention, the latter of which can be used as a sensitive tool to differentiate dementia diagnosis (Clark et al. 2010). Pupillometry assessment during HVLT testing to our knowledge has not yet been explored. Our goal was to show how pupillary dilation (a proxy for greater effort) during learning can predict delayed verbal memory retention in cognitively normal (CN) older adults and individuals with MCI.
Participants and Methods: 32 older adults (range = 62–85 years) underwent comprehensive neuropsychological assessment and were classified as CN (n = 20) or MCI (n = 12) based on Jak-Bondi actuarial neuropsychological criteria (Jak, Bondi et al., 2009). Pupillary responses were recorded using a Tobii pupillometer during HVLT learning trials. Pupil dilation during the three learning trials was averaged and the percent retention score was calculated using the formula [(Trial 4 ÷ Higher score of Trials 2 and 3) x 100].
Results: After adjusting for age, education, average performance across learning trials, and APOE e4 positivity (i.e., the presence of at least 1 e4 allele), there was a significant interaction between diagnosis (CN or MCI) and pupil dilation across learning trials to predict percent retention ($p = .020$). Examination using a multiple linear regression model revealed that higher pupil dilation across learning trials was positive/negative associated with lower percent retention among the CN group ($p = .015$), but not among the MCI group ($p = .942$).
Conclusions: The amount of pupil dilation during the learning trials added unique predictive value to the number of words retained at delay over and above several other predictors—including performance during the learning trials itself—only for the CN group. The differential effects of pupil dilation during learning on later retention between CN and MCI groups suggests that pupil dilation (i.e., a proxy for greater effort) may be a particularly sensitive marker among CN older adults, whereas MCI participants may have already exhausted any possible compensatory mechanisms and thus the magnitude of pupil dilation is less predictive in this group. Pupillometry is a non-invasive and cost-effective biomarker that may provide an efficient way to test for learning and memory difficulties and possible incident cognitive impairment among cognitively normal older adults.
Keywords: mild cognitive impairment**,** neuropsychological assessment**,** dementia - Alzheimer's disease
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20 Improvement During Inductive Reasoning Training is Associated with Lower Odds of Baseline and Incident Mild Cognitive Impairment

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Objective: Prior research has suggested that older adults at risk of cognitive impairment are less likely to profit from cognitive training in inductive reasoning. Alternatively, some studies have reported that elders who have received a cognitive training intervention have a reduced risk of subsequent cognitive impairment. Drawing on this past work, the current study focuses on a sample of older adults, all of whom received inductive reasoning training, and investigates whether individual differences in participants' session-to-session improvement over a 10-session inductive reasoning training

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program are associated with risk of cognitive impairment.
Participants and Methods: Older adult participants in this study had been assigned to the ten-session reasoning training arm of the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial and had attended at least one session. Analyses are based on 667 community-dwelling elders (mean age = 73.54 years, mean education = 13.50 years, 76.5% female, 26.7% African American) drawn from six geographic catchment areas in the United States. The dependent variable in this study was MCI status (0=met MCI criteria at some point during the 10-year study; 1=never met MCI criteria). The MCI variable included both baseline and incident cognitive impairment and was derived using actuarial neuropsychological criteria. The independent variables in this study were three components of inductive reasoning performance obtained from a 20-item reasoning measure (ten alternate forms) administered at the end of each of the ten training sessions. Using piecewise latent growth models, the three inductive reasoning performance components, used as predictors in a binomial logistic regression, were: (a) *initial level*; (b) *initial improvement* from training session 1 to 2, and (c) *ongoing improvement* from training sessions 2 to 10. The model predicting MCI status was also adjusted for covariates of age, education, gender, race, baseline MMSE scores, depressive symptoms, and self-rated health.
Results: Adjusting for covariates, higher *initial level* (odds ratio OR = 1.42), greater *initial improvement* (OR = 1.36), and greater *ongoing improvement* (OR = 3.04) were each associated with a greater likelihood of never being classified as having MCI status ($p < .05$).
Conclusions: The results suggested that, in participants randomized to receive inductive reasoning training, both higher initial level and, more importantly, greater subsequent improvement during training were associated with lower odds of ever being classified as MCI. Limitations of the current study included: 1) MCI status was derived from an actuarial approach using limited cognitive tests (as opposed to a clinical diagnosis based on a comprehensive neuropsychological evaluation), and 2) the use of cognitive measures, many administered in a group setting and/or not typically administered in a traditional neuropsychological evaluation. Future work will examine whether inductive reasoning training gains were differentially associated with baseline versus incident MCI, and whether associations differ when predicting amnestic versus non-amnestic MCI. ACTIVE also has session-to-session memory improvement data, and that will be examined. The current results are consistent with previous research suggesting that the magnitude of inductive reasoning training gains may be unique and sensitive indicators of cognitive impairment.
Keywords: mild cognitive impairment
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21 The Cognitive Change Index (CCI-40): Broadening the Assessment of Subjective Cognitive Concerns in Demographically Diverse Community Dwelling Older Adults

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Objective: Subjective cognitive concerns (SCC) expressed by older adults are increasingly recognized as one of the earliest markers of dementia risk. Perceived memory decline is often the initial presenting symptom of Alzheimer's disease (AD); however, memory SCC items may not the most sensitive to dementia risk or symptomatic prodromal stages such as mild cognitive impairment (MCI). Furthermore, it is essential to query cognitive domains beyond memory, as different aspects of cognitive decline may be uniquely associated with various dementias. Therefore, we expanded

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a widely used measure of SCC, the Cognitive Change Index (CCI) self-report, to broaden cognitive domains assessed, and examined a 40-item version, the CCI-40, in demographically diverse, community dwelling older adults with normal cognitive status or MCI.
Participants and Methods: Einstein Aging Study participants (n=330, mean age=77.4, 66.7% female, 45.5% White) completed the CCI, expanded CCI-40, and neuropsychological evaluation. The CCI-40 maintains the CCI's structure and includes the original 20 items. The additional 20 items were developed after analysis of measures utilized across international cognitive aging studies and literature on items most sensitive to cognitive decline. Participants rate their current functioning compared to 5 years ago on a 5-point Likert scale that references both ability (normal to severe problem) and change (no change/better to much worse). The CCI-40 taps memory (remote, retrospective, prospective subtypes; 21 items), executive functioning (5 items), language (4 items), attention/concentration (4 items), visuospatial/navigation (2 items), processing speed/mental clarity (2 items), orientation (1 item), and calculation (1 item). Participants were classified as MCI (n=104) or cognitively normal (CN; n=225) using Jak/Bondi criteria. Our primary analysis was logistic regression to examine the association of each CCI item and total scores with MCI status.
Results: The CCI-40 performed similarly to the original CCI: on both versions, persons with MCI endorsed significantly higher levels of SCC than CN (p<.001). A pattern of small, statistically significant correlations was observed on both CCI versions and neuropsychological tests across cognitive domains. Neither CCI version total scores were significantly associated with MCI status, after adjusting for age, sex, education, race/ethnicity, and depression. Controlling for the same variables, an item-by-item analysis revealed six items (one from the original CCI and five from the CCI-40) that were significantly sensitive to MCI. The relative odds of MCI ranged from 1.4-4.99 for the six individual items.
Conclusions: Overall, the CCI-40 performed similarly to the original in its ability to distinguish between MCI and CN and to associate with objective cognitive performance in community-dwelling older adults. A subset of six items was particularly sensitive to MCI status, and after replication in a larger sample, may be useful to form a brief screen. Future work will examine the ability of the CCI-40 to predict conversion from cognitively normal to subjective cognitive decline (SCD), MCI, and various forms of dementia. We predict that SCC in certain cognitive domains may be sensitive to preclinical AD and non-AD dementias.
Keywords: mild cognitive impairment**,** neuropsychological assessment**,** test development
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22 Diagnostic Validity Comparisons of MMSE and ADAS-Cog Using CSF Tau

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Objective: Alzheimer's disease (AD) pathology is typically present in the pre-clinical phases of the disease. One substantiated biomarker for AD pathology pertains to levels of the tau protein in cerebrospinal fluid (CSF tau). Standardized measures of cognitive functioning (e.g., Mini Mental Status Exam [MMSE], Alzheimer's Disease Assessment Scale [ADAS-Cog]) have historical value in identifying AD; however, the usefulness of these measures are less clear in earlier stages of disease progression commonly referenced as mild cognitive impairment (MCI). The current study aimed to explore the diagnostic validity of the MMSE and ADAS-Cog through comparison with CSF total tau (T-tau) in those diagnosed with MCI.
Participants and Methods: The MCI sample (n = 199) was drawn from archival Alzheimer's Disease Neuroimaging Initiative (ADNI) data.
Results: Neither MMSE total scores nor ADAS-Cog scores taken at the time of diagnosis were a significant predictor of CSF T-tau level. However, the model with ADAS-Cog scores

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predicting CSF T-tau trended towards significance ($F(1, 197) = 3.59$, $p = .06$, $R^2 = .13$). **Conclusions:** Results support the adjunctive clinical utility of standardized cognitive functioning measures while aligning with prior research indicating lower diagnostic value of such measures in individuals with MCI. Notably, the heterogeneity and variability in clinical severity amongst the MCI sample and the possibility of the presence of CSF T-tau despite the presence of another etiology reflect limitations of the current study. Further research refining the clinical utility of use standardized cognitive functioning measures with individuals with MCI would be of benefit.
Keywords: cognitive screening**,** mild cognitive impairment**,** assessment
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23 Communicative Participation in Older Adults with Mild Cognitive Impairment or Dementia from Alzheimer's Disease

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Objective: The key distinction between mild cognitive impairment (MCI) and dementia is the degree to which one's cognitive limitations interfere with activities and participation associated with independent living. However, determinations of activity/participation restrictions are highly dependent on the means of assessing those restrictions, which often do not comprehensively assess *communicative* activities beyond life-saving communication in emergency situations. This study more thoroughly assesses self-reported communicative participation in adults with MCI or early-stage dementia from Alzheimer's Disease using a relatively new scale, the Communicative Participation Item Bank (CPIB). Classifications of activity/participation restriction based on communicative tasks (as assessed by the CPIB) are compared against classifications of restriction based on more general tasks of independent living, as self-assessed by the Neuro-QoL Ability to Participate in Social Roles and Activities (NQ-SRA) Item Bank.
Participants and Methods: 33 people with at least mild cognitive impairment from AD (NIA-AA criteria) completed the Montreal Cognition Assessment (MoCA) and a battery of self-report measures including the CPIB, the NQ-SRA, the Neuro-QoL Cognition item bank, and the Neuro-QoL Depression item bank. The exact number of people with MCI versus dementia depends on the classification of independent living skills – the focus of this investigation. Communicative activities assessed by the CPIB include talking with a store clerk about a problem with a purchase, making new acquaintances, trying to persuade a friend or family member to see a different point of view, and having a long conversation with someone about a book, movie, show, or sports event. Examples of items from the NQ-SRA about general social roles and activities include being able to participate in hobby or leisure activities, run errands without difficulty, doing chores or home tasks, and keeping up with home responsibilities. Participants were recruited from other research studies and the community, had a mean age of 75 (range: 63-89), were 73% female, and 85% White. Degrees of participation restriction (no restriction, mild, moderate, severe) as measured by the CPIB and NQ-SRA were based on the cut points reported by Cohen, Harnish et al. 2021.
Results: Participant mean score on the MoCA was 20.0. On the NQ-SRA, 17 people (51%) produced scores suggestive of at least mildly restricted participation. On the CPIB, 22 (67%) produced scores suggestive of at least mildly restricted participation. When individual classifications were compared, 15 participants were classified by the CPIB as having worse participation, 8 were classified by the NQ-SRA as having worse participation, and 10 were classified equally by each measure. CPIB and NQ-SRA scores were not correlated: r=.077, p=.681. Neither CPIB nor NQ-SRA scores were correlated with depressive symptoms, but both were moderately correlated with cognitive symptoms such that more/worse cognitive symptoms were associated with worse participation.
Conclusions: Self-assessment of communicative activities and participation does

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not appear to be redundant with self-assessment of general life participation in people with MCI from AD and may be more sensitive to limitations. Future investigations could investigate how more thorough assessment of communication tasks contributes to overall diagnostic accuracy of normal aging, MCI, and dementia.
Keywords: activities of daily living**,** mild cognitive impairment**,** dementia - Alzheimer's disease
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24 Alzheimer's Disease Biomarkers and Neuropsychiatric Symptoms within a Cross-Cultural Sample

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Objective: Cross-cultural differences in neuropsychiatric symptoms and Alzheimer's Disease (AD) biomarkers are not well understood. This study aimed to: 1) compare depressive symptoms from the Geriatric Depression Scale-SF (GDS-15) across diagnoses of cognitively normal (CN), Mild Cognitive Impairment (MCI) and dementia as well as ethnic groups of 175 Hispanic Americans (HA) and 109 European Americans (EA), 2) determine differences in frequencies of neuropsychiatric symptoms as measured with the Neuropsychiatric Inventory Questionnaire (NPI-Q) among ethnic groups of HA and EA diagnosed as CN, with MCI or dementia, and 3) evaluate the relationship of depression (assessed using the GDS-15) and apathy (from the NPI-Q) with brain atrophy.
Participants and Methods: There were 284 participants (175 HA and 109 EA) evaluated in this study, 63.4% female (n = 180), with 40.8% (n = 116) born in the US. The mean age was 71.80 (SD = 7.91), with a mean of 14.99 (SD = 3.59) years of education. We used a univariate ANCOVA to assess differences across diagnoses and ethnicities on the GDS-15 total score controlling for demographic variables of age, education, and gender. We additionally conducted chi-squared and non-parametric tests for multiple comparisons to compare frequencies of neuropsychiatric symptoms between ethnic groups, as well as across diagnoses within each ethnicity. Finally, correlations analyzed cortical volumes with depression and apathy. False Discovery Rate (FDR) corrections for multiple comparisons were applied to the ANCOVA as well as frequency and correlation analyses.
Results: More depressive symptoms were reported in the MCI and dementia cohorts compared to CN, while older age corresponded with lower GDS total scores, remaining after FDR corrections. No differences in depressive symptoms were observed across ethnic groups. The prevalence of neuropsychiatric symptoms differed across diagnostic groups within each ethnicity, but not when comparing ethnic groups. Only apathy remained significantly different across diagnoses in the EA cohort, and for HA participants, delusions, agitation, apathy, motor disturbance, disinhibition, and hallucinations were significant after FDR corrections were applied. Higher frequencies of neuropsychiatric symptoms were reported in MCI and dementia. Reduced hippocampal, left entorhinal, left medial orbitofrontal (OFC) and superior frontal volumes were significantly correlated only with reported apathy on the NPI-Q ($ps \leq .01$) for the whole sample which remained after FDR corrections, and no significant associations were found with depressive symptoms. Upon dividing the sample by ethnic groups, only the EA group demonstrated significant negative correlations of apathy as reported on the NPI-Q with these memory and frontal regions ($ps < .05$) after correcting for multiple comparisons.
Conclusions: This study demonstrated that there are differences in the expression of neuropsychiatric symptoms across these two ethnic groups. Also, the most significant neuropsychiatric symptom was apathy in its association with the AD biomarker of cortical volume, which was driven by the EA group.
Keywords: apathy**,** depression**,** dementia - Alzheimer's disease
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25 Can Blood-Based Biomarkers of Neuronal Receptors Predict Cognitive Decline? A Preliminary Study

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Objective: Blood-based biomarkers have utility for diagnostics. Neurodegeneration is often accompanied by neuronal death, release of neuronal debris, and selective production of autoantibodies to clear this debris. Thus, disease-associated changes in autoantibody levels in the blood can be used as indicators of disease. Here, the Alzheimer's Disease Neuroimaging Initiative (ADNI) and human protein microarrays (HPMs) data were used to assess the relationship between levels of autoantibodies to debris from neuronal receptors and cognitive functioning over time.
Participants and Methods: Using CDI HPMs, levels of autoantibodies directed against five neuronal receptors (Adrenergic; ADRA1A, ADRB3; Gabaergic; GABRA1, GABRG1; Glutaminergic; GRIN2A]), that were significantly different from controls were selected. Neuropsychological tests included the Rey Auditory Verbal Learning Test (AVLT) Recognition task, 'animal' fluency test, Boston Naming Test (BNT), and Trail Making Test-B. Demographic-corrected z-scores were calculated using published normative data from the Mayo Older Americans Normative Study for the Rey AVLT and National Alzheimer's Coordinating Center normative data for the remaining tests. Twenty three (baseline mean age = 72.7; sex = 8 female) participants diagnosed with mild cognitive impairment (ADNI criteria) were selected. Hierarchical regression analyses were employed, where the outcome variables were autoantibodies directed against each neuronal receptor; block 1 included baseline neuropsychological tests; and, block 2 included the same neuropsychological tests collected a year later from the time of blood draw.
Results: Regression models (blocks 1 and 2) for ADRB3, GABRA1, and GRIN2A were not statistically significant (ADRB3; R^2=.17, p =.48; R^2=.47, F change=2.0, p=.23 [block 2 RAVLT Recognition β=0.741, p=.025]; GABRA1; R^2=.16, p=.51; R^2=.55, F change=3.0, p=.10 [block 2 RAVLT Recognition β= 0.77, p=.01; 'animals' β=-0.76, p=.04]; GRIN2A; R^2=.29, p=.16; R^2=.51, F change=1.6, p=.15, [block 1 BNT β=-0.54, p=.03; block 2 'animals' β=-0.74, p=.047], respectively), but generally had a trend towards significance in block 2. Comparatively, while GABRG1 also did not have statistically significant regression models (R^2=.38, p=.06; R^2=.57, F change=1.51, p=.09 [Block 1 BNT β=-0.54, p=.02, 'animals' β=0.51, p=.04; block 2 RAVLT Recognition β=0.58, p=.045]), the general trend was suggestive of stronger relationships between cognition and GABRG1 at baseline. The protein ADRA1A regression model was statistically significant in block 2 (R^2=.30, p=.15; R^2=.62, F change=2.96, p=.04 [block 1: BNT β=-0.54, p=.024; block 2 RAVLT Recognition β=0.799, p=.006]). Although most regression analyses did not reach statistical significance, individual predictors within the model were statistically significant.
Conclusions: Autoantibodies against neuronal receptor proteins detected in the blood may predict cognitive decline. Moreover, individual predictors within the model were statistically significant and may provide a potential temporal relationship between neuronal receptor death and cognition. Finally, the direction of these relationships varied and may indicate the stage of neurodegeneration (i.e., lower protein may suggest currently bound receptors and the beginning stages of death in that area). Future studies examining which autoantibodies against neuronal receptors could be the earliest indicators of neurodegeneration may elucidate potential mechanisms and populations of neuronal death.
Keywords: aging disorders, technology, mild cognitive impairment

26 Attention Outcomes in Chinese Patients with Hemophilia

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Objective: Hemophilia is a rare but life-threatening X-linked bleeding disorder that requires lifelong treatment. While clinical intracranial hemorrhage is uncommon among patients with hemophilia who receive adequate treatment, silent cerebral microbleeds may develop and lead to subtle or mild cognitive impairment in subgroups of patients. The objectives of this study are to evaluate attention outcomes in Chinese patients with hemophilia, and identify clinical factors associated with functioning in this population.
Participants and Methods: This cross-sectional study was conducted in the pediatric and adult hematology clinics of a public hospital in Hong Kong. We recruited male Chinese patients who were diagnosed with hemophilia A or B, and were aged > 8 years old. Participants completed the Conners' Continuous Performance Test III (CPT-III) to assess their attention functioning. Medical and treatment data was collected from the electronic health records. Impairment on each of the eight CPT measures was defined as a 1.0 standard deviation (SD) (ie. *T*-score>60) above age-adjusted reference norms (mean=50, SD=10). One-sample binomial tests were applied to compare the observed to the expected impairment rate (5%) in the general population. Mann-Whitney U test was conducted to compare the *T*-scores across pre-defined groups: (1) mild *versus* moderate-to-severe hemophilia; (2) hemophilia A *versus* hemophilia B; and (3) patients requiring regular infusion of clotting factors ("prophylaxis therapy") *versus* patients requiring infusion only for breakthrough bleeding ("on-demand" therapy).
Results: Forty-six patients completed the attention assessment, including 15 pediatric patients (age mean=12.2, SD=3.4 years; range 8.5–16.9) and 31 adult patients (mean=35.9, SD=12.2 years; range 19.2–65.3). The majority of patients were diagnosed with hemophilia A (n=38, 83%) and classified as moderate-to-severe hemophilia (n=40, 87%). The rates of impairment range from 4% to 22% across the attention measures (Table 1). One quarter (n=11, 24%) showed impairment in two or more CPT measures. Compared to an expected impairment proportion of 5% in the general population, a significantly larger proportion of patients with hemophilia demonstrated impairment in inattention (CPT commissions; $P<0.0001$) and sustained attention (CPT block change; $P=0.012$). As compared to patients with mild hemophilia, patients with moderate-to-severe hemophilia demonstrated poorer discrimination (CPT detectability 43.5 [SD=5.0] *versus* 50.1 [SD=7.3]; $P=0.047$), inattentiveness (CPT omissions mean 43.8 [SD=3.5] *versus* 47.6 [SD=6.7]; $P=0.038$) and perseveration (44.5 [SD=6.8] *versus* 49.5 [SD=9.7]; $P=0.040$). We did not observe significant differences in attention outcomes between patients with hemophilia A *versus* hemophilia B, and patients requiring "prophylaxis" *versus* "on-demand" therapies.

Table 1: Rates of impairment on CPT measures

CPT measure	Impairment rate (95% CI)	*P**
Detectability	10.8 (1.8 – 20.0)	0.068
Omissions	4.3 (0.1 – 10.2)	0.84
Commissions	21.7 (9.8 – 33.7)	**<0.0001**
Perseveration	8.7 (0.5 – 16.8)	0.25
Hit reaction time	8.7 (0.5 – 16.8)	0.25
Hit reaction time SD	4.3 (0.1 – 10.2)	0.84
Variability	8.7 (0.5 – 16.8)	0.25
Block change	13.0 (3.3 – 22.8)	**0.012**

* *P*-value: Comparison with the expected impairment rate of 5% in the general population

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Conclusions: Our study suggests that mild impairment in various attention measures is observed in a small cohort of patients with hemophilia in Hong Kong. Patients with moderate-to-severity hemophilia warrant closer monitoring with a more comprehensive neurocognitive assessment. Our future work includes examining the cerebral structural changes with neuroimaging and its association with functional outcomes.

Keywords: attention**,** genetic disorders**,** mild cognitive impairment

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27 Unmasking underlying cardiovascular risk factors through profiles of neuropsychological deficit in midlife: The Bogalusa Heart Study

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Objective: The vast majority of patients diagnosed clinically with either mild cognitive impairment (MCI) or Alzheimer's disease (AD) present with both neuropsychological and pathological heterogeneity. For example, underlying vascular disease is a common co-morbid factor in many patients diagnosed with MCI or AD. Statistical algorithms for neuropsychological (NP) classification may assist epidemiological studies in unmasking the association between cardiovascular risk factors (CVRFs) and cognitive function by providing information regarding the distribution of underlying clinical characteristics and neuropathology. This study explores the association between subclinical carotid atherosclerosis burden, measured by carotid intima-media thickness (cIMT) and NP profiles in midlife.

Participants and Methods: This cross-sectional study includes 1,203 participants (age 48 ± 5.3 years) from the Bogalusa Heart Study. Standard scores from eight NP tests were subjected to cluster and discrimination function analyses. Multinomial regression models were used to determine the association between subclinical carotid atherosclerosis and NP profiles. Ultrasound measurements of carotid intima-media thickness (cIMT) across regions were averaged in a cIMT-composite and dichotomized above the 50th percentile (> 0.87mm). Sensitivity analyses were performed using global cognitive z-score (GCS) tertile-derived subgroups with the lowest tertile indicating worse cognitive performance.

Results: Three clustered-derived NP profiles emerged including an (1) *early MCI-like* (n=192, 16%) group presented with impaired scores measuring information processing speed/ executive function (WAIS-IV Digit Symbol; Trail-Making Test-Part B) and episodic memory tests; (2) a *minimally suboptimal neuropsychological profile* group (n=704, 59%); and a (3)*cognitively normal group (n=307, 26%).* Participants in the early MCI-like profile were older [49.13 (4.86) p= 0.002], primarily men [54.2% (104) p< 0.001], black [56.2% (108), p< 0.001], and had less education [education level of college and above= 15.1% (29), p< 0.001] compared to the cognitively normal profile. They also showed higher systolic (SBP) levels [126.11mmHg (17.99), p= 0.01], higher HDL levels [48.80 (16.47), p= 0.007], and greater cIMT across carotid regions [p's< 0.05] compared to those in the cognitively normal profile. After adjustment for age, SBP, glucose, smoking status, atherogenic cholesterol and hypertension medication use, regression analysis showed that cIMT-composite ≥50thpercentile (greater than 0.87mm) was associated with higher risk of having an early MCI-like performance [OR=2.64, 95% CI (1.62, 4.28), p< 0.001] and minimally suboptimal performance [OR=1.36, 95% CI (0.98, 1.87), p= 0.05] compared to cognitively normal performance. After adjustment, participants with cIMT-composite ≥50th percentile showed higher risk for being in the lowest GCS tertile [OR=1.80, 95% CI (1.10, 2.70), p = 0.02], but not for the middle GCS tertile, when compared with highest GCS tertile subgroup.

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Conclusions: Clustering statistical methods identified and classified midlife participants with a higher burden of cardiovascular and dementia risk factors in an early MCI-like group determined primarily by neuropsychological tests. This classification also unmasked a stronger association with subclinical atherosclerosis. These results expand previous findings to a younger, community-dwelling cohort, suggesting an emerging group, possibly at greater risk for MCI and dementia syndromes, and further supports the need for refinement of MCI/ dementia diagnostic criteria to improve characterization of cognitive phenotypes.
Keywords: cardiovascular disease**,** executive functions**,** neuropsychological assessment

28 Comparison of the Predictive Utility of Various Subjective Cognitive Complaints Using Item Level Data from Everyday Cognition (ECog) Scales

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Objective: Subjective cognitive concerns (SCC) have been identified as a risk factor for the development of cognitive impairment and dementia. How best to measure SCC to optimize their predictive utility remains unclear. The purpose of this study is to compare the association between specific memory complaints and progression to MCI/dementia and progressive cognitive decline.
Participants and Methods: Item level data from the memory domain of the self report version of the Everyday Cognition scales (ECog) was used to measure specific memory complaints at study baseline in 415 individuals who were part of the University of California, Davis Alzheimer's Disease Research Center (~50% were from a racial/ethnic minority). These individuals were subsequently followed annually for 5 years on average and at each assessment received diagnostic evaluations as well as cognitive outcomes that were not used for the diagnosis. A total of 114 individuals progressed to impairment (Mild Cognitive Impairment (MCI) or dementia); the mean time to progression was 4.9 years (sd=3.4 years, range=0.8-13.8).
Results: Five of the 8 ECog memory items were associated with diagnostic progression with the strongest associations being difficulty recalling conversations a few days later (HR = 1.36, p = 0.003) and remembering appointments, meetings, or engagements (HR = 1.38, p = 0.006). A positive complaint on 6 of 8 ECog memory items (i.e., remembering items on a shopping list, remembering things that happened recently, recalling conversations a few days later, remembering where objects were placed, remembering the current date or day of the week and remembering appointments, meetings, or engagements) was significantly associated with progressive memory decline.
Conclusions: Results indicate that there are complaints that are more sensitive to risk of subsequent development of MCI/dementia within the next 4-5 years. In particular, recalling recent conversations and events are most predictive. However, when using a continuous model of memory change, which is generally a more sensitive indicator of disease than categorical diagnosis, most memory complaints captured on the ECog were predictive of subsequent decline.
Keywords: cognitive course

29 Stability in the Clinical Diagnosis of Mild Cognitive Impairment and Dementia in European Americans and Hispanic-Latino Americans

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Objective: The interaction of ethnicity, progression of cognitive impairment, and brain biomarkers in aging remains unclear. This study investigated the stability in cognitive status classification (cognitively normal [CN], mild cognitive impairment [MCI], or dementia) and compared brain Biomarkers (MRI structural neuroimaging and amyloid PET scans) between

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European Americans (EA) and Hispanic-Latino Americans (H/L) who presented a change in cognitive status and those who remained stable over time.
Participants and Methods: 317 participants (198 females, 201 H/L, and 116 EA, *M* age = 72.26 [*SD* = 8.08], *M* years of education = 14.95 [*SD* = 3.61]) were recruited from the 1Florida Alzheimer's Disease Research Center at Mount Sinai Medical Center in Miami, Florida, and were native English or Spanish speakers. The average interval between baseline and total follow-up time was 21.67 months (*SD* = 7.11) and was not significantly different across ethnic groups. A geriatric psychiatrist administered the CDR® Dementia Staging Instrument, the Mini-Mental Status Examination (MMSE), and the Geriatric Depression Scale-SF.
A comprehensive neuropsychological battery was administered. Participants were classified into diagnostic groups using an algorithmic diagnosis. Some participants also underwent a brain MRI scanning (*N* = 236) and were tested for brain amyloid load with PET scans at baseline (*N* = 226). ANOVAs with Bonferroni post-hoc tests compared the diagnostic and ethnic groups regarding hippocampal and entorhinal atrophy. Chi-square tests contrasted the frequency of elevated amyloid across diagnostic and ethnic groups. A stability index was calculated including the number of MCI progressors (progressed to dementia at follow-up) and MCI reverters (reverted to a diagnosis of CN at follow-up).
Results: There were no significant differences in biomarkers between ethnic groups in any of the diagnostic categories. The frequency of CN and MCI participants who were progressors and non-progressors (those who remained stable or reverted to a less severe diagnosis) was similar across ethnic groups. Progressors had greater HP and ERC atrophy at baseline compared to unstable non-progressors across ethnic groups, and more significant ERC atrophy was observed among progressors of the H/L group. For EA participants with MCI, there were 60% more progressors than reverters, while among MCI H/L, there were 7% more reverters than progressors. Binomial logistic regressions, including brain biomarkers, MMSE, and ethnicity predicting progression, demonstrated that only MMSE was a significant predictor for CN participants at baseline. However, for baseline MCI participants, HP atrophy, ERC atrophy, and MMSE predicted progression.
Conclusions: This study provided information regarding cognitive status stability among H/L, which demonstrated a higher rate of reversion from MCI to CN, in contrast to EA, which calls for more investigation. Moreover, the use of MTL atrophy as a predictor of future progression to dementia, is shown to be effective among MCI but not in CN. Ethnicity and amyloid status did not predict whether CN or MCI participants would be progressors or non-progressors.
Keywords: mild cognitive impairment**,** dementia - Alzheimer's disease**,** ethnicity

30 How Many Trials of Backwards Digit Task are Enough? Discriminating Mild Cognitive Impairment Subtypes on the BDT

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Objective: The Backward Digits Span Test (BDST) asks participants to repeat blocks of seven trials of 3-, 4- and 5-digit backward for a total of 21 trials with no discontinuation. Performance on this test clearly discriminates patients with mild cognitive impairment (MCI) from patients with dementia, and between MCI subtypes. However, work has yet to examine how many test trials are necessary to discriminate between MCI subtypes. This study investigated trial accuracy of the 5-span trial

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items of BDST across different subtypes of mild cognitive impairment.
Participants and Methods: Patients from Rowan University's Memory Assessment Program (N = 136, age = 75.11 ± 6.64, education = 14.74 ± 2.65, female = 72%) were administered the BDST as part of a comprehensive neuropsychological evaluation. Patients were categorized into four clinical groups: non-MCI (N = 53), subtle cognitive impairment (SCI) (N = 18), amnestic MCI (N = 30), and mixed/dysexecutive MCI (N = 35). For group categorization, Edmonds et al., 2015 criteria was used for SCI and Jak et al., 2009 criteria was used for MCI subtypes. Hierarchical linear regression models were constructed examining the effect of MCI subtype on correct serial recall and any order recall, controlling for age, education, and sex.
Results: Using SERIAL order scoring, patients with mixed/dysexecutive MCI scored lower than all groups on all 5-span trials (*p*'s < .01). There was an effect of education on five-span trials 1, 6, and 7, with higher levels of education corresponding with better serial order scores (*p*'s < .01). Five span trials 4 (η_p^2 =.120, .123, .116) and 7 (η_p^2 = .114, .114, .141) showed the largest effect sizes. When using ANY order scoring, patients with mixed/dysexecutive MCI scored lower than all groups on 5-span trials 1 and 3 (*p*'s ≤ .01).
Conclusions: When using SERIAL order scoring, only four trials of 5-span are required to separate the mixed/dysexecutive MCI group from other groups. At the beginning and end of the 5-span trial block (i.e., trials 1, 6, and 7), an effect of education can be seen, with higher levels of education corresponding with higher trial accuracy. Education may be serving as a protective factor against testing fatigue. When using ANY order scoring, trials 1 or 3 of 5-span can separate the mixed/dysexecutive MCI group from the other groups. Future research should examine the optimal number of trials. These results emphasize the importance of multiple trials which are often not done with traditional discontinuation rules. This research should be replicated with a larger, more representative sample - as these results come from a predominantly white, female, and highly educated sample - and should be extended to other neuropsychological protocols and cognitive domains.
Keywords: mild cognitive impairment**,** working memory**,** assessment
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31 Personal Medication Regimens and Performance on Medication Management Abilities Assessments in Older Adults

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Objective: As research supporting the clinical use of medication performance-based measures continues to grow, it is important to understand whether specific everyday routine medication skills may influence performance on these tests. This study examines whether experience managing personal medication regimens equal to or more complex than the Medication Management Abilities Assessment (MMAA), a standardize four medication regimen task, influences performance on the MMAA in cognitively intact older adults (OA) and older adults with mild cognitive impairment (MCI). We hypothesized OA and MCI groups whose personal medication regimen was more complex than the MMAA would perform better on the MMAA than those with less complex medication regimens.
Participants and Methods: Using a community dwelling sample, the Medication Regimen Complexity Index (MRCI) was used to code the complexity of OA (n=242, M_{age}=70.89, M_{edu}=16.54, Caucasian=93.6%) and MCI (n=59, M_{age}=70.32, M_{edu}=16.22, Caucasian=94.9%) participant's personal medication regimen. Both the OA and MCI groups were divided into groups based on MRCI scores (MRCI groups) and number of medications (MC groups). High MRCI was defined as MRCI scores greater than or equal to the MMAA's MRCI (18 points). High MC was defined as MC greater than or equal to the MMAA's MC (4 medications). Participants also completed neuropsychological tests.

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Wilcoxon-Mann-Whitney tests were used to examine differences in MMAA performance (MMAA total, total error, undertaking and overtaking errors) between MRCI and MC groups. Spearman correlations between MMAA variables and cognitive tests were conducted. All analyses were conducted separately for the OA and MCI samples. A Bonferroni correction was applied (p<.004).
Results: No significant MMAA performance differences were found between MRCI and MC group status for either OA or MCI (ps>.004) samples. Significant relationships between MMAA total and overtaking error variables and processing speed were found for the OA group (ps<.004; r_s = .185-.224). Significant relationships between MMAA total error and processing speed and executive functioning measures were found for the MCI group (ps<.004; r_s = .372 -.410).
Conclusions: In summary, cognitive ability but not personal medication regimen impacted MMAA performance in cognitively intact and MCI older adults. OAs with slower processing speed and individuals with MCI with slower processing speed and poorer executive functioning performed poorer on a novel medication management task. These findings may be important for delivering targeted interventions to patients at a higher risk for medication management difficulties when their routine is altered. However, cognitive variables only explained 3.4%-16.8% of MMAA performance variability, indicating other factors impact performance. Our hypothesis that personal medication routine complexity and medication would indirectly capture learned medication management skills and influence performance was not supported. These results may be due to the MRCI and MC variables not capturing a complex array of medication management techniques, including personal compensatory strategy skills or support from others, which needs to be directly measured. Although cognitive ability partially explains MMAA performance, other contributing factors need to be explored.
Keywords: activities of daily living, aging (normal), mild cognitive impairment
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32 Characterization of Demographics and Cognitive Abilities in Older Adults Undergoing Transurethral Resection of Bladder Tumor

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Objective: Despite the frequency of bladder cancer in older adults which typically results in transurethral resection of bladder tumor (TURBT) and repeat general anesthesia procedures, little is known about demographic and preoperative cognitive profiles. It is hypothesized that individuals undergoing TURBT would be predominantly older males with additional medical comorbidities and lower executive function performance relative to non-TURBT peers. This study examined a cohort of TURBT relative to non-TURBT peers for: 1) demographics and comorbidity; 2) presence of mild cognitive impairment; and 3) cognitive domain contribution to key latency and graphomotor metrics from a digital cognitive screener involving clock drawing to command and copy conditions (see Davoudi, Dion et al., 2021).
Participants and Methods: This is a prospective, observational, IRB-approved investigation. Individuals age 65+ (27 with bladder cancer scheduled to undergo TURBT and 27 non-TURBT peers) completed preoperative neuropsychological measures in the domains of speeded fluency, executive function, and declarative memory and a cognitive screener using digital clock drawing test (dCDT) to command and copy conditions. Mild cognitive impairment (MCI) was based on Jak and colleagues (2009) comprehensive criteria. Pearson's r correlation coefficients assessed cognitive domains to dCDT latency and graphomotor variables (total completion time, pre-first hand latency, total ink length, and total number of strokes). Bonferroni correction was applied.

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Results: Groups significantly differed in age (TURBT: 78.78±6.65 vs. 73.56±4.52 years), education (TURBT: 14.63±2.78 vs. 16.24±2.46 years), and male sex (TURBT: 89% male vs. 56%; all p's<.05). The TURBT group had a higher comorbidity index (Charlson Comorbidity Index: 2.37±1.36 vs. 0.29±0.61, p<.001; high in coronary artery disease, chronic obstructive pulmonary disease, chronic kidney disease). The TURBT group neuropsychological performance was approximately ½ standard deviation below peers on normative standardized composites of speeded fluency, executive function, and declarative memory; all p<.05), with 8 individuals meeting MCI criteria in the TURBT group relative to 4 in the non-TURBT group. Only within the TURBT group, speeded fluency on the dCDT copy condition was associated with total completion time (r(22)=-.49, p=.02) and pen strokes (r(22)=.48, p=.02).
Conclusions: TURBT participants were older, had more comorbidities, and performed at least ½ of a standard deviation lower than non-TURBT peers on cognitive composites. TURBT preoperative dCDT performance was associated with reduced speeded verbal fluency. Longitudinal research examining the contribution of preoperative cognitive function on post-operative outcomes after TURBT is needed.
Funding: R01 AG055337 and K07 AG066813.
Keywords: mild cognitive impairment**,** medical disorders/illness**,** aging disorders
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33 Cleveland Clinic Cognitive Battery (C3B): Preliminary Validation of a Self-Administered, Digital Tool for Detecting Mild Cognitive Impairment and Early Alzheimer's Disease in a Primary Care Setting

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Objective: A substantial proportion of Mild Cognitive Impairment (MCI) and early Alzheimer's Disease (AD) patients are underdiagnosed and underreported, with an AD diagnosis typically occurring late in the disease course. An early and accurate diagnosis of MCI and early-stage AD has substantial medical, emotional, social, and economic benefits. Early, accurate detection is particularly relevant with the recent FDA approval of aducanumab (Aduhelm). The iPad-based Cleveland Clinic Cognitive Battery (C3B), consisting of measures of episodic memory and processing speed, was developed as a brief (10-minute), low cost, self-administered, fully electronic medical record (EMR) integrated, digital cognitive assessment battery designed specifically for mass screening of MCI/early AD in elders undergoing annual wellness visits in a primary care setting. The purpose of the current study is to provide preliminary validation of the sensitivity of the two C3B tests, Visual Memory Test (VMT) and Processing Speed Test (PST), in discriminating MCI from healthy, cognitively intact elders and to compare the sensitivity of the C3B to typical standardized paper-and-pencil neuropsychological (NP) instruments used in dementia clinical practice.
Participants and Methods: Thirty MCI patients (17 males; 5 Blacks; mean age = 75.1 yrs.; mean education = 15.8 yrs.) were compared to 30 demographically-matched, cognitively intact elders (18 males; 6 Blacks; mean age = 75.5 yrs.; mean education = 15.7 yrs.). MCI patients were recruited from the Cleveland Alzheimer's Disease Research Center and met clinical, neuropsychological, and biomarker criteria for MCI as determined by a diagnostic consensus conference. Healthy controls were recruited from postcard advertisements. Participants self-administered the two C3B tests (VMT and PST) and underwent the following standardized, technician-administered NP tests: Hopkins Verbal Learning Test-Revised (HVLT-R) total recall, Brief Visual Memory Test-Revised (BVMT-R) total recall, and WAIS-IV Coding subtest (CODING). For each of the five measures, the two groups were compared on effect sizes (derived from independent t-tests) and signal detection methods [area-under-the-curve (AUC) of the receiver operating characteristic (ROC) curve].

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Results: As expected, statistical differences between the two groups were highly significant ($p<0.001$) on each measure. Large and comparable effect sizes (Cohen's D) were observed for the episodic memory measures: VMT (1.7), BVMT-R (2.5), and HVLT-R (2.5). The PST effect size (1.6) was larger than the CODING effect size (0.7). The AUC of the ROC curves were high for the C3B measures [VMT (0.89), PST (0.86)] and comparable to the technician-administered NP tests [BVMT-R (0.96), HVLT-R (0.96), CODING (0.76)].
Conclusions: The self-administered VMT and PST subtests of the C3B exhibited comparable ability to discriminate MCI patients from healthy controls. Based on these encouraging preliminary data, we are currently deploying the C3B in primary care clinics. Patients complete the C3B in the waiting room immediately prior to being seen by their professional caregiver. Raw C3B data are instantaneously transferred to the cloud, where adjusted scores, based on a normative database, are computed and automatically transferred directly into the electronic medical record (EMR). Ongoing studies are being conducted to determine the accuracy of the C3B for detecting MCI/early AD in this clinical setting.
Keywords: dementia - Alzheimer's disease**,** aging disorders**,** cognitive screening

34 Cognitive and Functional Change in Patients with Cognitive Impairment during the COVID-19 Pandemic

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Objective: The COVID-19 pandemic has significantly impacted daily life for individuals with cognitive impairment (CI) and their care partners. Social isolation, less access to routine healthcare, and increased psychological distress all place individuals with CI at risk for further decline (van Maurik et al., 2020). We examined cognitive and functional outcomes for individuals with CI who completed a comprehensive lifestyle intervention program during the COVID-19 pandemic.
Participants and Methods: Nineteen patients with CI and their care partners who joined the Emory Cognitive Empowerment Program (CEP) in January-February 2020 were included. Patients completed a baseline cognitive screen (Montreal Cognitive Assessment; MoCA) and questionnaires related to emotional well-being. Care partners completed the Functional Assessment Questionnaire (FAQ) to rate patients' instrumental activities of daily living as well as burden and mood questionnaires. The CEP, which includes cognitive training, physical activity, functional independence classes, and education focused on nutrition and wellbeing, was provided from time of enrollment through March 2021. After completing the program, patients and care partners were re-evaluated. The average age of patients was 75.6 years (SD_{age}= 6.4). The sample was primarily White (94.7%), male (73.7%), and well-educated (M_{edu}= 16.72, SD_{edu}= 2.4). At baseline, patients demonstrated mild global cognitive impairment (M_{MoCA1}= 20.2, SD_{MoCA1}= 3.1) and functional impairment (M_{FAQ1}= 12.3, SD_{FAQ1}= 6.4) as rated by their care partners. Additionally, 10.5% of patients were depressed at the time of enrollment compared to 5.3% of care partners.
Results: Paired sample t-tests were used to evaluate pre- to post-program changes. These analyses revealed that patients remained cognitively impaired, but that they did not show evidence of significant cognitive decline (M_{MoCA2}= 18.8, SD_{MoCA2}= 5.1, t= 1.52, p= 0.15). Care partners rated patients as significantly more functionally impaired (M_{FAQ2} = 16.1, SD_{FAQ2} = 6.2, t= -3.46, p< 0.01). Care partners reported experiencing more burden, though this increase only approached significance (t= -2.12, p= 0.06). There was no significant change in the number of individuals who met criteria for depression. Pearson correlations were conducted to examine the relationship between perceived burden and FAQ scores. These analyses found that care partner burden was significantly associated with FAQ ratings at the end of the program (r= .80, p< .001), but not at time of enrollment (r= .44, p= 0.08).
Conclusions: Findings suggest that cognitively impaired patients enrolled in a comprehensive

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lifestyle intervention program during COVID-19 did not experience significant global cognitive decline. However, care partners rated patients as significantly more functionally impaired. It is possible that emotional distress due to increased burden related to pandemic restrictions led to increased awareness and sensitivity to patients' functional deficits. Alternatively, the MoCA may not be sensitive enough to detect decline that may have occurred. Detailed neuropsychological measures may have been more sensitive in detecting domain-specific and overall cognitive decline over the study period.

Keywords: dementia - Alzheimer's disease**,** mild cognitive impairment**,** aging disorders

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36 Classification Accuracy of CVLT-II Embedded Validity Indicators in a Simulation Experiment

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Objective: A substantial portion of individuals undergoing neuropsychological assessment are apt to exhibit non-credible performance during testing, especially those complaining of mild traumatic brain injury. The CVLT-II is commonly used to assess memory during evaluations, and includes several embedded performance validity indicators (PVTs). These include the Forced Choice Index, Wolfe et al.'s (2009) logistic regression equation, and analysis of a suppressed primacy effect. Despite individual investigations demonstrating validity of these indices, there has been no direct comparison of the three. A simulation experiment was conducted in which healthy individuals simulated responses of a mild traumatic brain injury (mTBI) on the CVLT-II, and classification accuracy of the three indices was compared.
Participants and Methods: 160 college students were randomly assigned to groups as simulators or honest responding examinees. 120 participated as simulators, and 40 participated as honest responders. Forty simulators received a terse description of mTBI symptoms, forty received an extended description, and forty received an extended description and advice on eluding detection on PVTs. The CVLT-II and Word Memory Test were administered. Forced choice recognition, the Wolfe et al. logistic regression predicted score, and summed recall from the primacy region of the CVLT-II serial position curve were analyzed as embedded PVTs.
Results: ANOVA showed no differences in primacy recall on the CVLT-II. The three simulator groups achieved higher scores than the honest responders on the Wolfe et al. regression score and forced choice index, but the test-coached participants had higher forced choice scores than the other simulators. Logistic regression showed that only the Wolfe et al. regression score and forced choice index achieved significant variance in distinguishing simulators from honest responders. Using recommended cutoffs, both achieved acceptable sensitivity (>60%) with 90% specificity. Their combined value in the logistic regression achieved 90% sensitivity and 90% specificity. This was comparable to the Word Memory Test's accuracy.
Conclusions: Suppression of the primacy effect does not appear to be a valid predictor of non-credible performance in this sample. In contrast, the Wolfe et al. score and CVLT-II Forced Choice Index individually achieved satisfactory classification accuracy using established cutoffs. Their combination via logistic regression, however, surpassed their individual accuracy alone, with sensitivity values falling at 90%. Notably, their combination was comparable to the accuracy of a standalone PVT, namely the Word Memory Test. These data are based on simulators instead of patients, thereby limiting their generalizability. Similar accuracy values may not be obtained in patients with mTBI or other populations, and these data await replication.

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Keywords: validity (performance or symptom), memory disorders, traumatic brain injury

37 A Re-Validation of the Toronto Cognitive Assessment (TorCA) for the Prediction of Amnestic Mild Cognitive Impairment

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Objective: The Toronto Cognitive Assessment (TorCA) was developed to fill a need for brief assessment measures meant to be administered by any healthcare professional or trained assistant, effectively permitting more substantive screening for amnestic mild cognitive impairment (aMCI) on a wider scale. A recent study (Freedman et al., 2018) validated the TorCA for detection of aMCI. Our aim was to re-validate this measure in an independent sample of community dwelling older adults.
Participants and Methods: Ninety-four adults aged 60-89 were recruited from Baycrest Health Sciences Centre, and completed a gold standard neuropsychological assessment for differential diagnosis of normal cognition (NC) or aMCI (by consensus of 3 staff neuropsychologists). Participants also completed the iPad assisted version of the TorCA. Logistic regression (LR) and ROC analyses were used to examine the utility of the TorCA Total Score to detect aMCI in our sample. Additional LR analyses were conducted in an attempt to replicate previous results indicating improved predictive utility when considering performance on four specific TorCA indices, as opposed to the Total Score (i.e., Immediate Memory Recall, Delayed Memory Recall, Visuospatial, and Working Memory/Attention/Executive Control), and to explore alternative LR models utilizing data from all seven TorCA indices. Results obtained in our sample are compared with those seen in the initial validation study.
Results: Fifty-four participants were diagnosed with aMCI and 40 as NC, with no age, gender, education, or IQ differences between groups. In our sample, the TorCA Total Score predicted aMCI with a sensitivity and specificity (with 95% CI's) of .76 [.65-.87] and .63 [.48-.78], respectively, with PPV and NPV of .73 [.62-.85] and .66 [. 51-.81), respectively. The abovementioned four TorCA index scores considered together did predict slightly better than the total score alone, with sensitivity and specificity of .76 [.65-87] and .65 [.50-.80], respectively, and PPV and NPV of .75 [.63-.86] and .67 [.52-81], respectively. An alternative LR model including the Orientation, Delayed Memory Recall, Delayed Memory Recognition, Visuospatial, and Working Memory/Attention/Executive Control indices had somewhat improved predictive utility over the four index LR model, with a sensitivity and specificity (with 95% CI's) of .78 [.67-.89] and .75 [.62-.88], respectively, with PPV and NPV of .81 [.70-.91] and .71 [. 58-.85), respectively.
Conclusions: The overall accuracy of the TorCA against the gold standard in our sample was 70% using Total Score performance, with improvement to 77% accuracy in classification using a LR model considering performance on five TorCA indices. Results in our sample are not as robust as those originally observed by Freedman et al., (i.e., 79% accuracy for the Total Score and 92% accuracy for their four index LR model). Potential factors impacting classification accuracy include differences in sampling strategy and clinical diagnostic criteria used in the present study. Despite somewhat more modest accuracy observed in the current sample, our outcomes continue to support the validity of the TorCA as a screening tool with potential to streamline the pre-assessment for aMCI by medical practitioners.
Keywords: cognitive screening, mild cognitive impairment, aging disorders
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38 Personality predictors of compensation in cognitively healthy older adults and individuals with mild cognitive impairment

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Objective: Research supports the importance of compensatory strategies (CS) to improve everyday functioning and reduce caregiver burden. Cognitive abilities, mood, and memory confidence have been found to affect CS. However, there is limited research on the influence of personality on CS, particularly among older adults with cognitive impairment. This study's primary aims were to evaluate the impact of personality on CS and whether this differs between cognitively healthy older adults (HOA) and those with mild cognitive impairment (MCI). A secondary aim was to examine differences in self- and informant-report of CS.
Participants and Methods: 94 HOA (age *M* = 75.78; *SD* = 6.99) and 22 MCI (age *M* = 74.8; *SD* = 31.4) participants completed the Revised NEO Personality Inventory (used to assess agreeableness, neuroticism, openness to new experience, conscientiousness, and extraversion) and self-report measures from the National Institutes of Health (NIH) Toolbox (used to assess sadness, meaning in life, self-efficacy, anger, emotional support, instrumental support, loneliness, and positive affect). A grit scale was also completed. Self- and informant-report from the Everyday Compensation (EComp) Scale were used as measures of CS.
Results: Per self- and informant-report, HOAs utilized more strategies than MCI participants; however, both MCI and HOA participants endorsed using more CS than their informants noted. After controlling for age and group status (MCI/HOA), agreeableness and anger were significant negative and positive predictors, respectively, of self-report CS, and openness was a significant positive predictor of informant-report CS. For self-report, significant group by emotional support, instrumental support, and positive affect interactions negatively predicted CS. Using a moderation model, all three personality factors were significant focal predictors at the level of MCI. Neuroticism and anger were also significant positive predictors for MCI and HOA CS, respectively. For informant-report, a significant group by openness interaction predicted CS and openness was a significant focal predictor at the level of HOA. Grit and conscientiousness were also positive predictors of HOA and anger was a positive MCI CS predictor.
Conclusions: Personality factors that influence compensation appear to differ between group (MCI/HOA) and by CS source (self/informant). Overall, higher levels of openness, conscientiousness, and grit were related to increased CS use in HOA. However, higher rates of emotional and instrumental support and positive affect were related to lower CS use in MCI. Surprisingly, anger was the only common personality factor that predicted both MCI and HOA CS use. Results suggest that individuals with MCI with low levels of compensation may be overly reliant on their support network and may benefit from intervention (possibly focused on increasing openness, conscientiousness, and grit) to improve CS use, thereby improving independence.
Keywords: personality**,** everyday functioning**,** mild cognitive impairment

39 Perceived Workload on Verbal Memory Performance in Spanish-English Bilingual Traumatic Brain Injury Survivors

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Objective: The California Verbal Learning Test, Second Edition (CVLT-II) is a cognitive task that

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examines verbal memory. Studies show that persons with traumatic brain injury (TBI) underperform on the CVLT-II compared to healthy comparison adults. Additionally, research shows that bilingualism impacts cognition. In 2018, Hardy and Wright conditionally validated a measure of perceived mental workload: the NASA-Task Load Index (NASA-TLX). Researchers have reported that persons with TBI exhibit higher levels of perceived workload on memory tasks compared to healthy comparison adults. Furthermore, studies have shown that bilingual speakers report higher perceived workload on cognitive tasks compared to monolingual speakers. We evaluated the relationship between TBI and language on CVLT-II performance and perceived workload ratings. We expected that persons with TBI would underperform on the CVLT-II compared to healthy comparison participants; meanwhile the TBI participants would demonstrate higher perceived workloads. In addition, we expected that the bilingual group would underperform on the CVLT-II compared to the monolingual group; meanwhile, the bilingual group would demonstrate higher perceived workloads.
Participants and Methods: The sample consisted of 32 TBI (17 English-monolinguals; 15 Spanish-English bilinguals) and 50 healthy comparison (26 English-monolinguals; 24 Spanish-English bilinguals) participants. The CVLT-II was used to evaluate verbal memory performances and perceived performance was assessed by the NASA-TLX. TBI participants were tested 6 months or more post-injury. All participants passed performance validity testing.
Results: ANCOVAs controlling for age revealed that the healthy comparison group outperformed theTBI group on all CVLT-II tasks except the recognition discriminability task, p's<.05, np^2 =.11-.14. We found significant interactions on the CVLT-II short-delay cued recall and long-delaycued recall tasks where the bilingual TBI group outperformed the monolingual TBI group and the monolingual healthy comparison group outperformed the bilingual healthy comparison group, p<.05, np^2 =.10. Additionally, we found an interaction on the long-delay free recall where the bilingual TBI group outperformed the monolingual TBI group, p=.049, np^2 =.05. Next, on the NASA-TLX, we found that the TBI group reported higher levels of frustration and overall perceived workload on the CVLT-II compared to the healthy comparison group, p<.05, np^2 =.07-.12. Finally, an interaction emerged in perceived performance ratings, where the bilingual TBI group reported better perceived CVLT-II performances compared to the monolingual TBI group and the monolingual healthy comparison group reported better perceived CVLT-II performances compared to the bilingual healthy comparison group, p=.012, np^2 =.08.
Conclusions: As expected, participants with TBI demonstrated increased memory deficits and increased frustration compared to healthy comparison participants. However, we found that bilingual persons with TBI outperformed monolingual persons with TBI on several CVLT-II tasks; meanwhile, they reported better performance on CVLT-II tasks. Our results show that bilingualism may positively alter the expected trajectory of recovery (i.e., serve as a neuroprotective factor) and affect perceived performance on verbal memory tasks in TBI participants. Future research with a larger sample size should examine if bilingual persons with TBI that learned to speak English first compared to second impacts perceived workloads on the CVLT-II.
Keywords: memory complaints**,** traumatic brain injury**,** language
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40 Differences in Learning Characteristics in People with Systemic Lupus Erythematosus (SLE)

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Objective: Systemic Lupus Erythematosus (SLE) is an autoimmune disorder characterized by the presence of autoantibodies that can impact any system in the body, including the central nervous system (CNS). Cognitive dysfunction is well established in people with SLE. Memory difficulties are one of the more

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notable and severe areas of impairment in SLE. However, little is known about the specific type of learning dysfunction exhibited in this population. Thus, we sought to identify differences in learning characteristics in people with SLE when compared to healthy individuals.
Participants and Methods: We administered the California Verbal Learning Test: second edition (CVLT-II) to 59 female participants. Of those, 23 were healthy controls (HC), and 36 were diagnosed with SLE. Groups were not significantly different on mean years of education ($p > 0.05$); however, the average age of HCs ($M = 32.65$) was significantly lower than the SLE group ($M = 40.89$; $p = 0.01$). Average duration of diagnosis in individuals with SLE was 11.89 years.
Results: T-tests were conducted to compare groups on various measures of learning generated from the CVLT-II. As expected, people with SLE were found to have worse overall recall than HCs (Short Delay Free Recall [SDFR] $p = 0.019$) and a greater loss of information after a distractor (SDFR vs Trial 5 $p = 0.02$). Difficulty with discrimination was also shown on several variables (Total Intrusions $p = 0.062$, Total Cued Intrusions $p = 0.027$, Total Recognition Discrimination $p = 0.039$, Source Recognition Discrimination $p = 0.012$, Semantic Recognition Discrimination $p = 0.056$, and Total Recall Discrimination $p = 0.056$). All other learning and memory variables were not statistically significant ($p > 0.05$).
Conclusions: Results show a weaker learning profile in people with SLE compared to HCs. The specific differences suggest susceptibility to interference and difficulty with recall and recognition discrimination. The data do not suggest overt impairment on measures of encoding. Rather, the group difference more likely suggest dysfunction in the executive control of memory. Further research should identify disease specific characteristics that may underlie the learning differences, such as disease severity, illness comorbidities, or antibody presence in samples matched for age.
Keywords: learning**,** memory complaints**,** cognitive functioning
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41 A Moderation Analysis Evaluating the Relationship Between Processing Speed and MoCA Versus RBANS Memory Performances

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Objective: This study examined if and to what extent the relationship between memory performances on two commonly used cognitive assessment tools (i.e., Montreal Cognitive Assessment; MoCA and Repeatable Battery for the Assessment of Neuropsychological Status; RBANS) differs by degree of processing speed ability (as measured by Trails Making Test A & B; TMT A & B, and RBANS Coding). It was hypothesized that the correspondence between these two memory tasks would be smaller as processing speed slowed due to differences in the number of learning trials.
Participants and Methods: The sample consisted of 121 adults, 73 females (60.3%). White individuals made up the majority of the sample (96.7%; Black = 2.5%; Hispanics = 0.8%). The average age was 79.36 years (SD = 5.97, range = 51-91 years) and the average education was 13.07 years (SD = 2.8, range = 3-20 years).
The data were derived from an existing database of participants administered a brief neuropsychological battery and cognitive screening (i.e., MoCA) on the same date as part of their standard clinical evaluation by neuropsychology and neurology within a multidisciplinary neurocognitive clinic. A composite score for processing speed was created by calculating an average z-score for each participant on processing speed tasks (i.e., TMT A, TMT B, RBANS Coding). Correlations between processing speed and memory tasks (MoCA Delayed Recall vs. RBANS List Recall) were examined. A multiple linear regression was then conducted to evaluate a moderation model of the impact of processing speed on the relationship between memory tasks.
Results: Significant correlations were found between RBANS List Recall (RBANS LR) and

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MoCA Delayed Recall (MoCA DR; $r = 0.56$, $p < 0.001$) and between RBANS LR and the processing speed composite (PSC; $r = 0.34$, $p < 0.001$). The correlation between MoCA DR and the PSC approached significance ($r = 0.18$, $p = 0.053$). For the moderation analysis, main effects of MoCA DR ($t = 6.61$, $p<0.001$, $r_{MoCA\ DR\ (RBANS\ LR.\ PSC,\ Interaction)} = .48$) and processing speed composite ($t = 3.35$, $p = 0.001$, $r_{PSC\ (RBANS\ LR.\ MoCA\ DR,\ Interaction)} = .24$) were statistically significant. However, the interaction between MoCA DR and PSC on RBANS DR was not significant ($t = 1.66$, $p = 0.099$, $r_{Interaction\ (RBANS\ LR.\ MoCA\ DR,\ PSC.)} = .48$).

Conclusions: The results indicated significant relationships between memory tasks (i.e., MoCA DR and RBANS LR), as well as between processing speed and memory, with faster processing speed associated with improved memory performance. This is consistent with prior literature examining the relationship between processing speed and memory (Salthouse & Coon, 1993; Diamond, Johnson, Kaufman, & Graves, 2008; Tam & Schmitter-Edgecombe, 2013). However, the interaction between the PSC and MoCA DR on RBANS LR was not significant. This indicates that within our sample, an individual's processing speed abilities did not significantly impact the relationship between the two memory measures.

Keywords: memory disorders

42 Learning in the Absence of Training: Speed of Learning for Trained and Derived Relations using a Novel Stimulus Equivalence Paradigm

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Objective: Stimulus equivalence studies suggest that 1) learning can occur after a single training episode and 2) new relations can be established in the absence of explicit training. In this study, we developed a novel stimulus equivalence task that assesses the extent to which arbitrary relationships can be established among English consonant letters or abstract symbols from the Georgian language, with and without explicit training. We compared response times (RTs) for learning of explicitly trained relationships and derived relationships that lacked explicit training.

Participants and Methods: Participants were 52 young adults aged 18 to 29 years (73.1% female). Participants were explicitly trained on two associations (e.g., A à B and A à C). Participants were subsequently tested on the identification of these two explicit relations and the identification of four additional derived relationships between items that were not explicitly trained during training. Thus, six relations for three different stimulus sets were tested in each condition: A à B and A à C (trained); B à A and C à A (symmetry); and B à C and C à B (transitivity). Three-way repeated measures ANOVA assessed differences in RT to correct responses with stimulus type (letters and symbols), relation type (trained, symmetry, and transitivity), and trial number (1-6) as within-subjects factors.

Results: Participants responded faster to letters than to symbols, $F(1,33) = 39.44$, $p < .001$. Participants also responded to trained relations faster than derived symmetry ($t(33) = -2.68$, $p = 0.009$) and transitivity relations ($t(33) = -6.85$, $p < .001$) and to symmetry relations faster than transitivity relations ($t(33) = -4.17$, $p < .001$). RTs were also significantly faster overall for trial one than trial two and significantly slower for trial two than trials three through six, suggesting that RT peaks on trial two and then asymptotes by trial three. Lastly, for letters, trained relations were identified significantly faster than both symmetry and transitivity relations on trials one through three, but RTs for all three relations converged by trial 4. For symbols, trained relations were significantly faster than transitivity and symmetry relations on trials two and three. RTs for all three relations began to converge by trial 4, although transitivity RTs remained slightly slower than RTs for trained and symmetry relations.

Conclusions: After a single training, participants learned not only the two trained relations, but they automatically learned four additional relations between stimuli not previously taught. RTs were fastest for trained relations, followed by symmetry relations, then transitivity relations. Response times were also quicker for English letters as stimuli compared to

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abstract symbols. While initial RT differences were observed between the three relations, it is noteworthy that relationships between stimuli that were not initially taught came to be recalled as fast as relations that were initially trained by trial 4. This phenomenon of learning in the absence of training seen in healthy younger adults would be worthwhile to evaluate over the age span and in neurodegenerative conditions. Impairment in deriving symmetry and transitivity relations could reflect a cognitive risk factor.
Keywords: memory: normal**,** learning**,** computerized neuropsychological testing
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43 Subjective Memory and Spatial Abilities in Patients with Hippocampal Amnesia

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Objective: Hippocampal amnesic patients have been seminal in advancing our understanding of episodic, semantic, and spatial memory, and the role of the medial temporal lobes in mediating them. There is anecdotal evidence that amnesic patients HM and KC had insight into their anterograde amnesia, but the nature and extent of this insight has never been formally tested, especially in the spatial domain. Due to their stable and profound memory deficits, these patients can inform how other individuals with memory deficits understand and update information about themselves over time, and the sensitivity and specificity of standardized measures of subjective memory and spatial abilities.
Participants and Methods: Two well-characterized patients (DA, BL) with bilateral hippocampal damage who have different degrees of anterograde amnesia (severe and moderate, respectively) were tested. A control sample (N =115) matched in terms of age, education, and sex also participated. Testing took place online. Subjective memory measures included the Multifactorial Memory Questionnaire (MMQ; Troyer & Rich, 2017) and Survey of Autobiographical Memory (SAM; Palombo et al., 2013). Subjective spatial measures included the Santa Barbara Sense of Direction Questionnaire (SBSOD; Hegarty et al., 2002), Navigational Strategies Questionnaire (NSQ; Brunec et al., 2018), Wayfinding Questionnaire (WQ; Van der Ham et al., 2013), and a new Changes in Navigation Questionnaire (CNQ). To the best of our knowledge, this is the first time all of the above test measures have been administered to adult-onset hippocampal amnesic patients. Established measures assessing mood (Kroenke et al., 2001; Spitzer et al., 2006), new spatial learning (Four Mountains Test; Burles & Iaria, 2020), and associative memory (Face-Name Task; Troyer et al., 2011) were also included.
Results: Patients showed impaired performance compared to controls on objective metrics of new spatial learning and associative memory, corresponding to their deficits following hippocampal damage. On the MMQ, they both reported significantly lower appraisals of their memory abilities, poor memory satisfaction and greater reliance on compensatory strategies. Patients' appraisals of their episodic and semantic abilities on the SAM were comparable to those of controls. Only DA reported poor navigational ability compared to controls on the SBSOD, and greater reliance on map-based strategies on the NSQ than BL, reflecting optimal premorbid spatial strategies. On the WQ both patients showed significant elevations on the spatial anxiety subscale and both patients reported more changes in spatial abilities compared to controls on the CNQ. Both patients had elevated symptoms of anxiety and depression on screening measures.
Conclusions: The findings suggest that individuals with hippocampal amnesia do learn about their diminished memory and spatial abilities post-injury, particularly for those abilities which are exercised often and for which they receive feedback in daily life, as captured on the MMQ, CNQ and WQ Spatial Anxiety Subscale. No consistent differences were found, however, between patients and controls on tests that are oriented toward general, pre-morbid abilities (SAM, SBSOD, most WQ subscales). Our

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results suggest that the most sensitive tests of subjective cognitive decline and memory compromise are those that assess everyday memory and spatial abilities and place minimal weight on general, premorbid knowledge and skill.
Keywords: amnesia**,** memory complaints**,** metamemory
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44 Relationship Between Serial Position Effect and Salivary Cortisol in Older Adults

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Objective: The serial position effect is the tendency to recall items at the beginning (primacy) and end (recency) of a list best and the middle items the worst, demonstrated by a 'U-shaped' profile. Alternatively, individuals with memory impairment often demonstrate a 'J-shaped' profile, with a diminished primacy effect. Research suggests that an attenuated primacy effect on a word list learning task could be one of the earliest indicators of cognitive decline in older adults. Research has also shown that chronic elevations in cortisol are related to hippocampal atrophy and decreased learning and recall. Given the rehearsal and encoding required to recall words at the beginning of a list, we hypothesized that reduced primacy would be related to higher cortisol levels in older adults.
Participants and Methods: Data were taken from a deidentified dataset of 103 community-dwelling older adults (≥ 50 years of age) with no evidence of dementia who participated in a larger study on memory and stress (full study N=123) and who had cortisol data available for analyses. The sample was 56% female and 95.1% White, with a mean age of 60.56 (*SD*=8.275) and mean education of 15.03 years (*SD*=3.336). The Auditory Verbal Learning Test (AVLT) was used to assess the serial position effect. Primacy and recency were determined by summing the total correct words from the first ⅓ and the last ⅓ of the list, respectively, and were measured for trials 1-5 as well as immediate and delayed recall. Relative strength of primacy versus recency was also calculated by subtracting the recency score from the primacy score, such that positive scores indicate better primacy than recency and negative scores indicate worse primacy than recency (J-shaped profile). Salivary cortisol levels were indexed by the area-under-the-curve (AUC) using 6 sampling time points (initial, pre-AVLT, after an intervening working memory task during the delay, after AVLT delayed recall, and two during a post-test relaxation period).
Results: Four outliers on salivary cortisol AUC were removed prior to analyses. Pearson correlations were calculated for salivary cortisol relative to primacy, recency, relative strength of primacy for learning over trials (sum of trials 1-5), immediate recall, and delayed recall. Higher salivary cortisol AUC was correlated with worse AVLT delayed recall primacy (r=-.271, p=.006) and worse delayed relative strength of primacy (r=-.198, p=.047). Additionally, higher salivary cortisol AUC correlated with worse recency learning over trials (r=-.200, p=.045).
Conclusions: As hypothesized, salivary cortisol was related to worse primacy and relative strength of primacy, but only on the delayed recall trial of the AVLT, suggesting cortisol had a stronger association with long-term memory. Unexpectedly, salivary cortisol was also related to recency, but only during learning trials, suggesting, at least acutely, a relation of cortisol to attention. Future research should investigate the relationship between cortisol and serial position effects using larger and more diverse samples. Prospective studies might track the relationship of cortisol to changes in memory over time, using longer-term measures of cortisol such as hair cortisol concentrations.
Keywords: verbal abilities**,** hormones**,** aging (normal)
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45 Gender Differences in Serial Position Effect in Older Adults

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Objective: The serial position effect is the tendency to recall items at the beginning (primacy) and end (recency) of a list best and the middle items the worst. Primacy depends on one's ability to rehearse items at the beginning of the list, while the remainder of the list is presented, and move them to long-term storage; it is believed to indicate long-term memory. Alternatively, recency depends on short-term storage and working memory and therefore is anticipated to decline during recall trials, as recency items are less likely to move to long term storage. Research suggests that an attenuated primacy effect on a word list learning task could be one of the earliest indicators of cognitive decline in older adults. While research shows a verbal memory advantage in women across the lifespan, few studies have examined whether there are gender differences in the serial position effect. We examined whether there were gender differences in serial position effects in older adults.
Participants and Methods: Data were obtained from a deidentified dataset of 112 community-dwelling older adults (56% female, 93.5% White, mean age 60.56 (*SD*=8.275), mean education 15.02 years (*SD*=3.298)) with no evidence of dementia who participated in a larger study on memory and stress (full study N=123) and who had completed all measures of interest for the current analyses. The Rey Auditory Verbal Learning Test (AVLT) was used to assess the serial position effect. Primacy and recency were assessed with the sum of total correct words on the first ⅓ and the last ⅓ of the list, respectively, for trials 1-5, as well as immediate and delayed recall. Data were analyzed with 2 (gender) by 7 (AVLT trials) mixed model ANOVAs, one for recency and one for primacy.
Results: Collapsed across trials, women performed better than men on both recency (p=.038) and primacy (p=.001). For recency, there was a significant quadratic main effect of trials collapsed across gender (p<.001), such that the overall pattern showed increases in recency over time, but then a decline at immediate recall. There was no interaction with gender (p=.085). For primacy, there was a significant trial by gender interaction (p=.04). In initial learning trials, there were no gender differences in primacy, but there were significant gender differences in learning trials 3 (p=.005) and 5 (p=.036), with women outperforming men. These gender differences were sustained through immediate (p=.004) and delayed recall (p<.001).
Conclusions: Women and men followed the same pattern of learning and recall for recency, showing a decline in recency recall from learning trial 5 to immediate recall, which is consistent with recency as an indicator of short-term memory/attention. However, for primacy, gender interacted with trials, such that, over learning trials, the general female advantage in verbal memory emerged and was sustained during immediate and delayed recall. These results suggest that there may be gender differences in the degree to which primacy/recency patterns could predict future dementia for men and women, which should be explored further in future studies.
Keywords: demographic effects on test performance**,** verbal abilities**,** aging (normal)
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46 Prefrontal Cortex, Not Medial Temporal Lobe, is Associated with Memory in Middle-Aged Persons with HIV

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Objective: Aging with HIV is associated with accelerated brain aging and a greater risk of neurocognitive impairment, particularly memory deficits. Learning and memory impairment in people with HIV (PWH) have been associated with prefrontal cortex and basal ganglia dysfunction, resulting in a "subcortical profile" in which learning and delayed recall are impaired but recognition memory is spared. For the first time, a large group of PWH are reaching middle- and older-age. Therefore, it is unclear whether memory performance in older PWH is more characteristic of the frontal-subcortical pattern commonly seen in younger HIV cohorts or indicative of age-associated dementias such as Alzheimer's disease in which the medial temporal lobe (MTL) and learning, delayed recall, and recognition are all impacted. To address this gap, this study examined the relationship between all three components of episodic memory (learning, delayed recall, and recognition) and prefrontal and basal ganglia structures (implicated in HIV-associated cognitive deficits), as well as MTL structures (implicated in Alzheimer's disease).
Participants and Methods: Analysis included 93 PWH between the ages of 45 and 68 (Mean age=51±5.9 years, 85% male, 50% Black/39% non-Hispanic White) from the CNS HIV Antiretroviral Therapy Effects Research (CHARTER) multi-site study. Participants underwent neuropsychological testing and structural MRI. Eighty-nine percent of participants were on antiretroviral therapy (ART) and 73% had undetectable plasma HIV RNA. Participants completed tests of verbal and visual learning, delayed recall, and recognition (Hopkins Verbal Learning Test-Revised, Brief Visuospatial Memory Test-Revised). Demographically-corrected T-scores were calculated and then averaged to obtain learning, delayed recall, and recognition composites. FreeSurfer 7.1.1 was used to measure prefrontal structures (caudal middle frontal, rostral middle frontal, pars opercularis, pars orbitalis, and pars triangularis thickness), basal ganglia structures (caudate and putamen volumes), and MTL structures (hippocampal volume, entorhinal cortex thickness, and parahippocampal thickness). Multivariable linear regressions tested the association between the individual neuroanatomical measures and episodic memory outcomes. All models covaried for scanner, relevant imaging covariate (i.e., intracranial volume for volumes or mean cortical thickness for regional cortical thickness), and comorbid conditions and HIV disease characteristics (e.g., lifetime methamphetamine use disorder, major depressive disorder, ART status) related to the episodic memory outcomes.
Results: Thinner pars opercularis thickness was associated with worse learning (β=.36, *p*=.01), delayed recall (β=.39, *p*<.01), and recognition (β=.41, *p*<.01). Thinner rostral middle frontal thickness was also associated with worse learning (β=.34, *p*=.03) and delayed recall (β=.37, *p*=.02) but not recognition (β=.18, *p*=.21). Learning, delayed recall, and recognition were not significantly associated with basal ganglia, MTL, or other prefrontal structures (all *p*'s>.10).
Conclusions: Findings suggest that episodic learning and memory in middle-aged PWH are associated with prefrontal structures and not with MTL structures. This may suggest that, at least in middle age, learning and memory performance is more likely related to frontally-mediated etiologies, such as HIV, rather than early Alzheimer's disease pathology. However, this data is cross-sectional and continued research is needed to understand the relationship between episodic memory and preclinical signs of Alzheimer's disease, particularly as more PWH reach the sixth and seventh decades of life.
Keywords: HIV/AIDS**,** neuroimaging: structural**,** frontal lobes
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47 Investigation of the Relationship Between Circulating Endocannabinoid Concentrations and Episodic Memory in Preadolescents from the ABCD® Study Cohort

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Objective: The endogenous endocannabinoid (eCB) system is composed of cannabinoid receptors and two endogenous ligands (N-arachidonoyl ethanolamine, AEA and 2-arachidonoylglycerol, 2-AG) and has been implicated in supporting neuroplasticity and brain development. Preclinical research suggests that eCB system signaling modulates memory performance, however, the directionality of this relationship in human adult research is less consistent. Further, eCB signaling in limbic regions changes during adolescence. While these findings suggest the importance of the eCB system's role in brain development and cognition, limited research has investigated how differences in eCB concentrations is related to cognitive performance during early adolescent development. The current study aims to investigate whether serum AEA and 2-AG serum concentrations are associated with episodic memory performance in preadolescents from the Adolescent Brain Cognitive Development[SM] (ABCD) Study.
Participants and Methods: The current sample (110 youth; M_{age}= 11.9; range = 10.8-12.9 years old; 44.5% female; 64% non-Hispanic White) was drawn from the larger ABCD Study cohort, who were recruited at 9-10 years old. At 2-year follow-up, participants completed an optional blood draw, in which serum eCB concentrations were measured, and a questionnaire that assessed factors that may impact circulating eCB concentration (i.e., current pain and stress levels, recent exercise, and last mealtime). Participants were administered the NIH Toolbox Picture Sequence Memory Task and Rey Auditory Verbal Learning Test (RAVLT) to assess episodic memory performance. For the RAVLT, total words correct for Trials 6 and 7 were used as short and long delay outcomes, respectively. Separate linear regressions were conducted to examine the association between serum eCB concentrations and episodic memory performance in preadolescents while controlling for sex at birth and known factors that alter circulating eCB concentrations.
Results: Higher 2-AG serum concentration was associated with poorer performance on the picture sequence memory task (b= -.12, p=.04) and lower scores on RAVLT short delay recall (b= -.041, p=.08). AEA serum concentration was not significantly related to performance on either task. Secondary findings indicated that females remembered significantly more words on the RAVLT long delay recall task compared to males (p=.03).
Conclusions: Higher circulating 2-AG concentration was associated with poorer memory performance in preadolescents, while AEA concentration was not related to the selected memory outcomes. These preliminary findings are consistent with an adult sample with osteoarthritis pain (La Porta et al., 2015); however, clinical research has yet to be conducted in healthy youth. Therefore, additional longitudinal investigations into the relationship between circulating eCB levels and memory performance, and whether current mood, stress, or pain mediate these findings, in youth are needed.
Keywords: adolescence**,** memory: normal**,** neurotransmitter systems
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48 Is Personality Associated With Verbal and Visual Memory In Healthy Young Adults?

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Objective: Research on the cognitive correlates of personality has most commonly addressed the relationship between personality traits and

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executive functioning, but fewer studies have assessed the association between personality and memory. The extant literature generally suggests an association between higher levels of openness and greater recall of episodic memory and has predominantly focused on older adults, although some studies have instead found associations between *in*flexibility and memory. It is unclear whether trait conscientiousness, a robust predictor of academic performance, may also be associated with performance on memory tasks and whether these observed associations are present in healthy young adults. The purpose of this study was to evaluate the association between verbal and visual memory and dimensions of personality among healthy young adults. We hypothesized that higher levels of trait openness and conscientiousness would be associated with better performance on memory tasks.
Participants and Methods: University students from the Bronx, NY (*N*=79; mean age=20.4, Female=69.6%) were evaluated at two time points (baseline, two-week delay). Verbal memory was assessed using a modified version of the Rey Auditory Verbal Learning Test (ModRey, 20 words, 3 list A learning trials, 1 list B learning trial) adapted to assess variability in memory performance among non-clinical and preclinical populations. Visual memory was assessed using the Rey Complex Figure Task (RCFT). Both the ModRey and RCFT included an immediate recall, 30-minute delayed recall, and 2-week delayed recall conditions. Participants were unaware they would be re-tested on memory items after the 2-week delay. Personality was measured with the 50-item International Personality Item Pool (IPIP-50) and subscales were calculated for openness/intellect, conscientiousness, extraversion, agreeableness, and neuroticism. Estimated intellectual ability was assessed using the Weschler Test of Adult Reading (WTAR).
Results: A series of Pearson's *r* correlations were used to evaluate relationships between the Big-5 personality traits and performance on verbal and visual memory tasks. WTAR scores were unrelated to performance on verbal and visual memory tasks after a 2-week delay and as a result were not controlled for in subsequent analyses. Consistent with study hypotheses, openness/intellect was related to 2-week delayed recall of both List A (*r*=.30 *p*=.007) and List B (*r*=.33, *p*=.003) on the ModRey, as well as the proportion of words retained over the 2-week delay on List A (*r*=.30, *p*=.007) and List B (*r*=.32, *p*=.005). No other personality trait was associated with verbal memory, and all correlations between personality and visual memory (RCFT) were nonsignificant.
Conclusions: This study of healthy young adults revealed associations between trait openness/intellect and verbal memory performance after a 2-week delay. The use of a 2-week delay also suggests these are durable relationships. Contrary to our hypothesis, conscientiousness was unrelated to either verbal or visual memory. Trait openness/intellect may be related to flexible or adaptive strategies for the retention of material, greater levels of curiosity and engagement regarding the task, or historical exposure to cognitively enhancing activities. Understanding the connections between personality and cognitive ability has important implications for theoretical and applied research, and future work is necessary to further explore the mechanisms by which this connection operates.
Keywords: personality**,** memory: normal

49 Emotional Context-Dependent Effect: Perceptual vs. Conceptual processes

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Objective: Context-Dependent Effect (CDE) is a process through which restoration of the original learning context enhances the recall ability of the material being studied. There are several indications of the existence of CDE through the use of emotional scenes. Even though CDE has been studied extensively, all studies used the same type of context in the learning and test phases, only repeating or changing it (e.g., happy face in learning and angry face in test). We are not aware of any studies that examined the effect of a "conceptual CDE", namely, the effect of a distinct type of context in the learning phase (e.g., a happy expression in the learning without background) and in the test phase (e.g.,

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happy background in the test phase and neutral facial expression). In the current study, we examined CDE in different types of emotional contexts (facial expression and background scenes) through behavioral measures.
Participants and Methods: The study included 40 participants in the Face to Background (FTB) group and 35 participants in the background to face (BTF) group. All participants were students at Bar-Ilan University (Israel) and volunteers that were recruited for the study through an ad posted online. All were tested online via ZOOM software. The participants were exposed to pictures of faces with angry or happy expressions without an emotional background scene (the FTB group) or faces with neutral expressions with a positive or negative emotional background scene (the BTF group), and were requested to remember the faces for a subsequent memory test. In the testing session, they were asked to determine whether or not the person presented to them had appeared before, under two conditions: (1) where the context remains constant (FTB group: the context was represented by the background scenes, and was matched to the emotion that the face had in the learning phase; BTF: the context was represented by the facial expression, and was matched to the emotional background that appeared in the learning phase – the Repeat condition) (2) where the context changes (FTB group: the context was represented by the background scenes and was changed to a different emotion from what the face had in the learning phase; BTF: the context was represented by the facial expression that was different from the emotional background scenes that appeared in the learning phase – the Re-pair condition).
Results: CDE was found, such that the sensitivity measure was significantly higher under the Repeat condition compared to the Re-pair condition in both groups. The interaction between context and emotion was significant so that only for the negative stimulus was the sensitivity measure significantly higher when comparing the Repeat condition to the Re-pair condition. We found a similar trend of results using the measure C, C = 0.5 [z(H) + z(FA)], as a criterion or response bias. Finally, even though the effects were significant in both groups, we found a stronger effect among the BTF group.
Conclusions: This study provides evidence for the existence of conceptual CDE by using different types of emotional context in the learning and the test phases and expands our comprehension of context and its effect on memory.
Keywords: memory: normal**,** emotional processes**,** face processing

50 The Effect of Participation in Mentally Engaging Activities on Verbal Memory Functioning

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Objective: Epidemiological evidence have indicated that lifestyle factors characterized by engagement in leisure activities of intellectual and social nature is associated with slower cognitive decline in healthy elderly and may reduce the risk of dementia (Scarmeas et al., 2001; Scarmeas & Stern, 2003). The objective of this study is to examine the effect of participation in mentally engaging activities on verbal memory functioning. It was hypothesized that involvement in one or more mentally engaging activities will be related to higher performance on measures of verbal memory functioning.
Participants and Methods: We collected archival data from 308 adults referred for a neuropsychological evaluation at an outpatient clinic (Mean age = 56.9 +/- 16.4 years; Mean education = 14.9 +/- 2.7 years; 43% female). The sample was comprised of mostly individuals who identified as Caucasian (89%). Demographic characteristics (i.e., age, sex, and years of education), mood status (i.e, scores on self-reported measures of anxiety and depression), and lifestyle factors (i.e., engagement in one or more mentally challenging activities such as personal hobbies,

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and participating in one or more social and/or physical activities) predictor variables were included in two exploratory hierarchical regression models with WMS-IV Logical Memory II and CVLT-II Long Delayed Free Recall scores were used as criterion variables.
Results: In the first model, demographic characteristics (Step 1: $R^2\Delta$ = .074; p =.000), mood status (Step 2: $R^2\Delta$ =. 006; p = .487), and lifestyle factors (Step 3: $R^2\Delta$ = .03; p = .034) collectively accounted for a statistically significant amount of adjusted variance in WMS-IV Logical Memory II scores (adjusted R^2 = .08, p < 0.001). After accounting for the variances predicted by all variables, only years of education (B = .293, t = 3.485, p = 0.001) and participation in mentally engaging activities (B = 5.81, t = 2.602, p = .01) significantly predicted WMS-IV Logical Memory II scores. In the second model, the addition of lifestyle factors in the third step also contributed a significant amount of incremental variance (Step 3: $R^2\Delta$ = .036; p = .014) in prediction of CVLT-II Long Delayed Free Recall scores (adjusted R^2 = .105, p < 0.001). Again, only years of education (B = .079, t = 2.489, p = 0.014) and participation in mentally engaging activities (B = .244, t = 2.883, p = .004) significantly predicted CVLT-II Long Delayed Free Recall scores in the overall model.
Conclusions: Current results support conclusions that participating in lifestyle factors characterized by engagement in leisure activities of intellectual and social nature is associated with slower cognitive decline. Specifically, our findings suggest that along with years of education, participation in mentally engaging activities significantly predicted higher performance on tests of verbal memory, beyond demographic characteristics, mood status, and physical and social activities. It is worth noting that the social environment is potentially modifiable and thus conducive to intervention. A dedicated effort to enrich one's engagement in multiple leisure activities may help to lessen the impact that the aging process often has on neurological health.
Keywords: cognitive functioning**,** cognitive reserve**,** memory: normal

51 Elucidating the Relationship between Naming and Verbal Memory

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Objective: This study sought to determine which naming task would be the most predictive of a cognitive disorder diagnosis in veterans referred for neuropsychological evaluation and to examine whether performance on auditory naming predicts performance on verbal learning and memory tasks.
Participants and Methods: Veterans with valid cognitive test performance who completed the Auditory Naming Test (ANT), Visual Naming Test (VNT), Neuropsychological Assessment Battery (NAB) Naming, Boston Naming Test-2 (BNT-2), and California Verbal Learning Test, Second Edition (CVLT-II), during an extensive neuropsychological evaluation, were selected for inclusion. This resulted in a sample of 61 veterans (69% male; 67% White; 48% with cognitive disorder; age M= 49.51, SD=11.52). Variables of interest for confrontation and responsive naming tests included total correct, and when appropriate, tip-of-the-tongue (ToT) scores (responses given within 2-20 seconds). For the CVLT-II, total recall, short-delay free, long-delay free recall, and recognition hits were included.
Results: A logistic regression was computed to determine whether naming task performance (i.e., BNT-2, NAB naming, VNT/ANT) was predictive of neurocognitive disorder, after controlling for demographics. The model was significant, $\chi 2(12)=29.58$, $p<.01$, explaining 52.0% (Nagelkerke R^2) of the variance in diagnosis status and correctly classifying 85.0% of cases. Across naming tasks, low BNT-2 raw scores were associated with increased likelihood of a neurocognitive disorder. Separate multiple linear regression models were computed to determine if performance on confrontation and responsive naming tests significantly predicted total recall, short-delay recall, long-delay recall, and recognition performance on the CVLT-II. Results indicated that naming total correct and ToT scores accounted for 43,8% of the variance in CVLT-II total recall (R^2=.43.8, F[9,50]=4.33,

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p<.01). VNT ToT (β = -.42, p<.01). Naming total correct and ToT significantly predicted short-delay recall on the CVLT (R^2=.29, F[9,50]=2.25, p<.05) and VNT ToT significantly added to the prediction, p<.05. Naming total correct and ToT scores significantly predicted long-delay recall (R^2=.31, F[10,49]=2.19, p<.05), with VNT ToT trending toward significantly adding to the prediction, p <.06, respectively. NAB Naming VNT total correct, ANT total correct and ANT ToT responses were not predictive in any model. **Conclusions:** Findings support existing literature, illustrating that performance on naming tasks are predictive of neurocognitive disorders of various etiologies, including those not primarily associated with language impairment. Furthermore, performance on naming tasks, including confrontation naming and word-finding complaints, may relate to performance on different aspects of verbal learning and memory. Future research could examine the relationship between semantic and episodic memory in a longitudinal design.
Keywords: naming**,** memory: normal**,** neuropsychological assessment

52 Co-opting Neuropsychological Measures to Assess Pattern Separation and Perceptual Discrimination: Insights from Hippocampal Amnesia

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Objective: The brain's ability to orthogonally represent similar information to facilitate separate, fine-resolution memories is an integral process in our daily functioning. This phenomenon, referred to as pattern separation or mnemonic discrimination, is well-studied in behavioural, cognitive, and computational neuroscience, but it remains absent from standard neuropsychological assessments. Studies of memory-impaired individuals due to amnestic mild cognitive impairment and Alzheimer's disease indicate that the hippocampus is necessary for pattern separation and fine-grained perceptual (non-mnemonic) discrimination. Close consideration of multiple existing neuropsychological measures reveals select tasks that may be sensitive to pattern separation and fine-grained perceptual discrimination. In order to determine the utility of these for detecting impaired mnemonic and perceptual discrimination, we administered them to a rare individual with selective hippocampal lesions who exhibits impaired pattern separation on several experimental tasks, including the Mnemonic Similarities Test, and on tests of fine-grained perceptual discrimination (object oddity task, categorical face perception).
Participants and Methods: Patient BL is a 60-year-old male with 13 years of education who endured a brief period of anoxia following an electrical injury (1985), resulting in bilateral ischemic lesions restricted to the dentate gyrus of the hippocampus (approximately 50% along entire axis). Previous neuropsychological testing revealed that BL has average verbal and visual intelligence (WAIS-IV), attention and working memory, language abilities, and visual-spatial abilities, as well as fairly weak verbal (CVLT-3) and visual (Rey Complex Figure) information encoding and delayed recall. In the current study, BL was tested on a series of neuropsychological measures that require perceptual or mnemonic discrimination, and his performance was compared to normative data sets.
Results: Two tasks assessed mnemonic discrimination. BL was low average (10th percentile) when matching a target design amongst four options after a 1-second delay, on the Benton Visual Retention Test. On the Delayed-Match-to-Sample-48 Task (DMS-48), where BL viewed images and was asked to recognize (forced-choice) which he had seen previously, he was severely impaired (<1st percentile). Perceptual discrimination was assessed using eight tasks. On the Benton Visual Form Discrimination Test, where BL had to select which of four designs matched the template, BL's performance indicated moderate deficits (23/32). Similarly, BL performed in the low average range (14th percentile) when asked to match designs amongst arrays of increasingly similar options, on the Beery Visual Perception. On the Birmingham Object Recognition Battery, BL had difficulty determining whether two items were matched on length (0.1st percentile),

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position of a feature (<0.1st percentile), or size (16-18th percentile), but not if lines were parallel (37-40th percentile). Furthermore, he had difficulty deciding whether an animal or tool was real or a morph image (<0.1st percentile hard version; 14-16th easy version). Finally, BL's verbal (CVLT-3; 1st percentile) and visual (WRAML-3; 2nd percentile) encoding were poor, but he recalled what he encoded verbally (LDFR-T5: 25th percentile) and visually (Delayed Recall-T4: 55-58th percentile).
Conclusions: Here, we have demonstrated that a patient with selective hippocampal damage is impaired on neuropsychological measures that tap pattern separation/mnemonic discrimination and fine-grained perceptual discrimination. This work provides additional evidence of the role of the dentate gyrus in these processes and highlights a cognitive domain that should be considered in identifying patterns of deficit using currently available neuropsychological instruments.
Keywords: neuropsychological assessment**,** focal lesion**,** hippocampus
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53 Estimating the Probability of Conversion From Cognitively Healthy to Mild Cognitive Impairment: a Regression Model Based on Brain Folds and Curvatures

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Objective: Binary logistic regression models have proven to be a useful clinical tool in predicting factors that could contribute to the development of certain diseases. Studies that investigated the factors that predict mild cognitive impairment (MCI) reported an association with disease progression. Thus, we aimed to compare different predictive models to distinguish between cognitively healthy and MCI participants based on demographic, neuropsychiatric, and structural neuroimaging data.
Participants and Methods: 215 cognitively healthy participants (CH) and 355 patients with mild cognitive impairment (MCI) from the Alzheimer Disease Neuroimaging Initiative database were assessed with (1) the NeuroPsychiatric Inventory, (2) a comprehensive neuropsychological assessment, and (3) a 3T MRI. Statistical MRI data (cortical thickness, areas, curvatures, folding index, and volumes) were extracted with FreeSurfer 7.1.1. Binary logistic regression models were performed with IBM Statistics SPSS 27.0 software with the clinical group as a dependent variable and demographic, neuropsychiatric, and neuroimaging data as covariates. For each model, the characteristics of sensitivity, specificity, positive and negative predictive values, and Yule's Q coefficient were qualitatively compared to determine the best predictive model.
Results: Our model with the best results included the variables of cortical folding index, curvature and volumes of subcortical nuclei (caudate, pallidum, putamen, amygdala, hippocampus, thalamus) and spaces (ventricles, vessels). Other variables that were shown to influence the MCI prediction, were the MMSE (demographics) as well as a group of neuropsychiatric symptoms (agitation, depression, anxiety, apathy and eating disorders). Regions that were reported included: the curvature of the cingulate, temporal and insular regions and the folding index of the cingulate, frontal and temporal regions. The model presented in this study has a specificity of 92%, sensitivity of 94% and positive and negative predictive values of 95% and 90% respectively. Yule’s Q index (0.99) and Younden’s index (0.86) indicated strong relationships between the variables considered and the presence of MCI.
Conclusions: This study shows that neuropsychiatric symptoms have an important implication in distinguishing between CH and MCI patients. Furthermore, cortical curvature and folding features seem to be more specific

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and sensitive than subcortical features and other cortical factors such as cortical thickness or area. Further studies would be needed to understand the correlation between these features and biomarkers of Alzheimer's neurodegeneration (brain amyloid and tau deposits). These data are further complemented by the establishment of models to reliably distinguish MCI patients and patients with Alzheimer's disease.

Keywords: mild cognitive impairment**,** neuropsychiatry**,** neuroimaging: structural

54 Neuropsychological Functioning in Early-Stage Anti-IgLON5 Syndrome

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Objective: Anti-IgLON5 syndrome is a novel tau pathology that results in neurodegeneration. Deposits of hyperphosphorylated tau protein are frequently observed in numerous areas of the brain. The manifestation of symptoms tends to be insidious and the median age at symptom onset is generally in the mid 60s. Common symptoms include REM sleep behaviors, gait difficulties, dysphagia, ocular changes, and hallucinations, in addition to cognitive dysfunction (occurring in approximately 50% of individuals with anti-IgLON5). Cognitive decline has been described mostly in the later stages of the disease. The purpose of the case study was to offer insight into the cognitive deficits associated with early stage anti-IgLON5 syndrome.
Participants and Methods: The individual presented is an 85-year-old woman with 12 years of education with a vocational history mainly in clerical positions. She was referred for assessment of cognitive functioning in the context of self- and collateral-reported memory concerns (e.g., difficulty recalling conversations) and increasing reliance on family members for assistance with completing higher level tasks of daily living (e.g., medication and financial management) over the past three years. The individual was diagnosed with anti-IgLON5 syndrome approximately two years prior to this report. A comprehensive neuropsychological battery was administered.
Results: The primary neuropsychological findings in this profile are subtle difficulties with executive functioning including working memory and verbal learning/recognition inefficiencies (slowed learning and false positive errors). This is in line with previous studies that have reported evidence of diminished verbal memory span capacity and executive functioning problems. Interestingly, this individual did not show more significant difficulties with verbal memory or visuospatial functioning as documented in more clinically advanced cases. Overall, the findings in this case appear to support the general expectation that more prominent cognitive impairment emerges later in the disease process, and this may be especially true regarding visuospatial deficits and significant verbal learning and episodic memory problems.
Conclusions: The case presented here is of an individual who is significantly older than previously reported cases and relatively earlier in the disease process than other published cases, thereby extending our understanding of neuropsychological presentations of the disease. Weaknesses were seen in verbal working memory with a notable tendency to commit false-positive errors during the recognition memory test. Further, she did not benefit from semantic categorization. These findings are important for neuropsychologists for differential diagnosis. Specifically, the combination of behavioral features (e.g., sleep disorders, gait/movement issues, and hallucinations) with subtle cognitive changes impacting aspects of executive functioning may suggest an early anti-IgLON5 manifestation. The behavioral and cognitive features are similar to other neurodegenerative conditions, such as Lewy Body disease. Additionally, the presentation is heterogeneous and several features may also resemble other motor-variant disease processes such as progressive supranuclear palsy or multisystem atrophy. As such, anti-IgLON5 syndrome should be considered with these other low base rate conditions. The authors recommend that future studies of neuropsychological symptoms be conducted early in the processes of examining

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individuals suspected of IgLON5 antibody encephalopathy with serial neuropsychological evaluation to track decline as well as response to treatment.
Keywords: dementia - other cortical**,** executive functions**,** neuropsychological assessment

55 Verbal Fluency Intrusions in Mild Cognitive Impairment and Dementia: A Longitudinal Analysis

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Objective: Research shows intrusions in memory tests can predict cognitive impairment in abnormal aging. However, there is a need for additional research regarding the association of intrusions in verbal fluency tasks and clinical diagnosis of mild cognitive impairment, and dementia which is the aim of the current research. We expected that intrusion totals in category and phonemic verbal fluency tasks would distinguish MCI and dementia groups from cognitively normal controls and increase from year one to year 2 in MCI and dementia participants.
Participants and Methods: Participants from the 1Florida Alzheimer's Disease Research Center were diagnosed as cognitively normal (CN), with mild cognitive impairment (MCI), or dementia. Category (e.g., animals) and phonemic (e.g., letter F) fluency tasks were administered as part of a neuropsychological battery. Intrusions were identified and counted in each of these verbal tasks. They were defined as unrelated, linguistically related, phonemically related, and words that were not included in the English Dictionary.
233 participants were assessed during year 1 (M_{age} = 71.21, *SD* = 7.94; 62.2% female). Participants assessed during year 2 included 127 older adults (M_{age} = 71.54, *SD* = 7.94; 63.0% female). Univariate analyses of covariance were conducted to compare year 2 intrusion totals across year 2 diagnostic groups and year 1 intrusions across year 1 diagnostic groups. Age, sex, and education were also controlled for.

Univariate analyses were also conducted on 117 participants from year 2 (M_{age} = 70.89, *SD* = 7.86; 60.7% female) to compare year 1 intrusion totals to year 2 diagnostic groups. Linear regressions also evaluated diagnosis from year 2 as a predictor of year 1 intrusion totals in category and phonemic fluency. Covariates were age, sex, and education.
Results: Year 1 category and phonemic fluency intrusion totals had no significant differences between diagnostic groups.
In year 2, only category fluency intrusion totals were significantly different between diagnostic groups, $F(2, 121) = 7.80$, $p < .001$. There were significant differences in category intrusion totals between CN and AD ($p < .001$) and MCI and AD ($p < .001$), but no differences were observed between CN and MCI.
Only category fluency intrusion totals in year 1 were significantly different between diagnostic groups in year 2, ($F(5, 111) = 3.40$, $p = .037$. AD had significantly more category intrusions than CN ($p = .017$) but no significant differences were found between the other groups.
Clinical diagnosis of year 2 significantly predicted year 1 category task intrusion totals, suggesting an increase in these type of errors in relation to the severity of the cognitive decline ($F(4, 112) = 3.07$, $\beta = .063$, $p = .019$).
Year 1 phonemic intrusion totals were not predicted by diagnostic groups in year 2.
Conclusions: Although phonemic verbal fluency intrusions were not associated with diagnosis in the current study, category fluency intrusions seemed to have a stable association with diagnosis. This relationship was given more validity when increased intrusion totals from year 1 were aligned with increased severity of diagnosis in year 2. Further research should examine the potential for verbal fluency intrusions as an early predictor for later cognitive impairment.
Keywords: aging disorders**,** verbal abilities**,** fluency
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56 CVD Risk Factors and Neurocognitive Functioning in Older Veterans with Memory Complaints

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Objective: Risk factors for cerebrovascular disease (CVD) such as obesity, hypertension, high cholesterol and diabetes, are becoming increasingly more prevalent in the aging Veteran population. Especially when longstanding, CVD risk factors are associated with changes to brain structure, resulting in functional changes in cognition, particularly in the domains of executive functioning and memory. Recent work in our lab has reported that CVD risk factors have an additive burden in individuals with no reported cognitive complaints or overt neurologic disease. However, there is less research on whether these findings can be translated to clinical settings in which patients present with subjective cognitive complaints. . The purpose of this study was to examine the effect of CVD risk burden in Veterans presenting to an outpatient Neuropsychological clinic.
Participants and Methods: Retrospective chart review was conducted for older Veterans (100% men, aged 65-89) referred to an outpatient neuropsychological clinical for subjective cognitive concerns. All Veterans received full neuropsychological batteries consisting of similar measures that tested domains of attention, working memory, processing speed, visuospatial perception, language, learning and memory, executive functioning, and emotional distress. CVD risk factors were abstracted from the Veteran's medical record and diagnosed by their medical providers. Number of CVD risk factors (i.e., hyperlipidemia, hypertension, type 2 diabetes, evidence of microvascular changes on neuroimaging, and obesity) were then calculated and subjects were split into a low-risk (0-3 CVD RF; 14 Veterans) and high-risk (4-5 CVD RF; 6 Veterans) CVD factors groups.
Results: A one-way between subjects ANOVA revealed significant group differences in attention [DST; $F(1,18) = 5.96$, $p = 0.03$], working memory [DSB; $F(1,17) = 4.49$, $p = 0.04$], executive functioning [FAS, $F(1,16) = 4.81$, $p = 0.04$], and memory [CVLT-2 SDCR; $F(1,6) = 6.71$, $p = 0.04$], where veterans with more CVD risk factors consistently performed worse than veterans with fewer CVD risk factors.
Conclusions: hese results align themselves with prior research demonstrating more CVD risk factors are associated with poorer cognitive functioning, particularly in the domains of executive functioning and memory, in a population of male older Veterans. This supports our hypothesis that CVD risk factors have an additive negative effect on cognition in both research and clinical setting. Moreover, our findings suggest this pattern remains evident among older individuals with subjective cognitive concerns.
Keywords: cardiovascular disease

57 The Effect of Antipsychotics on Processing Speed in Geriatric Neurology Patients

Allison M Nobles, Steven A Rogers
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Objective: Antipsychotic drugs (APDs) are commonly used in the elderly population to treat the behavioral and psychological symptoms of dementia. In some clinical populations (e.g., schizophrenia), APDs can improve cognitive functioning, but there is much less research regarding the effects of APDs on cognitive functioning in the elderly. This study explores the impact of APDs on processing speed and speed-dependent measures among geriatric neurology patients.
Participants and Methods: A total of 416 patients (184 women, *M* age = 73.92, *M* = education = 14.80) participated in comprehensive neuropsychological assessment as part of outpatient neurological evaluations. Processing speed and speed-dependent measures included Trailmaking A & B, DKEFS, COWAT FAS and Animals, and WAIS-IV Coding, Arithmetic, Picture Completion, & Block Design.
Results: Patients taking APDs had significantly slower speeds on the set of processing speed and speed-dependent cognitive measures relative to those not taking APDs, Wilks $\lambda = .85$,

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p < .001. Independent samples *t*-test analyses revealed that geriatric patients taking APDs performed significantly worse on DKEFS Color Naming & Word Reading, WAIS-IV Arithmetic, Trails B, and Animals, *t*s(335-392) > 1.98, *p*s < .05 than those not taking APDs. These patients were further subgrouped into those who met the criteria for a mild cognitive impairment (MCI) and those who met criteria for dementia. Patients with the former who were taking APDs had significantly slower speeds on the set of processing speed/speed-dependent measures relative to those not taking APDs, Wilks λ = .66, *p* < .001. Subsequent *t*-test analyses showed that patients with MCI and taking APDs performed worse on DKEFS Color Naming, Word Reading, & Inhibition, WAIS-IV Coding & Arithmetic, FAS, Animals, and Trails A & B, *t*s(124-131) > 1.99, *p*s < .05, than those not taking APDs. In contrast, there was no significant difference in the set of speed-dependent measures between dementia patients taking APDs compared to those not taking APDs.
Conclusions: These findings suggest that APDs inhibit the processing speed of the geriatric neurology population, particularly among those with MCI. Specifically, APDs appear to slow the language and visual processing speed, verbal fluency, and most frontal-executive abilities of those with MCI compared to their counterparts not taking APDs. These differences do not appear to exist among those with dementia. These findings are likely secondary to the loss of white matter integrity associated with APDs; with the compromise of this integrity emerges a loss of processing speed. Such APD-induced white matter changes may be visible in MCI but not dementia because there is simply more white matter and cognitive reserve to disrupt. These findings have implications for discretionary use of APDs in the geriatric neurology population, as well as for evaluating and treating cognitive impairments in this population. Further research can differentiate the effects of certain classes of APDs.
Keywords: psychopharmacology**,** cognitive processing**,** aging disorders
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58 Healthy Older Adults' Proinflammatory Cytokine TNF-α Levels Predict the Semantic-Relatedness of Consecutively Generated Words in Category Fluency

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Objective: Recent studies suggest elevated proinflammatory cytokine levels are associated with cognitive dysfunction in older adults. Moreover, decrements in category switching have been observed in individuals with mild cognitive impairment. However, it is unclear whether individual differences in proinflammatory cytokine marker levels observed in healthy older adults predict meaningful performance patterns in neuropsychological measures. Thus, we tested whether proinflammatory cytokine – tumor necrosis factor alpha (TNF-α) - predicted individual differences in category verbal fluency performance.
Participants and Methods: All procedures were approved by the local Institutional Review Board. Healthy, non-cognitive-impaired older adults (n=45, mean age=74.3, 84% female) without history of major neurological or psychiatric disorder completed a comprehensive battery of neuropsychological testing which included category fluency (animals). Assessment of TNF-α levels were performed on blood obtained by venous puncture with the use of a specimen tube system. Primary behavioral outcome measures extracted from the category fluency test included: *raw total score* and *mean consecutive item semantic relatedness score* calculated using the latent semantic analysis R package: v0.5.1(https://cran.r-project.org/web/packages/LSAfun/LSAfun.pdf).
Results: Animal fluency total raw score was inversely related to participant's TNF-α level,

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such that greater TNF-α level predicted lower number of items generated in animal fluency (r=-.37, p<.05). However, Age was a confounding factor such that it was negatively correlated with category fluency raw total (r=-.43, p<.001) while also being positively correlated with TNF-α level (r=.30, p<.05). When controlling for Age (i.e., partial correlation), TNF-α was only trending toward negatively correlating with animal fluency total raw score (r=-.28, p=.069). On the other hand, mean consecutive item semantic-relatedness of words generated was strongly positively correlated with TNF-α level (r=.49, p<.001), such that greater TNF-α level predicted higher consecutive item semantic relatedness - significance of which was maintained even after controlling for age (r=.46, p<.005).
Conclusions: Higher levels of proinflammatory cytokine, TNF-α, predicted greater semantic-relatedness of consecutively generated items in animal fluency performance in healthy older adults even after controlling for age. The consecutive item semantic-relatedness measure used in this study is conceptually an inverse measure of category switching, a facet of executive function. Thus, current results align with prior results – e.g., Framingham Offspring study - that demonstrated association between TNF-α levels and executive functioning (EF). Future studies should conduct a longitudinal comparison of healthy individuals with higher and lower TNF-α levels repeat-performing the category fluency test, to examine whether individuals with high TNF-α show disproportionately greater cognitive decline over time.
Keywords: psychopharmacology**,** fluency**,** aging (normal)

59 Cognitive Correlates of Everyday Functioning in a Sample of Predominantly Low-Income, Community Dwelling, African-American Older Adults

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[1]University of Pittsburgh, School of Medicine, Pittsburgh, PA, USA. [2]University of Pittsburgh, Graduate School of Public Health, Pittsburgh, PA, USA. [3]RAND Corporation, Pittsburgh, PA, USA

Objective: Neuropsychological performance is used to predict everyday functional ability in the context of known or suspected neurodegenerative disease. Poorer delayed memory and processing speed are correlated with functional abilities (i.e. medication management) in older adults with mild cognitive impairment (MCI), with less robust associations in healthy older adults. However, previous work generally examined highly educated, predominantly White samples, with little understanding of these associations in other populations. The current study examined cognitive correlates of everyday functioning by overall cognitive impairment in a sample of mid-late life, mostly African-American, community members.
Participants and Methods: Cognition and everyday function were measured in 253 participants age 50+ years who were recruited from a larger community cohort study of two urban, low-income, primarily African-American neighborhoods in Pittsburgh, PA. Participants underwent neuropsychological evaluations from which cognitive domains were created by z-scoring individual test scores (adjusted for age, gender, and education) and using Cronbach's alpha scores to create domains (language, attention, delayed memory, visuospatial performance, and executive function). Performance-based measures of everyday functioning included number of cues provided on three Performance Assessment of Self-care Skills (PASS) subtests: shopping, medication management, and critical information retrieval (higher score = worse functioning). Self-reported cognitive decline was assessed via the Everyday Cognition (ECog) questionnaire (higher score = greater decline). Participants were divided into not cognitively impaired (NCI) and cognitively impaired (CI) groups via mean-split of Modified Mini-Mental State Test scores (mean=86). Four hierarchical linear regressions were run in each group, one for each outcome measure of functioning (PASS and ECog) using cognitive domains as predictors. Models adjusted for literacy (Wide Range Achievement Test - Reading (WRAT)) and neighborhood.

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Results: Eight participants were excluded due to missing or invalid data. Compared to the NCI group (N = 169), the CI group (N = 76) was older (68 years vs. 65 years), less educated (11 years vs. 12 years), performed worse across all cognitive domains (p's <.001), had lower WRAT scores (p<.001), and performed worse on all PASS measures (p's<.04). Both groups reported elevated ECog subjective cognitive complaints (1.46 vs. 1.53, p = .28). In the NCI group, worse executive function was associated with worse PASS shopping performance (beta = -.22, t = -2.48 p = .01). In the CI group, worse attention (beta = -.37, t = -3.12, p = .002) and worse visuospatial ability (beta = -.25, t = -2.09, p = .04) were associated with worse PASS critical information retrieval performance. Cognition was not associated with ECog scores in either group.
Conclusions: Executive function, attention, and visuospatial ability were associated with select PASS subtest performance. However, subjective decline was not associated with cognitive performance, despite endorsement of cognitive decline at levels typically seen in MCI. These findings suggest performance-based functional measures may be more sensitive to cognition than self-report measures in predominantly African-American, low-income urban communities, but this association may vary by performance measurement. Future work is needed to 1) refine the association between existing performance-based functional measures and cognition and 2) develop sensitive, population-appropriate measures for use in clinical and research practice.
Keywords: everyday functioning**,** cognitive functioning**,** activities of daily living

LIVE Plenary A: Presidential Address: Thinking of You

Presenter: Skye McDonald

2:30 - 3:25pm
Wednesday, February 2, 2022

Abstract & Learning Objectives:

Social cognition has rapidly gained traction as a major domain of neuropsychology, with impairment evident in many clinical disorders. Within this spectrum of abilities, the concept of Theory of Mind (ToM) looms large. ToM is the ability to guage another person's thoughts, beliefs and intentions. It is necessary in order to make sense of other people's behaviour and to unravel the interpersonal meanings in conversations where speakers frequently do not say what they mean. Clearly ToM plays a pivotal role in social functioning and is, therefore, a direct target for clinical assessment and remediation. Despite this, ToM is rarely assessed by clinicians. Further, debate continues as to whether ToM is a modular ability separate from other cognitive domains, such as executive function. Relatedly there is lack of clarity about how it should be measured (and by whom). In this talk Dr. McDonald will consider neuroimaging, experimental and clinical factors that contribute to an understanding of the nature of ToM. She will discuss the merits of common ToM assessment tasks and the minimum requirements for a clinical measure of ToM. Dr. McDonald will also consider how theoretical and empirical evidence regarding ToM abilities and their neural substrates might be translated into effective remediation strategies.

Upon conclusion of this course, learners will be able to:
- Describe some of the factors that influence ToM ability
- Critique different remediation strategies for improving ToM
- Compare assessment measures for ToM

Live Program Close

3:25 - 3:30pm
Wednesday, February 2, 2022

INS Awards Ceremony

3:30 - 4:30pm
Wednesday, February 2, 2022

INS Awards Committee Chair -- **Christian Salas Riquelme**

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Major Awards

INS Early Career Achievement Award -- **Porrselvi Ammaiappan Palanisamy** -- Technology for Resource Optimization: TAM Battery, a Neuropsychological Patient Management System

INS Benton Mid-Career Achievement Award -- **Carrie McDonald** -- Imaging Brain Networks in Epilepsy: Determining the Neural Basis of Cognitive and Clinical Co-morbidities

INS Mentoring Award -- **Stephen Bowden**

Program Awards

Graduate Student Award -- **Micah Savin** (Fordham University) *American Indian and Alaska Native Disparities in Trajectories of Cognitive Aging*

Postdoctoral Fellow Award -- **Siddharth Ramanan** (MRC Cognition and Brain Sciences Unit, The University of Cambridge, Cambridge, Cambridgeshire, United Kingdom; The University of Sydney, Brain and Mind Centre, Sydney, NSW, Australia; The University of Sydney, School of Psychology, Sydney, NSW, Australia; ARC Centre of Excellence in Cognition and its Disorders, Sydney, NSW, Australia) *Charting the Neural and Neurocomputational Bases of Behavioural, Cognitive, and Neuropsychiatric Heterogeneity in Frontotemporal Dementia*

Memory Award -- **Ana Jaquelin Ramos-de Jesus** (Columbia University) *The Effect of Diabetes and Neighborhood Adverse Factors on Memory Functioning*

Student-Liaison Committee Awards

-Graduate Student Awards:

Nicolás Corvalán (Argentina) *Cognitive Consequences of COVID-19: Results from A South American Cohort Study*

Samantha J Feldman (Canada) *Social Cognition and Social-Emotional Outcomes Following Pediatric Stroke*

Christine L Ginalis (USA) *Long-term Impact of Maternal Mental Health During Pregnancy on Subsequent Child Autonomic Modulation and Emotional Regulation*

April C May (USA) *Nicotine and Cannabis Co-Use and Associations with White Matter Health in the Developing Adolescent Brain*

Michelle Melis (Belgium) *The Impact of Mindfulness-Based Interventions On Brain Functional and Structural Connectivity: A Systematic Review*

Travel Awards

Lucia Crivelli (Argentina) *Guidelines for the Practice of Teleneuropsychology in Latin America: Recommendations from the Latin American working Group for Teleneuropsychology*

Nicolás Corvalán (Argentina) *Cognitive Consequences of COVID-19: Results from A South American Cohort Study*

Porrselvi Ammaiappan Palanisamy (India) *TAM Battery: Development and Validation of a Comprehensive Computer-Assisted Test Battery for Testing Cognition of Tamil Speaking Older Adults in India*

Desmond Warren (USA) *Perceived Stress and White Matter Hyperintensities: The Role of Race*

Symposium 01: Neuropsychological Outcomes in Pediatric Stroke: Recent Advances and Future Directions

3:30 - 5:00pm
Wednesday, February 2, 2022

26 Neuropsychological Outcomes in Pediatric Stroke: Recent Advances and Future Directions

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Chair

Lauren Krivitzky
Children's Hospital of Philadelphia, Philadelphia, USA

Discussant

Rich Boada
Children's Hospital Colorado, Denver, USA

The field of pediatric stroke has made significant advancements in the medical treatment of both the acute and chronic medical consequences of stroke in childhood over the past 5-10 years. Given the high rates of survival in pediatric stroke patients, practitioners are tasked with treating the ongoing motor and neuropsychological (cognitive, behavioral, socio-emotional) sequelae in their patients over the course of their development. The primary goal of our first three speakers in this symposium is to provide a review of the current “state of the knowledge base” regarding neuropsychological outcomes in pediatric stroke. Neuropsychological outcomes include cognitive function by domain, behavioral and emotional outcomes, as well as current cognitive rehabilitation studies and intervention models in pediatric stroke. Our fourth speaker will review the most relevant imaging studies, with a focus on functional imaging modalities and the relationship to neuropsychological outcomes and/or treatment thereof.
Finally, the speakers and discussant will review limitations and future directions for the study of pediatric stroke. This will include the need to better understand how cultural, language, and SES factors are likely to mediate outcome in pediatric stroke. Importantly, we will also discuss the importance of taking a multi-disciplinary approach to understanding and treatment of pediatric stroke and the need to create models that integrate the factors that impact outcome. These models can help to better delineate how different predictors interact, and how might predict different outcomes in different contexts. There may be some factors that, in combination, exacerbate poor outcome, while others may be protective and help moderate the effects of the stroke. Goal selection for rehabilitative and educational interventions will also depend on a better understanding of how these models differ across development, stroke type and severity, and socioeconomic contexts.
Keywords: stroke recovery**,** brain plasticity child brain injury

703 Psychosocial Outcomes in Pediatric Stroke

Lauren S Krivitzky
Children's Hospital of Philadelphia, Philadelphia, PA, USA. Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, USA

Objective: Despite a large body of research examining psychological functioning following stroke in adults, there have been fewer studies examining psychosocial outcomes in pediatric stroke survivors. Results from available studies suggest that behavioral and emotional problems are relatively common following pediatric stroke and have the potential to impact the child and families’ overall quality of life. Thus, treating these conditions is crucial for improving long-term outcomes in pediatric stroke survivors.
Participants and Methods: The focus of this presentation is to provide an overview the available studies that examine the prevalence of emotional and behavioral outcomes following pediatric stroke. This will include a review of the most frequently diagnosed developmental disorders (more commonly seen in perinatal stroke), coping and adjustment concerns (commonly seen in both perinatal stoke and school age stroke survivors) and changes to social functioning, family functioning, and quality of life.
Results: This will be followed by a more in-depth discussion of the most frequently made DSM diagnoses made following pediatric stroke: Attention Deficit Hyperactivity Disorder, Anxiety Disorders, and Mood Disorders. In addition to a more general description of these disorders, we hope to provide an overview of some of the specific issues and concerns when treating children with stroke and comorbid psychiatric issues. This includes an understanding of

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factors related to the potential neurologic basis of these conditions, other environmental and psychosocial factors that play a role, and the available evidenced based treatments.
Conclusions: We will end by discussing how impairments in related domains of functioning (i.e., deficits in executive functioning, language, social competence) can interfere with emotional and behavioral outcomes and potential future directions in terms of prevention and treatment of psychological disorders in pediatric stroke.
Keywords: stroke recovery**,** brain plasticity

702 Cognitive Outcomes in Pediatric Stroke

Robyn Westmacott
The Hospital for Sick Children, Toronto, ON, Canada

Objective: Stroke is a major cause of acquired brain injury in the pediatric population and it offers a unique opportunity to examine factors associated with adaptive and maladaptive plasticity. Despite the widely held belief that increased plasticity of the young brain protects against significant deficits, a substantial body of evidence indicates that individuals with a history pediatric stroke experience difficulties in various aspects of cognitive functioning, including attention, working memory, executive functioning, visual-spatial processing, visual-motor integration, encoding and retrieval, verbal fluency, and higher-level reasoning abilities. Interestingly, challenges in these areas often emerge over the course of development, in tandem with brain maturation and post-stroke brain reorganization.
Participants and Methods: This presentation will review recent neuropsychological literature on cognitive outcomes following pediatric stroke, highlighting the vulnerability of the developing brain, the long-term deficits that often result from early disruption of brain function and subsequent brain development, and the significant variability in outcomes seen across individuals.
Results: Heterogeneity in outcomes has been linked to a range of clinical and demographic factors, including those related to the brain (e.g., stroke type, lesion location and size, adaptive and maladaptive patterns of reorganization), the child (e.g., age at stroke, age at assessment, comorbid neurological conditions) and the environment (family stress, parent mental health, educational support).
Conclusions: Directions for future research will also be discussed, as we are just starting to understand how these factors interact to impact neurocognitive outcome and resiliency following pediatric stroke.
Keywords: cognitive functioning**,** stroke recovery

708 Functional Recovery and Rehabilitation in Pediatric Stroke

Christine Mrakotsky
Boston Children's Hospital, Boston, MA, USA. Harvard Medical Center, Boston, MA, USA

Objective: Although research on functional outcomes (cognitive, behavioral, emotional, adaptive, academic) of pediatric stroke is rapidly increasing, there continues to be very little extant literature on evidence-based functional therapies and interventions, particularly for cognitive and behavioral domains that tend to be affected. Beyond medical treatments, functional therapies often focus on the most prominent post-stroke deficits in sensorimotor and speech/language areas, however, interventions for more chronic or evolving higher-order cognitive, linguistic and behavioral deficits are notably less defined.
Participants and Methods: This presentation will review factors influencing stroke recovery, including timing of injury (perinatal/childhood), phases of recovery and rehabilitation (acute/chronic), medical, developmental, and environmental factors, and current models of rehabilitation. The standard of care will be introduced, including the benefit of multi-disciplinary stroke centers, role of neuropsychologists, existing therapeutic approaches (i.e. constraint/bimanual therapies) and novel interventions (i.e. non-invasive brain stimulation, robotics). Current models and guidelines for cognitive and behavioral interventions will be discussed, which stem from

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concepts applied in acquired brain injury (ABI). The limited number of studies on cognitive therapies (i.e. memory, executive) in pediatric stroke and their effectiveness will be reviewed.
Results: Far-transfer or long-term effects of these trainings are often slim. New evidence points to the need for holistic approaches that integrate multiple functions (cognitive, motor, behavioral) and components (psychoeducation of school and family, substitution, restoration) to optimize a child's independence. Familial, SES and cultural factors become equally important targets of intervention as will be highlighted by current data from our center, and strong evidence for family-focused interventions in ABI as a whole.
Conclusions: Current knowledge gaps will be discussed along with future directions for evidence-based interventions research.
Keywords: stroke recovery**,** brain plasticity**,** cognitive rehabilitation

711 Functional Imaging Correlates in Pediatric Stroke

Leigh Sepeta
Children's National Medical Center, Washington, DC, USA. National Institute of Neurological Disorders and Stroke, Bethesda, MD, USA

Objective: Neuroimaging tools have increasingly been employed to study the neural correlates of cognitive functioning. Pediatric stroke provides a unique population to use neuroimaging to study the impact of neurological disruption on brain structure and function.
Participants and Methods: This presentation will review the current literature on neuroimaging following pediatric stroke using structural MRI, DTI, and functional MRI (fMRI) and relate these modalities to cognitive functioning.
Results: Many aspects of structural MRI have been associated with cognitive deficits and poor motor outcomes after stroke, including larger lesion volume and specific lesion locations. While DTI studies are limited, white matter abnormalities are common after stroke and correlated with neurodevelopmental outcomes. Some recent evidence indicates that the timing of DTI scans is paramount. For example, waiting several months post-stroke to acquire DTI may more accurately capture these abnormalities and predict outcomes than imaging immediately after early stroke. FMRI, including both task-based and resting state, highlights both structural and functional reorganization following pediatric stroke. Task-based fMRI, such as language fMRI, studies have found left dominant language regions displaced to the homologous regions in the contralateral hemisphere and more bilateral activation overall. However, how this reorganization is related to cognitive outcomes is not clear, with some studies finding preservation of language abilities and others showing reduced language outcomes. Resting state fMRI shows that patients have altered network connectivity, with some evidence indicating altered default mode connectivity in specific. This connectivity has been found to be correlated with executive functioning ability.
Conclusions: Directions for future research will be addressed as new neuroimaging techniques allow for the study of the neural correlates of cognitive functioning after pediatric stroke.
Keywords: brain plasticity**,** neuroimaging: functional**,** neuroimaging: structural

Symposium 02: Assessment and Management of Apathy: A Transdiagnostic View

3:30 - 5:00pm
Wednesday, February 2, 2022

15 Assessment and Management of Apathy: A Transdiagnostic View

Chair

Fiona Kumfor
University of Sydney, Sydney, Australia

Apathy, which is defined as a reduction in goal-directed behaviour, is remarkably common in acquired neurological disorders. For example, apathy affects ~90% of people with dementia across the disease course and up to 70% of people with traumatic brain injury. Despite its

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prevalence the assessment of apathy to date has relied on subjective self- or informant-reports and has been quite simplistic focusing only on the presence or absence of apathy. This has meant that knowledge of the mechanisms which give rise to apathy is limited, which in turn has hampered the development of effective, evidenced-based, individually-tailored interventions.
In this symposium, we present a theoretically-driven approach to study the apathy syndrome, which recognises three distinct dimensions – emotional apathy, behavioural apathy and cognitive apathy - with divergent neurobiological bases. First, Kumfor will present a study examining whether cognitive apathy is associated with executive dysfunction in Alzheimer's disease and behavioural-variant frontotemporal dementia. The results reveal a common cognitive and neural substrate for cognitive apathy and planning capacity, providing an evidence base for interventions which focus on minimising complexity of tasks to improve functional ability and independence in people with dementia. Second, Wong will consider how modulating reward and effort can modulate goal-directed behaviour in behavioural-variant frontotemporal dementia. Surprisingly, results showed that even low reward levels were sufficient to bring performance of behavioural-variant frontotemporal dementia patients with clinically significant apathy, in line with controls. This study highlights a novel approach to the conceptualisation of apathy, and underscores the role for extrinsic reward to enhance motivation. Third, Wearne reports on a study which examines the relationship between apathy and depression in traumatic brain injury. The results point to a role for self-focussed cognitions in the manifestation of these related yet dissociable symptoms. Finally, Quang demonstrates the need for culturally-appropriate tools to assess apathy. The work highlights efforts to develop and validate measures of apathy which are suitable in Vietnam, a country with notably high prevalence of moderate to severe traumatic brain injury. The research also considers how differences in family relationships and cultural factors may be harnessed to improve apathy in these individuals.
Together this series of papers will introduce a theoretical framework for the investigation of apathy and highlight how this framework has led to new knowledge about the mechanisms which give rise to apathy across dementia and traumatic brain injury. We will also discuss how clinicians can use these findings to inform non-pharmacological interventions which address the different manifestations of apathy.
Keywords: apathy**,** dementia - Alzheimer's disease*,* traumatic brain injury

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411 Do Effort and Reward Influence Apathy in Behavioural-Variant Frontotemporal Dementia?

Stephanie Wong[1], Campbell Le Heron[2], Grace Wei[1], John R Hodges[1], Masud Husain[3], Olivier Piguet[4], Muireann Irish[1], Fiona Kumfor[1]
[1]University of Sydney, Sydney, NSW, Australia. [2]New Zealand Brain Research Institute, Christchurch, New Zealand. [3]University of Oxford, Oxford, United Kingdom. [4]University of Sydney, Sydney, Australia

Objective: Apathy is a core diagnostic feature of behavioural-variant frontotemporal dementia (bvFTD). This loss of motivation and pervasive decline in goal-directed behaviour is associated with functional decline, poorer prognosis and carer stress. The neurobiological mechanisms driving these symptoms are poorly understood and treatment options are limited.
Participants and Methods: This study aimed to investigate whether apathy in bvFTD may be driven by changes in effort-based decision-making, a process by which potential rewards and the effort cost required to obtain them are integrated to drive behaviour. Twenty-two patients with probable bvFTD and 20 age-matched controls were assessed using a novel paradigm in which participants decided whether to accept or reject a series of offers to gain different magnitudes of reward by squeezing a handheld dynamometer at varying levels of physical effort. Choice and force metrics were recorded for each of the 6 levels of reward and 6 levels of effort, which were manipulated independently so offers spanned the full range

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of possible combinations. A computational model of choice was used to estimate each participant's effort sensitivity and reward sensitivity.
Results: BvFTD patients showed clinically significant symptoms of apathy, as defined by Dimensional Apathy Scale (DAS). Contrary to our expectations, however, bvFTD patients performed in line with controls on the effort-based decision-making task. The two groups accepted a similar proportion of offers and did not differ in terms of reward or effort sensitivity. Importantly, these measures of task performance were significantly associated with DAS scores in controls, but not in bvFTD patients.
Conclusions: These findings demonstrate that effort-based decision-making may remain intact in bvFTD despite clinically significant levels of apathy, and point to potential differences in the roles of extrinsic versus intrinsic motivation in modulating symptoms of apathy in these patients.
Keywords: apathy**,** dementia - other cortical**,** motivation

412 A Shared Cognitive and Neural Basis Underpinning Apathy and Planning in Dementia

Fiona Kumfor[1], Peta Eggins[1], Grace Wei[1], John R Hodges[1], Masud Husain[2], Olivier Piguet[1], Muireann Irish[1], Stephanie Wong[1]
[1]University of Sydney, Sydney, NSW, Australia. [2]University of Oxford, Oxford, United Kingdom

Objective: Apathy is the most common and disabling non-cognitive feature of dementia, affecting up to 90% of individuals over the disease course. Despite its prevalence, the underlying mechanisms of apathy remain elusive. This study aimed to investigate whether cognitive apathy and executive functioning have a shared cognitive and neural basis.
Participants and Methods: We recruited seventy-one participants (31 variant frontotemporal dementia (bvFTD), 17 Alzheimer's disease (AD) and 23 controls). Participants were were assessed on a neuropsychological battery of executive tasks including the Zoo Map Test, Modified Six Elements Test, Tower Test and verbal fluency. The Dimensional Apathy Scale (DAS) was used to quantify cognitive apathy. Principal components analysis identified a single component underpinning performance on the neuropsychological tests, with both bvFTD and AD showing significantly reduced "planning ability" compared to controls.
Results: On the DAS, 74% of bvFTD patients and 59% of AD patients showed clinically significant cognitive apathy. Importantly, linear regression revealed that lower planning ability significantly predicted increased cognitive apathy, even after controlling for cognitive impairment and disease duration. Voxel-based morphometry analyses revealed that planning ability and cognitive apathy were both associated with atrophy of the right frontal pole and orbitofrontal cortex, as well as the thalamus and putamen. Cognitive apathy was uniquely associated with the bilateral inferior frontal gyrus and left postcentral gyrus whereas planning ability was uniquely associated with bilateral posterior temporal regions.
Conclusions: From a theoretical perspective, our results reveal a shared mechanism underpinning both cognitive apathy and planning deficits in bvFTD and AD. Clinically, this knowledge will help to improve the identification of apathy in clinical syndromes and inform targeted interventions to improve independence and wellbeing for those affected.
Keywords: apathy**,** dementia - other cortical**,** planning

416 Sticky Thinking: An Examination of the Relationships Between Rumination and Reflection with Apathy and Depression Following Severe Traumatic Brain Injury

Travis Wearne, Skye McDonald
University of New South Wales, Sydney, NSW, Australia

Objective: Apathy is common following traumatic brain injury (TBI), and is negatively related to a range of psychosocial outcomes and

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mood states. Apathy is traditionally viewed as a product of brain pathology following brain insult, and therefore the role of underlying cognitive and processing mechanisms has received little attention within the TBI literature. Previous studies have shown that rumination (i.e., repetitive and often negative thought processes) adversely perpetuates symptoms of psychological distress, while self-reflection is an adaptive process that promotes perspective taking, openness to experience and positive mental health. However, the role of these specific processes within the context of apathy following TBI has not been examined. The aim of this study is to investigate the relationship between the self-focussed processing styles of rumination and reflection with apathy and mood symptoms following severe traumatic brain injury.
Participants and Methods: Fifty participants with TBI (72% male; age = 46.6 years; PTA = 61.90 days) completed tests of executive functioning (i.e., COWAT, Trail Making Test, Digit Span Backwards and Haying) together with the Frontal Systems Behaviour Scale (FrSBe), The Dimensional Apathy Scale, The Rumination and Reflection Questionnaire (RRQ), and the Hospital Anxiety and Depression Scale (HADS). Thirty-one age- and gender-matched control subjects completed the FrsBe, RRQ and tests of executive functioning.
Results: TBI participants had significantly greater apathy compared to controls ($p < .005$), with 62% of those with TBI demonstrating clinically significant levels of apathy. Those with TBI also reported elevated depression ($p < .0005$) and had poorer cognitive performance across all measures examined ($ps < .0005$). Levels of rumination and reflection were consistent between groups ($p > .05$). By using cluster analyses, we found that TBI participants with low rumination and high reflection had significantly lower total apathy scores ($p < .05$). Indeed, there were no participants with TBI with high reflection and low rumination who had apathy scores that reached clinical concern. The same TBI participants also had significantly reduced behavioural apathy relative to those with high rumination with/without reflection. There was no significant effect of rumination/reflection on cognitive and emotional apathy for those with TBI. However, there was a negative correlation between reflection and emotional apathy following TBI, such that those with greater reflective tendencies had reduced emotional apathy. Interestingly, those with TBI had greater depression scores irrespective of their rumination and/or reflection processing. Executive functioning did not correlate with any apathy changes nor rumination/reflection following TBI.
Conclusions: Reflection without ruminative tendencies is adaptive in safeguarding against apathy following TBI, particularly for behavioural apathy. Individuals with greater rumination with/without reflection are at greater risk of increased apathy following TBI. Interestingly, these relationships appear to be specific to apathy following TBI, rather than mood symptoms, and are not related to executive functioning. These findings provide potential predictors of who is more susceptible to the manifestation of apathy following TBI. This study also raises the need and potential for simultaneous targeting of both rumination and reflection within the therapeutic context in the rehabilitation of apathy following brain injury.
Keywords: apathy**,** mood disorders**,** cognitive style

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847 Examining Apathy in Vietnam – a Country with High Prevalence of Moderate to Severe Traumatic Brain Injury

Halle Quang[1], Skye McDonald[1], Tuong-Vu Nguyen[2], Fiona Kumfor[3]
[1]University of New South Wales, Sydney, NSW, Australia. [2]Cho Ray Hospital, Ho Chi Minh City, Vietnam. [3]University of Sydney, Sydney, NSW, Australia

Objective: The last two decades have seen a slew of initiatives to characterise apathy after traumatic brain injury (TBI) in Western populations. However, despite the detrimental impact of TBI in other areas such as Southeast Asia, understanding of apathy in these regions remain elusive. Here, we investigate the profiles and psychosocial factors of apathy in Vietnam – a country with notably high prevalence of TBI.

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Participants and Methods: We recruited 61 people with moderate to severe TBI and 50 healthy participants from a specialised hospital for brain injuries in Vietnam. All participants and their informants completed the Vietnamese Dimensional Apathy Scale (V-DAS) to assess executive, emotional and initiation apathy domains. Relevant psychosocial factors pertaining to the Vietnamese culture were assessed via measures of family functioning, family members' overprotective behaviour and participants' self-efficacy.
Results: Informants rated participants with TBI as having elevated executive, emotional and initiation apathy on the V-DAS compared to control group. People with TBI rated their executive apathy as significantly lower than controls and their emotional apathy as similar to controls, indicating impaired insight. Apathy was predicted by several psychosocial factors, with unhealthy family functioning predicting executive and emotional apathy, overprotectiveness predicting emotional apathy and low self-efficacy predicting initiation apathy.
Conclusions: This study demonstrates that apathy is common in Vietnamese people following TBI and is predicted by culturally relevant psychosocial factors. Our findings highlight the crucial role of socio-cultural factors when assessing apathy and developing interventions to improve this syndrome in clinical practice.
Keywords: apathy**,** cross-cultural issues

Paper Session 01: Dementia 1

3:30 - 5:00pm
Wednesday, February 2, 2022

1 Charting the Neural and Neurocomputational Bases of Behavioural, Cognitive, and Neuropsychiatric Heterogeneity in Frontotemporal Dementia

Siddharth Ramanan[1,2,3,4], Hashim El-Omar[2], Daniel Roquet[2,3,4], Rebekah M Ahmed[2,5], John R Hodges[2,6], Olivier Piguet[2,3,4], Matthew A Lambon Ralph[1], Muireann Irish[2,3,4]

[1]MRC Cognition and Brain Sciences Unit, The University of Cambridge, Cambridge, Cambridgeshire, United Kingdom. [2]The University of Sydney, Brain and Mind Centre, Sydney, NSW, Australia. [3]The University of Sydney, School of Psychology, Sydney, NSW, Australia. [4]ARC Centre of Excellence in Cognition and its Disorders, Sydney, NSW, Australia. [5]Memory and Cognition Clinic, Department of Clinical Neurosciences, Royal Prince Alfred Hospital, Sydney, NSW, Australia. [6]The University of Sydney, School of Medical Sciences, Sydney, NSW, Australia

Objective: Frontotemporal dementia (FTD) is a group of young-onset neurodegenerative disorders primarily affecting frontal and/or temporal lobes. Two common clinical variants include a behavioural variant (bvFTD), presenting with primary behavioural/personality changes arising from early prefrontal atrophy, and a semantic variant (semantic dementia or SD), displaying semantic dysfunction and conceptual knowledge loss due to early anterior temporal lobe degeneration. Although treated as independent diagnostic entities, accumulating evidence indicates overlapping behavioural, cognitive, and neuropsychiatric profiles between both syndromes. Why such overlap occurs remains unclear, however, needs resolution for improved clinical diagnosis and characterisation of both syndromes. Here, we used data-driven methods to extract neurocomputational 'dimensions' of behavioural, cognitive, and neuropsychiatric heterogeneity in FTD. Each dimension commonly explains diverse symptoms, accounts for performance variations at individual- and group-levels, and reliably maps on to disintegration of large-scale brain networks supporting different cognitive and behavioural abilities. This approach allows for fine-grained characterisation of symptom variations in individual patients and FTD groups, and exploration of common and distinct neural contributors.
Participants and Methods: Sixty-two FTD patients (31 bvFTD, 31 SD) underwent comprehensive, multidomain neuropsychological and behavioural assessments, and whole-brain structural magnetic resonance imaging. To capture dimensions of performance heterogeneity, neuropsychological,

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neuropsychiatric, and behavioural data for all patients were entered into an orthogonally-rotated principal component analysis. This analysis distils the heterogeneous clinical profiles of bvFTD and SD into a set of independent, yet co-occurring, neurocomputational dimensions of performance variation, reliably reflecting individual-level gradations, and group-level variations in test performance. Dimensional scores were further entered as covariates into whole-brain voxel-based morphometry analyses to explore neural correlates of heterogeneity, irrespective of diagnostic label.
Results: Our principal component analysis revealed that symptomatic heterogeneity in bvFTD and SD can be captured along 8 independent, co-occurring dimensions: Behaviour, Language, General Cognition, Executive, Initiation, Disinhibition, Visuospatial, and Neuropsychiatric changes. Patient groups displayed comparable levels of dysfunction on Behavioural, General Cognition, Initiation, Disinhibition, and Neuropsychiatric dimensions, reflected in considerable individual-level overlap on these dimensions. Compared to bvFTD, SD patients displayed disproportionate impairment on the Language dimension. In contrast, greater impairment on Executive and Visuospatial dimensions was noted in bvFTD, relative to SD. Importantly, all dimensions emerged amidst significant frontotemporal degeneration in FTD, varying in a graded manner between individual bvFTD and SD patients. Irrespective of diagnosis, dimensions were associated with distinct patterns of structural brain atrophy, with Behavioural and Executive factors associated with fronto-parietal grey matter intensity decreases, the Language dimension with temporo-parietal atrophy, the General Cognition factor with parietal and subcortical grey matter intensity reductions, the Initiation factor with fronto-insular and striatal disintegration, and the Visuospatial dimension with temporo-occipital atrophy.
Conclusions: We demonstrate that heterogeneity in bvFTD and SD largely arises from systematic, graded, inter-individual differences along fundamental performance dimensions, linked to grey matter intensity decreases in fronto-temporal and striatal brain regions. These findings contrast current conceptualisations of heterogeneity arising from distinct cognitive 'subgroups' of FTD patients. Instead, they suggest that heterogeneity may be better captured by positioning bvFTD and SD individuals as varying along a continuous, multidimensional FTD space of cognitive, behavioural, and neural dysfunction.
Keywords: dementia - other cortical**,** cognitive functioning**,** neuroimaging: structural

2 The Characteristic Social Functioning Profiles in Each Primary Progressive Aphasia Variant

Maxime Montembeault[1], Christa Watson[1], Aaron W Scheffler[2], Joel Kramer[1], Bruce Miller[1], Maria Luisa Gorno-Tempini[1], Katherine P Rankin[1]
[1]Memory and Aging Center, University of California in San Francisco, San Francisco, CA, USA. [2]Department of Epidemiology & Biostatistics, University of California in San Francisco, San Francisco, CA, USA

Objective: Primary progressive aphasias (PPAs) are neurodegenerative diseases characterized by a slow, progressive, and relatively isolated decline in speech and language function. Nonetheless, non-linguistic symptoms are also observed and can contribute to early and differential diagnosis and prognosis. Although recent studies have suggested that some social functioning deficits can occur in some variants of PPA, no study has comprehensively investigated all social cognition domains and directly compared all PPA variants, including semantic variant (svPPA) patients showing predominant atrophy in the right anterior temporal lobe (ATL). The aim of this study is to determine the characteristic social functioning profile in each PPA variant.
Participants and Methods: The sample included 47 logopenic variant (lvPPA), 68 nonfluent/agrammatic variant (nfvPPA), 49 semantic variant with left ATL predominant atrophy (svPPA-L), 25 semantic variant with right ATL predominant atrophy (svPPA-R) and 54 healthy controls (HC). The side of the atrophy in svPPA patients was determined by comparing

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the gray matter volumes in the left vs right ATL using voxel-based morphometry.

Emotion reading was investigated using the Comprehensive Affect Testing System (CATS), the Dynamic Affect Recognition Test (DART) and the Awareness of Social Interference Test (TASIT) – Emotion Evaluation and Social Inference Minimal subtests. Real-life empathy was assessed with the Revised Self-Monitoring Scale (RSMS) and the Interpersonal Reactivity Index (IRI). Applied social cognition was assessed using the UCSF Cognitive and Emotional Theory of Mind Tests (cTOM, eTOM), the Social Norms Questionnaire (SNQ) and the Social Behavior Observer Checklist (SBOCL). Personality was assessed with the Big Five Inventory (BFI), the Interpersonal Adjectives Scale (IAS) and the Behavioral Inhibition/Activation Scale (BIS/BAS).

Results: Each PPA variant was characterized by a specific profile of social functioning impairments (two standard deviations below the average of HC). The lvPPA profile was most distinct from HC in terms of lower emotion reading, lower cognitive and emotional theory of mind (TOM) and higher behavioral reactivity and disorganization during cognitive testing. NfvPPA patients presented a more aloof and introverted personality as reported by their relatives and were more disorganized during testing. The svPPA-L profile was characterized by lower emotional reading, lower socioemotional sensitivity, a more aloof and introverted personality, impaired social norms knowledge and a reactive, disorganized, and insensitive behavior during testing. SvPPA-R patients presented with a similar profile as svPPA-L, but with additional personality features (lower openness and conscientiousness, higher cold-heartedness).
When comparing PPA variants, lvPPA patients presented significantly lower cognitive TOM, lower conscientiousness, and higher reactivity in comparison to nfvPPA. In comparison to both lvPPA and nfvPPA, svPPA-L and svPPA-R showed significantly lower social functioning in most domains. Finally, in comparison to svPPA-L, svPPA-R patients present significantly lower sarcasm detection abilities, socioemotional sensitivity, conscientiousness, and openness.

Conclusions: While all variants were impaired to some degree, svPPA patients show the most prominent deficits, and particularly svPPA-R patients. The current study highlights the importance of investigating social functioning in PPA variants to improve diagnostic sensitivity but also to provide more individualized patient care.
Keywords: social cognition**,** aphasia**,** dementia - other cortical

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3 The Effect of Mixed Alzheimer's Disease and Cerebrovascular Pathology on Cognitive Trajectories in the National Alzheimer's Coordinating Center Autopsy Sample.

Brandon E Frank[1], Madeline Ally[1], Yorghos Tripodis[1], Landon Hurley[2], Brett Martin[1], Joseph N Palmisano[1], Eric G Steinberg[1], Katherine Turk[1], Andrew E Budson[1], Maureen K O'Connor[1], Rhoda Au[1], Wei Q Qui[1], Lee E Goldstein[1], Ronald Killiany[1], Neil W Kowall[1], Robert A Stern[1], Thor D Stein[1], Ann C McKee[1], Jesse Mez[1], Michael L Alosco[1]
[1]Boston University Alzheimer's Disease Research Center, Boston, MA, USA. [2]Yale School of Public Health, New Haven, CT, USA

Objective: Cerebrovascular disease (CBVD) is commonly co-morbid with Alzheimer's disease (AD) neuropathology, with up to 80% of autopsy-confirmed AD cases having some form of CBVD. However, the effects of CBVD on the clinical presentation of AD are less well understood. This study leveraged the National Alzheimer's Coordinating Center (NACC) sample to examine the longitudinal course and presentation of deceased individuals with neuropathologically-confirmed AD and CBVD, defined as cerebral small vessel disease. Unlike past studies, we used propensity scores to isolate the effects of AD+CBVD from multiple forms of neuropathology and demographic covariates.
Participants and Methods: The sample included 2,423 brain donors with AD (Braak stage ≥ 3 and CERAD C score ≥ 2), with moderate to severe arteriosclerosis or

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atherosclerosis in 1,476 individuals. This sample excluded individuals without autopsy data and/or data on covariates. Brain donors completed a standardized battery to assess global cognition and functioning, attention, executive function, episodic memory, and language abilities. The Crosswalk study was used to harmonize versions of the NACC battery. Propensity score weighting improved the balance of covariates among brain donors with and without CBVD (standardized mean differences < 0.1). We used robust Bayesian estimation of longitudinal mixed-effects models with CBVD group, years to death at each visit, and a group × time interaction as predictors. Neuropsychological tests and the Clinical Dementia Rating Scale Sum of Boxes (CDR-SB) were our primary outcomes.
Results: Compared with autopsy confirmed AD alone, we found worse overall performance across time in the AD+CBVD group for naming, β = -1.04, 95%*CI* [-1.83, -0.25], Bayes factor [BF] = 2.52, and verbal fluency, β = -0.73, 95%*CI* [-1.30, -0.15], BF = 1.34, and more impaired CDR-SB scores, β = 0.45, 95%*CI* [0.01, 0.89], BF = 0.33. We also found a faster rate of decline for most measures, including the following domains: naming, β = 0.09, 95%*CI* [0.03, 0.16], BF = 0.69, verbal fluency, β = 0.10, 95%*CI* [0.04, 0.15], BF = 1.28, working memory, β = 0.05, 95%*CI* [0.02, 0.07], BF = 3.59, processing speed, β = -0.93, 95%*CI* [-1.35, -0.51], BF = 130.75, and overall functioning (CDR-SB), β = -0.08, 95%*CI* [-0.12, -0.05], BF = 18.11. Evidence for the effects ranged from weak (BF < 3.0) to strong (BF < 150).
Conclusions: In brain donors with autopsy confirmed AD, comorbid CBVD accelerated cognitive decline particularly for working memory, processing speed, and a clinical measure of functional decline. These results highlight the importance of multiple neuropathologies to the contribution of cognitive decline.
Keywords: dementia - Alzheimer's disease**,** cerebrovascular disease**,** neuropsychological assessment

4 Clinical and Cognitive Characteristics of Limbic Predominant Age-Related TDP-43 Encephalopathy (LATE)

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Objective: As Limbic Predominant Age-Related TDP-43 Encephalopathy (LATE) is a relatively new disease entity, little is known about the impact LATE pathology has on clinical symptoms and cognition. Furthermore, as LATE pathology impacts similar neuroanatomical networks as Alzheimer's disease (AD) and is often comorbid with AD, it can be difficult to differentiate pure LATE from pure or comorbid AD. We examined clinical symptoms and performance on cognitive testing between patients with autopsy confirmed LATE, AD, and comorbid AD and LATE.
Participants and Methods: Participants include 686 individuals from the National Alzheimer's Coordination Center (NACC) database who were over the age of 75 at time of death, had neuropathology data available, and did not have clinical or neuropathological indication of frontotemporal lobar degeneration (FTLD). There were 31 participants with LATE pathology (mean age: 80.6±5.4), 393 with AD pathology, (mean age: 77.8±6.4) and 262 with comorbid LATE and AD (mean age: 77.8±6.6). Differences between groups in demographics, clinical symptoms, and performance on memory and semantic knowledge measures from the Uniform Data Set (UDS) at the participant's initial study visit were analyzed.
Results: When analyzing group demographics, participants with LATE pathology were significantly less likely to report cognitive impairment at their initial visit (% reporting no impairment= LATE: 45.2%; AD: 28.0%; AD/LATE: 13.0%) and lived longer than the other groups (mean age of death= LATE: 89.46±5.3; AD: 86.1±6.6; AD/LATE: 86.5±6.6). Of the participants reporting cognitive impairment, LATE participants reported later onset of cognitive decline (mean age of onset= LATE: 78.8±5.7, AD:72.52±7.0, AD/LATE:72.9±7.0; F(2,516)=6.2, p<.01), On UDS measures, individuals with LATE had significantly higher scores on Mini-Mental Status Examination (MMSE; mean total = LATE:27.7±2.5; AD:25.2±5.2;

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AD/LATE:23.3±5.5; F(2,683)=15.3, p<.01), as well as on orientation to time and place. This group also demonstrated better learning (raw score out of 25= LATE: 9.8±5.3 (average % of total information learned: 39.2%), AD:8.3±5.4 (33.2%), AD/LATE:6.2±5.0 (24.8%); F(2,602)=14.4, p<.01) and delayed recall (LATE: 8.1±5.6 (average % of information retained: 82.7%); AD:6.5±5.9 (78.3%); AD/LATE:4.0±5.0 (64.5%); F(2,594)=17.3, p<.01) on Logical Memory. Significant differences were also found on measures of semantic knowledge, including Animal Naming (mean raw score = LATE:16.5±5.9; AD:15.3±6.5; AD/LATE:13.14±6.0; F(2,634)=10.0, p<.01) and Boston Naming Test (mean total correct=LATE:25.97±5.2, AD:24.3±5.6, AD/LATE: 22.12±6.8; F(2,593)=11.4, p<.01).

Conclusions: Participants with only LATE pathology on autopsy were less likely to report cognitive impairments, were older when cognitive symptoms began, and lived longer than patients with AD pathology or comorbid AD and LATE pathology. Participants with LATE pathology were classified as “cognitively normal” on the MMSE and had higher scores than the other groups on measures of orientation, memory, and semantic knowledge. For clinicians, patients with LATE may demonstrate impairment in similar domains as AD, but they tend to remain oriented, do not typically begin to demonstrate decline until their late 70s, and may look cognitively normal on cognitive screeners.

Keywords: cognitive functioning**,** aging disorders**,** memory disorders

5 It’s a Small World After All: Smallworldness Negatively Relates to Tau Burden in Women but not Men

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Objective: In early disease stages of Alzheimer’s disease (AD), women tend to bear greater burden of the AD pathological hallmark, pathologic Tau (Tau). Despite this increased burden, women often show a cognitive advantage in early AD stages. Although there is evidence that greater functional connectivity is cognitively advantageous, recent studies have reported that greater functional connectivity contributes to Tau propagation in individuals on the AD continuum. However, little is known about the role of sex in resting-state functional connectivity (rs-FC) and the interplay of sex, rsFC, and Tau burden. Reduced smallworldness (characterized by reduced clustering and increased path-length) is a marker of global altered network topography, whereby reduced smallworldness reflects inefficient rs-FC. We examined sex differences in smallworldness and, as an exploratory aim, whether sex moderates the relationship between smallworldness and Tau burden in cognitively normal (CN) older adults to characterize these relationships early in the disease process. We hypothesized that women would show decreased smallworldness and a stronger negative association between smallworldness and Tau burden compared to men.

Participants and Methods: This study included 51 cognitively normal (CN) participants from the Alzheimer’s Disease Neuroimaging Initiative (ADNI) study (62.7% women; 82.4% White; mean age=79.3 [SD=6.4]) who underwent Tau-PET imaging, resting-state fMRI, and neurocognitive testing. We used ANOVAs and chi-squares to examine sex differences in the continuous measures of smallworldness and Tau-PET standardized uptake value ratio (SUVR) and Tau positivity rates by Braak regions, respectively, and multilinear regression models to test a sex by smallworldness interaction on Tau standardized uptake value ratio (SUVR) in Braak regions 1, 3-4, and 5-6, controlling for relevant demographic covariates and respective Braak region volume.

Results: Mean smallworldness and Tau-PET SUVR in Braak regions 1, 3-4 , and 5-6 did not differ between men and women (*p*s>.050). Tau-positivity was 27% in women versus 4% in men in Braak-1 (p=.030), 6% in women versus 0% in men (p=.529) in Braak-3,4, and 0% in men and women in Braak-5,6 (p=1.000). We found a significant sex-by-smallworldness interaction on Tau-PET SUVR in Braak-3,4 (β=2.28, p=.028)

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and Braak 5,6 (β=2.28, p=.026). Interactions revealed that greater smallworldness relates to lower levels of Tau-PET SUVR in Braak-3,4 (β=-0.56, p<.001) and Braak-5,6 in CN women (β=-0.54, p=.001), but not in CN men (Braak-3,4: β=0.04, p=.844; Braak-5,6: β=-2.43, p=.756). In contrast, there was no sex-by-smallworldness interaction on Tau-PET SUVR in Braak-1 (β=1.20, p=.228), a region associated with early Tau deposition. Rather, greater smallworldness showed a near-significant association with lower levels of Tau-PET SUVR in Braak-1 across sexes (β=-0.27, p=.052).
Conclusions: Results suggest that smallworldness, reflective of altered rsFC topography, may be more predictive of Tau burden in CN women than in CN men. Furthermore, these sex differences may emerge in regions associated with later stages of Tau deposition even among individuals sustaining normal cognitive performance. Findings lend support for a female-specific rsFC mechanism of increased Tau burden. Future studies should investigate sex differences in alterations in rs-FC and their relationships with Tau propagation across the AD continuum, and whether rs-FC alterations may also serve as a mechanism underlying women's cognitive advantage despite greater tau burden in early disease stages.
Keywords: dementia - Alzheimer's disease**,** neuroimaging: functional connectivity**,** positron emission tomography

6 The Relationship Between Parity and Dementia Risk in Black and Latinx women

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Objective: Previous research has demonstrated a link between parity, or number of childbirths, and risk for dementia. This work has shown that women who had 5 or more children had an increased risk of dementia compared with women who gave birth to fewer than 5 children. Since previous studies have been conducted in predominantly non-Latinx white samples, it is unclear whether the relationship between parity and dementia risk varies across race and ethnicity. The purpose of this study was to determine whether parity is similarly associated with dementia risk among non-Latinx white, non-Latinx Black, and Latinx women.
Participants and Methods: Participants were women aged 65 and older in the Washington/Hamilton Heights/Inwood Columbia Aging Project who were not diagnosed with dementia at baseline. Of these 4222 white, Black, and Latinx women, only 3190 with data on number of childbirths were included in these analyses. Participants were assessed every 18-24 months for up to 25 years, with adjudication of dementia status at each visit. Parity was defined as the number of childbirths and categorized as follows: nulliparous (no births), primiparous (1 birth), multiparous (2-4 births), and grand multiparous (5+ births). Cox regression analyses were estimated to determine the relationship between parity and risk of incident dementia in each racial/ethnic group, in age-adjusted models. We then included education in the model, to determine if it mediated relationships between parity and dementia risk.
Results: In the entire sample in age-adjusted models, higher parity was associated with higher risk of incident dementia (HR = 1.12, CI = 1.08, 1.15). Compared with nulliparity, women with 1-4 births had a similar risk for dementia (HR = 1.18, CI = 0.92, 1.51) but those with grand multiparity showed an increased risk for dementia (HR = 2.28, CI = 1.74, 2.98). This effect varied by race/ethnicity. Among Latinx women, the risk for incident dementia increased by 7% with every parity level (HR = 1.07, CI = 1.03, 1.10) and by 67% for grand multiparity (HR = 1.67, CI = 1.53, 1.85). Higher parity was not associated with dementia risk for white and Black women. However, when education was included in the model, the relationship between parity and risk for dementia was no longer present (HR = 1.03, CI = 0.98, 1.07) nor was the increased risk for grand multiparity (HR = 1.06, CI = .73, 1.55) among Latinx women.
Conclusions: The relationship between parity and dementia risk is not consistent across racial and ethnic groups, and may be mediated by socioeconomic status (years of schooling served

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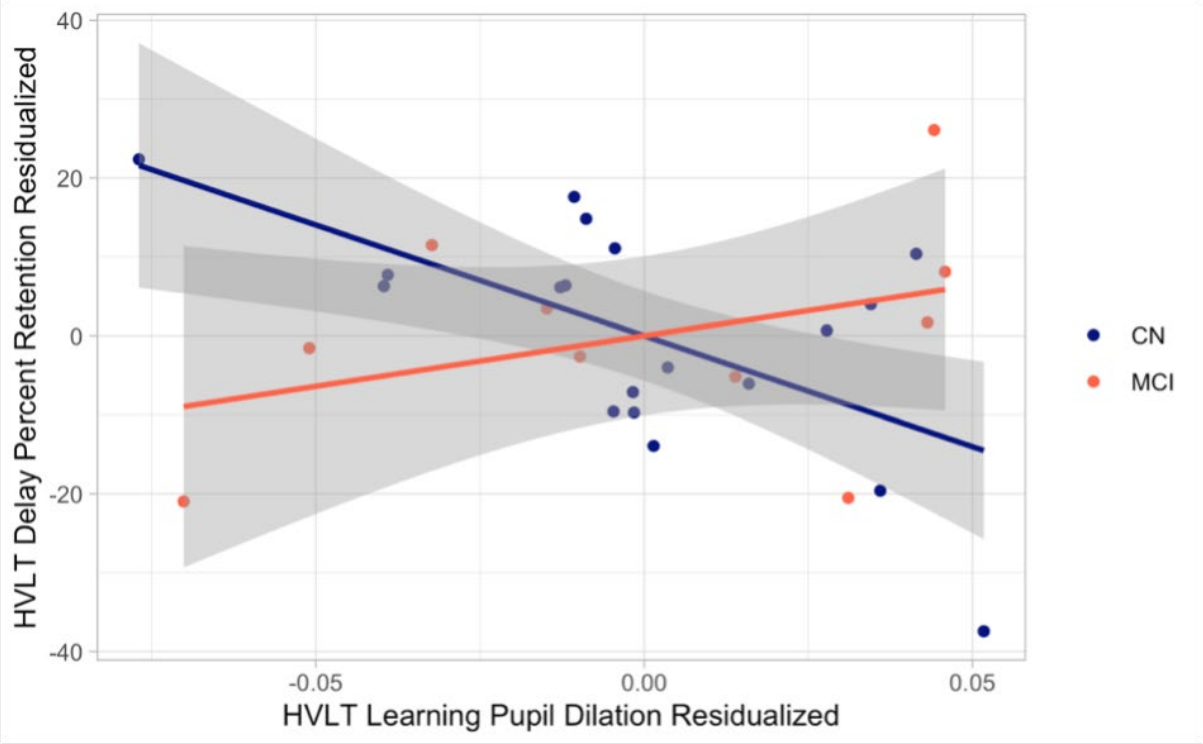

as an adult SES proxy in this analysis). Becoming a mother at an early age might interfere with educational and occupational pursuits, suggesting early motherhood may result in lower educational levels and SES. Since we did not measure age at first birth, the direction of the relationship is unclear. Future work must incorporate social factors when considering the link between reproductive history features and dementia risk in women.
Keywords: dementia - Alzheimer's disease

Paper Session 02: TeleNP

3:30 - 5:00pm
Wednesday, February 2, 2022

1 Measurement Methods Matter: Neuropsychological Tests are Not Equivalent When Administered by Telephone vs In-Person Producing Clinical Misclassification

Megan E O'Connell[1], Helena Kadlec[1], Vanessa Taler[2], Lauren E Griffith[3], Kristina Gicas[4], Christina Wolfson[5], Geva Maimon[5], Susan Kirkland[6], Parminder Raina[3]

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Objective: The Canadian Longitudinal Study on Aging (CLSA) is a population-based study of individuals 45-85 years old that included a brief neuropsychological battery. One cohort received these tests over the telephone (Tracking cohort, *N* = 21,241) and the second cohort received these same tests in-person (Comprehensive cohort, *N* = 30,097). We compared the measurement properties based on mode of delivery.
Participants and Methods: We found that the mode of delivery (telephone vs in-person) impacted the measurement of memory (measured with an immediate and delayed word list learning task) and executive function (measured with animal fluency and alternating numbers and letters). Using multi-group confirmatory factor analysis with the subsample of neurologically healthy participants with complete cognitive data and consistent language use (French or English) across tests (Tracking *n* = 14,415 participants with tests administered by telephone; Comprehensive *n* = 21,737 participants with tests administered in-

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person), we found that measurement of memory and executive function was different based on mode of delivery for raw test scores and for appropriately normed scores (i.e., normative corrected scores created within each cohort (and mode of delivery) stratified by language of administration, sex, education level, and corrected for age).
Results: The larger English-speaking subsample (*n* = 30,361) provided stronger evidence for measurement invariance than the smaller French-speaking subsample (*n* = 5,791), but differences in measurement based on mode of delivery was evident regardless. In both cohorts the same tests appeared more difficult when delivered remotely than when delivered in-person. Hearing acuity was rated as good to excellent for 88% of those in the neurologically healthy subsample who received the neuropsychological tests over the telephone and 89% of those in the cohort wo received the tests in person, suggesting hearing acuity did not explain the differences in measurement across cohorts. Using the full Tracking cohort, we compared the classification of cognitive impairment using the normative comparison standards for the remotely delivered tests with the inappropriate application of the in-person normative data to the remotely delivered tests. Classification of cognitive impairment was based on an algorithm to estimate baserates of expected number of abnormally low scores across the brief battery in a neurologically healthy subsample. We found that use of in-person normative data for interpretation of the cognitive status of persons who received these same tests remotely resulted in clinical misclassification of cognitive impairment. With inappropriate use of the in-person normative data applied to the remotely delivered tests, 7% of those classified as impaired would have been incorrectly classified as not impaired, whereas only 1% of those who were classified as unimpaired would have been incorrectly classified as cognitively impaired.
Conclusions: These findings were unexpected due to the fact that the tests in this brief neuropsychological battery were administered in the same way in-person and over the telephone with no modifications required for remote delivery. These findings have implications for the CLSA and suggest the neuropsychology tests cannot be easily combined across cohorts. These findings have larger implications, however, for teleneuropsychology and for remote clinical practice, particularly where in-person normative data are inappropriately applied to remotely delivered tests.
Keywords: teleneuropsychology**,** psychometrics**,** neuropsychological assessment

2 Comparing Performance between Video and Face-to-Face Neuropsychological Test Administration in a VA Hospital Setting

Michelle E Fox[1], Gregory J Lamberty[2,3]
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Objective: The COVID-19 pandemic has led to a proliferation of tele-neuropsychology practices with varying degrees of validation. As neuropsychologists assess the possibility of maintaining a degree of tele-health practice in the future, it is necessary to consider what measures may be appropriate to administer through non-traditional modalities. The goal of the present study was to evaluate task performance differences between patients who received video administration versus pre-pandemic face-to-face administration.
Participants and Methods: From July 2020 through July 2021, providers at the Minneapolis VA Health Care System administered test batteries through either an in-clinic “hybrid” approach, combining room-to-room video administration with brief face-to-face administration for motor-based tasks, or through “remote” video administration to community-based outpatient clinics around Minnesota and northern Wisconsin. 54 patients (4 female; M_{age}=63.91, SD_{age}=13.45) who completed outpatient neuropsychological testing and did not receive a cognitive diagnosis were selected for analysis. 35 patients completed a hybrid evaluation, and 20 patients completed a remote evaluation. 54 age- and sex-matched patients (4

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female; M_{age}=63.89, SD_{age}=13.31) who completed fully face-to-face outpatient testing between July 2015 and March 2020 and did not receive a cognitive diagnosis were selected for comparison. Exclusion criteria included history of ADHD, serious mental illness, and limited effort as determined by performance validity measures and examiner's behavioral observations. T-tests were used to compare raw scores from measures most commonly administered via video (WAIS-IV Digit Span, WAIS-IV Matrix Reasoning, Controlled Oral Word Association Test, Animal Naming, and Boston Naming Test) as well as standard scores from Test of Premorbid Functioning or Wechsler Test of Adult Reading.
Results: For those patients for whom premorbid estimates of intellectual functioning were available, the groups did not differ (t(63)=-1.43, p=0.15). Test performance did not differ between video and face-to-face administration of WAIS-IV Digit Span (t(102)=-1.39, p=0.17), WAIS-IV Matrix Reasoning (t(74)=-0.30, p=0.76), Controlled Oral Word Association Test (t(75)=-0.04, p=0.97), Animal Naming (t(72)=0.06, p=0.95), or Boston Naming Test (t(97)=-0.51, p=0.61).
Conclusions: Data suggest that at least among individuals who do not meet criteria for a neurocognitive disorder, administration of certain verbally-administered tasks is not compromised by a room-to-room or remote video setup. Such results increase confidence in the validity of evaluations conducted during the COVID-19 era and suggest that certain elements of remote testing for adult populations may be sustainable moving forward. This may allow for increased access to neuropsychology for individuals who live in rural areas or have limited transportation to clinics with neuropsychological services. Further investigation into the validity of video test administration in individuals with diagnosable cognitive impairment is warranted, as is video test administration into patients' homes.
Keywords: teleneuropsychology, neuropsychological assessment

3 Myths and Misconceptions About Older Adults and Technology Use in Clinical Research Studies.

Hannah Wilks[1], Jessica Nicosia[1], Andrew J Aschenbrenner[1,2], Sarah Adams[1], Marisol Tahan[1], Sarah Stout[1], John C Morris[1], Jason Hassenstab[1,2]
[1]Department of Neurology, Washington University in St. Louis School of Medicine, Saint Louis, MO, USA. [2]Department of Psychological & Brain Sciences, Saint Louis, MO, USA

Objective: While smartphone use has steadily increased over the last fifteen years, concerns remain about the "digital divide" that separates younger and older generations in their familiarity with technology. Skepticism about older adults successfully completing smartphone-based studies of cognition became particularly relevant during the COVID-19 pandemic as traditional neuropsychological testing was rapidly shifted to remote formats. The purpose of this study was to investigate older adults' current technology familiarity and usage trends compared to younger adults, and to examine participation factors among older adults enrolled in a smartphone-based study of cognition.
Participants and Methods: A technology familiarity assessment was administered to 40 younger (aged 18-30) and 41 middle-aged (aged 31-55) adults recruited from online sources. An additional 240 older adults (aged 66-93) enrolled in ongoing studies at the Knight Alzheimer Disease Research Center (Knight ADRC) also completed the assessment. The familiarity assessment combined objective testing and self-reported outcomes about technology knowledge, familiarity, perceived difficulty, and usage trends. Knight ADRC participants were also invited to participate in a smartphone-based cognitive assessment called the Ambulatory Research in Cognition (ARC) study. ARC is a high-frequency smartphone assessment which measures processing speed, visual working memory, and associate memory in four very brief (3-minute) daily sessions over one week. For the present study, ARC enrollment rates, reasons participants elected not to participate in ARC, and ARC adherence rates were examined.
Results: Analyses revealed a strong negative relationship between age and technology-related

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knowledge, usage, and perceived difficulty. Older adults self-reported significantly less technology usage and perceived technology to be more difficult to use than young and middle aged adults. Most participants who were introduced to the ARC smartphone-based study consented and chose to participate (83.6%). Of the individuals who elected not to participate in the study, the majority cited technology hesitancy (61%) as their reason for declining. However, among those enrolled in the study, there was no relationship between technology familiarity (defined as self-reported tech task frequency or perceived difficulty), technology icon knowledge, and ARC adherence. There were also no associations between self-identified race, education, or gender, and ARC adherence. Overall, older adults were highly adherent, completing an average of 24 of 28 ARC testing sessions and demonstrated remarkably low drop-out (6.3%).
Conclusions: Older adults were extremely likely to engage in novel smartphone-based cognitive testing, despite potential hesitations about technology knowledge, usage, and familiarity. Those who refused to participate in the smartphone-based study cited aversions to technology more frequently than non-technology related reasons. Critically, Knight ADRC participants were willing to enroll and were highly adherent with daily smartphone interactions regardless of technology familiarity, access issues, or other demographic factors. Our results suggest that concerns stemming from a lack of technology familiarity and technophobia among older adults are overblown and may reflect ageist attitudes.
Keywords: technology**,** aging (normal)**,** neuropsychological assessment

4 Telehealth Perceptions and Experiences of Persons with Parkinson's Disease During the COVID-19 Pandemic

Joshua T Fox-Fuller, Shraddha B Kinger, Emma Weizenbaum, Rini I Kaplan, Celina F Pluim, Timothy Wang, Luke Poole, Alice Cronin-Golomb

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Objective: At the onset of the COVID-19 pandemic, the healthcare landscape rapidly adapted to meet the needs of patients while following pandemic-related public health guidance. As insurance reimbursement policies in the U.S. relaxed, many practitioners began offering virtual visits for some patients. Here, we report survey findings from persons with Parkinson's disease (PwPD) regarding their comfort with technology and experiences with telehealth visits during the COVID-19 pandemic.
Participants and Methods: The Boston University Online Survey Study of Parkinson's Disease (BOSS-PD) enrolled 347 PwPD in 2017-2018. We re-contacted BOSS-PD participants for the COVID-19 follow-up survey; of these, 106 PwPD completed all survey elements reported here (mean [SDs] age: 67.3 years [7.8]; PD duration: 8.1 years [5.0]; education: 16.9 years [2.5]; 46 males, 60 females). Participants answered 9 items about their experiences with technology and telehealth visits (e.g., "Relative to times before COVID-19, I am more able to use technology to connect socially with my friends and family") using multiple-choice and Likert scales. Respondents were also asked if they used technology (e.g., phone/video calls) to attend healthcare appointments prior to COVID-19, and about their experiences and views of telehealth appointments during the pandemic, including their confidence/ease in using the chosen telehealth technology and the perceived quality/convenience of telehealth encounters. Frequency analysis was used to characterize survey responses, and t-tests to examine differences in the perceived quality/convenience of telehealth relative to in-person encounters associated with demographics (sex; median splits of age and PD duration; and education [>16 years vs. =<16 years]) or perceived technological savviness.
Results: Prior to the pandemic, 34.6% of respondents used technology at least occasionally (≥1 time/year) for medical or mental healthcare visits; by contrast, nearly all (92.5%) participated in ≥1 telehealth encounter in the last year. Of the latter, only 10% canceled or missed

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multiple telehealth appointments due to uncertainty or inability to use the technology their providers asked them use, and 60% rated the perceived quality/convenience of telehealth encounters as equal to or better than in-person visits. There were no differences in perceived quality/convenience of telehealth encounters by age, education, sex, or PD duration, nor did the perceived quality/convenience differ between those who did or did not view themselves as "technologically savvy" (all p >.10).
Conclusions: Most PwPD in this study participated in telehealth visits during the COVID-19 pandemic, and only a small percentage needed to cancel or re-schedule appointments due to their uncertainty or inability to use the technology their providers asked them use. Considering the inferred technological literacy of this particular sample (PwPD taking an online survey), however, caution must be taken when considering potential implications for the broader neurological population, including people with less technological literacy or limited access to technologies needed for telehealth encounters. Additional research is needed to determine if other variables, such as cognitive impairment and computer vs. smartphone access, impact engagement with telehealth visits and perceptions of their quality and convenience.
Keywords: technology**,** Parkinson's disease

5 Examining the Impact of the COVID-19 Pandemic on Diagnostic Certainty at an Autism Specialty Center

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Objective: Making diagnostic decisions about childhood neurodevelopmental and mental health conditions is a complex process. Many diagnostic evaluations abruptly shifted to a telehealth modality during the COVID-19 pandemic, further complicating the clinical diagnostic process for many providers. Research suggests variability in diagnostic certainty in diagnoses of autism spectrum disorder (ASD) made via telehealth. The purpose of this study was to compare rates of diagnostic certainty for children evaluated due to concerns about ASD in-person/pre-pandemic and via telehealth/during the pandemic.
Participants and Methods: The sample included 2,211 children, ages 1-21 years (M = 6.7; SD = 4.1), evaluated by a medical doctor (48.7%) or psychologist (51.3%) at an ASD specialty center, located in an urban setting within the Mid-Atlantic region of the US. A total of 664 children were evaluated in-person between 09/01/2019 and 03/13/2020 (i.e., pre-pandemic) and 1,458 were evaluated via telehealth from 3/14/2020 through 06/1/2021 (i.e., during the pandemic). Upon completion of the neurodevelopmental diagnostic evaluation, clinicians were required to provide a final determination (i.e., "*Yes," "No," "Possible,"* or "*Not Assessed*") for the following DSM-5 diagnoses: ASD, Intellectual Disability (ID), Attention-Deficit/Hyperactivity Disorder (ADHD), anxiety (ANX), depression (DEP), and behavioral disorder (BD; included any Disruptive, Impulse-Control, and Conduct DSM-5 disorder). Chi-square tests were used to assess differences in the frequency of these selections between the two time periods.
Results: For ASD diagnoses, *"Possible"* increased by 8.0% (p<.05) and *"Yes"* decreased by 8.3% (p<.05), whereas *"No"* was stable when comparing evaluations conducted in-person/pre-pandemic and via telehealth/during pandemic. For ID, *"Yes"* and "*No"* both decreased (i.e., 10.0% and 7.6%, respectively, p's<.05) and *"Not Assessed"* increased by 15.7% (p<.05), whereas *"Possible"* remained stable across time-periods. With regard to mental health diagnoses, rates were stable for ADHD, ANX and DEP, whereas, for BD, the rate of *"Yes"* increased by 11.1% (p<.05), *"Not Assessed"* decreased by 11.7% (p<.05), and *"No"* and *"Possible"* were stable across time periods.
Conclusions: Rates of diagnostic assessment, diagnoses made, and diagnostic certainty were similar between in-person/pre-pandemic and telehealth/during the pandemic evaluations for ADHD, ANX and DEP. In contrast, decreased

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certainty was observed for ASD diagnosis via telehealth/during the pandemic. While clinicians less frequently evaluated for ID, there was an increase in the assessment and diagnosis of BD via telehealth/during the pandemic. Taken together, these data suggest that ASD and ID diagnosis may be under-diagnosed among children evaluated during the COVID-19 pandemic. This could result in increased wait-times post pandemic, given many of these children may need re-evaluation. Delayed diagnosis may lead to delays in access to critical interventions. Future research should explore the unique contributions of evaluation modality and pandemic factors on rates of assessment, diagnosis, and certainty in diagnosis for childhood neurodevelopmental and mental health conditions to inform future models of care.

Keywords: teleneuropsychology**,** autism spectrum disorder**,** intellectual disability

6 Clinical Utility of Teleneuropsychology Service Model Among Pediatric Patients with Low Intellectual Functioning

Rowena Ng[1,2], Natasha N. Ludwig[1,2], Rachel Peterson[1,2], Lisa Jacobson[1,2]
[1]Kennedy Krieger Institute, Baltimore, MD, USA. [2]Johns Hopkins University School of Medicine, Baltimore, MD, USA

Objective: Teleneuropsychology (teleNP) with pediatric patients is a rapidly evolving model of care due to COVID-19 social distancing restrictions. While the utility of teleNP with adult patient populations is well supported, validation studies within pediatric populations are limited, especially within a telehealth-to-home context. Furthermore, the reliability of teleNP among those with low intellectual functioning and clinically diverse samples remain virtually non-existent. Addressing this gap in literature will be imperative for informing future models of accessible clinical care and research to better meet the needs of these children. As such, this study aimed to 1) examine the association between performance on select Wechsler subtests when administered in-person and in a re-evaluation via teleNP among a clinically-referred pediatric cohort; and 2) compare reliability characteristics across testing modality between subgroups of patients with low (LIF) versus broadly average (BA) intellectual functioning.
Participants and Methods: This study involves a retrospective medical chart review of 35 pediatric patients who underwent in-person neuropsychological evaluation at an academic medical center between 2015 and 2019 (M_{age}= 10.10 years, *SD*=2.93, range=6.22-21.33), and subsequently, a home-based teleNP assessment between 2020 to 2021 (M_{age}= 13.47 years, *SD*=2.88, range=8.70-24.38). Test-retest intervals ranged from 1.63 to 5.34 years ($M_{interval}$=3.36, *SD*=1.07). The sample was diverse with approximately 63% referred from various medical specialty clinics and the remainder referred for ADHD/learning or psychiatric concerns. All patients completed the Similarities, Matrix Reasoning, and Digit Span subtests from either the WISC-V (94.3%) or WAIS-IV (5.7%) at both time-points. Full-scale intellectual quotient (FSIQ) from the initial session was available for all, and applied to determine the two subgroups. Patients with LIF yielded FSIQ<80 at initial in-person assessment (*N*=10, M_{IQ}=61.30, SD_{IQ}=13.54), while those in the BA group were >80 (*N*=25, M_{IQ}=102.88, SD_{IQ}=12.35).
Results: Partial correlations were conducted while controlling for duration between test sessions. Relatively strong associations were observed in test-retest performance on Similarities (r=0.705, p<0.001), Matrix Reasoning (r=0.756, p<0.001), and Digit Span (r=0.813, p<0.001) subtests. Among LIF patients, these effects remained robust across Similarities (r=0.762, p=0.017), Matrix Reasoning (r=0.795, p=0.01), and Digit Span (r=0.744, p=0.022) subtests. Reliable change index scores (RCI) were computed and coded for statistical significance (RCI > 1.96). Chi-square analyses did not reveal differential distribution of significant RCI between the LIF and BA groups across Digit Span (40% vs. 24%), Similarities (10% vs. 24%), and Matrix Reasoning (20% vs. 20%) subtests.
Conclusions: Performance on select Wechsler subtests during in-clinic and subsequent teleNP assessments were strongly related in a pediatric

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clinically-referred sample. Reliability of test scores across modality was high and comparable for children with BA and LIF, although it should be noted our study included a small sample size and limited test measures. Results support the utility of teleNP services in children with a broad range of intellectual functioning; however, future prospective studies are warranted. Limitations of teleNP and practical test considerations will be discussed.
Keywords: teleneuropsychology**,** intellectual disability**,** intellectual functioning

Paper Session 03: Cognition and Health Behavior

3:30 - 5:00pm
Wednesday, February 2, 2022

1 Exercise, Executive Functioning, and The Mediating Role of Frontoparietal Network Activation among Children from the ABCD study

Ileana Pacheco-Colón, Angela R Laird, Samuel W Hawes, Raul Gonzalez
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Objective: Studies have documented effects of exercise on children's executive functioning (EF) and brain structure/function. However, it is not yet clear whether exercise effects on children's EF can be explained by underlying neural mechanisms, as studies have failed to find and/or examine associations between these constructs. The current study examines cross-sectional associations between exercise and EF, and explores a potential mediating role for task-related activation of the frontoparietal network (FPN) among children from the Adolescent Brain and Cognitive Development (ABCD) study. We hypothesized that a) more exercise would predict better EF, and b) this association would be mediated by FPN activation during an *N*-back task, such that more exercise would predict greater FPN activation, which would in turn predict better EF.
Participants and Methods: Data were obtained at the baseline assessment of the ABCD study, and consisted of 7,333 children ages 9-10 with good-quality *N*-back imaging data. Lifetime exercise was assessed through the Sports & Activity Involvement Questionnaire completed by parents. Participants completed the NIH Toolbox cognition measures, which yielded the Fluid Intelligence Composite, our primary measure of EF.
Participants also completed two runs of an emotional *N*-back task in the scanner. Focusing on the 2-back versus 0-back contrast, we utilized average beta-coefficients for each region-of-interest (ROI), averaged across runs, provided in the ABCD 3.0 data release. FPN ROIs included: frontomarginal gyrus/sulcus, frontopolar gyrus/sulcus, middle frontal gyrus/sulcus, superior frontal gyrus, intraparietal sulcus, inferior frontal sulcus, supramarginal gyrus, precentral sulcus, and inferior temporal sulcus.
We used latent variable modeling and found that selected ROIs loaded significantly onto a higher-order FPN factor (CFI=.895, RMSEA=.057). To address hypotheses, we first examined the direct effects of exercise on EF through linear regression (Path c). We then ran a mediation model estimating the effect of exercise on FPN activation during an N-back task (Path a), the effect of FPN activation on EF (Path b), and the direct effect of exercise on EF after controlling for the mediating influence of FPN (Path c'). Analyses controlled for age, sex, parental education, income, race/ethnicity, internalizing and externalizing problems, parental monitoring, and school engagement and involvement.
Results: The direct effect of exercise on EF was small but significant, such that more exercise predicted better EF (Path c: ß=.030, p=.016). Our mediation model revealed that exercise did not predict FPN activation (Path a: ß=.012, p=.357). In contrast, greater FPN activation predicted better EF (Path b: ß=.092, p<.001). After accounting for the role of FPN activation, the effect of exercise on EF remained unchanged (Path c': ß=.029, p=.019). The indirect effect of exercise via FPN was nonsignificant (Path a*b: ß=.001, p=.361).
Conclusions: Findings suggested that more exercise predicted better EF among children; however, this association was small and not explained by FPN activation. Although greater FPN activation during *N*-back task predicted

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better EF, results did not support a mediating role for FPN activation in the association between exercise and EF. More work is needed to determine whether cognitive benefits of exercise among children are clinically meaningful and related to other brain-based metrics.
Support: F31-DA047750-01A1(Pacheco-Colón); U01-DA041156(Gonzalez)
Keywords: executive functions**,** fluid intelligence**,** neuroimaging: functional

2 Making Movement: Associations of Aerobic Activity with Depressive Symptoms and Cognitive Functioning in a Diverse High-risk Sample

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[1]Department of Psychology, Georgia State University, Atlanta, Georgia, USA. [2]Emory University School of Nursing, Atlanta, Georgia, USA. [3]Gerontology Institute, Georgia State University, Atlanta, Georgia, USA

Objective: Numerous studies underscore salient associations between exercise, fewer depressive symptoms, and better cognitive functioning; however, the literature rarely includes well characterized, high risk, non-white populations. Factors including race and ethnicity are important because they impact risk for depression and trajectories of cognitive and brain aging, as well as access to and participation in structured exercise. Therefore, the present study examines the cognitive and mood benefits of exercise in a 60% Black sample of middle-aged adults with a parental history of Alzheimer's disease.
Participants and Methods: Self-report of exercise frequency and cardiovascular risk were collected from 79 participants (mean age = 58.86 ± 6.85, 60% Black, 66% female). Depressive symptoms were measured by the Center of Epidemiologic Studies Depression Scale (CES-D). Cognitive flexibility was assessed with Trail Making Test part B, and verbal learning and memory with the Buschke Selective Reminding Test. Regression analyses were performed in which exercise frequency was related to CES-D and cognitive test scores, controlling for medical and demographic factors.
Results: Self-report of engaging in aerobic exercise over the past four months was associated with better total and delayed recall on the Buschke. Self-report of engaging in any exercise over the past month was marginally associated with lower total CES-D scores. Follow-up analyses examining the CES-D negative affect, anhedonia, and somatic subscales showed higher levels of exercise over the past month were associated with lower somatic symptoms of depression. Results did not differ by race.
Conclusions: These data support recent studies highlighting the cognitive and mood benefits of exercise. This study fills important gaps in the exercise literature by demonstrating these associations in a diverse and high risk sample, thus moving this area of research towards greater clinical relevance. In light of health disparities in vascular disease, which poses risks for depression and cognitive impairment, future studies in diverse samples should examine the interrelationships of vascular intervention such as exercise with cognitive functioning and mood.
Keywords: diversity**,** depression**,** movement

3 Understanding Cultural Differences in Perceived Social Isolation as Predictors of Cognitive Performance: A HABS-HD Data Study

Mirna L Arroyo-Miranda, Andrea P Ochoa Lopez, Luis D Medina
University of Houston, Houston, Texas, USA

Objective: Social isolation has negative effects on health, including cognitive health. A variety of proximal and distal factors influence how individuals perceive their connectedness with others, which in turn affects cognition through multi-path mechanisms. Hispanics/Latinos may be more susceptible than non-Hispanics/Latinos to changes in cognition related to social

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isolation, possibly due to Latino cultural values such as *familismo*. However, evidence on this cultural difference is currently mixed. In this study, we assessed the effect of demographic, environmental, and general health factors associated with perceived social isolation on cognitive performance. We evaluated the contribution of each factor and compared these between Mexican-American (MA) and non-Hispanic White (nHW) participants; we hypothesized that these three factors would contribute differently to cognitive performance between the two demographic groups.
Participants and Methods: We used data from the Health & Aging Brain Study - Health Disparities (HABS-HD), which includes approximately 1,000 MA and 1,000 nHW from the Texas community. After exclusion criteria, a cross-sectional sample of 984 participants (45.5% MA) was analyzed. Controlling for potential confounders, we performed linear regressions between a composite cognitive score (composed of memory, executive function, processing speed, and language measures) and each of the social isolation factors in separate and omnibus models. Results were compared between MAs and nHWs.
Results: Mexican Americans composed 45.5% of the sample (57.3% female). MAs were slightly younger (69.7±8.2 years MAs vs 64.2 ±7.4 years nHWs, p<0.001), and less educated than nHWs (10.0±4.4 years for MAs, p<.001; 15.7±2.6 years for nHWs,). In the overall sample, only demographics (age and marital status) and general health factors (health status, diabetes, and alcohol consumption) were significantly associated with cognitions, explaining 23% of the variance (p<.001). Group comparisons between MAs and nHWs showed that more demographics (i.e., age, gender, marital status, worrisome personality traits) and general health factors (health status and alcohol use score) accounted for 19% (p= 0.001) of the variance in nHWs, while only age and marital status demographic factors and health status accounted for 23% (<.0.001) of the variance in MAs.
Conclusions: Our findings suggest that personal and health characteristics influence the effect of perceived social isolation on cognitive status among older adults. Furthermore, compared to non-Hispanic Whites, fewer factors accounted for greater variance in Mexican Americans. While this difference may be attributable to cultural differences, additional research is necessary to identify modifiable lifestyle factors to prevent cognitive decline in culturally diverse older adult groups.
Keywords: chronic stress**,** minority issues**,** cognitive functioning

4 Help Seeking Behavior: Examining the Contribution of Subjective Cognitive Decline and Sociodemographic factors

Martina Azar[1,2], Silvia Chapman[3], Jillian Joyce[3], Maria Schultheis[2], Zoe Zhang[2], Preeti Sunderaraman[3], Megan Barker[3], Stephanie Cosentino[3]
[1]VA Boston Healthcare System, Boston, MA, USA. [2]Drexel University, Philadelphia, PA, USA. [3]Columbia University Medical Center, NY, NY, USA

Objective: Disparities Alzheimer's disease (AD) prevalence, as well as in help seeking (HS) have been posited to exist across sociodemographic groups in the US, warranting a public health concern (Centers for Disease Control and Prevention, 2018). Research addressing SES disparities has often focused on clinical symptoms of AD, limiting its application to preventative efforts. Early HS is crucial for early intervention and planning of care. Subjective cognitive decline (SCD), a posited preclinical marker of AD, can provide a useful context in which to examine early HS. The current study examined the relationship between SCD and HS as a function of three sociodemographic factors (i.e., level of education, self-reported race/ethnicity, SES).
Participants and Methods: The current sample consisted of 137 cognitively healthy older adults (z > -1.5 SD on objective cognitive testing), aged 56 to 92 (M= 73.77, SD=6.83) with a mean education of 16 years (SD=2.4 years). 28% of the sample self-reported as race/ethnic minorities (e.g., African American, Asian, Other.) Participants completed a 20-item SCD questionnaire assessing perceived cognitive difficulties across both memory and non-memory

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domains in comparison to same aged peers. Questionnaires were used to assess HS behavior (e.g., Have you gone to the doctor specifically for memory concerns?) and mood (i.e., GDS-15, BAI). Binary logistic regressions were used to examine: a) the association between SCD and HS and b) the contribution of education and race/ethnicity to the relationship between SCD and HS, including depressive and anxiety symptoms as covariates. Fisher's exact tests were used to examine the relationship between SCD and HS across different SES groups.
Results: SCD was positively associated with HS, b = 0.04, SE=0.01, p=0.006, odds ratio=1.04, 95% CI [1.02, 1.06]. The current model correctly classified 70.8% of participants, an improvement from the null model (67.9%) explaining a relatively small proportion of the variance in help seeking behavior, Snell R^2 = .10, Nagelkerke's R^2 = 0.13. Level of education was associated with HS (b=0.22, SE=0.09, p=0.02, 95% CI [0.04, 0.40] when controlling for SCD (p=0.01), anxiety (p=0.07), and depression (p=0.89). There was a marginal interaction between level of education and SCD, suggesting that the relationship between SCD and help seeking behavior was marginally moderated by education level, $\chi2(1) = 3.62$, p = 0.057. Self-reported race (p=0.35) and the interaction of race and SCD (p=0.23) were not related to HS, after controlling for SCD (p=0.01), anxiety (p=0.27), and depression (p=0.78). SCD and HS were not related across the high and low SES group, $\chi2$ (1)=0.53, p=0.50.
Conclusions: Overall, as expected, individuals with higher levels of SCD reported higher levels of help seeking. However, preliminary analyses suggest that education may moderate this relationship such that those with fewer years of formal schooling may be less likely to seek help. Findings elucidate the importance of tailoring interventions as a preliminary stepping stone in addressing help seeking disparities for individuals who are disproportionately affected by dementia in the USA.
Keywords: cognitive functioning**,** cross-cultural issues**,** diversity

5 Cognitive Impairment and Reading Level on Surgery Cancellation

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Objective: One third of elective procedures are performed on older adults and this proportion will continue to increase over time as population ages. The national institutional cancellation rates average 7-8% with some institutions reporting as high as 16.9% in general surgery cancellations (Zietlow et al., 2020). Hospitals have yet to consider cognitive impairment and reading level as relevant factors to surgery cancellation. This investigation assessed surgical cancellation relative to preoperative cognitive profile (type/severity) and reading level for individuals age 65+ referred to the Perioperative Cognitive Anesthesia Network (PeCAN) within a tertiary hospital.
Participants and Methods: Data represent January 2018 to December 2019 using IRB approved protocol with honest broker extraction. As part of the PeCAN program, individuals age 65+ receive a preoperative cognitive screener including 3-word memory test and digital Clock Drawing Test, frailty and education (Amini et al., 2019). Based on screening criteria, preoperative staff refer for neurobehavioral assessments with a neuropsychologist for case planning and PCP referral. Standardized neuropsychology measures were used to create composites for a memory domain (Hopkins Verbal Learning Test: list learning total immediate, delay, discrimination) and attention domain (letter F fluency, digit span forwards, backwards). The composite standardized score was graded as mild (SD -0.5 to -0.99), moderate (SD -1.0 to -2.0), or severe (SD < -2.0). The Wide Range Achievement Test-Version 3 measured reading level.
Results: Of 12,880 individuals age 65+ assessed in the preoperative anesthesia clinic, 2,991 were referred for a neurobehavioral exam as a result of cognitive screener. Of the referrals, 1,655 were seen by a neuropsychologist with 134 excluded for reporting due to incomplete data. Of the 1,588 who have surgery cancellation information, 960 were classified having at least mild deficits in

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attention (n=162), memory (n=371), or both (n=427). Surgery cancellation occurred for 191 individuals (12.03%). Of those with a complete neurobehavioral exam (1,363), surgery cancellation was highest for those with cognitive impairment ($\chi^2(1)=7.15$, $p<.01$; 80% of cancellations, n=119). Cancellation was more frequent for those with combined attention and memory deficits ($\chi^2(3)=18.18$, $p<.001$; 45% of cancellations), regardless of the severity of this deficit (χ^2 (2)=4.94, p= .08). Of the 1,401 patients who completed a reading evaluation, 155 individuals cancelled surgery. Cancellations were highest for those with less than 8th grade reading level (45.16%), followed by 9-12th grade level (40.65%) and lowest for college reading level (14.19%); ($\chi^2(2)=15.34$, $p<.001$).
Conclusions: Higher rates of surgical cancellation were identified for individuals with both memory and attention deficits, regardless of impairment severity, and lower grade equivalent reading scores. Cancellation of elective scheduled surgeries leads to inefficient use of staff and patient time, and resources (Kaddoum et al., 2016). Identifying contributors to cancellations is an essential first step to improving patient care resources. Our data suggest it is relevant to consider preoperative cognitive function and reading abilities for at risk patients, particularly given expected increases in older adults electing surgical procedures over the next decade. Future work involves systematically assessing reasons for cancellations in these at-risk individuals.
Funding: K07 AG066813, R01 AG055337, Paul Satz Term Professorship Funding.
Keywords: cognitive screening**,** aging (normal)

6 Episodic Future Thinking and COVID-19 Vaccination Behavior

Jennifer J. Vasterling[1,2], Ginette LaFleche[1,2], Virginie M. Patt[1,2], Renee Hunsberger[1], Mieke Verfaellie[1,2]
[1]VA Boston Healthcare System, Boston, MA, USA. [2]Boston University School of Medicine, Boston, MA, USA

Objective: The ability to imagine a detailed and well-specified future (i.e., episodic future thinking) depends on cognitive processes mediated by the medial temporal lobes (Schacter & Addis, 2007) and has been linked to decision making (Palombo, Keane, & Verfaellie, 2015). Vaccine hesitancy represents a current public health focus, with decision making around vaccine behavior poorly understood. Prior literature suggests that the emotional consequences of psychological trauma exposure may be associated with difficulty vividly imagining a positive future (Kleim et al, 2014). The aim of this study was to examine associations among future thinking, COVID-19-related beliefs and behaviors, and vaccination status/intent in a trauma-exposed population.
Participants and Methods: We administered surveys querying about pandemic risk (e.g., unprotected large gatherings prior to vaccination availability) and protective (e.g., mask wearing) behaviors, associated beliefs, and vaccination status/intent to a sample of n = 19 (1 female; 18 male) trauma-exposed military veterans who previously underwent (M = 40.2 months; SD = 14.4 months) assessment of posttraumatic stress disorder (PTSD) with the Clinician Administered PTSD Scale for DSM-5 (Weathers et al., 2013) and completed an episodic future thinking paradigm (Addis et al., 2008). The future thinking paradigm required respondents to describe in detail future events in response to positive and negative cue words. Narratives were scored using an adapted autobiographical interview scoring procedure (Levine et al., 2002).
Results: Generation of a higher number of more event-specific (internal) details was associated with being vaccinated (or intent to do so) (r = 0.45; p = .05). Beliefs that the vaccination would be effective (r = 0.73; p < .001), beliefs about COVID-19 risks (r = .51; p = .02), and restraining from engaging in high-risk behaviors at the height of the pandemic (r = -0.49; p = .03) were likewise associated with being vaccinated or intent to do so. Although PTSD symptom severity was not directly associated with vaccination behavior, more severe PTSD symptoms were associated with beliefs that the vaccination would be ineffective (r = 0.51; p = .03).

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Conclusions: Results add to a growing literature that highlights the functional importance of the ability to imagine a detailed future and emphasize the need for interventions that bolster underlying neurocognitive processes associated with future thinking. Our findings further identify PTSD as an indirect influence on vaccination behavior, highlighting the broader health significance of PTSD.
Keywords: post-traumatic stress disorder**,** cognitive processing**,** social processes

Poster Session 04: Neurodevelopmental | Prenatal

7:30 - 8:30am Thursday, 3rd February, 2022

Program Change: *Effect of Cognitive Fatigue on Clinical Performance in Flight Medicine* has been moved from Poster Session 04 Position #21 to Poster Session 09 Position #66

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1 Sensitivity and Specificity of Executive Function Assessment Methods in Pediatric ADHD: A Quantitative and Qualitative Approach

Blake Gimbel[1,2], Aly Pachter[3], Theresa Lafavor[3]
[1]Proof Alliance, Saint Paul, MN, USA. [2]Minnesota Neuropsychology, LLC, Saint Paul, MN, USA. [3]Pacific University, Hillsboro, OR, USA

Objective: A growing body of evidence suggests considerable heterogeneity in executive function (EF) test performance in youth with attention-deficit/hyperactivity disorder (ADHD), and there is ongoing debate regarding the clinical use of EF assessment methods in the diagnosis of ADHD. Given multiple etiologies that can contribute to poor EF test performance, tasks-based EF tests may be better at excluding control children (i.e., specificity) than at confirming ADHD in children with the diagnosis (i.e., sensitivity), while informant ratings of EF (i.e., caregivers, teachers) may show the opposite pattern (i.e., better sensitivity than specificity). In this study, we examined the sensitivity and specificity of task-based and rating-based measures of EF as well as qualitative information gathered from neuropsychological reports.
Participants and Methods: We conducted a retrospective chart review of 61 children referred for neuropsychological evaluation at a university-based clinic (36 children diagnosed with ADHD, 25 clinical controls; mean age 11.46). Participants were administered measures of intelligence (WISC-IV/WISC-V) and EF (DKEFS), while informants (caregivers and teachers) completed a rating-based measure of EF (BRIEF/BRIEF-2). Chi square analyses and independent samples *t*-tests were used to examine group differences. Sensitivity and specificity analyses (i.e., percent correctly and incorrectly classified) were conducted using clinical indicators of impairment (BRIEF/BRIEF-2 standard score of 65 or higher; discrepancy of greater than 1 standard deviation between EF task performance and estimated IQ). For a subset of participants (N = 18), we calculated the sensitivity and specificity of qualitatively coded ADHD symptoms.
Results: Group comparisons revealed estimated IQ was significantly higher in the ADHD group compared to the control group (t[58] = 2.08, p =.042). Participants in the ADHD group demonstrated significantly higher parent ratings of global EF impairment (t[53] = 2.24, p =.029) and cognitive EF impairment (t[54] = 2.04, p =.046) compared to those in the clinical control group. No other significant group differences were found. Impairment on 1 or more task-based EF measure correctly classified 63.9 percent of the ADHD cases (i.e., sensitivity) and 37.5 percent of clinical control cases (i.e., specificity). Impairment on 2 or more task-based EF measures reduced sensitivity (38.9% correctly classified) but increased specificity (70.8% correctly classified). Parent ratings showed poor sensitivity (37.1%) and specificity (35%), while teacher ratings showed better sensitivity (65%) than specificity (50%). Qualitatively coded inattentive symptoms showed poor sensitivity (50%) but good specificity (87.5%), while hyperactive/impulsive symptoms showed poor sensitivity (20%) but excellent specificity (100%).

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Conclusions: Our results suggest that task-based measures may be more useful in ruling out a high likelihood of ADHD, especially when including multiple EF domains (i.e., lack of impairment suggests no ADHD diagnosis), but are inadequately sensitive to the broad range of difficulties experienced by individuals with ADHD. Rating-based EF measures, on the other hand, did not usefully discriminate between ADHD and other clinical diagnoses, while descriptive information from clinical interviews and behavioral observations may be particularly useful clinical tools in helping clinicians evaluate the likelihood of ADHD. Implications for clinical neuropsychological practice are discussed.
Keywords: attention deficit hyperactivity disorder**,** assessment**,** executive functions
Correspondence: Blake Gimbel, PhD; Proof Alliance; Minnesota Neuropsychology, LLC; gimb4687@pacificu.edu

2 Impact of Attention Difficulties, Processing Speed, and Intelligence on Math Achievement in School-Aged Children: A Preliminary Study

Faye E Domokos, Jennifer Bolden, McKenzie Martin, Alyssa Cooley
University of Tennessee, Knoxville, TN, USA

Objective: A burgeoning area of research is investigating processing speed ability as a predictor of academic functioning for individuals with attention difficulties (Cook, Braaten, & Surman, 2018). Mental processing speed is vital to an individual's ability to acquire novel information and learn increasingly complex material. Children/adolescents with predominantly attention problems are more likely to possess processing speed difficulties compared to controls (Goth-Owens et al., 2010). Extant research has examined processing speed and its predictive value of math achievement for pediatric populations with inattention symptoms, though with mixed results (Thaler et al., 2012; Child et al., 2019). More work is needed to elucidate the relation between processing speed, inattention, and math achievement. The current study hypothesized that (1) inattention symptoms would be negatively correlated with math achievement; (2) processing speed would be positively associated with math achievement; and (3) processing speed would contribute uniquely to math achievement over and beyond age, sex, IQ, and inattention.
Participants and Methods: A clinic sample of children between the ages of 7 and 12 years (n = 37; M_{age} = 9.67; 76% male) was recruited via flyers and website postings or referred by community resources. Participants completed a comprehensive psychoeducational testing battery. The Coding and Symbol Search subtests from the Wechsler Intelligence Scale for Children, 4th/5th editions (WISC-IV/WISC-V; Wechsler, 2003; Wechsler, 2014) assessed processing speed, while Math Concepts & Application and Math Computation from the Kaufman Test of Educational Achievement, 3rd Edition (KTEA-3; Kaufman & Kaufman, 2014) measured math achievement. Parent/guardian ratings from the Child Behavior Checklist (CBCL; Achenbach, 2014) gauged attention problems. The Vocabulary subtest from the WISC-IV/WISC-V was used as a proxy for intelligence to control for overlap between constructs since it does not rely on visually-mediated stimuli, nor does it require any visual-motor coordination.
Results: Bivariate correlations revealed that both tests of mathematic achievement (i.e., Math Concepts & Application and Math Computation) were significantly associated with IQ and the two measures of processing speed (i.e., Coding and Symbol Search). A series of hierarchical regressions revealed that only IQ contributed to math achievement scores (17.8%-30.9%) after controlling for both age and sex. Processing speed nor attention difficulties explained any significant difference in math achievement scores.
Conclusions: The study aimed to examine cognitive factors' utility in predicting math achievement. Given that vocabulary was utilized as a proxy for intelligence and accounted for a significant amount of variance in math achievement, it may be that verbal skills are critical for the formation of math abilities and therefore should be considered a target for early screening. Additionally, the contribution of

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processing speed skills to predicted math achievement may have been impacted by differences in visual-motor coordination and short-term visual memory abilities, and thus urges future research to continue investigating how specific cognitive difficulties manifest in academic settings for children with attention problems.

Keywords: attention, mathematics ability

3 Utility of Teacher-Specific vs. Multi-Rater Consensus Reports of ADHD Symptomology in Detecting Working Memory Impairment

Jason S Feldman, Cynthia L Huang-Pollock
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Objective: Modest correlations between parent and teacher ratings of ADHD symptomology have been widely documented (Burns et al., 2014; Narad et al., 2015) and reflect legitimate, clinically meaningful differences in behavior across settings (De Los Reyes, 2013). Managing rater discrepancies in a way that enhances ADHD assessment remains a prominent focus in the literature. Integration approaches using confirmatory factor analysis (CFA) have become increasingly favored in that the target trait is represented by an error-free latent factor capturing rater agreement, while rater-specific variance is parsed into separate latent factors (Bauer et al., 2013). Latent general ADHD factors are considered the optimal dimensional representation of the syndrome (Arias et al., 2018), and general factors indexing agreement align well with the DSM conceptualization of ADHD as a cross-contextual behavioral trait.
However, relative to parents, teachers show greater measurement precision and better discriminate children's placement along a latent continuum of ADHD symptomology (Makransky & Bilenberg, 2014). Additionally, stronger correlations between teacher-reported symptoms and impairment (i.e., social, academic, self-esteem) suggest ADHD symptoms to be more problematic in school than at home (Power et al., 2017). It is therefore possible that teachers' ratings of ADHD symptomology may offer incremental prediction of cognitive impairment associated with ADHD over and above parent-specific or consensus reports.

This study aims to determine whether teacher (vs. parent) ratings of ADHD symptomology contain unique clinical information that is distinctly associated with ADHD-related cognitive impairment and may therefore prove diagnostically informative. To this end, we examine whether teacher-reported symptoms incrementally predict working memory (WM) impairment over and above a latent general ADHD factor capturing rater agreement.
Participants and Methods: Children (N=409) aged 8-12 (M=10.05,SD=1.22) were community recruited from Centre, York, and Dauphin counties of Pennsylvania. Ratings of the 18 ADHD symptoms were obtained via parent- and teacher-report on the ADHD Rating Scale (DuPaul et al., 1998). All 36 ratings (18 parent, 18 teacher) loaded onto a latent general ADHD factor, the 18 inattentive and hyperactive ratings (9 parent, 9 teacher) loaded onto separate latent domain factors, and each informant's 18 ratings loaded onto separate rater factors. The digits backward and letter-number sequencing (WISC;Wechsler, 2003) and finger windows backwards (WRAML-2;Sheslow & Adams, 2003) subtests were used to create a latent WM factor. Modeling was carried out using the R package lavaan.
Results: First order correlations were as anticipated. The initial model fit the data well, χ^2(522,N=409)=812.77,p<.001,CFI=.969,TLI=.963,RMSEA=.037, as did Model 2 after adding the WM factor, χ^2(625,N=409)=904.47,p<.001,CFI=.972,TLI=.967,RMSEA=.033. In Model 2, the teacher perspective factor (β=-0.27, p=.001) and inattention factor (β=-0.19, p<.001) predicted poorer WM over and above the general factor (β=-0.35, p<.001) (Figure 1). There was no association between WM and the parent (β=-0.007, p=.91) or hyperactivity (β=0.003, p=.96) factors.

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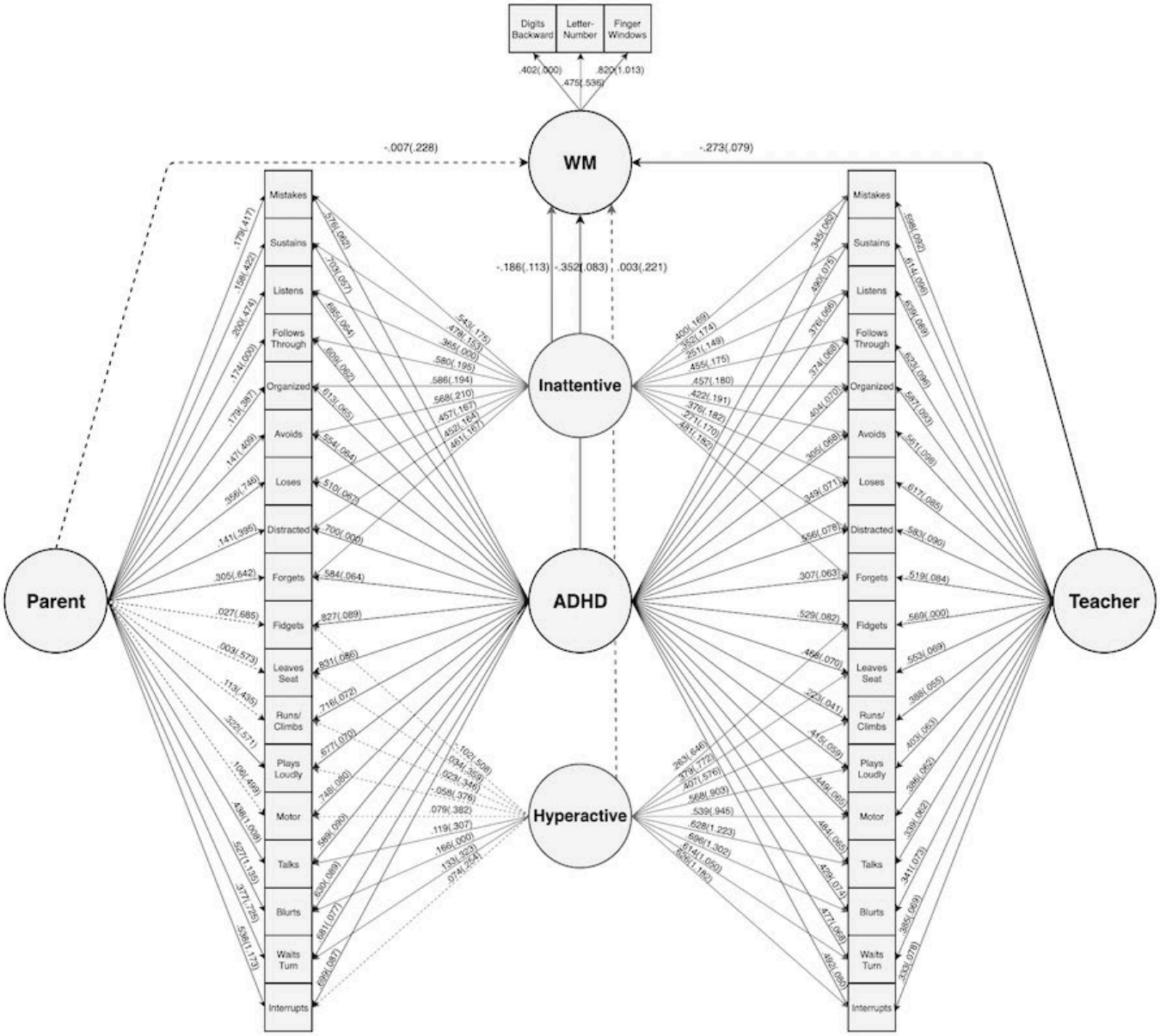
Figure 1

Full structural equation model



Note. Left and right indicator columns represent parent and teacher ratings of each symptom, respectively. Regression/loading paths for inattention and hyperactivity factors depicted in grey for ease of viewing. Dotted lines represent nonsignificant paths.

Conclusions: In a trifactor model of ADHD, teacher (but not parent) ratings predicted cognitive impairment over and above the general "consensus" ADHD factor. These results suggest elevated teacher vs. parent reports on

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ADHD rating scales may convey greater risk of WM deficits.
Keywords: attention deficit hyperactivity disorder**,** working memory
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4 Evaluating the Simple View of Reading in Children with ADHD

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Objective: The simple view of reading (SVR) is an influential model of reading which asserts children's reading comprehension performance can be explained entirely by two interrelated components, decoding and language comprehension. In developmental samples of children and adolescents, latent estimates of decoding and language comprehension account for 77%-100% of the variance in the reading comprehension across ages, reading skill levels, and orthographies. In contrast, in neurodevelopmental samples of children with ADHD, decoding and language comprehension only account for 30-50% of the variance in reading comprehension, suggesting that the simple view may not hold for these children (Mackenzie, 2019). However, studies of children with ADHD have neglected to use latent estimates of decoding and language comprehension, and/or failed to account for both decoding and language comprehension when examining predictors of reading comprehension. The current study addresses these limitations and is the first to use multiple indicators and latent estimates of decoding, language comprehension, and reading comprehension to investigate the validity of the SVR for children with ADHD.

Participants and Methods: Participants included 220 children ages 8-13 years (78 girls), including 135 children with ADHD recruited as part of a larger study. Reading comprehension was assessed using the *Reading Comprehension* and *Silent Reading Fluency* subtests from the KTEA-3 (Kaufman & Kaufman, 2014). Decoding was assessed using the *Word Reading*, *Nonsense Word Decoding* and *Word Reading Fluency* subtests from the KTEA-3. Language Comprehension was assessed using the *Language Comprehension* subtest from the KTEA-3 and the *Vocabulary* and *Similarities* subtests from the WISC-V (Weschler, 2014). Latent estimates of decoding, language comprehension, and reading comprehension will be derived from the two or three subtests that measured each skill.
Results: Data collection is complete and currently in the screening/cleaning phase. Analyses will be conducted as follows: Measurement models will be created for each of the three constructs of interest, with each construct comprised of two or three tests. Next, structural models will be created with decoding and language comprehension predicting reading comprehension. Finally, a multigroup model will be tested to examine the extent to which decoding and language comprehension predict reading comprehension as strongly for children with ADHD as they are expected to for children without ADHD.
Conclusions: Examining the relevance of the simple view of reading for children with ADHD is essential because it can reveal how reading difficulties operate similarly or differently in this population, suggest why reading difficulties are so common in these children, and inform more effective reading interventions for children with ADHD.
Keywords: attention deficit hyperactivity disorder**,** reading (normal)

5 Latent Structure of Working Memory and Emotion Regulation in Pediatric ADHD

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Objective: Working Memory (WM) and Emotion Regulation (ER) are two domains commonly affected in pediatric ADHD. However, impairments across domains are not uniform and children with ADHD may present with variable WM profiles and subsequent ER deficits (Nigg, 2020). Therefore, this study aimed to adequately characterize the latent structure of WM and ER in a clinical sample of children with ADHD and comorbid conditions.
Participants and Methods: Participants included English-speaking children (ages 6-16; N=739) diagnosed with ADHD who completed a neuropsychological evaluation at a Midwestern pediatric neuropsychology clinic. 22% of the sample was diagnosed with ADHD only, 21% had ADHD and a comorbid internalizing disorder, 5% had ADHD and a comorbid externalizing disorder, and 52% was diagnosed with ADHD and a comorbid developmental disorder. The WM indicators included scaled scores from the WISC-V Digit Span and Picture Span subtests. The ER indicators were parent and teacher-report on the Emotional Control and Shift Scales from the BRIEF-2. Latent Profile Analysis was conducted to determine the best-fitting model residual covariance structure as well as optimal number of latent profiles. We ran separate models with an increasing number of latent profiles. Fit statistics were obtained for each model, and were compared to those of other models to determine the best fitting model (and thus, the number of latent classes) for the data. Multiple fit statistics (i.e., AIC, BIC, AWE, CAIC, BLRT, BF, and cmP_k) were examined, and the most parsimonious model was selected based on the preponderance of evidence.
Results: Results indicated that a two-class model that included residual indicators equated across classes fit the data best of the 12 candidate models compared, as evidenced by lowest BIC statistic of models compared (e.g., BLRT $p < .001$, $cmP_k = 0.80$). The WM/ER Class 1 (*Cognitive Weakness)*; 62% of the sample) had significantly lower digit-span scores, and generally persevered emotion regulation functioning per parent/teacher report. Class 2 (*Emotionally Dysregulated)* had average working memory scores, and elevated emotion regulation problems. Using the DCAT three-step prediction method, latent class membership did not differ by comorbid diagnosis (χ^2=3.89, p=.27), age (χ^2=0.31, p=.58), gender (χ^2=0.002, p=.96), or verbal IQ (χ^2=1.08, p=.58).
Conclusions: Findings suggest that children with ADHD and comorbid conditions do not have uniform patterns of WM and ER. In our sample, the *Cognitive Weakness group* had more cognitively based problems, and the *Emotionally Dysregulated Group* had more emotionally-based problems. Moreover, auditory-WM tasks may be more sensitive than visually-based WM tasks. Future work may investigate other predictors of latent class membership including ADHD subtype and race/ethnicity, and replicate findings with a more diverse sample. The presence of multiple, distinct groups may indicate that different treatment types may be differentially benefit individuals.
Keywords: working memory**,** emotional processes

6 Neuropsychological Profile Differences Between ADHD Subtypes in an Adult Clinical Sample

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Objective: Although the neuropsychological profile within Attention-Deficit/Hyperactivity Disorder (ADHD) has been researched, fewer studies have investigated specific neuropsychological profile differences among individuals diagnosed with ADHD-Inattentive (ADHD-I) versus ADHD-Combined (ADHD-C), particularly among adults. This cross-sectional study examined the neuropsychological performance differences between ADHD-I and ADHD-C among a sample of adults for ADHD evaluation while controlling for symptom and performance validity.
Participants and Methods: This cross-sectional study included 311 consecutive adults referred for a comprehensive neuropsychological evaluation of ADHD at an academic medical center. Inclusion criteria were: 1) met DSM-V ADHD diagnostic criteria, 2) ≤1

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performance validity test (PVT) failure out of a battery of 5 administrated PVTs, 3) valid ADHD symptom reporting on the Clinical Assessment of Attention Deficit-Adult, and 4) no use of prescribed psychostimulants on evaluation day. Following these exclusions, the final sample was 162 with 86 in the inattentive group and 76 in the combined group. The sample was 38.9% male, 50.6% Caucasian, 21.6% African American, 13% Hispanic, with a mean age of 28.1 (*SD*=7.312), education of 15.65 years (*SD*=1.733), and an average Test of Premorbid Functioning estimated IQ of 106.4 (*SD*=8.075). Neuropsychological tests administered were the Conners Continuous Performance Test-3 (CPT-3), Trail Making Test A & B (TMT A & B), Stroop Color and Word Test (SCWT), Wechsler Adult Intelligence Scale-IV Working Memory (WMI) and Processing Speed (PSI) Indices, Rey Auditory Verbal Learning Test (RAVLT), Verbal Fluency (FAS/Animals), and the Brief Visual Memory Test-Revised (BVMT-R).
Results: One-way analysis of variance showed no significant differences between ADHD subtypes on premorbid IQ (*F*=1.739, *p*=.189), age (*F*=.134, *p*=.715), or education (*F*=.218, *p*=.641). One-way analysis of variance was used with ADHD-type as the fixed factor and normative neuropsychological test performance scores as outcome variables. Results demonstrated no significant differences were found between groups on CPT-3 omissions (*F*=.203, *p*=.653), commissions (*F*=.891, *p*=.347), variability (*F*=.018, *p*=.892), hit rate (*F*=2.131, *p*=.146), and detectability (*F*=.009, *p*=.924), as well as TMT A (*F*=1.331, *p*=.250), TMT B (*F*=3.441, *p*=.065), SCWT color-word trial (*F* =.003, *p*=.957), WMI (*F*=.839, *p*=.361), PSI (*F* =.669, *p*=.415), RAVLT immediate recall (*F*=.637, *p*=.426), RAVLT short delay recall (*F*=.336, *p*=.563), RAVLT long delay recall (*F*=.852, *p*=.357), BVMT immediate recall (*F*=.164, *p*=.686), BVMT-R delayed recall (*F*=.152, *p*=.697), Verbal Fluency- FAS (*F*=.577, *p*=.449), and Animals (*F*=.082, *p*=.775).
Conclusions: There were no significant differences between ADHD-I and ADHD-C when comparing mean performance on a neuropsychological testing battery that comprehensively assessed multiple neurocognitive domains. Therefore, in the absence of a discrete neuropsychological profile, validity-controlled ADHD symptom inventories are necessary to differentiate ADHD subtypes. Nonetheless, comprehensive neuropsychological evaluations allow for evaluation of individual-specific deficits and need for tailored accommodations and recommendations given the heterogenous nature of the ADHD presentations.
Keywords: attention deficit hyperactivity disorder**,** neurocognition**,** validity (performance or symptom)
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7 Applying Network Analysis to Executive Functions: Differences in Network Parameters between Children with and without Attention-deficit/hyperactivity Disorder

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Objective: This study examined whether parameters of an executive function (EF) network model differed between children with and without attention-deficit/hyperactivity disorder (ADHD). Prior research has identified healthy EF network development involves greater differentiation (lower correlations between executive functions) and higher shifting centrality (shifting having the highest correlations with other executive functions). ADHD is often characterized by executive dysfunction, leading to the hypothesis that the EF network of children with ADHD would have lower differentiation and lower shifting centrality.
Participants and Methods: A sample of 141 children and adolescents with ADHD were matched on age, gender, race/ethnicity, and maternal education to 141 typically developing children and adolescents (72.3% boys, 27.7% girls; 66.7% White, 19.1% African American, 9.2% Latinx, and 4.9% other/unreported). All participants completed three NIH Toolbox Cognition Battery EF tests: Dimensional Change Card Sort, measuring shifting; Flanker,

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measuring inhibition; and List Sorting, measuring working memory (WM). Mean scores were compared between participants with and without ADHD. The three tests were included in a Bayesian partial correlation network model, with edge weights (partial correlations), expected influence (centrality), and global strength (differentiation) compared between participants with and without ADHD. A 95% credible interval (CI) of a difference score not inclusive of zero indicated a group difference. **Results:** Participants with and without ADHD did not differ in mean performances (*d* range: .05 to .11). Participants with and without ADHD modestly differed in global strength, GS_{diff}=-.13 (95% CI: -.36, -.01), with slightly higher differentiation in children with ADHD. The shifting-inhibition edge weight was lower among participants with ADHD, EW_{diff}=-.20 (-.38, -.03), whereas the inhibition-WM edge weight was higher among participants with ADHD, EW_{diff}=.22 (-.01, .45). There was no group difference in the shifting-WM edge weight, EW_{diff}=-.09 (-.32, .15). Centrality of inhibition and WM did not differ between groups, but shifting centrality was higher among typically developing participants, EI_{diff}=-.28 (-.54, -.03). Inhibition was the most central node among participants with ADHD, whereas shifting was the most central node among participants without ADHD. **Conclusions:** This is the first study to examine the network structure of EF in children with ADHD, and to compare that network structure to typically developing children. The findings correspond with a delayed maturation hypothesis of ADHD development, by which the network parameters of participants with ADHD reflect an underdeveloped network involving lower shifting centrality, with a weaker shifting-inhibition correlation, and higher inhibition centrality, with a stronger inhibition-WM correlation. The slight difference in global strength did not align with the hypothesis; but global strength may be too gross a measure of differentiation, and separate EFs may increase or decrease in correlations at different rates during development. Increased shifting centrality in typically developing children resulted from stronger correlations between shifting and other EFs; however, inhibition and WM were less correlated in typically developing children. The network parameters differed by ADHD status even in the absence of group differences in mean test performances, meaning an assessment of centrality and edge weights may provide new insight into group differences in EF associated with ADHD.

Keywords: executive functions**,** attention deficit hyperactivity disorder**,** cognitive functioning

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8 The Relationship Among the Test of Variables of Attention (TOVA) and Other Measures of Attention/Executive Functioning in a Pediatric Sample

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Objective: Continuous performance tasks (CPTs) can provide information about patterns of attention deficits. Existing literature has examined the relationship between performance on CPTs with behavioral ratings of attention/executive functioning (EF; Bodnar, Prahme, Cutting, Denckla, & Mahone, 2007; Brewis, 2002; Schatz, Ballantyne, & Trauner, 2001). However, the relationship between the Test of Variables of Attention (TOVA) and performance-based measures of attention/EF is limited. Therefore, we sought to examine the relationship among TOVA scores and other measures in a pediatric sample. **Participants and Methods:** Ninety-eight clinically-referred patients (Males = 46.9%; Age: *M* = 14.72, *SD* = 2.09; Full-Scale IQ: *M* = 102.17, *SD* = 13.8; Parent education: *M*=15.5, *SD* = 2.5) were administered the TOVA, along with the Delis-Kaplan Executive Function System (D-KEFS), Wechsler Intelligence Scale for Children, 5th Edition (WISC-V) or Weschler Adult Intelligence Scale, 4th Edition (WAIS-IV), and parents completed the Behavior Assessment System for Children, 3rd Edition (BASC-3) and the Behavior Rating Inventory of Executive Function, 2nd Edition (BRIEF-2).

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Results: Significant correlations among TOVA and DKEFS included: ADHD Score with Color-Word Inhibition (CWI; r = .41, p < .001), Trail Making Switching (r = .23, p = .03), and Design Fluency (DF; r = .32, p = .002); Response Time (RT) with CWI (r =.38, p <.001) and DF (r = .23, p = .030); Response Time Variability (RTV) with CWI (r =.35, p =.001) and DF; Commission Errors with DF (r =.28, p =.008); and Omission Errors with DF (r =.35, p =.001). Significant correlations among TOVA and WISC-V/WAIS-IV included: ADHD Score with Working Memory Index (WMI; r = .24, p = .02), Processing Speed Index (PSI; r = .26, p = .01), and Full-Scale IQ (FSIQ; r = .26, p = .01); RT with PSI (r = .23, p = .02); RTV with WMI (r = .21, p = .04) and PSI (r = .22, p = .03); and Omission Errors with FSIQ (r = .29, p = .004). Only RTV was significantly correlated with BASC-3 Hyperactivity (r = -.21, p = .06).
Conclusions: Results demonstrated many significant correlations among the TOVA with other commonly administered performance-based measures of attention/EF, which suggests that TOVA adds clinically useful information to a comprehensive battery.
Keywords: everyday functioning**,** test reliability**,** attention deficit hyperactivity disorder
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9 Symptom Invalidity of Self-Reported Executive Dysfunction in Assessment of Adult Attention-Deficit/Hyperactivity Disorder

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Objective: Studies of symptom invalidity in attention-deficit/hyperactivity disorder (ADHD) focus on self-reported ADHD symptoms, with findings that individuals can easily feign ADHD. However, the potential influence of invalid report on other types of behavior rating scales used in ADHD assessments remains unclear. Executive function (EF) rating scales do not exclusively consist of behaviors used to diagnose ADHD; however, the subjective nature of these measures means they may be susceptible to invalid presentations. We examined the influence of invalid presentations, as measured by performance validity tests (PVTs) and symptom validity tests (SVTs), on self-reported executive dysfunction and its relation to ADHD symptom report, psychiatric symptom report, and EF test performance among adults undergoing ADHD assessment.
Participants and Methods: Cross-sectional archival data from a psychology outpatient clinic included 55 individuals (*M*age=24.9±6.4; 65.5% female; *M*education=14.8±1.9) referred for ADHD assessment. Participants completed ADHD symptom ratings (Conners' Adult ADHD Rating Scale), EF ratings (Barkley Deficits in Executive Function Scale), Minnesota Multiphasic Personality Inventory-2-Restructured Form/-3, neuropsychological EF tests (working memory, abstract reasoning, set-shifting, inhibition, and phonemic fluency), PVTs, and SVTs. Using Sherman et al. criteria (2020), invalid neurocognitive presentations were defined by invalid scores on one of the following: 1) at least two PVTs, 2) at least two nonredundant SVTs, or 3) at least one PVT and one SVT. Twenty-eight participants were classified in the invalid group.
Results: The invalid group reported significantly higher ADHD symptoms (ps<.01, Cohen's ds=.75-.78), higher executive dysfunction (p<.001, d=1.41), and higher emotional/internalizing dysfunction (ps≤.01, ds=.72-.79) than the valid group. The invalid group scored worse on tests of working memory (p=.03, d=.60) and inhibition (p=.04, d=.61), but not on other EF tests (ps=.16-.80, ds=.07-.36). Bivariate correlations between total EF ratings and total ADHD symptom ratings decreased after excluding invalid presentations (rs=.74 to .52; Z=-1.50, p=.06) but remained statistically significant. For the valid group, higher self-reported total executive dysfunction was more strongly related to higher self-reported total emotional/internalizing dysfunction (r=.79, p<.001; Z=-1.99, p=.04) than to self-reported total ADHD symptoms (r=.52, p=.005), and was related to lower performance on only one EF test (r=-.50, p=.01; all other rs=-.30-.03). For the invalid group, higher self-reported total executive dysfunction was related to higher self-reported total ADHD symptoms (r=.75, p<.001), but not to

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total emotional/internalizing dysfunction (*r*=.24). EF ratings and EF tests were not related in the invalid group (*r*s=-.38-.12).
Conclusions: Results indicate that EF rating scales are susceptible to invalid presentations to a similar degree as ADHD symptom rating scales even when using conservative validity classification criteria. After accounting for invalid presentations, self-reported executive dysfunctions may be related to psychiatric distress more than ADHD symptom report. Overall, these findings highlight the importance of assessing symptom invalidity when interpreting outcomes of EF rating scales, particularly given that most self-report EF measures do not contain a psychometrically validated SVT.
Keywords: noncredible presentations**,** attention deficit hyperactivity disorder**,** executive functions
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10 Atypical fronto-subcortical white matter microstructure in relation to delay discounting and emotion dysregulation in children with ADHD

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Objective: Children with attention-deficit/hyperactivity disorder (ADHD) tend to show stronger delay discounting (DD; e.g., preference for immediate reward) and greater emotion dysregulation. Difficulties with self-regulation of emotions and behavior in the context of reward among children with ADHD is thought to be associated with disruptions in neural circuitry involving top-down regulatory processes associated with prefrontal cortical (PFC) regions and bottom-up reward and emotional processing associated with subcortical limbic structures. In this study, we examined the effects of diagnosis and sex on fractional anisotropy (FA) in fronto-subcortical limbic circuitry implicated in ER. We further examined associations between FA within fronto-subcortical tracts with behavioral measures of DD and ER, specifically tasks involving frustrative non-reward (FNR; i.e., frustration go/no-go [fGNG] and mirror tracing persistence task [MTPT]).
Participants and Methods: Children ages 8-12 years diagnosed with ADHD (n=102, 29 girls) and typically developing controls (n=87, 30 girls) underwent diffusion tensor imaging (DTI) and parent- and child self-ratings of emotion regulation and irritability were obtained. Probabilistic tractography was performed using FSLs FDT and fronto-subcortical white-matter tracts were reconstructed between subregions of the striatum (dorsal executive and ventral limbic areas) and amygdala with prefrontal cortex (PFC) regions of interest (ROIs) including the dorsolateral (dlPFC), orbitofrontal (OFC) and anterior cingulate (ACC) cortical regions. Statistical analyses tested effects of diagnosis and diagnosis-by-sex interactions on tract fractional anisotropy (FA) covarying for age, average framewise displacement (index of head motion during the scan), and race. In addition, brain-behavior partial correlations (controlling for age, FD, and race) between tract FA with significant diagnostic differences and (1) questionnaire measures of parent-rated ER and (2) task measures of DD (involving rewards and delays experienced in real-time and money) and FNR were performed.
Results: A main effect of diagnosis was observed for FA in the left and right OFC-limbic striatum tracts (*p*s=.033, .015, respectively) and the left ventral ACC-amygdala tract (p=.043), with reduced FA in children with ADHD. Across all children, lower FA in the left OFC-limbic tract was significantly correlated with greater parent-reported problems with ER on the Emotion Regulation Checklist, Negative Lability Scale ($r(80)=-.239$, $p=.038$). In addition, reduced FA within the left ventral ACC-amygdala tract correlated with lower frustration tolerance as evidenced in quitting a frustrating task sooner (MTPT; $r(45)=.427$, $p=.005$). Furthermore, a diagnosis × sex interaction was observed for FA in the left OFC-amygdala tract ($p=.031$), with decreased FA in boys with ADHD compared to TD boys ($d=0.42$) and increased FA in girls with ADHD compared to TD girls ($d=-0.25$). Diagnostic group differences were observed for

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measures of emotion regulation and DD (specific to ADHD girls). No significant partial correlations were observed between FA in tracts with diagnostic group differences and performance on the DD and fGNG tasks.
Conclusions: Findings suggest that the pattern of anomalous white matter microstructure in neural circuitry involving ventral PFC connectivity with the ventral striatum and amygdala differs among girls and boys with ADHD and in relation to ER. These results contribute to the limited literature on the neurobiological basis for DD and emotion dysregulation in children with ADHD and highlight the need for future research focused on ADHD-related sex differences in these brain-behavior relationships.
Keywords: brain structure**,** emotional processes**,** attention deficit hyperactivity disorder
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11 Distinct Patterns of Neuropsychological Performance in Adult ADHD and Psychiatric Comorbidities

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Objective: Attention Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by a persistent pattern of inattention, hyperactivity, and/or impulsivity that interferes with functioning or development. Adult ADHD is associated with higher rates of psychiatric comorbidities, such as anxiety or depression, but the individual and combined effects on neuropsychological performance are not well understood. The current study aimed to examine the possibility of distinct neuropsychological patterns of performance across three diagnostic groups: ADHD only, psychiatric only (anxiety or depression), and ADHD with psychiatric comorbidities (anxiety or depression).
Participants and Methods: Two hundred participants from an outpatient clinic underwent neuropsychological testing. Participants who failed effort testing were excluded from the study. Diagnoses included in the study were ADHD, Major Depressive Disorder, Generalized Anxiety Disorder, Anxiety Disorder Not Otherwise Specified, adjustment Disorder with depression, adjustment disorder with anxiety, and adjustment disorder with mixed anxiety and depression. Neuropsychological measures of interest were extracted from a clinically derived battery. Latent profile analysis (LPA) was utilized to identify subgroups based on patterns of performance across as subset of neuropsychological data that included attention (Brief Test of Attention, Gordon Diagnostic System distractibility, Conners' Continuous Performance Test [CPT-3] Omissions and Commissions), processing speed (Coding subtest), and executive function measures (Stroop Interference, California Verbal Learning Test-2nd Edition semantic clustering). The Depression, Anxiety, and Stress Scale-42 Item was utilized as a measure of current emotional functioning. LPA models were compared to determine which model best fit to the data using fit statistics (e.g., Bayesian Information Criterion [BIC], correct model probability [cmP]). When the best-fitting model was identified, class separation was evaluated using classification diagnostics including the average posterior class probability (AvePPk), the odds of correct classification ratio (OCCk), and the modal class assignment proportion (mcaPk).
Results: LPA revealed three distinct profiles within the sample: within normal limits group, a global attention difficulties group, and psychiatric and impulsive group. This model fit the data best compared to other models (cmP = 1.00), and had the lowest BIC (i.e., 9523.96). Furthermore, this model was within normal limits for diagnostic criteria (e.g.,mcaPk = 0.43; AvePPk = 0.93; OCCk = 16.24). The global attention difficulties group exhibited significant deficits on all aspects of attention, whereas the group with the highest self-reported psychiatric symptoms exhibited select difficulties on impulsivity on the CPT-3

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Commissions. No group exhibited significant difficulties with processing speed or executive function.
Conclusions: Results from this study suggest that LPA is a useful tool to help elucidate subtle differences in neuropsychological performance across adult ADHD subgroups with and without psychiatric comorbidities. Future studies with additional neuropsychological variables and more specific psychiatric diagnoses may provide information regarding the subtleties of adult ADHD subgroups and comorbidities.
Keywords: attention deficit hyperactivity disorder**,** anxiety**,** depression
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12 Diagnostic accuracy of the Conners' Adult ADHD Rating Scales – Self-Report: Long Version (CAARS-S:L) among Veterans.

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Objective: The prevalence of ADHD has more than doubled in VA settings between 2009 and 2016 (Hale et al., 2020). However, symptoms of ADHD are commonly present in other psychological disorders, and persons with ADHD are at increased risk of depression, anxiety, substance use, and PTSD (Marshall et al., 2018, Suhr et al., 2008). Given the rising rates of ADHD among Veterans, accurate diagnosis of ADHD is essential. This study examines the relationship of the CAARS-S:L subscale scores (Conners, et al., 1999) and subsequent ADHD diagnosis in a mixed sample of Veterans.
Participants and Methods: In this retrospective study, 124 Veterans (M_{age} = 36.8, SD_{age} = 10.4, M_{edu} = 14.3, SD_{edu} = 3.0, 14% female) were referred for neuropsychological evaluation that included the CAARS-S:L. Among valid CAARS-S:L profiles, two patients were removed due to TBI and one was removed for psychosis. Participants with DSM-5 diagnoses included 52 (41.9%) with ADHD, 53 (42.7%) with mood disorders, 26 (21.0%) with PTSD and 24 (19.4%) with anxiety disorders. ADHD diagnoses were assigned via the comprehensive neuropsychological evaluation that included a review of CAARS-S:L scores. The CAARS-S:L is a 66-item self-report measure assessing current symptoms of ADHD, with four factor-analytically derived subscales (i.e., inattention/memory problems, hyperactivity/restlessness, impulsivity/emotional lability, problems with self-concept), and three DSM-IV-related subscales (i.e., Inattention, Hyperactivity, and Total).
Results: A MANOVA of the four factor analytically derived subscales on ADHD diagnosis status was non-significant (Wilk's Lambda = .933, F [4, 108] = 1.94, p = .109). Another MANOVA of the DSM-IV Inattention and Hyperactivity subscales on ADHD diagnosis showed a main effect for diagnostic group (Pillai's Trace = .097, F [2, 119] = 6.39, p = .002). Persons with ADHD scored higher on the DSM-IV Inattention and Hyperactivity subscales than those without ADHD. To further explore the strength of the relationship of DSM-IV subscales with ADHD diagnosis, logistic regression revealed a significant relationship with the Inattention subscale (χ^2[1] = 9.05, p = .003), but the model explained only 11.3% of variance in diagnosis. Likewise, the DSM-IV Hyperactivity subscale predicted diagnosis (χ^2[1] = 6.87, p = .009) but explained only 7.9% of variance. Regarding subscale elevations of T ≥ 65 on DSM-IV Inattention, Hyperactivity, or Total subscales, sensitivity and specificity, respectively, were .98 and .17 for one or more scales, .89 and .32 for two or more scales, and .60 and .64 for three scale elevations.
Conclusions: Although the CAARS-S:L DSM-IV subscales factor into subsequent ADHD diagnosis, their influence is limited within this mixed Veteran sample. In similar clinical settings, where there are high rates of psychiatric comorbidity, elevations on CAARS-S:L subscales per manual norms may result in a high number of false positive errors, even when elevations on multiple scales are required to raise suspicions of an ADHD diagnosis. Findings underscore the limitations of relying exclusively on self-report measures. Further research should focus on the specificity of the CAARS-

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S:L within mixed samples when diagnosticians are blinded to response profiles.
Keywords: attention deficit hyperactivity disorder**,** assessment
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13 Detecting Invalid Performance among Patients Referred for Attention-Deficit/Hyperactivity Disorder Evaluation: Cross-Validation of Non-Memory Performance Validity Tests

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Objective: Although freestanding performance validity tests (PVTs) generally have more robust accuracy for detecting invalid performance, the incremental value provided by including multiple embedded PVTs in a test battery is crucial to ensure that consistently valid test performance is maintained throughout the evaluation while combating the increased evaluation time, burden, and costs associated with using additional freestanding PVTs. This study cross-validated non-memory, embedded PVTs derived from Verbal Fluency (VF) and the Trail Making Test (TMT) that have previously been validated in mixed clinical samples for detection of invalid test performance in a clinical sample of patients referred specifically for attention-deficit/hyperactivity disorder (ADHD) evaluation.
Participants and Methods: This cross-sectional study used data from a sample of 305 consecutive adult patients clinically-referred for evaluation for purposes of diagnostic clarification and treatment planning related to suspected ADHD (39% male/61% female; 47% Caucasian; 23% Hispanic; 14% African American; 11% Asian; 5% other) with M_{age}=27.68 (*SD*=6.75) and $M_{education}$=15.67 years (*SD*=2.05). Patients were classified has having valid (*n*=274) or invalid (*n*=31) neuropsychological test performance based on six independent criterion PVTs. Receiver operating characteristic curve (ROC) analyses assessed optimal cut-scores and associated sensitivity/specificity for raw scores and demographically-corrected T-scores for the following tests: VF F/A/S, VF Animal Naming, TMT-A, and TMT-B.
Results: Areas under the curve (AUCs) were significant (*p*s<.01) ranging from .65-.73 for all embedded PVTs examined, except for VF Animal Naming-T (AUC=.51; *p*=.86). Optimal cut-scores were as follows: VF F/A/S-raw: ≤29 (.48 sensitivity/.88 specificity); VF F/A/S-T: ≤35 (.32 sensitivity/.89 specificity); VF Animal Naming-raw: ≤16 (.29 sensitivity/.90 specificity); TMT-A-raw: ≥34 (.36 sensitivity/.89 specificity); TMT-A-T: ≤34 (.32 sensitivity/.91 specificity); TMT-B-raw: ≥85 (.52 sensitivity/.88 specificity); and TMT-B-T: ≤35 (.45 sensitivity/.87 specificity).
Conclusions: Overall, all non-memory indices, except for VF Animal Naming-T, significantly differentiated invalid from valid performance. Across VF and TMT PVTs, raw scores generally demonstrated better sensitivities (29%-52%) compared to demographically corrected T-scores (32%-45%), with VF F/A/S-raw, TMT-B-raw, and TMT-B-T showing the highest sensitivities. Overall, results provided preliminary cross-validation support for the clinical utility of these indices as non-memory embedded PVTs among adults referred for ADHD evaluation.
Keywords: validity (performance or symptom)**,** attention deficit hyperactivity disorder

14 Do Age and Personality Traits Moderate the Association Between Symptoms of Attention-Deficit/Hyperactivity Disorder and Executive Functioning?

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Objective: Features of attention-deficit/hyperactivity disorder (ADHD), including inattention, hyperactivity and impulsivity, are normally-distributed within the population. Even at low levels, they may be associated with executive dysfunction; yet, some individuals

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with even strong ADHD features exhibit normal or above-average executive abilities. The personality psychology literature suggests that certain traits are positively (conscientiousness) or negatively (neuroticism) associated with executive abilities, and may thus explain some of the heterogeneity in executive abilities in individuals with mild, moderate, and high levels of ADHD symptoms. Growing evidence also indicates that the extent of executive dysfunction associated with ADHD symptoms may depend on whether it is quantified using standardized vs. self-reported measures. In two studies, we used difference executive measurements to tested the hypothesis that conscientious and neurotic personality traits moderate the relationship between ADHD symptoms and executive functioning. Considering recent evidence for age-related changes in ADHD features and executive abilities, a second objective was to test age as an additional moderator.
Participants and Methods: Data were collected from 1,063 adults aged 18—85 (M=47.6, SD=17.8; 64.5% female) from the Nathan Kline Institute Rockland Sample (Study 1) and 200 adults aged 18—47 (M=19.9, SD=4.1; 86.0% female) recruited locally (Study 2). All completed measures of ADHD symptoms (Conners Adult ADHD Rating Scale in both studies), personality (NEO-FFI-3 in Study 1; HEXACO in Study 2), and executive functioning (composite scores of inhibition, shifting and fluency from the standardized Delis-Kaplan Executive Function System in Study 1; self-reported difficulties with time management, organization, self-restraint and self-motivation from the Barkley Deficits in Executive Functioning in Study 2). In both studies, personality and age were tested as potential moderators of the relationship between ADHD symptoms and executive functioning using hierarchical regression models.
Results: In Study 1, inattentive and impulsive symptoms were positively associated with performance on standardized shifting (binattention=0.033, p=.004; bimpulsivity=0.036, p=.003) and fluency measures (binattention=0.030, p=.017; b impulsivity=0.031, p=.019). Inattention was additionally associated with inhibition (b=0.028, p=.020). Neuroticism was negatively associated with set-shifting (b=-0.042, p<.001) and fluency (b=-0.026, p=.006). Neither personality construct moderated the relationship between ADHD symptoms and executive functioning, nor did age (.318<p<.951). In Study 2, increasing ADHD symptoms and lower conscientiousness predicted worse executive pe rformance in all models except one. Conscientiousness was a significant moderator in several models: associations between inattention and time management (b=.013, p=.006); inattention and self-restraint (b=-.011, p=.031); inattention and self-motivation (b=-.017, p=.001); hyperactivity and self-restraint (b=-.015, p=.015); and impulsivity and self-motivation (b=-.015, p=.017) were stronger in individuals with low conscientiousness. Neuroticism (called 'Emotionality' in HEXACO) generally did not impact ADHD/executive function relationships, nor did age.
Conclusions: ADHD symptoms and personality traits are independently associated with executive performance. The moderating role of personality may depend on whether executive functioning is measured using standardized neuropsychological instruments vs. self-reported scales, as prior research suggests these instruments capture independent facets of this construct. We found no evidence that age impacts ADHD/executive function relationships, but this should be validated in a sample with greater representation of older adults with clinically significant ADHD.
Keywords: executive functions**,** personality**,** aging (normal)

15 The Relation Between Working Memory, Error-Related Brain Activity, and Symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD)

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Objective: Accurate assessment of working memory (WM) abilities is important given its critical role in development across a range of domains. Event-related potentials (ERPs) may be useful in assessing WM given their direct nature in measuring brain activity and previously demonstrated clinical utility. Two ERPs elicited following errors, the error-related negativity (ERN) and error positivity (Pe), may be reflective of WM given the necessity of executive function/cognitive control processes in identifying errors and adjusting behavior to optimize performance. Several studies found WM abilities to be associated with both the ERN and Pe in adult populations, but no study has examined these relations in school-age children using construct-valid WM tasks. The aim of the current study was to examine relations between WM, the ERN/Pe, and ADHD symptoms in a school-age sample.
Participants and Methods: The sample included 53 children ages 8-12 (*M*=10.36, *SD*=1.42; 16 female) with ADHD (*n*=16), ADHD and common comorbidities (*n*=29) and common clinical diagnoses without ADHD (*n*=8). ADHD symptoms were assessed using the ADHD-RS-5; WM was measured using three well-validated tasks reduced to a single component score for data analysis. Children completed a go/no-go task during EEG recording. The ERN was defined as the average voltage 50-ms before and after the most negative peak following the response, while the Pe was defined as the mean voltage 200-500 ms following the response. Regression-based residual scores were computed to reflect the difference wave between correct and erroneous responses. Bias-corrected, bootstrapped conditional effects modeling was conducted to a) assess the variance in ERN and Pe accounted for by WM; and b) examine the extent to which WM's impact on ADHD symptoms was conveyed via WM-ERN/Pe associations.
Results: Results showed that working memory was not associated with the ERN (*B* = -.22) or Pe (*B* = .37, both 95%CIs include 0.0). However, an increased Pe predicted fewer ADHD symptoms (*B* = -.33, 95%CI excludes 0.0), while no relation was observed between the ERN and ADHD symptoms (*B* = -.09, *ns*). Working memory predicted ADHD symptoms when controlling for the ERN (*B* = -4.75, 95%CI excludes 0.0) but not when controlling for the Pe (*B* = -3.98, 95%CI includes 0.0). No conditional effects of working memory on ADHD symptoms via ERN/Pe pathways were observed (both 95%CIs include 0).
Conclusions: In contrast to previous literature, albeit few studies, working memory does not appear to be associated with two error-related ERPs, the ERN and Pe, in a clinically diverse sample of school-age children. Consistent with the mixed literature in the area, results from the current study also did not support an association between the ERN and ADHD symptoms. However, the Pe may be a more informative ERP in this domain as a decreased Pe was associated with greater ADHD symptoms. Future research examining associations between additional executive functions, such as set shifting and inhibitory control, and the ERN/Pe will be informative for better understanding the cognitive processes that may underlie these error-related ERPs, and the utility of these relations in characterizing ADHD.
Keywords: working memory**,** event-related potentials**,** attention deficit hyperactivity disorder
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16 Association Between Sluggish Cognitive Tempo and Academic and Social Functioning in Children

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Objective: The aim of this study was to examine whether parent and teacher ratings of Sluggish Cognitive Tempo (SCT) predicted poorer academic and social outcomes above and beyond IQ, ADHD symptoms, and internalizing symptoms, which have been found to co-occur with SCT and independently relate to academic/social functioning.
Participants and Methods: Participants were 113 children and adolescents (42.5% female) between 9 and 14 years of age with and without ADHD diagnoses who were evaluated at a private psychological practice in the Upper

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Midwest. Participants completed the Wide Range Achievement Test – Fourth Edition (WRAT-IV) and Reynolds Intellectual Assessment Scales (RIAS). Additionally, 88 educators and 105 caregivers of the participants completed measures of behavior and psychological symptoms, including SCT, using either the Teacher Report Form (TRF) or Child Behavior Checklist (CBCL). A total of 80 participants had both the TRF and CBCL completed. First, bivariate zero-order correlations were performed to examine relationships between SCT and measures of academic/social functioning. Indicators of functioning that significantly related to teacher or parent rated levels of SCT were then entered as the dependent variable of a hierarchical regression model, in which IQ, ADHD symptoms, and internalizing symptoms were entered as predictors the first step and SCT was added in the second. Non-parametric test options (e.g., Spearman's rank correlation and logistic regression) were utilized based on the normality of the variables included in each model, as determined by the Shapiro-Wilk test.
Results: Based on zero-order correlations, higher teacher rated levels of SCT were modestly related to increased teacher rated social problems (r_s (86) = .23, p < .05) and poorer performance on Math Computation (r_s (86) = -.24, p < .05). There were no significant relationships found between CBCL ratings of SCT and social problems or academic achievement scores. While the overall hierarchical linear regression model for Math Computation was significant at stage 1(F (3, 84) = 3.70, p < .05), the addition of teacher rated SCT did not explain a significantly larger proportion in the variance at stage 2 (F (1, 83) = 2.07, p = .15). Additionally, the overall hierarchical logistic regression model for teacher rated social problems (normal vs. borderline clinical to clinical) was statistically significant at stage 1 (*Chi-square* [3] = 26.63, p < .001); however, the model fit did not improve once teacher rated SCT symptoms were added (*Chi-square* [1] = 1.14, p = .29). Further, in both models, teacher rated SCT failed to significantly associate with the dependent variables after adjusting for IQ, ADHD symptoms, and internalizing symptoms.
Conclusions: The results highlight the importance of continuing to examine functional deficits associated with SCT while ensuring that statistical models adjust for key covariates to gain a greater understanding of how SCT uniquely impacts functioning in children/adolescence. These considerations are critical in evaluating the diagnostic validity of SCT.
Keywords: academic achievement**,** social processes
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17 Does Training Working Memory or Inhibitory Control Produce Far-Transfer Improvements in Set Shifting for Children with Attention-Deficit/Hyperactivity Disorder?

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Objective: Children with Attention-Deficit/Hyperactivity Disorder (ADHD) tend to show impairments in set shifting task performance. However, evidence suggests that directly training set shifting may not improve set shifting task performance in this population. We hypothesized that the impairments exhibited by children with ADHD during set shifting tasks may be due to deficits in other executive functions, as set shifting tasks also include working memory and/or inhibitory control demands. In the current study children with ADHD were randomly assigned to working memory or inhibitory control training protocols and we examined the extent to which these trainings produced improvements in set shifting task performance for children with ADHD.
Participants and Methods: Children with ADHD ages 8-12 (M=10.41, SD=1.46; 12 girls; 74% Caucasian/Non-Hispanic) were randomized to either central executive training (CET; n=25) or inhibitory control training (ICT; n=29). Secondary intervention targets included set

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shifting (2 tests). The study's primary analyses included a series of 2 (treatment: CET/ICT) x 2 (task: Global-Local/Number-Color) x 2 (timepoint: pre/post) ANOVAs for speed and accuracy shift costs, with post hoc comparisons following significant interactions and *a priori* planned contrasts. Additionally, sensitivity analyses probing for treatment-related improvements in non-specific aspects of task performance were conducted.
Results: Results of the 2x2x2 ANOVAs indicated ICT was superior to CET for improving shifting accuracy (treatment x time: p=.03, BF_{10}=3.01, η^2=.09, d=0.63). ICT was also superior to CET for improving shifting speed, albeit on only one of the two outcome tasks (p=.02, BF_{10}=4.53, η^2=.08, d=0.59). CET did not produce improvements in shifting speed or shifting accuracy on either task (p>.52, BF_{01}>2.62), but showed evidence for more general (non-shifting-specific) improvement in response times on one of the two outcome tasks (shift trials, d=0.70; non-shift trials, d=0.68).
Conclusions: Taken together, results of the current study indicate that inhibitory control training produced superior far-transfer improvements in children's set shifting accuracy compared to working memory training. However, our results also indicate that working memory training may be important for improving overall set shifting task speed in children with ADHD. Thus, if replicated, these findings indicate that both inhibitory control and working memory trainings may be efficacious treatments to employ in clinical practices that employ a personalized medicine approach and identify patients with ADHD who exhibit set shifting deficits.
Keywords: attention deficit hyperactivity disorder**,** cognitive functioning
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18 The Cognitive Impact of Comorbid Psychopathology on Adults Diagnosed with Attention-Deficit/Hyperactivity Disorder

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Objective: Research indicates that the presence of neurodevelopmental disorders, such as Attention Deficit/Hyperactivity Disorder (ADHD), and psychiatric conditions (e.g., anxiety, depression) independently result in cognitive difficulties in domains including attention, executive functioning, and memory. Although patients with ADHD often present with comorbid psychiatric conditions, few studies have investigated the impact of comorbidity on cognitive functioning across multiple domains. Further, to date, most investigations into patients with comorbid ADHD and psychopathology have tended to focus on either pediatric or adolescent populations. To address this gap, the current study examined the impact of the presence of additional psychiatric disorders on the cognitive performance of young adults with ADHD. We hypothesized that the ADHD patients with comorbidity would demonstrate poorer performance when compared to the ADHD patients without additional psychiatric diagnoses.
Participants and Methods: This cross-sectional study included data from consecutive adult patients referred for neuropsychological assessment at a Midwestern academic medical center to evaluate for potential ADHD. The sample was limited to examinees with valid neuropsychological test performance per objective performance validity tests (N=253). Sample demographic composition was 40% female/60% male, 49% White, 22% Hispanic, 13% Black, 10% Asian, and 6% other ethnoracial group. One hundred fifty-six patients (62%) were diagnosed with a comorbid psychiatric disorder. Patients had a mean age of 27.65 (SD = 6.78) and education of 15.71 (SD = 2.06). All patients completed the Rey Auditory Verbal Learning Test (RAVLT), the Wechsler Adult Intelligence Scale-IV (WAIS-IV) Working Memory (WMI) and Processing Speed (PSI) Indices, Stroop Color and Word Test (SCWT), and Trail Making Test (TMT), as part of a

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standardized assessment protocol. A one-way between-subjects ANOVA (patients diagnosed with comorbid ADHD and psychopathology compared to patients diagnosed with only ADHD) was conducted to investigate the effects of comorbid psychopathology on cognitive performance.
Results: RAVLT Total Learning (F = 0.002, p = 0.97), RAVLT Delayed Recall (F = 0.12, p = 0.73), WAIS-IV WMI (F = 0.89, p = 0.35), WAIS-IV PSI (F = 0.19, p = 0.66), SCWT Color/Word Trial (F = 0.66, p = 0.42), TMT Part A (F = 0.75, p = 0.39), and TMT Part B (F = 2.27, p = 0.13) did not significantly differ between the ADHD/Psychopathology and ADHD-only groups.
Conclusions: Although the presence of comorbid psychiatric conditions increases the psychopathological burden upon ADHD patients, the results from the current study suggest that this increased emotional burden does not lead to greater cognitive impact. These findings are consistent with past research in pediatric literature that indicates comorbid psychopathology does not significantly impact cognitive performance in patients with ADHD and expands these findings to adults.
Keywords: attention deficit hyperactivity disorder**,** cognitive functioning
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19 COVID-Related Issues that may Mimic ADHD symptoms: Findings from a Virtual ADHD Screening Clinic

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Objective: Restrictions related to the COVID-pandemic have resulted in increased mental health symptomology, changes in activity level and loss of structure/routine, and increases in the use of maladaptive coping strategies, all of which can affect focus and concentration. As such, clinicians have been increasingly approached by never-before-diagnosed young adults who now suspect they suffer from Attention Deficit/Hyperactivity Disorder (ADHD). Differential diagnosis is difficult in this population due to inaccurate recall of childhood behaviors, possible loss of access to teachers and parents, and the increased impact of ADHD mimics. This study set out to evaluate what percentage of young adults referred to an ADHD screening clinic during the COVID pandemic met full criteria for this disorder as well as to identify the most prevalent ADHD mimics in this population.
Participants and Methods: Ninety-six community college or university students (ages 17-35) attended a virtual screening appointment through a university-based assessment center between June 2020 and July 2021 to determine whether they suffered from previously undiagnosed ADHD. Due to COVID restrictions, the entire assessment was completed online. The virtual screening interview was supplemented by self and observer ratings of ADHD symptoms, self-ratings of functional impairment, review of historical records, retrospective symptom ratings given by parents/caregivers, evaluation of emotional functioning, and symptom validity measures.
Results: Although all referred students complained of current problems with attention, concentration, restlessness, and functional impairment, less than 3% met all DSM-5 criteria for ADHD. Objective review of past records as well as information from parents/caregivers regarding past and current symptoms was critical in making this differential diagnosis. Common reasons for elevated symptoms during COVID included stress, anxiety, depression, lack of structure (due to remote learning), sleep disturbance, and/or excessive substance use, and the negative effects of 24/7 interaction with electronic devices. Higher levels of noncredible symptom reporting were associated with higher self-reports of ADHD symptoms and functional impairment compared with those who passed effort measures.
Conclusions: The results demonstrate that most postsecondary students seeking first-time assessments for ADHD are unlikely to meet criteria for this diagnosis and that clinicians should suspect alternative causes for such reported symptoms. This study also highlights the overlap between lifelong ADHD symptoms and similar concerns brought on by acute stressors (e.g., stress, anxiety, depression, lack

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of structure, sleep disturbance, excessive substance use, and/or the negative effects of 24/7 interaction with electronic devices), issues which have been increasingly noted in young adults since the start of the pandemic. Symptom report alone was not sufficient to confirm this diagnosis in young adult and a comprehensive screening including thorough exploration of the client's history and presenting issues (using objective records when possible and informant ratings) as well as ADHD mimics was needed to perform an accurate differential diagnosis.

Keywords: attention deficit hyperactivity disorder**,** assessment

20 Sexually dimorphic patterns of anomalous volume, surface area, and cortical thickness in ADHD

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Objective: Attention deficit hyperactivity disorder (ADHD) is a prevalent neurodevelopmental disorder in children and adolescents characterized by inattention, impulsivity, and hyperactivity. In childhood, ADHD is more common in boys than in girls, whereas the prevalence of ADHD in adulthood is more similar among men and women. This may suggest distinct developmental patterns of ADHD symptomatology and impairment in males and females. While studies have shown differences in neuroanatomy between individuals with ADHD compared to typically developing (TD) controls and sex differences in neuroanatomical trajectories, there is a lack of research examining ADHD-related sex differences in brain development. This study examines sex differences in children and adolescents with and without ADHD by examining differences in brain volume, surface area, and cortical thickness and whether these differences change across development.

Participants and Methods: This study evaluated cross-sectional and longitudinal T1-weighted whole brain images from 567 children aged 8-17 years (meanADHD=11.06, SDADHD= 2.28; meanTD=10.99, SDTD=2.16): 292 ADHD (30% female) and 275 TD controls (32% female). Repeated scans were obtained from 122 participants at least one year apart. Freesurfer was used to generate volume, surface area, and cortical thickness in frontal lobe regions of interest and MRICloud was used to obtain subcortical volumes for basal ganglia, thalamic, and limbic structures. All imaging measures were harmonized using ComBat, a parametric empirical Bayes approach that adjusts for variations in scanner model and head-coil that occurred over the data collection period. All analyses controlled for IQ, socioeconomic status, and global measures of brain size (total cerebral volume, total surface area, average cortical thickness). Linear mixed effects models examined effects of diagnosis (Dx), sex and their interaction across age. Further mixed effects models were employed to examine linear and quadratic age trajectories.

Results: For cortical regions, left anterior cingulate (ACC) showed consistent results across volume, surface area and cortical thickness. Left ACC volume was reduced in girls with ADHD compared to TD girls ($p<.001$), whereas there were no significant effects of diagnosis in cortical ACC volumes for boys. Similarly, girls with ADHD showed smaller surface area ($p=.021$) and cortical thickness ($p=.008$) in the left ACC than TD girls, though boys did not show any significant differences. In the right premotor area, boys with ADHD showed significantly smaller volume than TD boys ($p=.036$) and ADHD girls ($p=.031$). Within the ADHD group, there were main effects of sex in the left ($p<.001$) and right ($p=.001$) amygdala and the left ($p=.006$) and right ($p<.001$) hippocampus, such that ADHD girls had smaller volumes than ADHD boys. An examination of age-related changes in cortical and subcortical volume, surface area, and cortical thickness

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suggest that the observed effects do not vary as a function of age in this cohort.
Conclusions: Findings suggest that children with ADHD show sexually dimorphic patterns of anomalous frontal lobe morphology. The most robust findings show abnormalities in the left ACC for girls with ADHD across volumetric, surface area and cortical thickness analyses that persist across development.
Keywords: attention deficit hyperactivity disorder**,** neuroimaging: structural**,** brain structure

22 Differential Developmental Patterns of Irritability, Depression, and Anxiety in Boys Versus Girls with ADHD

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Objective: Both emotion dysregulation (ED) and comorbid emotional symptoms such as irritability, depression, and anxiety are causes of significant impairment in children with Attention-Deficit/Hyperactivity Disorder (ADHD). Considering the prevalence of ED in children with ADHD (60%), it has been suggested that difficulties with emotion regulation represent a “core feature” of the disorder. However, less is known about the developmental patterns or impact of sex on difficulties with emotion regulation.
Participants and Methods: This study examined cross-sectional and longitudinal data from a large sample (n=383, 84 with repeated time points) of children ages 8-17 years-old with either a diagnosis of DSM-5 ADHD (n=246, 68 girls) or TD controls (n=137, 51 girls). Participants with ADHD were also permitted to have comorbid oppositional defiant disorder (35%), anxiety (33%) and depression (6%). Self-report measures of irritability, Affective Reactivity Index-Self (n=352); depression, Children’s Depression Inventory (n=300); and anxiety, Multidimensional Anxiety Scale for Children (n=294) were provided by participants. Linear mixed effects models were conducted to test for effects of age, diagnosis (Dx), sex, and their interactions for measures of irritability, depression and anxiety (total scores). Analyses were also conducted among children with ADHD only (without comorbid disorders) and findings remained the same.
Results: Self-reported irritability significantly decreased with age among boys with ADHD (p<.001), with a greater decrease in irritability with age compared to TD boys (p=.003) and girls with ADHD (p=.001). Examination of effects within age groups revealed that boys with ADHD reported greater levels of irritability than TD boys in childhood, but similar levels in adolescence. In contrast, girls with ADHD reported persistently elevated irritability compared to TD girls across development.
Similarly, self-reported anxiety significantly decreased with age among boys with ADHD (p=.003), with a greater decrease in anxiety with age compared to TD boys (p=.003) and girls with ADHD (p=.001). Examination of effects within age groups revealed that boys with ADHD reported greater anxiety symptoms than TD boys in childhood, but similar levels in adolescence. In contrast, girls with ADHD reported persistently elevated anxiety compared to TD girls across development.
Self-reported depression increased with age among TD girls only (p=.055) but remained relatively constant for girls and boys with ADHD and TD boys. Within both childhood and adolescence, boys and girls with ADHD both reported more depressive symptoms than their TD peers (boys: p=.003; girls: p<.001).
Conclusions: Findings suggest important differences between boys and girls with ADHD regarding age-related change in symptoms of irritability, depression, and anxiety from childhood through adolescence. In general, while boys with ADHD showed a decrease in symptoms across development, girls showed consistently increased levels of symptoms. These findings are consistent with reports of increased psychiatric hospitalizations, self-injury, and emotion dysregulation in women with ADHD. Future work should focus on identifying underlying mechanisms and therapeutic approaches for the problematic trajectory of emotion dysregulation in girls with ADHD.
Keywords: attention deficit hyperactivity disorder**,** emotional processes**,** aging (normal)

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23 The Effects of Substance Use on ADHD Symptomology in Late Childhood

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Objective: High rates of comorbidity between Attention-Deficit/Hyperactivity Disorder (ADHD) and Substance Use Disorder have been well documented within the literature, particularly among adolescents. Further, previous work has demonstrated a relationship between childhood ADHD diagnosis and later substance use; however, the effects of early substance use patterns on ADHD symptoms have been understudied. Also of concern are how related diagnostic and health factors (e.g., sleep dysfunction, physical activity, and comorbid conduct disorder) may also play a role in the relationship between ADHD and substance use. Here, we aim to investigate how substance use patterns in late childhood impact longitudinal ADHD symptom trajectories while controlling for comorbid variables of interest.
Participants and Methods: The present analysis included 5,259 participants, balanced by sex assigned at birth (52.3% male), who were enrolled in the Adolescent Brain Cognitive Development (ABCD) Study. Participants were recruited at baseline between the ages of nine and ten years old and followed for two years. Once a year, participants underwent RA administered substance use interviews including alcoholic sipping behaviors and average weekly caffeine use. Primary caregivers of participants completed the Child Behavior Checklist from which DSM-5 oriented ADHD problem scores were obtained. A series of multilevel mixed models were run to compare how late childhood substance use patterns predicted ADHD symptom trajectories over a two-year period—while controlling for age, race, sex, parental education, parental marriage status, household income, comorbid Conduct Disorder, sleep dysfunction, and physical activity.
Results: Participants who engaged in moderate weekly caffeine use (3+ standard caffeine drinks) demonstrated significantly higher ADHD symptoms at two years compared to mild and non-caffeine drinkers (p=.025). Further, participants who engaged in moderate overall substance use (2+ yearly substance uses) demonstrated significantly higher ADHD symptoms at two year compared to mild and non-substance using children (p=.003). Sipping behavior did not significantly predicting ADHD symptom trajectories.
Conclusions: Longitudinally, moderate caffeine and total substance use demonstrated increased ADHD symptoms across time. This indicates that even in late childhood, early and relatively moderate substance use consumption can impact behavioral trajectories. While at its earliest, most substance use literature focuses on mid- to late-adolescence and young adulthood, these early patterns suggest a need for increased attention in late childhood substance use. Further, these effects additionally apply to caffeine use, which is relatively understudied in childhood and adolescents, emphasizing a need for clinicians and researchers to more closely investigate caffeine consumption in children and how it may impact behavioral profiles. Future work should continue to investigate these patterns as well as examine potential mechanisms behind the relationship between substance use and ADHD symptoms.
Keywords: substance abuse**,** child development disorders**,** child development (normal)

24 A Preliminary Investigation of the Test of Attentional Distraction in Identifying Noncredible Attention Deficit Hyperactivity Disorder in Diagnosis-Seeking Postsecondary Students.

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Objective: Attention Deficit Hyperactivity (ADHD) is difficult to diagnose in young adults. This is due to a number of factors, including

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problems obtaining accurate retrospective information about childhood symptoms, high prevalence rate of inattentive symptoms in many other psychological conditions, and ease of feigning symptoms of ADHD by young adults motivated to obtain the diagnosis for reasons of secondary gain. Unfortunately, few symptom or performance validity tests exist that are specificallyl designed to detect feigned ADHD. Recently, however, Morey developed a novel performance validity test for the detection of feigned attention problems, the Test of Attentional Distraction (TOAD; Morey, 2016). The TOAD is a computer-based program designed to mimic a continuous performance test (CPT). However, while the task appears to require sustained attention and focus, the TOAD is actually a low-difficulty CPT; it simply measures basic response time and accuracy. Presently, however, the TOAD has only been validated using analog malingerers instructed to feign ADHD. Therefore, the purpose of this study was to provide preliminary data from actual clients who underwent a screening assessment for ADHD regarding performance on the TOAD and other ADHD and validity measures.
Participants and Methods: Data from twenty-six postsecondary students undergoing assessment for suspected ADHD was used in this preliminary investigation. None had a previous diagnosis of ADHD, but now believed they had this condition. Data were collected between September 2019 to February 2020; subsequent COVID restrictions prevented completion of the in-person testing required for the TOAD. Clinical interview data was supplemented by self and observer ratings of ADHD symptoms, review of historical records, retrospective symptom ratings given by parents/caregivers, results from the Test of Variables of Attention, evaluation of emotional functioning, and both performance and symptom validity measures (Word Memory Test or Medical Symptom Validity Test (Green, 2003;2004) and the Conner's Adult Attention Deficit/Hyperactivity Rating Scale (CAARS) Infrequency Index (CII; Suhr et al., 2010).
Results: Eight subjects obtained TOAD scores suggesting a high likelihood of noncredible performance. Those who failed reported significantly higher levels of inattention (p>.01) and hyperactivity (p>.01) compared with those who passed. While failing the MSVT was correlated with failing the TOAD (p=.42), TOAD failure was related more highly with failure on the CII (p=.07). Five of the 26 subjects failed the CII, and the mean scores on the CAARS were significantly higher for those who failed the TOAD compared with those who passed (Hedge's correction values were all highly significant).
Conclusions: Similar to other recent studies, this preliminary investigation suggests that those who exaggerate symptoms of ADHD may be identified more easily by validity measures specific to ADHD complaints. Students identified as reporting noncredible ADHD symptoms were more likely to fail the TOAD than were those who appeared to report honestly. Further, TOAD failure was associated with higher mean CAARS self-report scores. This investigation provides preliminary support for use of the TOAD as a performance validity test for use in the assessment of ADHD in young adults.
Keywords: attention deficit hyperactivity disorder**,** malingering**,** assessment

25 Central Executive Training for ADHD Effects on Academic Achievement, Productivity, and Success in the Classroom

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Objective: Children with ADHD demonstrate impairment in academic functioning. Converging evidence indicates that ADHD-related executive dysfunction, particularly in working memory and inhibitory control, likely is the mechanism underlying many functional impairments associated with ADHD, including academic functioning. Central executive training (CET) is a 'level 2' evidence-based treatment for improving ADHD-related executive dysfunction and core behavioral symptoms. The current study aims to assess the relative benefit of two, matched neurocognitive training interventions, CET and inhibitory control training (ICT), and gold-

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standard behavioral parent training (BPT) for improving academic achievement and academic performance in children with ADHD.
Participants and Methods: A carefully phenotyped sample of 108 children with ADHD ages 8-13 (*M*=10.29, *SD*=1.50; 32 girls; 75% White/Non-Hispanic) collected across 2 clinical trials were treated with either CET (10-week treatment; n= 52), ICT (10- week treatment; n= 29), or BPT (manualized 9-session treatment; n= 27). Academic outcome data were collected at pre-, post-, and follow-up timepoints. Academic performance outcomes were measured 1-2 months post-treatment via masked teacher ratings across the Academic Success, Impulse Control, and Academic Productivity subscales from the Academic Performance Rating Scale. Academic achievement outcomes were measured at 2–4-month follow-up testing via the Reading Comprehension, Math Concepts and Applications, and Listening Comprehension subtests from the Kaufman Test of Educational Achievement- Third Edition. Mixed-model ANOVAs with post-hocs were used to compare group effects on the academic outcomes. Follow-up exploratory analyses were employed to independently evaluate the results for both trials and compare CET effects across trials.
Results: Across clinical trials, CET was superior to BPT and ICT (*d*=0.62-0.88) at 1-2 months post-treatment for improving masked teacher perceptions of academic performance, including Academic Success, Impulse Control, and Academic Productivity. Both CET (*d*=0.76) and ICT (*d*=0.54) were superior to BPT for improving academic achievement in Reading Comprehension, Math Concepts and Applications, and Listening Comprehension at the 2–4-month follow-up. Specifically, CET was superior to ICT (*d*=0.56) and BPT (*d*=0.71) for improving math-problem solving skills, and CET was superior to BPT for improving reading comprehension skills (*d*=0.64). CET was associated with increases in language comprehension skills in trial 1 (*d*=0.46), however this effect did not replicate in trial 2. Neither BPT nor ICT were associated with changes in language comprehension (*d*=0.01-0.20).
Conclusions: The results provide strong support for the efficacy of CET for children with ADHD. CET provided the greatest academic far-transfer effects relative to ICT and BPT, resulting in improvements in both teacher perceptions of academic performance and objectively measured academic achievement. These findings link working memory abilities and academic achievement in children with ADHD and are consistent with model-driven hypotheses that underdeveloped executive functions likely contribute to academic difficulties in children with ADHD.
Keywords: academic achievement**,** executive functions**,** working memory

26 Processing Speed Mediates the Relationship between Intelligence and Word List Learning in Pediatric ADHD

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Objective: The investigation of specific neurocognitive deficits associated with Attention Deficit Hyperactivity Disorder (ADHD) is an area of growing research, particularly as it relates to the role of neuropsychological evaluation in the diagnosis of ADHD. Previous research examining ADHD in pediatric and adult populations suggests higher IQ is a protective factor against deficits on commonly used neuropsychological assessments. In order to further explore the buffering effect of IQ in pediatric ADHD populations, the current study examined the relationship between Full-Scale IQ (FSIQ) and verbal learning. We subsequently analyzed the mediating role of both working memory and processing speed, two domains often implicated in ADHD, in this relationship.
Participants and Methods: Participants included English-speaking children, ages 6-16 (M = 11.38, SD = 4.03) diagnosed with ADHD (N = 117) who completed a neuropsychological evaluation at a Midwestern pediatric neuropsychology clinic. FSIQ, Working Memory Index (WMI) and Processing Speed Index (PSI) were obtained from the Wechsler Intelligence Scale for Children (WISC-V; Wechsler, 2014).

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Verbal learning was measured using the total words learned across five trials on the California Verbal Learning Test-Children's edition (CVLT-C). Linear regression analyses with mediation were conducted with PROCESS (Hayes, 2021) in SPSS Version 27 to determine if WMI and PSI explained significant variance in the relationship between FSIQ and CVLT-C total words learned.
Results: Analyses revealed a significant positive relationship between FSIQ and total words learned on the CVLT-C, after controlling for age (F (2,114) =13.90, p<.001, $R2$=.20) supporting the notion that as FSIQ increases, number of words learned increases. Processing speed significantly mediated the relationship between FSIQ and total words learned (ab=.22, 95% CI [.10, .37]). Working memory did not significantly mediate the relationship between FSIQ and total words learned (ab= .04, 95% CI [-.11, .17]).
Conclusions: Findings suggest that FSIQ may act as a buffer against deficits on commonly used neuropsychological tests (i.e., CVLT-C). Moreover, findings highlight processing speed as a specific component of IQ that is responsible for this buffering effect. Although working memory is posited as an implicated domain in pediatric ADHD, WMI did not explain significant variance in the relationship between FSIQ and total words learned on the CVLT-C within the current study. Findings highlight the utility in examining the sub-components of IQ to elucidate the neurocognitive deficits underlying pediatric ADHD.
Keywords: attention deficit hyperactivity disorder**,** pediatric neuropsychology

27 Developmental Patterns of Reward and Punishment Sensitivity in Children and Adolescents with ADHD

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Objective: Motivational models of ADHD postulate an imbalance in Sensitivity to Reward (SR) and Sensitivity to Punishment (SP) such that ADHD is associated with increased SR and decreased SP compared to typically developing (TD) children. Adolescence is a developmental period associated with increased risk behavior, particularly among children with ADHD, thought to be related to increased SR and decreased SP. The current study examines age-related changes in SR and SP from childhood to adolescence among girls and boys with ADHD and TD peers using a laboratory task and questionnaire measures.
Participants and Methods: Participants include 8-17 year-old youth diagnosed with ADHD (n=150, 46 girls), and TD peers (n=99, 37 girls) who completed the Point Scoring Reaction Time Task for children-revised (PSRTT-CR). The PSRTT-CR is a performance-based measure of SR and SP that examines change in reaction time (RT) during varying motivational conditions (e.g., reward and punishment). The dependent variables analyzed are SR (percent change in RT from no-reward to reward block) and SP (percent change in RT from punishment trials to post-punishment block). Parents also completed the Sensitivity to Punishment Sensitivity to Reward Questionnaire (SPSRQ) providing ratings of SR and SP during daily activities.
Results: Across the sample, task-based SR increased with age (r=*.26,* p<.01) whereas SP decreased with age (r=*-.17,* p<.01). However, this relationship varied across subgroups, such that SR increased with age among boys with ADHD (r=.23, p<.05) and TD boys (r=.27, p<.05); whereas, for girls, SR increased among girls with ADHD (r=.39, p<.01) but not among TD girls (r=.15, p=.39). Whereas, for SP, there was a consistent effect of ADHD diagnosis for both boys and girls such that SP decreased with age among TD girls (r=-.48, p<.01) and TD boys (r=-.34, p<.01) but not among youth with ADHD (boys: r=.05, p= .65.; girls: r=-.15, p=.32). For parent-reported measures, across the sample, SR decreased with age (r=-.18, p<.05), while SP showed a trend to decrease with age (r=-.136, p=.07). Within subgroups, boys with ADHD showed decreased parent-rated SR with age (r=-.27, p<0.05), whereas age was not significantly associated with SR or SP among girls with ADHD or TD youth.
Conclusions: Task-based SR increased with age from childhood to adolescence for both ADHD and TD boys and girls with ADHD, but not for TD girls. Adolescent risk-taking tends to be greatest among males, which may be related

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to increased SR. Girls with ADHD showed similar age-related changes in SR as boys, placing them at greater risk for negative outcomes compared to TD girls. The finding of decreased SP with age among TD youth, but not those with ADHD, suggests that atypical development of SP may be a central feature of ADHD, contributing to problematic outcomes in adolescence. Age-related changes in parent-reported SR/SP differed from task measures suggesting that they may assess different aspects of motivation. Further longitudinal research is needed to understand how these sex-differences in developmental trajectories of SR and SP impact clinical outcomes in the context of ADHD and other externalizing disorders, which are more common in males, as well as internalizing disorders, which are more common in females.

Keywords: adolescence**,** attention deficit hyperactivity disorder**,** child development disorders

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28 A Construct Validation of a Novel, Eye-Tracking-Based, Visual Attention Disengagement Task

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Objective: Attentional control refers to the capacity to flexibly deploy and shift attention in a goal-direct manner and is one facet of executive function. A reduced capacity to disengage attention as appropriate to context (attention control deficits) has been implicated in the etiology and maintenance of depressive disorders. Dysfunctional attention control captures and holds attention to dysphoric information, making it difficult to flexibly shift or disengage attention in an adaptive manner. Novel eye-tracking paradigms have shown delayed visual attentional withdrawal from sad faces (▲sad) and motivated disengagement from happy faces (▲happy) with depression severity, depressive affect in daily life, and rumination. However, as both disengagement forms share method variance, it is unclear whether the above noted findings reflect a general attention-shifting deficit, or valence-specific attention disengagement effects. This study tests the factorial and convergent validity of the a novel eye-tracking attention disengagement task in a mixed psychiatric inpatient, clinically-referred, and community-dwelling sample of adults with various depressive disorder histories. It was hypothesized that a bifactor model, containing a general attention switching and specific negative disengagement and positive disengagement factors, would best fit the data, and the specific factors would predict depression severity.
Participants and Methods: Participants (N=302, M_{age}=26.5, SD=13.1) completed a measure of depression (CES-D) and a visual attention disengagement task (disengagement task) via E-prime and the Tobii x3-120Hz eye-tracking system. During the disengagement task, participants viewed same-actor face-pairs (disgust-neutral, sad-neutral, happy-neutral, neutral-neutral) that were drawn from KDEF database. Participants freely viewed the face pairs and shifted their attention in response to a visual prompt. Attention disengagement indices reflect the speed with which participants shifted visual attention away from a valenced face towards a neutral face in response to a visual prompt (i.e., a shape framing the target face) during 16 ▲happy & ▲sad trials. A series of CFAs tested one-factor (general attention-switching), two-factor (negative disengagement & positive disengagement), and bifactor models.
Results: As predicted, the bifactor model evidenced the best fit to the data (χ^2=88.17, p =.47, CFI=1.00, RMSEA=.002) compared to the other models (one-factor, CFI = .85, RMSEA=.05, & two-factor, CFI = .88, RMSEA = .05). Five positive-valenced trials significantly loaded onto the positive-valence disengagement factor (λs=.35-.64, ps < .05) with three at a trend level (λs =.21-.33, p <.10); five items loaded onto the negative-valence disengagement factor (λs =.28-.58, p <.05); eleven loaded onto the general attention-switching factor (λs =.25-.98, p<.05). In support of its validity, the negative-valence disengagement factor significantly predicted depression severity (b=4.02, p <.001) as did the positive-valence disengagement factor at a trend level (b=-1.90, p=.09); the

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general attention-switching factor was unrelated to CES-D scores.
Conclusions: Our results are the first to support the specificity of valanced-attention disengagement relative to general attention-switching through the novel eye-tracking disengagement task. Clinical implications will be discussed.
Keywords: attention, depression

29 Concurrent and Incremental Validity of Parent- and Teacher-Report Questionnaires and Neuropsychological Measures of Executive Functions, Attention, and Hyperactivity in a Pediatric Outpatient Community Mental Health Clinic Sample

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Objective: Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder that has a significant impact on the academic, social, and health functioning of those with ADHD. Despite many studies on the constructs of attention, hyperactivity, and executive functioning, the measurement properties of commonly used diagnostic instruments, including concurrent validity with other commonly used measures and the construct and incremental validity of each measure, are unclear. Furthermore, testing specific psychometric properties is less frequent in naturalistic samples of children and adolescents presenting to community-based clinics and instead rely on validation research with strict exclusion criteria (e.g., no comorbid diagnoses). The purpose of this study is to elucidate the characteristics of children and adolescents presenting to a community-based mental health clinic, as well as the concurrent and incremental validity of commonly used parent- and teacher-report questionnaires and neuropsychological measures of inattention, hyperactivity, and executive functioning in a community-based clinic.
Participants and Methods: Participants included 597 children and adolescents aged six to 18 years presenting to a community-based mental health clinic for a psychological assessment between 2010 and 2019. Data from each participant's psychological report, including demographic information, diagnoses (if present), and measure scores were collected. Questionnaires included the BASC (2nd and 3rd editions), Conners 3, and BRIEF (1st and 2nd editions). Neuropsychological measures included the D-KEFS, NEPSY-II, and CPT (2nd and 3rd editions). We used Spearman's rank-order correlations to test concurrent validity across attention, hyperactivity/impulsivity, and executive function variables. We used logistic regression to test incremental validity of measures in the diagnosis of ADHD.
Results: Of the 597 participants, 59.3% were male. The mean age was 11.2 (SD = 3.29). The sample was 86.3% White, 5.7% Latino/Latina, 1.3% African American, 0.8% Asian, 0.5% Native American, and 0.5% Pacific Islander. Regarding ADHD diagnosis, 49.8% of all participants were diagnosed with ADHD (including all ADHD subtypes and unspecified/not otherwise specified diagnoses). Regarding comorbid diagnoses, 34.3% of those diagnosed with ADHD were diagnosed with at least one other disorder (of those, 29.3% were also diagnosed with a learning disorder, 18.2% ODD, and 6.7% MDD). After correcting for multiple comparisons, correlations between attention, hyperactivity, and executive function constructs on questionnaires were significantly and moderately-to-strongly correlated (Spearman's ρ = .27-.82) to each other (e.g., BASC Attention Problems and Conners Inattention) and across parent and teacher forms (e.g., BASC Parent Hyperactivity and BASC Teacher Hyperactivity). Neuropsychological measures were not significantly correlated to other neuropsychological measures or questionnaires (Spearman's ρ = .02-.38). Logistic regression indicated that neuropsychological measures do not generally increase prediction of ADHD diagnosis above and beyond questionnaires.

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Conclusions: Results indicate that questionnaire-based measures of attention, hyperactivity/impulsivity, and executive function are highly correlated and that parent- and teacher-reports generally agree. These high correlations suggest some redundancy in the assessment and diagnosis of ADHD across questionnaire measures and reporters. Questionnaire measures and neuropsychological measures were not related, suggesting they measure different constructs, or different aspects of the same construct. Neuropsychological measures may be better suited for characterization of difficulties and recommendations than for diagnostic purposes.
Keywords: attention deficit hyperactivity disorder**,** executive functions**,** psychometrics
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30 Differential Risk-Taking Across Development Among Girls & Boys With and Without ADHD

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Objective: Risk-Taking increases in adolescence, including behaviors such as substance use, gambling, risky sexual activity, and risky driving, and has been linked to Attention deficit/hyperactivity disorder (ADHD). However, whether children with ADHD show a greater relative increase in risk-taking behavior from childhood through adolescence is unclear. This study examines age-related changes in risk-taking among both boys and girls diagnosed with ADHD as compared with typically developing peers from childhood through adolescence.
Participants and Methods: Participants between ages 8-18 years old diagnosed with ADHD (n=181, 53 girls) and typically developing (TD) controls (n=102, 38 girls) completed the Balloon Analogue Risk Task (BART), a laboratory task assessing risky decision-making show to relate to real-world risky behavior. Statistical analyses examined the correlation between age and risk taking on the BART, assessed as adjusted average pumps across trials examined across the entire sample of girls and boys with ADHD and within diagnosis x sex subgroups (ADHD girls, TD girls, ADHD boys, TD boys). Analyses controlled for the presence of comorbid internalizing disorders (e.g., anxiety and depression) among children with ADHD as this may impact risk-taking.
Results: Risk-Taking on the BART significantly increased with age across the whole sample (r=.297, p<.001). However, this relationship differed among girls and boys with ADHD. Specifically, a positive correlation between age and risk-taking was observed for boys, regardless of diagnosis (TD boys: r=.439, p<.001; ADHD boys: r=.288, p=.001), whereas girls with ADHD also showed a positive relationship (r=.351, p=.010) but TD girls did not (r=.072, p=.669). Comparison of correlation coefficients suggests that the relationship tended to be stronger among girls with ADHD than among TD girls (p=.090), whereas there was no difference among boys with and without ADHD (p=.131).
Conclusions: Findings suggest that girls diagnosed with ADHD may be at risk of engaging in more risk-taking behaviors from childhood into adolescence in comparison to typically developing girls. In contrast, age-related increases in risk-taking were similar in boys with and without ADHD. This increase in risk-taking may relate to poorer functional outcomes in adolescence and young adulthood among girls compared to boys diagnosed with ADHD in childhood. Further examination of risk-taking behaviors among children with ADHD should be considered using a larger longitudinal sample, oversampled for girls with ADHD and with comorbid emotional and behavioral disorders, to help elucidate the developmental trajectory of risk-taking in this clinical population.
Keywords: attention deficit hyperactivity disorder

31 What can Schizencephaly Look Like in Adulthood: A Case Study Examining the Psychiatric, Neuropsychological and Functional Presentation of a Rare Disorder

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Objective: Schizencephaly is a congenital cortical malformation characterized by abnormal unilateral or bilateral clefts in the cerebral hemispheres. The clinical manifestations are diverse and may include any combination of motor, cognitive, and psychiatric elements. That said, owing to its rarity, little is known about the neuropsychiatric presentation of this disorder in adults.
Participants and Methods: We review a case of a 31-year-old male psychiatric inpatient with open-lip schizencephaly who was admitted following the exacerbation of longstanding affective dysregulation, executive dysfunction and related neurobehavioral challenges, and social difficulties. He underwent psychiatric, neuropsychological and occupational therapy assessments as part of his clinical care.
Results: Despite evidencing broadly normal verbal and visual intellectual skills, he demonstrated wide-spread cognitive deficits across most domains. Further, and congruent with his cognitive status and clinical presentation, the occupational therapy assessment found his functional abilities to be low across many skills necessary for independent living. Overall, his functional problems were judged to be secondary to his neurocognitive and neurobehavioral sequelae, as no clear evidence of mood, anxiety, or psychotic symptomatology was exhibited.
Conclusions: This case report helps build awareness of this condition in adults, adds to the limited information on how individuals with this rare disorder can present in adulthood and exemplifies the need for multidisciplinary monitoring as individuals age.
Keywords: neuropsychological assessment**,** brain disorder

32 A Bifactor Model Supports Autism Symptomatology Measured with the ADOS-2 as Unidimensional and Not Predicted by Cognitive Functioning

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Objective: Autism is a heterogeneous neurodevelopmental disorder characterized by impairments in social communication and the presence of restricted and repetitive behaviors or interests (RRB's). Despite the use of strong tools like the *Autism Diagnostic Observation Schedule, Second Edition* (ADOS-2), a gold-standard autism assessment, it remains a challenging disorder to measure and diagnose. Cognitive functioning can influence the presentation of autism symptoms and children's performances on tests like the ADOS-2. Further, there is inconsistency in the literature regarding the dimensionality, or factor structure, of autism measured by the ADOS-2, i.e., how many distinct subcomponents of autism symptomatology are represented. Studies have also demonstrated moderate to large correlations between autism factors, suggesting the presence of a general autism trait, which is not represented in many factor-analytic studies. The present study compares several factor structures of the ADOS-2, including a bifactor model, which hypothesizes a general autism trait and specific social communication and RRB-based subcomponents. We will also investigate if cognitive abilities predict the severity of general and specific autism symptoms.
Participants and Methods: This study examined retrospective chart review data from 188 children (68% male) referred for autism evaluations who were administered Module 3 of the ADOS-2. Children's racial backgrounds were as follows: 23.9% Black, 63.8% White, 8.0% Mixed-Race, 1.6% Asian, 0.5% American Indian, and 2.1% unknown or declined to respond.
Results: Findings demonstrated the superior fit of a bifactor model to characterize autism symptomatology on the ADOS-2, Module 3 compared to unidimensional, two- and three-factor models. Factor loadings revealed that most items loaded more highly on the general autism factor than their respective specific factors, i.e., Social Affect (SA) and/or RRBs, except for items A8: Conversation and D1:

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Unusual Sensory Interest in Play Material/Person. Results confirmed the ADOS-2's ability to assess autism overall. However, nuanced RRB's were not fully captured by the measure. Regarding cognitive functioning, findings revealed non-significant effects of cognitive functioning on severity of autism symptoms measured by the ADOS-2.
Conclusions: The use of a bifactor model to characterize autism traits offers a promising new direction for studying autism symptomatology. The bifactor model provides a way in future studies to investigate relations between demographic and environmental variables and both a general autism trait, and autism subcomponents having accounted for variance explained by the general trait. This is a unique ability of the bifactor model compared to other models and is particularly relevant for studies of autism biomarkers and genetic etiologies, which are often hypothesized to relate to specific subcomponents of autism rather than a unitary autism trait. Clinically, the unidimensionality of the bifactor model in this study supports the usefulness of the ADOS-2. Ratings on just two items appear to be more indicative of difficulties associated with specific SA or RRB traits than the overall factor. Results also support previous concerns that the ADOS-2 may not be a strong measure of RRB's, particularly detecting unique RRB subdomains. Lastly, findings suggest that cognitive abilities may not heavily influence children's performance on Module 3 of the ADOS-2.
Keywords: autism spectrum disorder**,** cognitive functioning**,** psychometrics

33 Working with Rare Disorders: Case Study of an Individual with Jordan's Syndrome

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Objective: Jordan's Syndrome is a rare neurodevelopmental disorder caused by de novo mutations in the *PPP2R5D* gene. The disorder was officially named in 2014 based on whole genome sequencing methods. Currently, an estimate of 200 children around the world have been formally diagnosed with this condition although it is estimated that around 250,000 children suffer from this mutation but remain undiagnosed. Jordan's Syndrome is linked to other medical and neurodevelopmental conditions, including intellectual disabilities, hypotonia and autism spectrum disorder (ASD). In addition, the identified mutations on the *PPP2R5D* gene are linked to Parkinson's Disease, Alzheimer's Disease, and cancer. There is very limited research on the cognitive, neuropsychological, and social profile for Jordan's Syndrome and prognosis given its rarity, leaving more questions than answers for newly diagnosed families. This case study summarizes the neuropsychological and social-emotional profile of a youth with Jordan's Syndrome to inform the scant literature on this rare disorder.
Participants and Methods: AG (initials have been changed to protect confidentiality) is a 16-year-old male residing in Western Canada, diagnosed with Jordan's Syndrome during his early teens. He was referred for a neuropsychological assessment to document his cognitive, learning, and social-emotional profile to support planning into adulthood. AG held previous diagnoses of ADHD and Learning Disabilities in Math and Writing. He was seen in a psychology training clinic by a PhD student in Clinical Neuropsychology where a comprehensive battery of cognitive, neuropsychological, academic, and social-emotional tests was administered.
Results: AG's neuropsychological profile indicated a relative strength in verbal reasoning, and weaknesses in perceptual reasoning, working memory, and processing speed. AG struggled significantly with attention and executive function tasks, including sustain attention, cognitive flexibility, task initiation, and planning/organization. Academically, there were significant difficulties with math calculations/problem solving. In terms of memory, AG had stronger visual memory skills, and benefitted from cueing and multiple choice options to aid in his memory. Concerning mental health and social functioning, AG experiences difficulties with anxiety and social withdrawal. He struggles with social understanding and relationships, and seeks adult-contact instead of same-age peer relationships. He was noted to

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struggle with pragmatic aspects of language such as turn-taking and understanding non-verbal cues in conversations, although he did not meet criteria for ASD.
Conclusions: AG's cognitive and social profile is consistent with a Nonverbal Learning Disability (NVLD) profile. Features of ASD were present, although he did not meet criteria for an ASD diagnosis. There is scant information regarding long-term trajectory and typical cognitive/behavioural profile for individuals with Jordan's syndrome but the information that exists suggests the possible presence of global developmental delays (including delayed achievement of milestones and mild intellectual disability), and differences in social communication (including ASD). Similarities and differences between AG's profile and other published cases of Jordan's Syndrome will be discussed along with developmental considerations, and assessment and intervention recommendations.
Keywords: neuropsychological assessment**,** genetic disorders**,** executive functions

34 Beyond the Conservative Hypothesis: A Meta-Analysis of Lexical-Semantic Processing in Williams Syndrome

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Objective: Williams syndrome (WS) is a rare genetically based neurodevelopmental disorder, traditionally described as being characterized by relatively spared linguistic abilities despite serious deficits in other cognitive domains (e.g., Bellugi et al., 2000). Among these spared linguistic skills in WS, an atypical vocabulary (as a sign of unusual semantic memory organization) has been reported as one of the most notable features of their language (e.g., Rossen et al., 1996). However, other research has concluded that language skills in WS do not exceed what is expected based on participants' mental age, nor do they show evidence of atypical underlying linguistic knowledge (e.g., Musolino et al. 2010). This approach suggests that linguistic development proceeds normally in WS, although it is delayed due to the overall intellectual disability of this population (i.e., the 'conservative hypothesis'; Karmiloff-Smith & Thomas, 2003). Due to the great variability of results among the studies exploring the lexical-semantic skills in WS, the aim of the present study is to conduct a systematic review and meta-analysis to explore whether people diagnosed with WS have unusual lexical-semantic skills.
Participants and Methods: We carried out a systematic literature search using several scientific online databases. The literature search identified 357 articles, and after full-text examination, we found 42 studies matching our criteria. In these studies, 747 WS participants and 1444 controls were recruited. In total, 180 effect sizes were included in our study.
In order to assess whether people diagnosed with WS have unusual lexical-semantic skills, we carried out a multilevel meta-analysis, including *control group* (chronological age-matched, mental age-matched, other disabilities) and *type of task* (vocabulary tasks, sentence processing/semantic integration tasks, semantic organization/fluency tasks, semantic working memory tasks) as moderators.
Results: We observed that *control group* was a significant moderator ($p < .001$). Nevertheless, *type of task* was not ($p = .79$).
To further explore the moderating role of *control group*, we conducted separate analyses for each control group. Regarding the comparison with chronological age-matched participants, we found that participants with WS had worse lexical-semantic skills, $g = -1.00$, $z = -7.61$, $p < .0001$. The same applied to the comparison with mental age-matched participants, although the effect size was smaller, $g = -.29$, $z = -3.00$, $p < .01$. However, when compared to participants diagnosed with other disabilities, we found the opposite pattern, $g = .43$, $z = 1.97$, $p < .05$.
Conclusions: In summary, we observed that people diagnosed with WS have worse lexical-semantic skills than their chronological and mental age-matched peers, but that they showed better skills than people diagnosed with

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other disabilities. Although the former observation is congruent with the conservative hypothesis, we believe that the latter is not. Namely, if language development were simply delayed in WS, we would expect to have found similar results for this group and the control group composed of people with other disabilities. Nevertheless, our results might suggest that the cognitive structures underlying lexical-semantic behaviors are relatively spared in WS, allowing them to use a more complex vocabulary than would be expected given their cognitive disability.

Keywords: William's syndrome**,** language**,** semantic processing

35 Association Between Sleep-Disordered Breathing and Executive Function Using the BRIEF-2 for Children with Down Syndrome

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Objective: Down syndrome (DS) is the most prevalent genetic cause of intellectual disability (Centers for Disease Control and Prevention, 2006). Youth with DS demonstrate executive function (EF) difficulties on lab-based tests and by informant report. The most frequently used rating scale of EF is the Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000). Studies using versions of the BRIEF have found youth with DS display a unique profile of EFs which includes strengths in emotional control and weaknesses such as working memory and planning/organization (e.g., Daunhauer et al., 2014; Lee et al., 2011, 2015).

Sleep-disordered breathing (SDB), which is highly prevalent (31-66%) in children with DS (Esbensen & Hoffman, 2018), has been found to be related to EF difficulties in DS using informant-report (Chen, Spano, & Edgin, 2013; Joyce et al., 2020) and direct measurement (Breslin et al., 2014; Joyce et al., 2020). However, no study to date has examined the relation between SDB and EFs using the BRIEF-2. This is the aim of the current study.

Participants and Methods: Analyses were conducted using data from 29 children with DS (19 F, M = 11.51 years, range = 6 to 17). Parent- (n = 29) and teacher-reported (n = 18) EF skills were measured using the BRIEF-2 (Gioia et al., 2015). Primary analyses were conducted using the BRIEF-2 indexes: Behavior Regulation Index (BRI), Cognitive Regulation Index (CRI), and Emotion Regulation Index (ERI). SDB was measured with the Sleep-Related Breathing Disorder scale of the Pediatric Sleep Questionnaire (SRBD-PSQ; Chervin et al., 2000, 2007). A modified SRBD score was used in the current study in order to exclude items that overlapped with items on the BRIEF-2 (6 items removed; 16 items used to calculate the SRBD score.

Results: Linear regressions were conducted to examine associations between SDB scores (IVs) and BRIEF-2 indexes (DVs). Greater SDB significantly predicted more parent-reported difficulties on the BRI (R^2 = 0.15, F(1, 27) = 4.84, p = .04), CRI (R^2= .15, F(1, 27) = 4.81, p = .04), and ERI (R^2= .15, F(1, 27) = 4.77, p = .04), and greater teacher-reported difficulties on the CRI (R^2= .43, F(1, 16) = 12.00, p = .003) and ERI (R^2= .25, F(1, 16) = 5.24, p = .04), but not BRI (R^2= .04, F(1, 16) = .63, p > .05). To examine which scales within the CRI (Working Memory, Initiate, Task-Monitor, Plan/Organize, Organization of Materials) and ERI (Shift, Emotional Control) were most related to SDB, exploratory Pearson correlations were conducted. After Holm-Bonferroni correction, only teacher-reported Plan/Organize (r = .76, p = .003) was significantly related to SDB. (Without correction for multiple comparisons, parent-reported Working Memory, and teacher-reported Plan/Organize, Initiate, and Shift scales were also associated with SBD.)

Conclusions: In children with DS, parent-reported SDB predicts parent- and teacher-reported EF skills using the BRIEF-2. Cognitive and emotion regulation appears to be most associated with SDB across settings, with evidence for a strong association between school-related planning/organization and SBD.

Keywords: intellectual disability**,** executive functions**,** sleep

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36 Examining BASC-3 Parent Rating Scale Profiles in Individuals With and Without Intellectual Disability

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Objective: Despite the presence of social, emotional, and behavioral (SEB) difficulties in individuals with intellectual disability, there is little research examining how commonly used parent rating scales characterize these difficulties in this group. The Behavior Assessment System for Children, 3rd Edition, Parent Rating Scale (BASC-3-PRS) is a parent rating designed to assess behaviors reflecting everyday SEB, and adaptive symptomology in children. The study's purpose was to investigate profiles on the BASC-3-PRS in children with intellectual disability (ID) compared to those with average intellectual skills (AV) and then determine if those differences continue when controlling for language ability. It was hypothesized that both clinically referred groups would demonstrate high rates of SEB symptoms as measured by the BASC-3-PRS, but that those differences would disappear when controlling for language level.
Participants and Methods: Participants included 1,070 youth (NID=122, NAV=948) ages 6 to 20 years old (Mage=11.43, SD=3.69) referred for outpatient evaluation at an academic medical center. Consecutive referrals were eligible for inclusion if they had a BASC-3-PRS, an intellectual quotient (IQ) from a standardized measure of general intellectual skills, and a General Adaptive Composite (GAC) and Communication subscale (COMM), from the Adaptive Behavior Assessment System, 3rd Edition. The ID group was comprised of children with IQ and GAC standard scores both < 70 (MIQ=55.62, SD=9.52; MGAC=59.99, SD=5.82; MCOMM=3.07, SD=1.95), whereas the AV group included children with IQ and GAC scores > 70 (MIQ=93.73, SD=14.88; MGAC=85.65, SD=10.02; MCOMM=7.92, SD=2.22). Multivariate analyses of variance (MANOVA) and Multivariate analyses of covariance (MANCOVA) were performed to assess mean differences in BASC-3-PRS scale scores between groups and the effect of language as a covariate, respectfully.
Results: Children with ID demonstrated at-risk (T=60-69) or clinically significant (T=70+) mean elevations on the Hyperactivity, Attention Problems, Atypicality, and Withdrawal scales, whereas the AV group demonstrated no elevations. The ID group demonstrated higher scores compared to the AV group across the Hyperactivity, Attention Problems, Atypicality, and Withdrawal scales (all p≤.001). Anxiety was lower within the ID group when compared to the AV group (all p≤.001), all other scales were similar across groups (p>.05). Effects across scales were small (ηp2 =.018-.040), except for a medium effect for Atypicality (ηp2 =.071). After controlling for language ability, the only differences that persisted were lower scores across the Anxiety and Depression subscales (both p≤.001; Typical: T<60) within the ID group compared to the AV group, though they were clinically unmeaningful. Effects across scales were small (ηp2 =.012-.032).
Conclusions: Findings suggest that referred children with ID demonstrate elevated hyperactivity, inattention, withdrawal, and atypical behavior on the BASC-3-PRS. Contrastingly, the BASC-3-PRS did not indicate elevated levels of aggression, poor conduct, anxiety, depression, or somatization within the ID group, which was unexpected given previous research. Similarly unexpected, the BASC-3-PRS identified no emotional or behavioral concerns in the AV group, despite being referred for clinical evaluation. Secondarily, findings are consistent with research indicating that profiles on SEB rating scales may be affected by language ability level. Future prospective research comparing the BASC-3-PRS to other gold standard measures of SEB symptomology, especially in consideration of language skill level, is needed to better inform the utility of this tool in children with ID.
Keywords: intellectual disability, assessment

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37 "Understanding the Relationship Between Self-esteem, Depression and Understanding Personal Strengths in Autistic Youth"

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Objective: Autism spectrum disorder (ASD) is a complex developmental condition that involves persistent challenges in social interaction, speech and nonverbal communication, and restricted/repetitive behaviors. Research indicates that low self-esteem is prevalent in autistic youth, as well as comorbid depression. Although the reasons are unclear, lack of knowledge of one's personal strengths may contribute to low self-esteem and depression in this population. Despite characteristic challenges experienced by autistic youth, they have unique character strengths that should be explored and utilized in their education and therapeutic goals. However, very little is known about how autistic individuals characterize their strengths, and whether identification of strengths is associated with better self-esteem and mood. The current study aims to explore associations between self-esteem, depression levels, and personal character strength identification in adolescents with ASD.
Participants and Methods: Twenty-seven adolescents with ASD were included in this study (age range 13-23 years). They were required to fill out a number of questionnaires. To assess character strength identification, Global Assessment of Strengths (GACS) was used. In addition, participants filled out Rosenberg Self-Esteem Scale (RSES), and Center for Epidemiological Studies – Depression Scale (CES-D) to evaluate self-esteem and depression. Pearson correlations were performed to explore relationships between variables (self-esteem, depression and strength identification).
Results: There was significant a positive correlation between (RSES) and (GACS), r =. 500**, p =.008, which shows that higher self-esteem is associated with greater identification of character strengths. Higher strength identification was also negatively correlated with depression levels, r = -.462, p = .015. In addition, self-esteem and depression were negatively correlated, r =.-.609**, p = .001, which shows that higher self-esteem is associated with lower depression scores.
Conclusions: The results of the current study indicate that strength identification was associated with better self-esteem and lower depression levels. As expected, self-esteem and depression are highly correlated. Our findings point toward future work designing interventions which may help autistic individuals to identify their character strengths to improve self-esteem and minimize depressive symptoms. Thus, character strength identification may have a beneficial impact on overall functioning in the autism population.
Keywords: depression, self-esteem
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38 Communication Skills in Autism: How do they Relate to the Job Interview Process?

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Objective: Autism spectrum disorder (ASD) is a complex developmental condition that involves persistent challenges in social interaction, speech and nonverbal communication, and restricted/repetitive behaviors. These challenges may have a negative impact as individuals with ASD age, including in their attempts to gain employment. For example, communication deficits can play an important role in performance on job interviews, a fundamental

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step in obtaining employment. Therefore, exploring communication skills and investigating their association with how youth perceive their performance in job interviews is an important step in designing interventions that can help this population. The current study aims to investigate the relationship between communication abilities as well as self-perception of self-efficacy in job interviews.
Participants and Methods: Twenty-eight children with ASD were included in this study with an age range of 15-24 years and a mean age of 19.1 years. Participants completed a mock job interview, and then a questionnaire to measure how well they thought they performed in the interview. Their parents filled out the La Trobe Communication Questionnaire that evaluates their perception of their children's communication ability across multiple domains: initiation/conversion flow, disinhibition/impulsivity, conversation effectiveness and partner sensitivity.
Results: There was a significant positive correlation between the La Trobe Communication Questionnaire total score and the Interview Self-Efficacy Scale total score, r =.561*, p =.012. In addition, there was a significant positive correlation between the partner sensitivity subcategory in the La Trobe Questionnaire and the Interview Self –Efficacy Scale, r= .463*, p=.020.
Conclusions: The results of the current study indicate that a greater sense of self-efficacy in job interviewing in adolescents with ASD is associated with better communication skills. These results highlight the importance of communication skills in job interviews, specifically the way that adolescents with ASD view their own performance. These findings shed light on the importance of targeting communication abilities of autistic youth as it may improve confidence in job interviewing, and hopefully employment outcomes.
Keywords: adolescence**,** autism spectrum disorder
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39 Cognitive Features Differentially Relate to Fragile X Protein Levels in Males and Females with Fragile X Syndrome

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Objective: Fragile X Syndrome (FXS) is an X-linked neurodevelopmental disorder. FXS is caused by triplet repeat expansion and resultant methylation of Fragile X mental retardation 1 (FMR1) gene resulting in deficient production of fragile X protein (FXP; formerly termed fragile X mental retardation protein (FMRP)). FXS is the most common form of inherited intellectual disability and the most single gene cause of autism. Several studies have established a link between peripheral blood FXP levels and general intellectual functioning in individuals with FXS. However, there are no known studies exploring the relationship between FXP levels and other key aspects of cognition in this population. Identifying these relationships may be helpful in better understanding the pathophysiological basis of cognitive deficits in FXS.
Participants and Methods: Eighteen male and nine female (17-40 years old) age-matched individuals with FXS were included in this analysis. Blood samples were obtained from participants to confirm full mutation FXS status and obtain the FXP levels. Using an optimized Luminex-based blood spot assay that allowed us to detect very low concentration levels of FXP. In addition, all participants completed: 1) a verbal working memory task, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS): Word List subtest and 2) an auditory processing task, Woodcock-Johnson IV (WJ): Auditory Attention subtest. We conducted separate ANOVAs to compare sexes on neuropsychological measures. Next, we conducted inter-correlations among task variables as well as with FXP levels.
Results: Verbal working memory was significantly reduced in males with FXS

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compared to females (t=2.31, p=0.03). Unexpectedly, we found males with FXS had only marginally reduced auditory attention skills compared to their female counterparts (t=1.82, p=0.08). At the group level, more words remembered related to increased auditory attention (r=0.50, p=0.01) and higher FXP levels (r=.72, p=.002), but these relationships were not significant in males or females alone. In contrast, higher FXP levels were marginally related to improved auditory attention in females with FXS (r=0.73, p=0.06).
Conclusions: Consistent with prior reports, females with FXS have higher verbal working memory abilities when compared to males with FXS. Yet, we demonstrate for the first time that higher FXP levels were associated with a greater number of words remembered among individuals with FXS, suggesting verbal working memory abilities may be higher among males with FXS and females who produce FXP. On the other hand, sex differences on the auditory attention task were only trend-level significant, suggesting auditory processing abilities may be more similar in males with FXS and females despite higher overall intellectual abilities among females. One possible explanation for this is our finding of a relationship between lower FXP and lower auditory processing skills specifically in females with FXS. This suggests that auditory attention may be more closely tied to underlying FXS pathology in females, and less susceptible to suspected compensatory patterns typical arising from X-activation. Together, our findings indicate FXP levels are associated with auditory processing and verbal working memory abilities differentially in males and females with FXS, which provides important new insights into underlying pathophysiological mechanisms and treatment planning.
Keywords: fragile X syndrome**,** cognitive functioning**,** verbal abilities

40 Title: Effectiveness of Novel Social Communication Measure LaTrobe in Adolescent with Autism

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Objective: One of the major deficits in individuals diagnosed with autism spectrum disorder (ASD) is social communication. However, there is a lack of social communication measures that address various types of social communication, including conversation flow, conversation effectiveness, sensitivity to partner, disinhibition, and impulsivity. The current study examines the effectiveness of a social communication measure typically used in individuals with Traumatic Brain Injury (LaTrobe Communication Questionnaire; LCQ: Douglas, 2010) in individuals with autism. The LCQ addresses various domains of social communication.
Participants and Methods: Nineteen autistic adolescents agreed to participate in the study. The sample comprised of 5 Females 14 males, with a mean age of 19.10 (±2.53) years. To measure social communication, we asked the parents of the individuals with ASD to fill the LCQ, as well as the Social Responsiveness Scale (SRS-2), a measure often used to validate autism diagnosis. The SRS-2 assesses various autism symptoms, including social awareness and social communication. Pearson correlations were performed between subscores of both SRS-2 and LCQ.
Results: We found a strong correlation between various subtests of SRS-2 and the LCQ. Notably, there were strong correlations between LCQ sensitivity to conversation partner subscore and SRS-2, $r = .591$, $p < .001$. A strong positive correlation was also observed between the disinhibition/impulsivity subscale of the LaTrobe Questionnaire () and SRS, $r = .692$, $p < .001$, as well as the conversation flow subscale of LaTrobe and SRS-2, $r = .638$, $p < .001$. These correlations indicate that those with more social communication concerns as measured by the LCQ were also likely to have higher autism traits, including difficulties in social awareness and communication.
Conclusions: This study represents one of the first studies to use LCQ to investigate social communication skills in adolescents with ASD. We found that most of the subscales of LCQ (conversation flow, partner sensitivity,

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disinhibition/impulsivity) were highly correlated to the SRS-2 and its subscales (i.e. social awareness, social cognition, social communication, and social motivation) in adolescents with Autism. Future research is needed to validate the LCQ for use in ASD.
Keywords: autism spectrum disorder**,** social cognition**,** adolescence
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41 Sex Differences in High Functioning Autism on the Social Perception Tests of the NEPSY-II

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Objective: Research suggests a “female phenotype,” in which females with Autism Spectrum Disorder (ASD), exhibit subtler symptoms when compared to their male counterparts. It was initially thought that the ratio for girls to boys with ASD was 1:10; however, it is now thought to be closer to 1:3. Females “camouflage” their social difficulties and exhibit stronger verbal skills, often performing well on formal neuropsychological measures assessing for ASD-related symptoms. This results in females falling below the diagnostic threshold leading to misdiagnosis, diagnosis late in life, or never being diagnosed. Current research looking at sex differences within this population consists of predominantly male participants, uses subjective data (rating scales), or includes measures that are not often used in ASD evaluations. The present, study aimed to extend research on sex differences by comparing scores on the Social Perception subtests of the NEPSY-II. Goals of this study included (a) evaluate how children with high functioning ASD perform on these subtests, (b) assess differences in performance on each subtest between sexes, and (c) evaluate if this measure is sensitive enough to capture characteristics associated with ASD’s in high functioning children.
Participants and Methods: Using archival data collected from private practices, this study analyzed raw and converted scores of the Social Perception subtests of the NEPSY-II; Affect Recognition (AR) and Theory of Mind (TOM). This study included archival data from 45 neuropsychological evaluations (19 females, 26 males), ages 6-16, who met DSM-5 criteria for ASD, Level 1. Children with FSIQ and VCI below 80 or a comorbid language disability were excluded from the study.
Results: Results indicated (a) on average, both girls and boys with high functioning ASD fell in the average range, (b) females obtained more raw scores than boys on TOM, (c) boys and girls with high functioning ASD had comparable performance on AR, (d) overall, the social perception subtests on the NEPSY-II did not successfully capture difficulties in AR and TOM in children with HF ASD.
Conclusions: This study found that a common measure used to assess for ASD symptomology, may not be sensitive enough to capture deficits in social cognition among children with high functioning ASD. This indicates new and more sensitive measures should be developed to capture deficits within this population, current neuropsychological measures may require different cut off scores for “impairment,” and clinicians should be aware of test norms and test sensitivity when choosing measures assessing for ASD symptoms. Additionally, to better determine differences between male and female presentations, research should explore the quality of responses at the item level between these groups.
Keywords: autism spectrum disorder**,** social cognition**,** neuropsychological assessment

42 The use of eye tracking, cognitive ability, and language to predict Autism symptomology, developmental delay, and language delay in toddlers

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Objective: Screening and diagnosis of autism spectrum disorder (ASD) is a complex process. Some thoroughly researched and reliable

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instruments such as the Autism Diagnostic Observation Schedule (ADOS-2) are commonly used, however, using these instruments to diagnose ASD is resource/training intensive and costly. In addition, many other difficulties in early childhood manifest with similar symptoms as ASD. Eye tracking is beginning to be used a screener to identify ASD symptoms early in life. Research examining combinations of variables as screeners that could be implemented on a larger scale is also emerging. This study examines the use of eye tracking in combination with a measure of early cognitive ability and language (the Mullen Scales of Early Development). The goal is to examine the effectiveness of these measures together compared to the ADOS-2.
Participants and Methods: This study uses a database available through the National Institute of Mental Health's National Data Archive. The sample includes 49 children with a final diagnosis of ASD, 19 with developmental delay, 46 with a language delay, and 70 typically developing (TD) children. They were shown the eye tracking task between the ages of 12 and 36 months (M = 24.00, SD = 9.21), with a final diagnosis being given at age 3. Participants were shown video clips with geometric shapes on one side of the screen and social stimuli on the other side of the screen. Latent discriminant analyses (LDA) were used to identify the maximum amount of separation between the groups using the combination of eye tracker and Mullen and this was compared with the ADOS.
Results: The first LDA containing variables from the Mullen (receptive language, expressive language and cognitive ability) as well as the eye tracking variable (fixation duration on social stimuli) was able to predict group membership with 70% accuracy. This was comparable to the second LDA which had the same variables from the Mullen as well as the ADOS total score and predicted group membership with 73% accuracy. When the same variables were used to predict membership with only the ASD and TD groups, the accuracy was at 88% with 97% specificity.
Conclusions: This study demonstrates that this combination of variables is effective in distinguishing ASD from other developmental issues. In areas where the ADOS and other gold standard measures of ASD diagnosis or screening are not available, the eye tracking in combination with specific neuropsychological variables provides good information regarding ASD symptomology. In addition, symptom level interventions targeting factors such as social engagement would benefit from a quick, objective and easy to use task such as eye tracking.
Keywords: autism spectrum disorder**,** intellectual functioning**,** language: development

43 Characterizing Scores on the CBRS Caregiver/Parent Form in Individuals with Intellectual Disability

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Objective: The Conners Comprehensive Behavioral Rating Scales, Caregiver/Parent Form (CBRS) is a measure of psychosocial, behavioral, and academic functioning in children ages 6 to 18 years. Individuals with intellectual disability (ID) often struggle within these areas of functioning; however, the utility of the CBRS for children with intellectual disability has not been well explored. The purpose of this study was to characterize and compare CBRS profiles in a clinically referred sample of children with intellectual disability (ID) and those with average intellectual skills (AV). Given the clinical nature of the sample, it was expected that both groups would demonstrate symptoms as measured by the CBRS.
Participants and Methods: Participants included 426 youth (N_{ID}=46, N_{AV}=380) ages 6 to 18 years (M_{age}=11.40, SD=3.35) referred for an outpatient (neuro)psychological evaluation at an academic medical center. Consecutive referrals were eligible for inclusion if they had a CBRS, a standardized intellectual quotient (IQ), and a General Adaptive Composite (GAC) from the Adaptive Behavior Assessment System, 2nd/3rd Edition. Criteria for inclusion in the ID group included IQ and GAC standard scores both <70 (M_{IQ}=60.70, SD=8.10; M_{GAC}=61.24, SD=5.61), whereas participants in the AV group had IQ

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scores from 90-109 (M_{IQ}=98.83, *SD*=5.29; M_{GAC}=84.95, *SD*=10.33). Multivariate analyses of variance (MANOVA) was performed to assess group mean differences on 11 Content sub/scales (i.e., Emotional Distress and Academic Problems Content scales were excluded as their subscales were included instead). Notably, there was homogeneity of variance-covariances matrices, as well as homogeneity of variances for 6/11 sub/scales. **Results:** As a group, participants with ID demonstrated elevations (i.e., ≥1 SD above the normative mean) across all content sub/scales, with 5/11 scales reaching scores ≥2 SDs above the normative mean (i.e., Social Problems, Language, Math, Hyperactivity/Impulsivity, Perfectionistic and Compulsive Behaviors). Those in the AV group demonstrated mean elevations across all sub/scales with the exception of Separation Fears and Perfectionistic and Compulsive Behaviors; however, only 1/13 sub/scales reached scores ≥2 SDs above the normative mean (i.e., Social Problems). The ID group had more elevated scores compared to the AV group across sub/scales (p<.02), with the exception of Worrying, Separation Fears, Defiant/Aggressive Behaviors, and Physical Symptoms. All significant effects were small (η_p^2=.015-.023), with the exception of a medium effect for Perfectionistic and Compulsive Behaviors (η_p^2=.058), and as expected, medium to large effects for Language and Math (η_p^2=.086 and .106, respectively). **Conclusions:** Consistent with previous research suggesting high rates of psychiatric and behavioral problems in children with ID, findings indicate participants with ID in this sample generally demonstrated significant symptoms across most CBRS sub/scales. Furthermore, results suggest that children with ID in this sample typically demonstrated more academic problems (i.e., Language and Math) and Perfectionistic and Compulsive Behaviors, as captured by the CBRS, than children with average intellectual skills referred for a clinical evaluation. Results are limited by the non-prospective nature of this study and the small number of participants in the ID group. Future studies comparing the CBRS to a gold-standard comparator in children with ID are warranted to inform clinical care and research design for this underserved group.

Keywords: intellectual disability, pediatric neuropsychology

44 Sensory abnormalities across psychiatric and neurodevelopmental conditions in childhood.

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Objective: Sensory Abnormalities (SAs) are a core diagnostic feature of Autism Spectrum Disorder (ASD), yet there is growing evidence that they are also prevalent in other child psychiatric and neurodevelopmental conditions. This study aimed to extend the empirical literature examining SAs across a range of conditions in children and adolescents. We investigated diagnostic group differences in SAs, specific SA presentations, and how quantity of SAs are associated with internalizing/externalizing problems. **Participants and Methods:** A clinically referred outpatient sample of 1210 youth ages 6-17 (11.1 ± 3.1 yrs; 37.3% girls) was used to examine the association between psychopathology and sensory abnormalities (SAs). First the association between 7 diagnostic groups (i.e., attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), mood disorders (MD), anxiety disorders (AD), psychosis, conduct disorder (CD) and oppositional-defiant disorder (ODD) and the 5 most frequently described SAs were examined using logistic regression analyses examining all diagnostic groups simultaneously while controlling for comorbidity. Next, a negative binomial regression using all diagnostic groups was used to predict number of SAs. Finally, hierarchical multiple regression analyses examined the association between number of SAs which consisted of 4 groups (0, 1, 2, 3 or more SAs) and internalizing and externalizing

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problems controlling for age, sex, psychotropic medication, and full-scale IQ in step 1 and ASD status in step 3. A critical value of .05 was used to determine statistical significance.
Results: A diagnosis of ASD increased the risk of having any of the five SAs (Odds Ratios (OR) between 2.29 -3.47; all p-values <.002). Additionally, ADHD was associated with specific SAs (pain hyposensitivity; OR=1.57, p =.037) and food texture sensitivity (OR=1.44, p =.049). Children with AD had an increased risk for gagging/vomiting (OR=1.44, p =.019), tactile defensiveness (OR=2.01, p <.001), and hypersensitive for noise (OR=2.22, p =.004). The negative binomial regression yielded significant incidence rate ratios (IRR) for ADHD (IRR = 1.17, p = .013), ASD (IRR = 1.96, p < .001), AD (IRR = 1.36, p < .001), and ODD (IRR = 1.17, p = .049). A significant association between number of SAs and internalizing problems was found where youth with 1, 2, and 3 or more SAs had higher t-scores of respectively 4.4 (p<.001), 6.5 (p<.001), and 9.5 (p<.001) on internalizing problems compared to children with no SAs. Smaller but significant associations were found on externalizing problems where youth with 1, 2, and 3 or more SAs had respectively 2.3 (p=.008), 2.7 (p=.004), and 5.0 (p<.001) higher t-scores.
Conclusions: SAs are most prevalent in ASD, but are not unique to this disorder. Particular SAs are also significantly associated with ADHD (hyposensitivity to pain and food texture sensitivity) and AD (tactile defensiveness and hypersensitivity to noise). Higher quantity of SAs are especially associated with internalizing problems (and weaker but significantly associated with externalizing problems). These findings have implications for differential diagnosis, clinical considerations, and treatment planning.
Keywords: neuropsychological assessment**,** sensory integration**,** psychopathy

45 How do Children with Reading Disabilities, Math Disabilities and Comorbidity Differ in Phonological Awareness and Executive Functions?

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Objective: This study aims to compare Brazilian children with reading disabilities (RD), math disabilities (MD) or reading and math disabilities (RMD; comorbid profile) to a typical achievement (TA) group in phonological processing (phonological awareness and rapid automatized naming) and executive functions (EF; verbal and visuospatial working memory, cognitive flexibility, inhibition and verbal fluency) abilities.
Participants and Methods: The sample comprised 416 children ranging from 7 to 11 years old (M=9.05, SD=.91), from 3nd and 5th grades of public schools in two Brazilian capitals. Children who performed above the 25th percentile in the Word and Pseudoword Reading Test - LPI and Arithmetics Subtest of the Brazilian School Achievement Test – TDE tests belonged to the control group (n = 333; 80%). Children who performed below the 16th percentile on the LPI test and above the 25th percentile on the TDE belonged to the RD group (n = 22; 5.3%), while children who scored above the 25th percentile on the LPI test and below the 16th percentile on the TDE test were classified in the MD group (n = 44; 10.6%). Finally, children who performed below the 16th percentile in both tests were included in the RMD group (n = 17; 4.1%). We conducted linear mixed-models using sex and groups of learning disabilities as between-subjects factors, school-Socieconomic Status (school-SES) and intelligence as covariates (fixed-effects), and city as a random effect (in all models); this procedure was repeated when analyzing cognitive variables scores as the dependent variables. A set of models with increasing

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degrees of complexity was estimated for each dependent variable. A decision about the best model fit was made based on the Akaike Information Criterion (AIC).
Results: We found shared deficits in phonological awareness, rapid automatized naming and orthographic verbal fluency among children with RD, MD and RMD compared to controls (TA > RD, MD, RMD). In these variables, the MD group also showed better performance than RD and RMD (MD > RD, RMD), and RD and RMD did not differ significantly. Furthermore, only the RD group showed deficits in verbal short-term memory and in cognitive flexibility and inhibition tasks compared to TA group. The RMD group also showed impairments in verbal working memory compared to TA and MD (TA > RMD, MD > RMD).
Conclusions: Deficits in phonological awareness, rapid automatized naming and orthographic verbal fluency were shared among children with RD, MD and RMD compared to TA children, controlling for sex, school-SES and intelligence. Children with RMD were the only group that presented impairments in verbal working memory. These results suggest that both phonological processing (e.g., phonological awareness and rapid automatized naming) and executive domains (e.g., verbal working memory) might be important factors associated with the comorbidity between dyslexia and dyscalculia.
Keywords: reading disorders**,** mathematics disability**,** learning disabilities

46 Efficacy of a Peer-Based In-Home Education Program in Improving Social-Emotional Outcomes of Parents and Children

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Objective: Early opportunities are essential for optimal cognitive and social-emotional development in young children. Significant disparities in educational and social-emotional outcomes exist between racial/ethnic groups, particularly impacting children growing up in impoverished environments. Home visitation intervention programs, such as the Home Instruction for Parents of Preschool Youngsters (HIPPY), have been used for decades to improve academic readiness in vulnerable children. Although the benefits of HIPPY on academic performance are well-documented, there has been no examination of social-emotional benefits to participating parent-child dyads.
Participants and Methods: This study followed a HIPPY cohort for one year to evaluate change in parental and child social-emotional and behavioral functioning. 157 parent-child dyads completed questionnaires assessing adverse childhood experiences (ACES), parental depression (CESD-R), parental stress (PSI), social connectivity (SNI), and child behavioral/emotional functioning (BASC) at three timepoints over the course of the program. Given the COVID-19 pandemic, a measure of COVID exposure/stress (CEFIS) was also completed. The HIPPY cohort was diverse: 49% of the sample identified as White, 12% as Black/African American, 11.5% as Asian/Pacific Islander, and 4.5% as other. Sixty-five percent of the sample listed Spanish as their primary language.
Associations between demographic and moderator variables (e.g., parental ACES) with the main outcome variables (e.g., BASC, CESD-R, PSI) were examined. Repeated measures ANOVAs were used to explore change in parent and child social-emotional and behavioral functioning over the program year. Repeated measures ANCOVAs were used to examine the impact of parent trauma exposure and a cumulative psychosocial risk index on outcomes.
Results: Parents demonstrated reduced stress, $F(1.87, 205.29)=5.46$, $p=.006$, and increased social connection, $F(2, 224)=5.19$, $p < .006$. Parents that reported significant depression at baseline reported a significant decrease in symptoms, $F(2, 38)=4.24$, $p=.02$. Finally, there was a significant reduction in child externalizing behaviors, $F(1,97)=12.24$, $p=.001$, and significant improvement in child adaptive functioning, $F(1,97)=7.59$, $p=.007$, over the

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course of the program. There was no effect of ACES score or the cumulative risk index score on any outcomes.
Conclusions: This study provides novel evidence that HIPPY positively impacts participants' social-emotional functioning. Participation in HIPPY was associated with decreased parental stress, decreased parental depression (for those who reported clinically significant depressive symptoms at baseline only), and improved child externalizing behaviors (e.g., hyperactivity, aggression) and adaptive functioning (e.g., adaptability, social skills). It is noteworthy that the sample reported a decline in stress and depression during a global pandemic in which most data collected to date indicate significant increase in social-emotional and psychological problems in the general population (Xiong et al., 2020) and in children specifically (Marques de Miranda et al., 2020). There are implications for the implementation of HIPPY in high-risk communities and suggest a broader purpose for the program to address social-emotional functioning of both parent and child. The emphasis on parent peer relationships utilized by the HIPPY program provides a cost-effective, sustainable community-based intervention as an alternative to more costly interventions implemented by professionals in the community and without placing additional burden on families to obtain needed services (i.e., transportation, insurance coverage, etc.).
Keywords: child development (normal), multiculturalism

47 Genetic and Neural Risk of Specific Reading Disability Within a Family Case Study: A Clinical Application

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Objective: Imaging and genetic studies have helped to characterize the biological risk factors contributing to development of specific reading disability (SRD) at sample and population level. The current exploratory study aimed to apply this research literature to an individual family to examine how this knowledge could be applied to understand clinical risk within a (or a set of) clinical case(s).
Participants and Methods: Participants were a pair of twins discordant for SRD (age 9) and their older sibling with reading difficulty (age 11). Intraclass correlations were used to understand similarity of imaging phenotypes between each pair of siblings. Reading-related genes and brain region phenotypes, including asymmetry indices representing the relative size of structures in the left as compared to right hemispheres, were then descriptively examined to determine which risk factors were related to reading within the family.
Results: For genetics, there were SNPs that were concordant between the SRD siblings and not the typically developing (TD) sibling in the genes *ZNF385D, LPHN3, CNTNAP2, FGF18, NOP9, CMIP, MYO18B*, and *RBFOX2*. Overall imaging phenotypes tended to be similar among all sibling pairs for grey matter volume and surface area, but cortical thickness in reading-related ROIs was more similar among the siblings with SRD, followed by the twins, and then the TD twin and older sibling, suggesting cortical thickness may be an important differentiator of risk for members of this family. Siblings with SRD tended to have more symmetry in cortical thickness in the transverse temporal and superior temporal gyri, while the TD sibling had greater rightward asymmetry. The TD sibling had a greater leftward asymmetry of grey matter volume and cortical surface area in the fusiform gyrus, supramarginal gyrus, and transverse temporal gyrus.
Conclusions: Overall, this exploratory study demonstrated that reading-related risk factors appeared to correspond with SRD within this particular family, suggesting that examination of biological risk factors early in life may be beneficial for timely identification and intervention. Future studies may benefit from the use of polygenic risk scores or machine learning to better combine and integrate imaging genetics knowledge to understand SRD risk at sample and population level and translate this understanding at family and individual level.
Keywords: neuroimaging: structural, reading disorders, genetics

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48 Reading Accuracy Skills in Children with New/Recent-Onset Epilepsy and the Influence of Semantic Memory

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Objective: Academic problems and neurocognitive deficits are significantly associated with childhood epilepsy. Central to academic success, reading difficulties continue to emerge as the most consistent area of concern across studies (Wo et al., 2017). Understanding reading at the skill level (i.e., word recognition, fluency, decoding) and exploring cognitive influences of those skills might provide greater understanding of reading and learning in children with epilepsy and inform specific interventions (Reilly & Neville, 2011). Evidence for semantic memory in literacy skill development (Lah & Smith, 2014) may provide a cognitive indicator that could serve as a target area for intervention. Through secondary analysis of existing longitudinal data of children with new/recent-onset epilepsies, the purpose of this study was to examine reading accuracy skills at baseline and investigate cognitive abilities associated with semantic memory as compared to typically developing youth.
Participants and Methods: Participants (*N*=284) were aged 7-18 years, comprised of 106 controls and 178 new/recent-onset epilepsy, including 89 genetic focal epilepsy (FE) and 89 genetic generalized epilepsy (GGE). The control group was comprised of age- and sex-matched first-degree cousins of the epilepsy participants, with no clinical history. Children underwent comprehensive neuropsychological testing that included measures of academic achievement (Woodcock-Johnson Test of Achievement, Third Edition (WJT) and Wide Range Achievement Test, Third Edition (WRAT-3)) and language (Vocabulary subtest of the Wechsler Abbreviated Scale of Intelligence (WASI) and Expressive Vocabulary Test (EVT)). Baseline data were analyzed through a series of analysis of covariances (ANCOVA) and Structural Equation Modeling (SEM) path analyses with age covariate.
Results: Significant ($p < .001$) group differences were observed for WASI and EVT with both epilepsy groups performing worse than controls, regardless of age. Although no overall significant group differences were identified across reading skills, post hoc revealed GGE performed significantly ($p < .05$) lower than controls on WRAT-3, regardless of age. Results of the SEM path analyses revealed vocabulary and expressive vocabulary were significantly ($p < .001$) and positively correlated to represent a semantic memory construct. Semantic memory had a significant direct influence ($p < .001$) on each reading skill for all groups. The coefficients of determination revealed semantic memory accounted for approximately 40% to 82% of variance across reading skills in the control group, 65% to 73% in the FE group, and 66% to 88% in the GGE group, respectively.
Conclusions: Children with newly diagnosed epilepsy showed impairments in aspects of semantic memory as compared to their peers. Despite these impairments, the current study found semantic memory directly influenced reading skills across all groups and likely impacted the word recognition impairment observed in children with GGE. Early identification of academic and cognitive difficulties is needed to ameliorate the impact epilepsy has on academic achievement. Additionally, effective interventions built around enhancing aspects of semantic memory like verbal knowledge could help children with epilepsy, as well as for all children, develop better reading skills and improve overall quality of life.
Keywords: epilepsy / seizure disorders**,** reading disorders**,** semantic processing
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49 The Roles of English and Spanish Language Skills in Word Reading, Math

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Computations, and their Overlap in Middle School English Learners

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Objective: Among at-risk bilingual samples, research evaluating the roles of first and second language processes as potential shared risk factors in comorbid reading and math difficulties is limited, though such work has the potential to inform identification and intervention approaches. The role of language in foundational math skills in at-risk bilingual children is also understudied. Thus, the current study utilized both continuous and categorical approaches to evaluate the extent to which English and Spanish language skills account for unique versus shared variance in reading and math achievement in a sample of middle school English Learners (ELs) identified as having reading difficulties. We expected that language skills would relate to both reading and math outcomes when controlling for demographic covariates. We expected larger effects for English skills as well as stronger relationships between language and reading relative to language and math.
Participants and Methods: As part of a larger project, 161 middle school ELs (mean age = 12.5, 41% female) identified as struggling readers were administered a battery of nine language tests (along the dimensions of vocabulary/syntax, expressive/receptive, and English/Spanish skills), single word reading, and math computations. English and Spanish factor scores were created using structural equation modeling. Multivariate regression was used to test effects of language skills on reading, math, and their overlap. To consider these relationships categorically, a cut-off score of 85 on the math computations measure was used to identify a comorbid group (RDMD). Logistic regression tested the extent to which English and Spanish skills predicted whether students were classified into the reading difficulties-only (RD) or RDMD group.
Results: English skills (β = 0.37, $p < .001$) and Spanish skills (β = 0.16, $p = .030$) significantly predicted word reading, and the model accounted for 21% of the variance. Both English (β = 0.16, $p = .036$) and Spanish skills (β = 0.19, $p = .014$) significantly predicted math computations, and the model accounted for 5% of the variance in computations. English skills were significantly more predictive of word reading than computations ($F = 6.55$, $p = .011$), whereas Spanish skills did not differentially predict outcomes ($F = 0.05$, $p = .831$). Findings from the logistic regression showed that both English (B = -0.52, $p = .016$) and Spanish skills (B = -0.48, $p = .010$) uniquely predicted comorbidity classification status, and these parameter estimates did not significantly differ from one another (Wald $\chi^2 = 0.02$, $p = .876$).
Conclusions: Findings highlight the shared role of language skills in both reading and math outcomes in this population, consistent with the multiple deficit framework of comorbidity. Though language accounted for only a small portion of variance in computations, our results provide novel support for the shared role of Spanish skills in word reading and math computations at this age level. Taken together, our findings suggest that ELs should be monitored for problems in both reading and math, and that their language skills should be considered more wholistically (e.g., both Spanish and English skills) particularly when evaluating their risk status for co-occurring reading and math problems.
Keywords: academic skills, bilingualism/multilingualism, language

50 Impact of Acculturation on Working Memory and Math Achievement in Community College Students

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Objective: We live in an increasingly multicultural society which is reflected in the student population. In the community college (CC) setting, students from underrepresented groups are over-represented in remedial math courses and are less likely to complete the sequence. The extant literature suggests higher levels of acculturation, both cultural adoption and cultural maintenance, support academic success. Working memory (WM) is a well-known

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domain-general predictor of mathematical development and has been shown to relate to math achievement r = .38. Given this moderate relation, additional predictors of math achievement warrant investigation. In the present study, we investigated the potential moderational role of acculturation (cultural adoption and maintenance), on the WM-math relation in a diverse group of CC students (n = 94). Math was assessed both by a standardized measure of math computation and a measure of "everyday math" word problems including medical and financial management. We expected that higher levels of acculturation (adoption and maintenance) would decrease WM load (via cognitive load) and aid math performance. At higher levels of acculturation, the WM-math relation was hypothesized approximate meta analytic findings, r = .38. Alternatively, at low levels of acculturation, the WM-math correlation was anticipated to be attenuated due to the added variability in culture and the negative impact low acculturation levels have on WM and cognitive load.
Participants and Methods: A diverse sample of CC students (ages 18-25) who were enrolled in a math course were included. Participants completed an online survey covering demographic and cultural domains, then completed in-person cognitive testing to assess language abilities, WM, and math ability. Bivariate correlations and regression based moderation analyses were used. Post-hoc analyses were conducted to assess for three-way interactions with baseline verbal or math abilities.
Results: WM-math correlations averaged r = .38. Acculturation did not significantly relate to either outcome variable. Neither cultural adoption (computations: F = 1.68, p = .199; word problems: F = .42, p = .521) nor cultural maintenance (computations: F = .83, p = .364; word problems: F = .36, p = .550) moderated the WM-math relations. Post-hoc analyses revealed significant three-way interactions between cultural adoption and math computation across different levels of vocabulary (F = 4.66, p = .034) and math abilities (F = 6.16, p = .015).
Conclusions: The hypothesized moderational role of acculturation on the WM-math relation was not supported. Post-hoc analyses revealed that the cultural adoption-math relationship varied across different levels of vocabulary and math abilities, although not in the direction anticipated. Finding suggest complex relationships between WM, acculturation, and math such that acculturation does impact math performance when either vocabulary or math abilities are strong. At low levels of math or vocabulary, students' WM may already be overtaxed, such that higher acculturation levels cannot benefit the student. Whereas when baseline abilities are average/high, increased cultural adoption can benefit the student by potentially decreasing cognitive load and freeing additional WM capacity which can be applied to the task. Findings could identify patterns of students at risk for math failure and inform future intervention/policy development to address their needs and support success.
Keywords: acculturation**,** mathematics ability**,** working memory
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51 Circulating Endocannabinoid (eCB) Levels and Mathematics Functioning in Preadolescent Youth: Pilot Data from the ABCD eCB Substudy

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Objective: The endogenous endocannabinoid (eCB) system includes cannabinoid receptor 1 (CB1R), CB2R, and two endogenous ligands (N-arachidonoylethanolamine; AEA and 2-arachidonoylglycerol, 2AG). The eCB system is thought to play a significant role in neuroplasticity and neurodevelopment, including during adolescence. Animal and human research has shown high density of CB1R and eCB signaling in the parietal, PFC, limbic system, cerebellum and ventral striatum. A small number of adult studies have demonstrated a link between circulating AEA and 2AG levels and cognition, especially executive functioning; however, no studies to date have examined

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other cognitive outcomes, such as mathematics ability, in developing youth. Here, we examined the links between circulating AEA and 2AG and mathematic functioning in a healthy sample of 12-14 year olds enrolled in the Adolescent Brain Cognitive Development (ABCD) Study eCB Substudy.
Participants and Methods: 75 youth (aged 12-14; female=30, male=45) completed the three-year follow-up of the ABCD study and pilot eCB Substudy. By using mass spectrometry, concentrations of circulating AEA and 2-AG were measured from blood serum. Youth were administered the Standard Mental Arithmetic Response Time Evaluation (SMARTE), which assesses enumeration, fluency, and recall mathematics performance. Multiple linear regressions were used to determine the associations between math performance subscales and AEA and 2-AG concentrations after controlling for demographics & state factors linked with eCB levels.
Results: 2AG concentrations were significantly associated with increased math task recall performance (p=.02) and marginally predictive of increased fluency performance (p=.04). AEA concentrations were not significantly related outcomes. Covariates known to influence eCB concentrations (current pain, stress, recent exercise/food intake) did not affect findings.
Conclusions: This is the first study to date linking *ex vivo* circulating 2AG concentrations with superior math task recall and fluency performance in healthy developing preadolescents. This is consistent with prior work in adult samples linking current serum eCB levels and cognition and establishes a novel link between the eCB system and mathematics functioning in developing youth. Future research should aim to identify the underlying neuronal processes, examine links between the eCB system and math learning difficulties, and further establish the longitudinal relationships between eCB circulating levels and adolescent neuronal development.
Keywords: mathematics ability**,** adolescence**,** neurotransmitter systems
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52 Validity of the 6-item Reading Subscale of the Colorado Learning Difficulties Questionnaire in Monolingual and Bilingual Children of Hispanic Descent.

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Objective: The Colorado Learning Difficulties Questionnaire (CLDQ) is a parent report screening measure previously validated in mostly Caucasian school-age children using both clinical and community samples (Willcutt, et al., 2011). The 6-item reading subscale of the CLDQ predicts the presence of dyslexia well, but it is unclear how its predictive validity may vary across monolingual and bilingual children of Hispanic descent. The present study investigated the internal consistency and predictive validity of the reading subscale in a large cohort of monolingual and bilingual children of Hispanic descent.
Participants and Methods: 702 children of Hispanic descent (mean age = 11.9, sd = 2.1), 259 of whom were Spanish-English bilinguals, participate in this study. Age-normed measures of single-word and connected text reading accuracy, phonological coding, spelling, and reading fluency were obtained and combined into a literacy composite, with children scoring -1.33 s.d. or more below the population mean classified as dyslexic. English was the primary language of instruction for all children, so reading and spelling measures were administered in English.
Results: Results showed that the CLDQ has excellent internal consistency (Cronbach's alpha > .9). Receiver operating characteristic analyses indicated good predictive validity (AUC = .81, p<.001 for bilinguals; AUC = .85, p < .001 for monolinguals). Sensitivity and specificity were 71% and 78%, respectively, at a cutoff of 2.75 for the bilingual group. In the monolingual group, sensitivity and specificity were 78% and 77% respectively, at a cutoff of 2.92. In a multiple regression predicting reading ability, the CLDQ added significant unique variance above

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and beyond IQ, phonological awareness and rapid naming skills. Sensitivity was prioritized over specificity given the screening nature of the CLDQ, as false positives can be identified at later stages of an assessment process.
Conclusions: Our results indicate that there is a slightly different cutoff on the reading subscale for monolingual and bilingual participants, with the former subgroup requiring a higher (more severe) cutoff to achieve similar specificity. This suggests that parents of monolingual children identify the presence of reading difficulties slightly more so than parents of bilingual children, even though the children may not meet criteria for reading difficulties on formal reading measures. Overall, these results indicate that the CLDQ reading subscale has good predictive validity as a screening instrument for dyslexia in monolingual and bilingual children of Hispanic descent, which will facilitate its use in clinical, educational, and research contexts.
Keywords: dyslexia, bilingualism/multilingualism

53 Examining the relationship between IQ, adaptive functioning, and parent self-efficacy

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Objective: Parental self-efficacy (PSE) is a parent's belief in their ability to influence their child and direct the environment to foster ongoing development and success. Research suggests that parents of children with behavioral challenges may feel low levels of PSE; however there have been no studies to our knowledge that have examined the extent to which other child functioning factors (i.e., intellectual functioning, adaptive skills) may impact PSE. Examining patient factors that predict PSE may be helpful for neuropsychologists in identifying risk and informing care. The purpose of this study is to investigate the manner in which intellectual functioning and adaptive skills may predict PSE in a sample of youth and young adult patients. Higher intellectual and adaptive functioning scores were hypothesized to be positively related to PSE.
Participants and Methods: Participants included 912 patients between the ages of 6-22 years (M_{age}=11.57, *SD*=3.47), referred for outpatient (neuro)psychological evaluation. Consecutive referrals were eligible for inclusion if they had an intellectual quotient (IQ) from a standardized clinical measure of general intellectual skills (i.e., WASI-2, WAIS-4, WISC-4, or WISC-5; M_{FSIQ}=90; *SD*=17.67), a General Adaptive Composite (GAC) from the Adaptive Behavior Assessment System, 2nd/3rd Edition (M_{GAC}=83; SD=12.26), as well as a complete pre-evaluation PSE questionnaire typically completed by the mother (84%). The PSE Questionnaire is a novel 13-item (each item on a 5-point Likert type scale) measure with three scales (i.e., Understanding, Advocacy, and Management) designed to assess parent's perception, understanding and ability to manage/advocate for their child's needs (M_{Total}=47; *SD*=10.11; $M_{Understand}$=12.66; *SD*=4.01; $M_{Advocate}$=11.63; *SD*=3.05; $M_{Management}$=22.37; *SD*=5.33). This PSE measure expands upon the work of Bodin et al. (2007) and Austin et al. (2019) who developed questionnaires to assess PSE and parental satisfaction post neuropsychological evaluation. Four multiple regression analyses were conducted to explore the relationship between child intellectual and adaptive functioning, and PSE (i.e., overall total and scale totals).
Results: FSIQ and GAC together accounted for 6.6% of the variance of PSE_{Total} [$F(2, 909)=32.32$, $p<.001$], 3% of both $PSE_{Understand}$ [$F(2, 909)=14.12$, $p<.001$] and $PSE_{Advocate}$ [$F(2, 909)=14.20$, $p<.001$], and 8.4% of $PSE_{Management}$ [$F(2, 909)=41.69$, $p<.001$]. Both FSIQ and GAC significantly predicted PSE_{Total} [FSIQ ($\beta=-.140$, $p< .001$), GAC ($\beta=.189$, $p< .001$)], $PSE_{Understand}$ [FSIQ ($\beta=-.043$, $p< .001$), GAC($\beta=.034$, $p< .003$)], $PSE_{Advocate}$ [FSIQ($\beta=-.033$, $p< .001$), GAC($\beta=.023$, $p< .009$)], and $PSE_{Management}$[FSIQ ($\beta=-.065$, $p< .001$), GAC($\beta=.131$, $p< .001$)].
Conclusions: This study found that intellectual and adaptive functioning explain a small, but statistically significant degree of variance in all PSE scales and total PSE ratings. As expected, as children showed more adaptive dysfunction, PSE decreased. Surprisingly, as cognitive

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functioning increased, PSE declined. This may be due to the reduced availability of supports/services with increased intellectual skill, despite clinical concerns that led to (neuro)psychological evaluation in this group; however, this idea warrants further exploration. Further research is needed to explore the ways in which other child and family factors may impact PSE. This is important because determining these factors will allow neuropsychologists and other service providers to identify families who may benefit from additional supports to improve understanding, access resources, and boost parental advocacy for children and young adults with complex needs.

Keywords: cognitive functioning**,** adaptive functioning**,** neuropsychological assessment

54 Subsequent Postnatal Neurocognitive Function Due to Hypothyroidism During Pregnancy: A Systematized Literature Review.

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Objective: The purpose of this poster is to illustrate a Systematized Literature Review (SLR) of subsequent offspring neurocognitive functions due to hypothyroidism in pregnancy and the importance of interdisciplinary intervention and prevention. Hypothyroidism is a metabolic disorder in which the TS4 hormone is insufficient (Khan, 2017). TS4 deficiencies during pregnancy are critical events that could potentially interact with the development of the fetus. Thyroid hormones are essential for neurodevelopment through specific time windows influencing neurogenesis, neuronal migration, neuronal and glial cell differentiation, myelination, and synaptogenesis (Thompson, et. al., 2017). Alarmingly, there is a 15.5 percentage of women in the U.S. who have hypothyroidism during their pregnancy. Of these cases, 30% to 80% are undetectable or missed during pregnancy (Mintziori et al., 2015). In their newborns, the central nervous system function may be impaired, contributing to a low intelligence quotient and intellectual disability (Thompson et. al., 2017). Despite this, there is a lack of literature on the impact of hypothyroidism in neurocognitive processes.

Participants and Methods: The researchers conducted an SLR using peer-reviewed databases from August to October 2019 with a total of 70 articles. A systematized protocol was developed using a five-phase method; however, these did not meet the PRISMA criteria since they did not evaluate the risk of bias. The following inclusion criteria were used: a) identifies hypothyroidism in pregnancy, b) provides data on neurocognitive function regarding hypothyroidism in pregnancy and their offspring, (c) articles must have been published in peer-reviewed journals from 2005-2019. Descriptive analyses (i.e., mean, mode, standard deviation) were conducted.

Results: In terms of neurocognitive functions, 50% of the articles reported neurocognitive deficiencies in the offspring due to hypothyroidism during pregnancy. Specifically, 29% of articles reported a low intellectual quotient, followed by 20% on memory deficiencies, 19% on fine motor function deficiencies,15% on gross motor deficiencies. Over 10% of the articles presented deficiencies of communication, attention, and psychomotor functions in the offspring of mothers with hypothyroidism during pregnancy. Finally, congenital conditions such as Autism Spectrum Disorder (37%), Attention Deficit and Hyperactivity Disorder (27%), and Intellectual Disability (18%) were reported.

Conclusions: In this SLR, 79% of articles reported that hypothyroidism affects the cognition of the offspring. The bulk of the literature examined points to an association between maternal hypothyroidism and adverse neurocognitive and neurodevelopmental outcomes in offspring and thus the importance of early intervention. Therefore, the education, intervention, and prevention of neurocognitive function delay on the offspring of women with hypothyroidism should be addressed by an interdisciplinary team composed of neuropsychologists, endocrinologists, and gynecologists.

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Keywords: hypothyroidism**,** cognitive functioning**,** perinatal factors
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55 Parent-Educators Contribute to Later Academic Achievement During COVID-19 in Very Preterm and Full-Term Children

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Objective: The COVID-19 pandemic put a heightened importance on the caregiver's role in their child's education as schools shifted to remote learning. Parents have had to take on the role of parent-educators to compensate for the reduction in teacher-led instruction during COVID-19, but there is little information on the long-term academic effects of the parent-educator during remote learning. Information on the relationship of parent-directed learning during the pandemic to subsequent academic achievement is especially important for vulnerable populations such as those born very preterm (VPT; gestational age 30 weeks), with well-documented deficits in school readiness and early academic abilities. One of our aims was to compare VPT children to full-term (FT) controls on parent-directed learning activities early in the pandemic (hour and amount of supervision) and on children's mathematics and literacy skills as measured during an early school-age assessment 1-2 years later. A second aim was to examine associations of the achievement measures with the hours spent and amount of supervision provided in the earlier parent-directed activities.
Participants and Methods: Participants were 26 VPT and 18 FT children and primary caregiver dyads (M_{age} at COVID-19 timepoint = 6.2 years; M_{age} at academic assessment = 7.0 years). Parent-directed learning activities were assessed using a web-based survey administered during the stay-at-home order in Ohio in the spring and summer of 2019. Children's academic achievement was assessed starting in the late-winter of the 2020-2021 academic year using the Kaufman Test of Educational Achievement-3rd Edition (KTEA-3) subtests of Math Concepts & Application, Letter & Word Recognition, and Spelling. Group comparisons were conducted using t-tests. Associations between early measures of parent-directed learning activities with a composite of the three achievement tests were explored using multiple regression, controlling for family socioeconomic status (SES) and birth status.
Results: The FT group had higher scores than the VPT group on Math Concepts & Applications, Letter & Word Recognition, and Spelling (ps < .05) but the groups did not differ significantly on earlier parent-directed educational activities or parental supervision. More parental supervision predicted higher academic achievement scores at follow-up (β = .51 p < .01, R^2 = .448).
Conclusions: The results confirmed previous findings of deficits in early mathematics and literacy in VPT children and indicated that early academic success was related to the amount of parental educational supervision provided earlier in the pandemic. Parental involvement in children's in-home educational activities may thus serve as a protective factor for later academic outcomes.
Keywords: prematurity**,** academic achievement**,** pediatric neuropsychology
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56 Executive Functions and Preliteracy Skills in Preterm-Born Preschoolers

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Objective: A large body of research in typically developing children reveals that deficits in executive functions (EFs) are associated with academic underachievement at school age. Similarly, in typically developing preschoolers and kindergartners performance on EF tasks has been linked to measures of school readiness. The latter term has been used to describe a set of academic precursor skills that establish cognitive and behavioral preparedness to begin formal schooling. Children who recall instructions, attend to the task, plan and follow through, and inhibit task-irrelevant responses, have greater school success. Compared to typically developing term-born children, preterm-born (PT) children are more likely to exhibit cognitive, behavioral, and academic deficits, but also poor performance on EF tasks. The study of PT children, whose scores often extend to the lower end of the performance range, provides developmental scientists with a unique opportunity to gain further insight into the interdependence between executive and scholastic skills. In the current study, we wished to examine the relationships between three EFs (working memory, motor inhibition, and verbal fluency) and preliteracy linguistic skills in PT preschoolers.
Participants and Methods: Working memory, motor inhibition, and verbal fluency, three discrete EFs, were assessed in a large sample of 214 PT (< 34 weeks gestation) preschoolers (3-4 years of age; 116 singletons, 98 multiples). Working memory was evaluated with two CELF-P2 subtests: Recalling Sentences and Concepts and Following Directions. Motor inhibition and verbal fluency were assessed with the NEPSY-II Statue and Word Generation subtests, respectively. Our outcome measure of preliteracy skills was the Core Language Index (CLI) from the CELF-P2, a global index amalgamating expressive vocabulary, knowledge of grammar, and sentence comprehension. Children with a history of moderate to severe intracranial pathology or cerebral palsy were excluded.
Results: We conducted four separate mixed model linear regression analyses using the CLI as the predicted variable. Mixed effects modeling was used to account for shared variance due to inclusion of participants who were products of multiple gestation. Our predictors of interest were the scaled scores from the Statue, Word Generation, Recalling Sentences, and Concepts and Following Directions subtests. Gestational age, total perinatal complications, sex, and socioeconomic status were used as covariates. We found that motor inhibition (Statue, $F[12,182] = 2.32$, $p = .007$), verbal fluency (Word Generation, $F[14, 183] = 3.38$, $p < .001$), and working memory (Recalling Sentences, $F[15,181] = 13.19$, $p < .001$; Concepts and Following Directions, $F[14,197] = 13.59$, $p < .001$) scores were all significantly associated with preliteracy skills (CLI).
Conclusions: In a sample of PT preschoolers, measures of motor inhibition, verbal fluency, and working memory were significantly associated with preliteracy skills even after adjustment for perinatal risk and sociodemographic factors. In PT-born children, early EF deficits may constitute an important risk factor for subsequent underachievement in literacy. Follow-up with academic performance measures obtained at school age will help substantiate the predictive value of the three preschool EF measures investigated here. Future studies should also explore potential perinatal mechanisms accounting for the extent of deficit in various EFs.
Keywords: executive functions**,** language: development
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57 Anthropometric Measurements at Birth and Preschool Executive Functioning in Preterm-Born Preschoolers

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Objective: Adverse neurocognitive sequelae associated with preterm (PT) birth are well documented; however, the combination of suboptimal intrauterine growth and preterm birth has been shown to confer additional outcome risk. Thus, PT children with suboptimal birthweight (BW), length, or head circumference (HC) may be particularly vulnerable to early developmental deficits in various executive functions (EFs). The current study aims to add to the limited body of research available on the relationships between anthropometric measures obtained at birth (indexing cumulative prenatal growth) and both direct and indirect measures of EFs in preterm-born preschoolers.
Participants and Methods: At preschool age (3-4 years), PT children (N = 203) were assessed using direct performance measures as well as parental behavioral ratings. Anthropometric measures (BW, length, and HC) were collected retrospectively from birth records and converted to SD units (z-scores) using appropriate reference norms. Linear mixed model analyses were conducted to account for shared variance due to inclusion of participants who were products of multiple gestation. Anthropometric measures obtained at birth were entered separately, in each model, as predictors of interest, whereas SES, sex, and gestational age (GA) served as covariates in all analyses. Dependent variables included direct EF performance measures of working memory (CELF-P2 Recalling Sentences and Concepts & Following Directions), verbal fluency (NEPSY-II Word Generation), and motor inhibition (NEPSY-II Statue). Indirect measures based on parental ratings included the Externalizing Problems T score (Child Behavior Checklist [CBCL]), which may be viewed as an index of behavioral disinhibition, and the Global Executive Composite [GEC] score (Behavior Rating Inventory of EF – preschool version [BRIEF-P]). The BRIEF-P was available for a smaller subset of 99 participants only. All analyses were conducted following exclusion of cases with history of significant neurological insult (moderate or severe intracranial bleed or cerebral palsy).
Results: A significant inverse relationship was observed between birth length (in SD units) and the CBCL Externalizing Problems T Score (t [197.39] = -2.00, p = .046). Additionally, we observed a trend for an association between birthweight SD and the CBCL Externalizing Problems T Score (t [191.59] = -1.65, p = .099). A trend for an association was also observed between birthweight SD and the BRIEF-P GEC (t [96.36] = -1.77, p = .076), as well as the CBCL Externalizing Problems T Score (t [191.59] = -1.65, p = .099). No significant associations were observed between anthropometric measures and the three direct EF measures.
Conclusions: The current study revealed that smaller standardized birth length was associated with increased parental endorsement of problem behaviors linked to behavioral (executive) disinhibition. Nonsignificant trends for associations in the same direction were also observed between birthweight and measures of EF based on parental ratings. Interestingly, while indirect EF measures based on parental ratings were associated with anthropometric measures obtained at birth, direct EF measures of our preterm-born preschoolers' performance could not be linked to anthropometric indices.
Keywords: executive functions**,** prenatal factors**,** prematurity
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58 Profiles of Neurocognitive Abilities Following Preterm Birth Reveal Subtle Areas of Vulnerability

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Objective: Children born preterm are at risk for myriad neurocognitive challenges compared to same-age peers. Previous research has revealed patterns of neurocognitive performance following preterm birth in early development (Johnson et al., 2018) and at 10-years-old (Heeren et al., 2017). However, researchers have not explored the presence of these patterns at the age of school-entry when academic readiness and emerging executive functions become particularly relevant for early learning. This study takes a latent profile analysis approach in identifying patterns of neurocognitive functioning in early childhood to shed light on subtle phenotypic differences within this population.
Participants and Methods: Data from 212 patients (males(N)=120, average age=5.78 years) were gathered via review of patient records from the Neuropsychology department at Children's Healthcare of Atlanta. All patients have a history of preterm birth (average gestational age=28.0 weeks) and completed a full neuropsychological evaluation including the following assessments: Differential Ability Scale-II, Comprehensive Test of Phonological Processing-Second Edition, Wechsler Individual Achievement Test-Third Edition, Bracken School Readiness Assessment-Third Edition, and the Wide Range Assessment of Visual-Motor Abilities. A latent profile analysis was conducted to determine profiles of neurocognition. Follow-up analyses investigated differences in sex composition, gestational age, chronological age, birthweight, length of NICU stay, and parent-report symptoms of executive functioning (Behavior Rating Inventory of Executive Function-Second Edition), behavior (Behavior Assessment System for Children-Third Edition), and adaptive functioning skills (Adaptive Behavior Assessment System-Third Edition) based on profile membership for a subset of the sample.
Results: To maximize model fit statistics, the three profile solution was selected (aic=24224.05, bic=24526.14, entropy=.91, average posterior probability=.89). Profile 1 included 73 patients who exhibited broadly average neurocognitive abilities. Profile 2 included 101 patients who exhibited low average neurocognitive abilities, with specific vulnerabilities observed in early academic skills and executive functioning. Profile 3 included 38 patients who exhibited neurocognitive abilities in the low or below average range. Follow-up analyses of differences across parent-report measures based on profile membership further defined profile-specific phenotypes. Specifically, Profile 1 had more internalizing symptoms, Profile 2 had greater difficulties with aspects of executive functioning and functional academics, and Profile 3 had greater difficulties with daily living skills (*ps*<.05). There were no differences across profiles with respect to gestational age, chronological age, birthweight, or length of NICU stay (*ps*>.38).There was a higher proportion of males in Profile 1 compared to the other two profiles.
Conclusions: Together, results suggest three different neurocognitive profiles at age of school-entry for children born preterm. Results indicate 1) one profile including individuals with neurocognitive abilities within normal limits and some mood-related vulnerabilities, 2) one profile of individuals with broadly low average performance and specific vulnerabilities related to executive functioning and early academics, and 3) one profile of individuals with broadly lower neurocognitive abilities and adaptive functioning deficits. Knowledge of these profiles and potential cognitive, emotional, and/or adaptive vulnerabilities may be clinically impactful in identifying children who could benefit from increased academic and therapeutic intervention at the age of school entry, as well as those who may benefit from ongoing neuropsychological evaluation despite demonstrating neurocognitive abilities broadly within normal limits.
Keywords: prematurity**,** neurocognition**,** neuropsychological assessment
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59 Relationships Between Sleep Time Variability and Neurobehavioral Outcomes in Children With and Without Fetal Alcohol Spectrum Disorders (FASD)

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Objective: The effects of prenatal alcohol exposure on sleep quality have been understudied, and the possibility that sleep disturbances contribute to deficits in other cognitive and behavioral domains has not been explored. The current study aimed to characterize sleep quality in children with fetal alcohol spectrum disorders (FASD) and understand relationships with neurobehavioral functioning.
Participants and Methods: Participants aged 6-10 years with (alcohol-exposed [AE] = 27) and without prenatal alcohol exposure (control [CON] = 27) were included in the study. Objective sleep was measured via two-week wrist actigraphy recording. Parents also completed sleep diaries and sleep questionnaires (Children's Sleep Habits Questionnaire, Pediatric Sleep Questionnaire). Children completed neuropsychological testing (NIH Toolbox Cognition Battery) and parents completed the Child Behavior Checklist (CBCL) and Behavior Rating Inventory of Executive Functioning – Second Edition (BRIEF-2) as measures of problem behaviors and executive functioning skills. For a subset of participants (n=31), neuropsychological assessment was modified and conducted remotely due to the COVID-19 pandemic. Multivariate analysis of variance was used to characterize the objective and subjective sleep profile and examine group differences. Multiple regression examined the relationships between sleep quality and neurobehavioral performance.
Results: There were no group differences on actigraphy metrics averaged across two weeks; however, AE showed significantly greater intraindividual variability on most actigraphy measures (p's < .05), particularly total sleep time (p = .002), and parents reported significantly more sleep problems in AE than CON (p = .002). AE performed significantly lower than CON on the subset of cognitive measures administered to the full sample, which included Picture Vocabulary, Picture Sequence Memory, List Sorting Working Memory, and Oral Reading Recognition subtests (p's < .05). CBCL and BRIEF-2 scores were significantly higher for AE compared to CON (p's < .05), reflecting more behavioral and executive functioning problems. There were no main effects of COVID or Group x COVID interactions for any neurobehavioral outcome. Greater sleep time variability was significantly correlated with poorer Picture Sequence Memory performance (r = -.35, p = .016) and more parent-reported problems with attention (ρ = .34, p = .017), rule breaking behavior (ρ = .34, p = .018), sluggish cognitive tempo (ρ = .30, p = .04), and working memory (ρ = .31, p = .028). For attention problems and sluggish cognitive tempo, regression analyses revealed a main effect of group (Attention: b = 9.47, p = .001; Sluggish Cognitive Tempo: b = 4.71, p = .038) and a trend-level effect of sleep time variability (Attention: b = 0.12, p = .09; Sluggish Cognitive Tempo: b = 0.11, p = .053).
Conclusions: Despite similar two-week average sleep outcomes, children with FASD showed greater intraindividual sleep variability and parents reported more sleep problems. Across the sample, greater sleep time variability was associated with poorer episodic memory and more behavior problems related to attention, rule breaking behavior, sluggish cognitive tempo, and working memory. Interventions targeting variability in sleep, particularly sleep duration variability, may improve sleep quality and some aspects of cognition and behavior in children with FASD. Supported by F31AA027148 and R21AA026697.
Keywords: fetal alcohol syndrome**,** sleep**,** pediatric neuropsychology
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60 Exploring Characteristics of Cognitive Phenotypes in Pediatric Patients Born Preterm

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Objective: There is growing interest in identifying cognitive phenotypes within clinical populations, particularly in groups where outcomes are often heterogeneous. Our team previously explored neurocognitive outcomes in youth with histories of preterm birth to determine subsets of patients with differing cognitive phenotypes using cluster analysis. Analyses identified two distinct cognitive clusters (broad average [BA] and mild-to-moderate impairment [MMI]) that did not differ on sociodemographic factors (i.e., mean age, gender, race) and birth characteristics (i.e., gestational age, birth weight, maternal age). The current study aimed to explore other prematurity-related medical variables in an attempt to better characterize the two clusters. In addition, there was interest in determining if parent report of executive dysfunction and adaptive impairment differed between the BA and MMI clusters. It was anticipated that parents of children in the MMI cluster would report greater executive dysfunction and more adaptive deficits.
Participants and Methods: 150 patients ages 8-21 years old (median=10.75) born <37 weeks gestation were retrospectively examined from a clinical database. Patients who failed performance validity testing or had IQs <50 were excluded. All variables were converted to z-scores. In the initial study, k-means clustering was utilized. To explore current hypotheses, clusters were compared using chi-square and Mann-Whitney U tests due to non-normal distributions of most variables. Effect sizes were calculated for all variables.
Results: Additional information was gathered from subjects' medical records; however, detailed prematurity data was not available for all subjects. Clusters did not differ on prematurity-related medical variables (. Effect sizes ranged from n^2=0.00-0.04. In contrast, mean parent-report scores for adaptive behavior were statistically significant with parents of the MMI group reporting poorer adaptive functioning (p=.003, n^2=.14). Mean parent-report ratings of executive functioning did not differ between clusters (p=.286, n^2=.01). Interestingly, parents reported clinically elevated symptoms in both the BA and MMI groups.
Conclusions: Results are consistent with prior research which suggests that a specific neuropsychological profile cannot be expected based on a history of prematurity alone. For some patients, the impact of prematurity is minimal, while other patients show more significant cognitive impairment across domains. While current analyses of available medical variables did not differentiate the two clusters, it is possible that other prematurity-related medical factors (e.g., NICU-specific information, days on ventilation, IVH, etc.) may account for group performance differences, which we plan to explore in the future. In keeping with expectations, parents reported greater adaptive impairment in the MMI group compared to the BA group, suggesting a functional impact from the cognitive deficits. While parent report of executive functioning symptoms was not statistically different between the BA and MMI clusters, parents reported clinically elevated symptoms in both the BA and MMI clusters. This may be reflective of broad attention and executive issues in children with HPTB, regardless of neuropsychological functioning. Additionally, these findings continue to suggest the need for further studies with larger samples and greater variability to conduct latent profile analysis to develop generalizable models of cognitive phenotypes in pediatric patients with histories of prematurity.
Keywords: pediatric neuropsychology**,** neuropsychological assessment**,** cognitive functioning
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61 Late and Moderate Prematurity: Behavioral and Neuropsychological

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Outcomes in Attention, Working Memory, and Executive Functioning

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Objective: This study sought to broaden the findings of the current research on the relationship between late and moderate preterm (LAMP) birth and long-term neurocognitive outcomes—specifically those related to Attention-Deficit/Hyperactivity Disorder (ADHD). The purpose of this study was to better understand the relationship between gestational age (GA) and ADHD by a) comparing prevalence of diagnosis between term-born and LAMP children, b) comparing ADHD behavioral symptom severity between term-born and LAMP children, c) and by examining neurocognitive status between term-born children and LAMP children (with and without ADHD diagnoses). The study also examined other factors that contribute to the relationship between GA and ADHD, including consideration of other risk factors and potential symptom mitigating factors.
Participants and Methods: Retrospective study of 169 patients between the ages of 8.01 to 12.95 years of age with a mean of 10.54 years, SD 1.34 years, who completed a comprehensive neuropsychological evaluation in a large metropolitan health system (including WISC-V, CPT-3, D-KEFS). It was a clinical sample. Caregivers reported on patients' perinatal and early history and completed behavior rating forms. 51 patients identified as female (30.2%) and 118 identified as male (69.8%). 37.8% identified as a racial minority, 53.8% were from caregivers with limited academic achievement (high school or less), 36.7% had Medicaid insurance, 51.5% had a family history of ADHD, and 13.0% had prenatal exposure to substances (tobacco, alcohol, and/or illicit substances). The sample had notable rates of pregnancy and delivery complications. 9.47% of the mothers had pre-eclampsia and 7.10% required hospitalization during pregnancy. 21.3% of the participants were admitted to the NICU at birth and 9.47% required oxygen. Taken together, the sample was a high risk sample.
Results: GA was not related to ADHD prevalence. Lower GA predicted higher ADHD-related symptom severity (Conners-3). Though LAMP children did not differ from their term-born peers across measures of neurocognitive functioning, lower GA showed a marginally significant negative relationship with overall neurocognitive functioning (WISC-V FSIQ). Risk factors such as family history of ADHD and in-utero exposure to substances were consistently significantly related to ADHD symptom severity, and cumulative risk negatively impacted overall cognitive functioning, attention, working memory, and executive functioning. Lastly, moderation analyses showed that gestational age interacts with birthweight at a marginally significant level in predicting overall cognitive functioning.
Conclusions: LAMP birth and ADHD share risk factors, and many of those risk factors have a negative impact on neurocognitive functioning (Howson et al., 2012; Shapiro-Mendoza & Lackritz, 2012). Consistent with prior literature, overall intellectual functioning, working memory, and EF (specifically cognitive flexibility) were significantly negatively related to cumulative risk. It may be the case that the observed neurocognitive deficits associated with LAMP birth reflect, at least in part, other risk factors associated with poorer neurodevelopmental outcomes. Though GA among LAMP children may not be a significant predictor for neurocognitive outcomes, it is reasonable to expect that in a population with a higher prevalence of risk factors, there would also be a higher rate of associated neurocognitive weaknesses. It follows that this higher risk population would endorse a greater number of known risk factors, and that those risk factors would predict greater pathology including behavioral challenges and neurocognitive weaknesses.
Keywords: prematurity**,** attention deficit hyperactivity disorder**,** cognitive functioning

62 Long-term Impact of Maternal Mental Health During Pregnancy on Subsequent Child Autonomic Modulation and Emotional Regulation

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Objective: To assess the long-term developmental impact of anxiety exposure in-utero on subsequent child's autonomic functioning and emotional regulation. To test autonomic modulation as a possible mechanism of action for the connection between maternal anxiety during pregnancy and subsequent child emotional regulation.
Participants and Methods: The present study examines mother-child dyads (subsample of N= 109) from the longitudinal Stress in Pregnancy study. Prenatal anxiety was self-reported by the mother via the State-Trait Anxiety Scale during the second trimester of pregnancy. Child developmental measures were assessed at 5-years-old. Autonomic modulation in the child was assessed by vagal tone, which was calculated by the high frequency band of the heart rate variability power spectrum during a 5-minute baseline measure. Anxiety symptoms in the child were measured by the Behavioral Assessment System for Children-2. Mediation analysis was utilized to test the objectives.
Results: Prenatal anxiety was a significant predictor for vagal tone (β=-0.009, $p<0.001$) and child anxiety symptoms (β=-0.009, $p=0.002$). Vagal tone predicted anxiety symptoms accounting for prenatal stress (β=-4.7441, $p=0.026$). After controlling for vagal tone, prenatal anxiety was no longer associated with child anxiety symptoms (β=0.0753, $p=0.148$). Mediation analysis using bootstrapping procedure revealed that vagal tone mediated the relationship between prenatal anxiety and child anxiety symptoms (β=0.044, 95% CI [0.007, 0.085], $p<0.05$).
Conclusions: Results indicate that in-utero exposure to prenatal anxiety has a lasting impact on the child's autonomic nervous system development. Importantly, changes in vagal tone from prenatal anxiety exposure is driving the relationship between prenatal anxiety and child anxiety symptoms, indicating that maternal anxiety during pregnancy alters the development of the autonomic nervous system with long-term effects on the child's emotional regulation. The results suggest that the prenatal period is a crucial window for maternal interventions to promote mental health in the mother and long-term adaptive neurodevelopmental health outcomes in the child. Specifically, the autonomic nervous system should be considered a target for intervention and assessed in a multidimensional model of fetal programming and subsequent mental health risk of the child.
Keywords: anxiety, prenatal factors, child development (normal)
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13 Clinical Neuropsychology Roles for Neurogenetic Conditions: Examples from Neurofibromatosis Type 1

Chair

Bonnie Klein-Tasman
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Discussant

Rene Pierpont
University of Minnesota Medical School, Minneapolis, USA
Keywords: neurofibromatosis, neurocognition, genetic disorders

297 Reliability of Attention/Executive Functioning Measures in Young Children with Neurofibromatosis Type 1: A Pilot Study

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Objective: Children with neurofibromatosis type 1 (NF1) often demonstrate difficulties with attention and executive functioning that can be evident starting at a young age. There has been little research about which measures of attention are most suitable for use with young children with NF1. This pilot study explored the reliability

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of several computerized measures of attention, a digits forward task, and parent report measures of attention for young children with NF1.
Participants and Methods: Participants (*n*=16; ages 4-6 years; *M*=5.45, *SD*=0.75) were seen twice, with approximately 8 weeks between visits. At each study visit, participants completed the Conners Kiddie Continuous Performance Test 2nd Edition (K-CPT 2); NIH Toolbox Flanker, Dimensional Change Card Sort (DCCS), and List Sort Working Memory (LSWM) Tasks; Cogstate Identification Task; and Differential Ability Scales-2nd Edition (DAS-II) Digits Forward Task (DF). Caregivers also completed the Behavior Rating Inventory of Executive Function (BRIEF) preschool or 2nd Edition form; and the Conners Early Childhood (EC) Inattention/Hyperactivity Scale at each study visit. Statistical analyses for evaluating evidence for test-retest reliability included assaying Intraclass correlation Coefficient (ICC) values and Pearson r values. ICC values are the preferred metric for reporting reliability, as they reflect the agreement between two scores, while Pearson r values describe the consistency between scores (Liu et al., 2016). Both are reported here for comparative purposes because some of the present measures only provide Pearson r values as indices of test-retest reliability in their respective manuals.
Results: ICC values ranged from excellent [ICC>0.90; Conners EC], good [ICC between 0.75 and 0.90; K-CPT 2 Omissions; DAS-II DF, BRIEF Shift, Emotional Control, Working Memory, Global Executive Composite], moderate [ICC between 0.50 and 0.75; NIH Flanker; K-CPT 2 Detectability, Hit Reaction Time; BRIEF Inhibit], and weak [ICC<0.50; NIH DCCS, LSWM; Cogstate Identification; K-CPT 2 Commissions, Perseverations, Variability, Hit Reaction Time Block Change, Hit Reaction Time Interstimulus Interval]. Pearson r values ranged from strong [*r*>.50; NIH Flanker; K-CPT 2 Detectability, Omissions, Commissions, Hit Reaction Time; DAS-II DF; BRIEF Inhibit, Shift, Emotional Control, Working Memory, Global Executive Composite; Conners EC], moderate [*r* between .30-.50; NIH LSWM; K-CPT 2 Perseverations, Hit Reaction Time Block Change, Hit Reaction Time Interstimulus Interval], to weak [*r*<.30*;* NIH DCCS; K-CPT 2 Variability].
Conclusions: Each measure demonstrated strengths and weaknesses, and there may not be a “one size fits all” measure for use with young children with NF1. However, the Behavior Rating Inventory of Executive Function Preschool/Second Edition, Conners EC Inattention/Hyperactivity Scale, DAS-II Digits Forward, and the Conners Kiddie Continuous Performance Test Second Edition generally showed the highest reliability.
This work was supported by a grant from NF Midwest.
Keywords: neurofibromatosis**,** neurocognition**,** attention

296 International Collaboration to Identify Endpoints for Clinical Trials in NF1

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Objective: To describe and discuss the work of the Response Evaluation in Neurofibromatosis and Schwannomatosis (REiNS) collaboration. REiNS is an international group working to develop standardized clinical trial endpoints to determine response to treatment in Neurofibromatosis Type 1 (NF1), Neurofibromatosis Type 2 (NF2), and schwannomatosis. Previously, studies in NF have used a variety of clinical endpoints which makes it difficult to compare study findings. Identifying standardized outcome measures for clinical trials helps to generalize findings across studies. The REiNS collaboration includes physicians, psychologists, neuropsychologists, speech pathologists, and other health providers, as well as patient representatives, from around the world. REiNS is organized into 8 working groups focused on areas of possible outcomes for clinical trials in NF: imaging of tumor response, functional outcomes, visual outcomes, patient-reported outcomes, neurocognitive

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outcomes, whole-body MRI, disease biomarkers, and cutaneous neurofibromas. The larger REiNS collaboration meets twice per year and individual groups meet on a more frequent basis.
Participants and Methods: The work of the neurocognitive outcome group will be highlighted. This group currently consists of 24 individuals, 20 health care providers and 4 patient representatives. The group reviews neuropsychological measures to assess their feasibility for use in clinical trials with NF. Committee members use a standardized rating form (Cog-RATE) to review each measure on 6 criteria: 1) patient characteristics 2) use in published studies, 3) domains assessed, 4) availability of standard scores, 5) psychometric properties, and 6) feasibility for use in clinical trials. Each measure is discussed by the group and measures with high ratings are recommended for use in clinical trials.
Results: Since its inception in 2011, the REiNS collaboration has published 12 papers, with 10 additional papers to be published in 2021. The neurocognitive outcome group has published a paper on recommendations for measures of attention for use in clinical trials. Papers focused on measures of social skills and preschool attention measures have been accepted for publication.
Conclusions: The REiNS collaboration has demonstrated a successful model for international professionals working together to identify, evaluate, and standardize appropriate outcome measures for clinical trials in NF1, NF1, and schwannomatosis. These recommendations will be continuously updated as new information becomes available.
Keywords: neurofibromatosis**,** neurocognition

309 Examining Cognitive Load in Children with Neurofibromatosis Type 1 Compared to Typically Developing Children

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Objective: Cognitive load is defined as the amount of mental resources used in working memory to perform various tasks (Guyan, 2013). Cognitive load includes intrinsic, extraneous, and germane factors. Deficits in attention, inhibition, and working memory are highly prevalent in children with neurofibromatosis type 1 (NF1), which align with overload in the intrinsic and extraneous factors of cognitive load. Cognitive overload essentially effects the way individuals processing information, which can impact learning, communication, socialization, and other functions. In this study, we aim to understand and describe the presence of cognitive overload in children with NF1 compared to non-affected children.
Participants and Methods: Participants include children diagnosed with NF1 (N=24) and age- and sex-matched typically developing controls (TDC; N=27). All participants were between 7 and 15 years of age (M=10.7; SD=3.35). Participants underwent a brief neurocognitive evaluation that included an intellectual screen and the Tasks of Executive Control (TEC). The TEC combines an n-back paradigm that increases working memory load, and a go/no-go task that manipulates inhibitory control demands. There are 3 levels of WM demand presented (0, 1, 2-back), crossed with absence vs. presence of an inhibitory signal. Alpha was set at .05 for all analyses. General Linear Models were applied to evaluate between (NF1 vs. TDC) and within group (task load) differences.
Results: Children with NF1 had significantly greater problems with accuracy and speed tasks than TDC even without adding cognitive load (Accuracy Target, Standard, Commissions, and Response Time $p<.05$). The addition of working memory load resulted in significant differences in performance on Standard response accuracy ($F=5.86$; $p=.01$; *Eta squared*=.10) such that participants with NF1 performed worse than TDC. The difference was specific to working memory load and no inhibitory control demands

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as there were no group differences on tasks that added the inhibitory control factor.
Conclusions: Children with NF1 appear to be particularly susceptible to an increase in cognitive load, resulting in poorer accuracy and decreased efficiency. When cognitive load is increased, children with NF1 tend to sacrifice the mundane/standard task responses in favor of the novel task responses. This suggests that they are unable to manage the load of multiple cognitive demands and appear to respond preferentially to novel stimuli at the expense of other task demands. These findings support interventions targeting working memory in NF1 to support improvements in areas impacted by cognitive load, which are relevant to everyday functioning such as learning and socialization.
Keywords: executive functions**,** genetic disorders
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428 Cognitive Predictors of Late School Age Academic Functioning in Children with Neurofibromatosis Type 1

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Objective: Academic problems are common among children with neurofibromatosis type 1 (NF1). While past studies have examined the concurrent cognitive contributors to academic functioning, studies are needed to assess early school age cognitive contributors to later school age academic functioning in children with NF1. Thus, early school age cognitive predictors of later school age academic performance will be examined in children with NF1. Intellectual functioning, attention, and working memory will be examined as predictors due to previous studies suggesting these areas are impacted in children with NF1.
Participants and Methods: Children with NF1 (n=24) were evaluated during early school age (ESA; ages 5-7) and late school age (LSA; ages 9-13). Lab-based measures of intellectual functioning, attention and working memory were assessed at the ESA time point using the Differential Ability Scales, Second Edition (DAS-II) General Conceptual Ability (GCA), Recall of Digits-Forward (DF) and Recall of Digits – Backward (DB) scores, respectively. At the LSA time point, math abilities were assessed using the Wechsler Individual Achievement Test, Third Edition (WIAT-III) Math Problem Solving (MPS) and Numerical Operations (NO) subtests and reading abilities were examined using the Reading Comprehension (RC), Pseudoword Decoding (PD), and Word Reading (WR) subtests.
Results: GCA was significantly correlated with later RC ($r_s(22) = .480$, $p = .018$), MPS ($r_s(22) = .457$, $p = .025$), NO ($r_s(22) = .606$, $p = .002$), and WR ($r_s(22) = .575$, $p = .003$), but GCA was not significantly associated with later PD ($r_s(22) = .364$, $p = .080$). DF was significantly associated with later MPS ($r_s(22) = .599$, $p = .002$), NO ($r_s(22) = .410$, $p = .047$) and WR ($r_s(22) = .452$, $p = .027$), but DF was not significantly associated with later RC ($r_s(22) = .125$, $p = .559$) or PD ($r_s(22) = .254$, $p = .231$). DB was significantly correlated with later MPS ($r_s(19) = .720$, $p < .001$), WR ($r_s(19) = .611$, $p = .003$), PD ($r_s(19) = .622$, $p = .003$), NO ($r_s(19) = .639$, $p = .002$), but DB was not significantly related to later RC ($r_s(19) = .347$, $p = .123$).
Conclusions: Early school age cognitive predictors (intellectual functioning, attention, and working memory) were shown to be associated with later school age academic functioning. In particular, working memory appears to be a strong predictor of math and reading performance and should be investigated further. These findings also suggest that strategies to support attention and working memory may be particularly important to support academic achievement in children with NF1. Future research should investigate additional cognitive domains that may also be associated with later school age academic performance in children with NF1.
Funding sources: NF Midwest, NF MidAtlantic, NF Northeast, University of Chicago CTSA grant UL1 RR024999, and the University of Wisconsin – Milwaukee Research Growth Initiative.
Keywords: neurofibromatosis**,** neurocognition

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CE Workshop 09: Optical Brain Monitoring via Functional Near Infrared Spectroscopy

Presenter: Hasan Ayaz

8:00 - 9:30am Thursday, 3rd February, 2022

Abstract & Learning Objectives:
Functional near-infrared spectroscopy (fNIRS), a noninvasive and wearable brain-monitoring technology relies on optical techniques to detect changes of cortical hemodynamic responses to human perceptual, cognitive, and motor functioning. Wearable and mobile neuroimaging for localized brain activity monitoring using fNIRS offers a unique opportunity in understanding natural cognitive processes, and specifically, the workload of disability populations performing complex coordinated motor tasks in active and realistic settings. FNIRS is an increasingly popular neuroimaging modality that can assess brain activity ecologically valid everyday life settings. This workshop is focused on introducing fNIRS based optical brain monitoring, its physiological and physical principles, data collection and signal processing techniques as well as data analysis procedures. There will be both theory as well as review of current emerging applications with the technique from aerospace to medicine, with diverse populations and towards clinical solutions. The tutorial is aimed to get researchers started on fNIRS and designed for both beginner and intermediate researchers.

Upon conclusion of this course, learners will be able to:
- Identify the physiological basis and imaging principles by which current functional Near-Infrared Systems (fNIRS) operate
- Critically articulate the advantages and disadvantages afforded by optical brain imaging methods
- Give examples of situations in which fNIRS may offer current or eventual clinical of field application and promising research directions/technological developments.

CE Workshop 10: Perspectives on Neuropsychological Assessment of Deaf and Hard of Hearing Children and Adults

Presenter: Lawrence Pick

8:00 - 9:30am Thursday, 3rd February, 2022

Abstract & Learning Objectives:
It is estimated that over a billion individuals in the world are deaf or hard of hearing, and these numbers are anticipated to increase due to limited access to quality health care, exposure to recreational and occupational noise, and other factors. This group of people is extremely diverse, and their lives are shaped by the etiology, type, onset and course of their hearing status, as well as related developmental, language, educational and cultural experiences. Unfortunately, many people who are deaf and hard of hearing experience barriers to accessing quality physical and behavioral healthcare. Within the field of neuropsychology there are a limited number of measures that have been developed and standardized for use with these populations, and few neuropsychologists have been trained to provide culturally and linguistically appropriate and accessible services. This presentation will explore the neurocognitive functioning of people with different hearing statuses, discuss the demographic and background characteristics that may influence performance during neuropsychological assessment, review and demonstrate suitable spoken, written and sign language measures, and describe approaches to case formulation and differential diagnosis. Suggestions also will be offered for working with language interpreters and providing accessible feedback sessions and reports.

Upon conclusion of this course, learners will be able to:
- Describe the types, etiologies, and sociocultural perspectives of different hearing statuses
- Discuss culturally and linguistically appropriate and accessible approaches to

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neuropsychological assessment of deaf and hard of hearing individuals
- Evaluate the strengths and weaknesses of available neuropsychological measures developed for and used with deaf and hard of hearing individuals

Paper Session 19: Rehabilitation

8:00 - 9:30am Thursday, 3rd February, 2022

1 Neuropsychological Intra-Individual Variability in Post-Acute Traumatic Brain Injury Rehabilitation: Associations with Functional Outcomes

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Objective: Intra-individual variability (IIV), or the dispersion of scores across tasks in neuropsychological assessment, has been associated with underlying neuropathology, and functional outcomes in individuals who have experienced a traumatic brain injury (TBI). These outcomes include quality of life, behavioral difficulties, and health status. The heterogeneous clinical symptom presentation after TBI suggests that IIV may have utility as a marker of neuropsychological functioning above and beyond normative mean score comparisons. Clinical use of IIV in the context of TBI rehabilitation, however, is not well understood. This study aimed to examine IIV within neuropsychological domains as a factor associated with functional outcomes during post-acute recovery from TBI. Cluster analysis was used to investigate domain-specific dispersion phenotypes as useful clinical profiles for assessing functional difficulties.
Participants and Methods: A retrospective record review was conducted of adults who received rehabilitation services for TBI at a residential post-acute rehabilitation facility (final *n*=103). Representative neuropsychological measures assessing the domains of attention, memory, language, and executive functioning were selected from a larger battery administered upon admission. IIV (dispersion) within domains was calculated by dividing the standard deviation of T-scores by mean performance, resulting in a coefficient of variance (CoV). Functional difficulties were assessed at admission and discharge using the individual subscales of the Mayo-Portland Adaptability Inventory (MPAI-4) and the Disability Rating Scale (DRS). Relationships between dispersion and demographic, and functioning variables were examined using Pearson's correlations. Domain dispersion was used to identify IIV phenotypes using k-means cluster analysis. Emergent phenotypes were compared on functional outcomes at admission and discharge using mixed-design ANOVA.
Results: Executive functioning dispersion was negatively associated with age (p=.004). Attention dispersion was positively associated with ability (p=.01), and adjustment difficulties (p=.001) at admission. Memory dispersion was negatively associated with disability rating at admission (p=.041). Cluster analysis of dispersion scores revealed three distinct phenotypes characterized by: 1. High dispersion in attention and executive functioning (AED; n=18, 8.3%); 2. Elevated dispersion in memory and language (MLD; n=39, 17.9%); and 3. Low dispersion across all domains (LD; n=46, 21.1%). Mixed-design ANOVAs indicated significant Time X Phenotype interactions on ability (F[2,70]=4.11, p=.02) and adjustment functioning (F[2,81]=6.31, p=.003) scales. Simple effects found that phenotypes differed on functioning at admission such that the AED type had greater difficulty with ability functioning (M=25.08, SE=2.5) than the LD type (M=17.24, SE=1.67; p=.002) and the MLD type (M=16.65, SE=1.62; p=.002). AED type also had greater difficulty on adjustment functioning (M=25.80, SE=1.69) than the LD group (M=18.77, SE=1.12; p=.007) and the MLD group (M=19.77, SE=1.13; p=.014). There were no differences in difficulties with participation functioning or the DRS. At discharge, no group differences on any functional outcome remained.
Conclusions: Results of this study suggest that IIV within neuropsychological domains has utility in predicting functional difficulties of individuals beginning rehabilitative services for TBI. The emergence of within-domain dispersion

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phenotypes holds clinical promise for identifying neuropsychological profiles associated with functional declines, particularly high variability in attention and executive functioning. At discharge, functional differences between dispersion phenotypes were ameliorated, suggesting improvements in cognitive stability during recovery may coincide with functional improvements.
Keywords: traumatic brain injury**,** cognitive rehabilitation**,** neuropsychological assessment

2 The Development of an Interdisciplinary Virtual Group-Based Intervention for Youth with Persistent Post-Concussion Symptoms and Their Caregivers: An Intervention Mapping Approach

Hiba Al-Hakeem[1,2], Kylie Mallory[2,3], Brendan Lam[2], Brenda Knapp[2], Kim Moody[2], Tess Bardikoff[2], Andrea Hickling[2], Shannon Scratch[2,3]
[1]University of Windsor, Windsor, Ontario, Canada. [2]Bloorview Research Institute, Toronto, Ontario, Canada. [3]University of Toronto, Toronto, Ontario, Canada

Objective: Youth with persistent post-concussion symptoms (PPCS) often experience health challenges in physical, social, and emotional domains. Families play an important role in helping youth manage their concussion symptoms. There are currently no holistic evidence-based interventions tailored to the needs of youth with PPCS and their families. The objective of this study is to describe Move&Connect (M&C) −an interdisciplinary virtual group-based intervention for youth with PPCS and their caregivers− using the Intervention Mapping (IM) approach.
Participants and Methods: The six-step IM approach was utilized to guide the development of the M&C intervention. The first step of *Needs Assessment* was conducted to explore program development specifications by surveying youth with PPCS (n = 36) and facilitating a focus group for caregivers (n = 5). The second IM step, *Objectives*, was based on the collected data covering advocacy skills training, mental health support and psychoeducation to caregivers; these activities were combined with active rehabilitation (AR) in the intervention program for youth with PPCS. The next IM step of *Design* was guided by the model of Family-directed Approach to Brain injury, and supplemented by participants' suggestions regarding exercise routines, educational topics and other concerns. Multiple meetings were held with an interdisciplinary team −including a clinical neuropsychologist, social worker, physiotherapist and occupational therapist− to produce the intervention components and reference material. Further consultations with stakeholders and a family leader with lived experience were also integrated into the step of *Production* in order to finalize the creation of the intervention process. The last two IM steps of *Implementation* and *Evaluation* will assess the program feasibility and effectiveness in a future pilot trial.
Results: M&C is a holistic interdisciplinary and group-based intervention with two program arms that run in conjunction: M&C-Youth and M&C-Caregivers. Both programs are comprised of six, one-hour sessions that are delivered weekly using Zoom Healthcare platform. M&C-Youth involves circuit exercises, psychoeducation, and socializing with other youth having similar experiences. Session topics are focused on concussion symptoms, coping skills, headache management, stress reduction and social support. The AR component involves exercises on strength, cardio and dynamic stretching. The sessions will be delivered by an occupational therapist and a physiotherapist. M&C-Caregivers involves psychoeducation topics, and group activities followed by discussion and reflections. Session topics consist of concussion ripple effects, school advocacy and transitions, youth well-being, family dynamics, parenting and stress management. M&C-Caregivers will be delivered by a clinical neuropsychologist and social worker. Handouts and additional resources such as websites and flyers will be provided to youth and caregiver participants.
Conclusions: The IM approach provides a useful framework to guide the systematic development of Move&Connect components based on the needs of youth with PPCS and their caregivers. This novel interdisciplinary group-based intervention sheds light on

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strategies to improve the well-being of families dealing with concussion. Virtual interventions are gaining importance with technology advances and COVID-19 restrictions to promote accessibility, convenience and professional support.
Keywords: concussion/ mild traumatic brain injury**,** pediatric neuropsychology**,** learning

3 Use of the ReMIND Package for Individuals with Traumatic Brain Injury

Sarah Raskin, Gianna Barbadillo, Aspen Hawkins, Samantha McAward
Trinity College, Hartford, CT, USA

Objective: A series of memory training exercises have been created to rehabilitate memory in individuals with neurological disorders (ReMIND). The objective of this study was to determine the efficacy of this treatment package designed to improve memory functions in individuals with memory deficits after traumatic brain injury.
Participants and Methods: Individuals were between the ages of 21 and 60 and had no other neurologic or psychiatric disorders. There were a total of 30 participants. All treatment was provided individually and took place for one hour per week, two-three times per week, over the course of six-eight weeks, depending on scheduling but to ensure a total of 10 sessions. Treatment included a series of modules some of which are restorative (attention process training, prospective memory training) and some of which are compensatory (use of external aids; mindfulness; visualization). All participants served as their own control in a crossover design with the control condition being an educational package about the brain and the nature of brain injury. Half of the participants received the control condition first and half received the treatment condition first. All participants were administered a battery of standard neuropsychological measures and measures of daily living both before and after the active treatment condition and the active control condition. Measures were the Brief Test of Attention, Hopkins Verbal Learning Test, Memory for Intentions Test, Stroop Word-Color Interference Test and a memory diary study used in previous publications.
Results: McNemar's test for change indicated that participants demonstrated significant improvement ($p<.01$) in measures of attention, prospective memory, and executive functions after the treatment condition but only in attention after the control condition. Similarly, individuals demonstrated improvement in measures of daily life only after the active treatment condition and not after the active control condition.
Conclusions: This flexible package allows for individuation of treatment within a standardized and manualized package and appears to provide gains in daily functioning within a relatively short time frame.
Keywords: brain injury**,** traumatic brain injury**,** treatment outcome

4 Effects of Motivationally Enhanced Compensatory Cognitive Training on Modifiable Risk Factors for Mild Cognitive Impairment

Zanjbeel Mahmood[1], Scott C Roesch[2], Marilyn Huckans[3,4], Maya E O'Neil[3,4], Amy J Jak[5,6], Elizabeth W Twamley[5,6]
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Objective: Individuals diagnosed with Mild Cognitive Impairment (MCI) are at a higher risk for conversion to a range of dementing neurocognitive disorders and, therefore, may be particularly motivated and well suited to participate in interventions to slow cognitive decline. Cognitive and lifestyle interventions targeting modifiable disease protective factors (e.g., physical activity [PA] and sleep) can slow the rate of cognitive decline. Availability of psychometrically validated subjective indices of PA and sleep offer a practical and economical

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method of assessing these cognitively salient lifestyle factors in the context of longitudinal studies of older adults with MCI. Moreover, the burgeoning availability of inexpensive, accurate wearable devices to measure PA and sleep makes valid, unobtrusive objective measurement of these outcomes possible. As such, the current study examined the efficacy of an integrated cognitive and lifestyle intervention, Motivationally Enhanced Compensatory Cognitive Training (ME-CCT), compared to Goal-focused Supportive Contact (SC), in improving subjectively and objectively measured sleep and PA in older Veterans with MCI. Given the well-documented adverse impact of pain on sleep and PA, pain's role as a moderating factor was also explored.

Participants and Methods: 74 participants were randomized to receive 8 weekly, 2-hour manualized group sessions of either ME-CCT or SC as part of a randomized controlled trial (ClinicalTrials.gov identifier: NCT0322548). All participants completed self-report measures of sleep (Insomnia Severity Index) and PA (Community Healthy Activities Model Program [CHAMPS] questionnaire) at baseline, mid-treatment, and post-treatment. Fitbit data, specifically daily step counts and total sleep time, were collected for a subset of the participants for the duration of the study (n=25). Pain intensity was assessed using the PROMIS Pain Intensity scale.

Results: The sample consisted of mostly male (89%), white (85%) participants, aged 55-90 (M=71, SD=7.9), with a mean of 14 years of education (SD=2.1). Mixed-effects models demonstrated that, compared to the SC group, the ME-CCT group did not differentially improve on either subjective or objective measures of PA or sleep (*ps*>.05). However, pain significantly moderated treatment effects on objective sleep (t(37.93)=3.24, p=0.002, r=0.47), and had a medium, albeit trend-level, moderation effect on objective PA (t(45)=-1.907, p=0.063, r=0.27). Specifically, objective average daily sleep time increased for only the ME-CCT participants with high baseline pain intensity (B=10.53, p=0.011) and SC participants with low baseline pain intensity (B=5.73, p=0.029). In contrast, PA levels increased only for ME-CCT participants with low baseline pain intensity (B=116.3, p=0.026); no significant change in objective PA was seen in the SC group, regardless of pain intensity.

Conclusions: ME-CCT improved Fitbit-measured PA and increased average sleep time for those with low pain intensity and high pain intensity levels at treatment outset, respectively, underscoring the utility of consumer wearable devices in assessing behavioral functioning. The lack of findings for subjective indices of PA and sleep supports the growing understanding of perceived and objective behavioral functioning as related, but unique constructs, and underscores the best practice recommendation to include both subjective and objective measures of behavioral functioning within studies. ME-CCT warrants larger investigations to examine its efficacy in improving disease protective factors, along with cognition and functioning.

Keywords: mild cognitive impairment**,** sleep**,** clinical trials

5 Higher-Order Resting State Network Changes Associated with Improved Useful Field of View Performance After 3 Months of Cognitive Training in Healthy Older Adults

Cheshire Hardcastle[1], Jessica N. Kraft[1], Hanna K. Hausman[1], Andrew O'Shea[1], Alejandro Albizu[1], Nicole D. Evangelista[1], Emanuel Boutzoukas[1], Kailey Langer[1], Emily J. Van Etten[2], Pradyumna K. Bharadwaj[2], Hyun Song[2], Samantha G. Smith[2], Eric Porges[1], Steven DeKosky[1], Georg A. Hishaw[2], Samuel Wu[1], Michael Marsiske[1], Ronald Cohen[1], Gene E. Alexander[2], Adam J. Woods[1]
[1]University of Florida, Gainesville, Fl, USA. [2]University of Arizona, Tucson, AZ, USA

Objective: Performance on a speed-of-processing/divided attention task, the Useful Field of View (UFOV), is associated with instrumental activities of daily living and number of motor vehicle accidents in the elderly. Cognitive training in UFOV reduced dementia risk at a 10-year follow up. Despite its impact, no study has explored resting-state network changes associated with cognitive interventions

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utilizing UFOV. Prior research shows that resting-state brain networks associated with inter-network modulation and executive functioning [frontoparietal control network (FPCN); cingulo-opercular network (CON)] are associated with UFOV performance, and networks associated with attention and cognitive status [dorsal attention network (DAN) and default mode network (DMN)] may change after cognitive training. A better understanding of the functional neural correlates related to improved UFOV performance after cognitive training may help researchers boost training efficacy and identify functional brain changes associated with reduced dementia risk. This study explored the association of 4 higher-order resting state networks connectivity change with UFOV performance change after three months of multidomain cognitive training in healthy older adults.
Participants and Methods: 58 healthy older adults (mean age = 71.2, SD = 4.7) were recruited as part of a larger clinical trial through the University of Florida and the University of Arizona. Participants were randomized to a cognitive training (n=30) or an education control (n=28) group. Computerized cognitive training included 40-hours of 4 attention/speed-of-processing (including the UFOV task) and 4 working memory tasks over a span of 12-weeks. The education training group watched 40 total hours of 40-minute educational videos over a span of 12-weeks. All participants randomly received sham or active transcranial direct current stimulation, although this was not a variable of interest in this study. UFOV performance was measured at pre- and post-training timepoints. Resting-state functional magnetic resonance imaging was gathered at pre- and post-training timepoints. Functional images were processed and average connectivity of FPCN, CON, DMN, and DAN were extracted through use of the CONN Toolbox v18b via SPM 12. To capture meaningful change from pre- to post-training, reliable change indices were calculated for all resting state networks and UFOV performance for the cognitive training group, controlling for variance of change observed in the education training group. Multiple linear regressions predicted UFOV reliable change from resting state network reliable change, controlling for tDCS group, age, mood change, sex, education, and scanner.
Results: Pre-post improvement in UFOV performance was significantly associated with pre-post strengthening in FPCN (β=-.444, *p*=.037). CON (β=-.370, *p*=.128), DMN (β=-.018, *p*=.935), and DAN (β=-.053, *p*=.820) reliable change did not significantly predict reliable change in UFOV.
Conclusions: Increased connectivity of the FPCN, which is involved in internetwork modulation, associated with improvements in the UFOV task after 3 months of attention/speed-of-processing and working memory training. This suggests that 1) cognitive training tasks may target the FPCN and 2) the FPCN could be a neural correlate of the reduced dementia risk and the maintenance of activities of daily living observed after UFOV training. The dorsolateral prefrontal cortex, a hub region of the FPCN, could also serve as a neural target to strengthen the cognitive training response.
Keywords: aging (normal)**,** cognitive functioning**,** neuroimaging: functional connectivity

6 The Role of the Frontoparietal Control Network for tDCS-Related Improvements of Working Memory Function in Older Adults

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Objective: Transcranial direct current stimulation (tDCS) is widely investigated as a tool for enhancing cognitive function in older adults with and without neurodegenerative disease. Pairing tDCS stimulation with active engagement of cognitive systems (*e.g.,* cognitive training; CT) maximally enhances synaptic plasticity and neural efficiency of cognitively trained brain systems (*e.g.*, working memory). Recent studies have demonstrated an association between frontoparietal control

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network (FPCN) connectivity and working memory performance. Further, evidence suggests applying tDCS to frontoparietal regions strengthens FPCN connectivity when paired with working memory training. The current study therefore sought to evaluate the relationship between task-based connectivity within the FPCN and tDCS-related working memory improvements.
Participants and Methods: Twenty-eight healthy older adults (ages 65-89) were randomized to receive either 20 minutes (active: [age=73.57(7.84), MoCA = 27.85 (1.79), 7F:7M]) or 30 seconds (sham: [age=73.78(7.06), MoCA = 27.00 (2.07), 8F:6M]) of 2mA tDCS with a 30 second current ramp up and down during a two-week working memory and processing speed cognitive training intervention (ten sessions). Participants were stimulated during cognitive training at the F3-F4 locations to target the bilateral dorsolateral prefrontal cortex of the FPCN network. Participants performed two-back working memory tasks in a 3-Tesla scanner pre-/post-intervention to assess alterations in working memory performance and task-based FPCN connectivity. ROI-to-ROI Fisher-transformed bivariate regressions between BOLD time series within nodes of the Yeo et al. 2011 FPCN were extracted in MATLAB 2020b with the CONN toolbox version 19c. Repeated measures ANCOVA was used to assess changes in FPCN functional connectivity and working memory performance. Linear regressions were used to demonstrate the relationship between changes in FPCN connectivity and working memory performance. Age, sex, and years of education were entered as covariates in all models.
Results: The active tDCS group showed higher connectivity within the FPCN (g=0.46) compared to the sham tDCS group. Participants receiving active tDCS also demonstrated a larger improvement in two-back working memory performance (g=1.24) compared to the sham group. Higher FPCN connectivity was associated with two-back working memory improvements (F[5,20]=3.94,p=0.012,η^2=0.496) over the two-week intervention. A significant main effect of treatment group (β=0.129,p=0.004) and sex (β=-0.796,p=0.030) was observed with the active tDCS and female participants showing the greatest improvements in both FPCN connectivity and working memory performance. While the interaction of treatment group and FPCN connectivity was not significant when controlling for the main effects, the relationship of FPCN connectivity with two-back performance explained a greater portion of variance within the active (R^2=0.139) versus sham (R^2=0.004) treatment group.
Conclusions: Novel methodologies are being developed to assess and augment the neuroplastic response of brain tissue (*e.g.*, CT + tDCS) to flatten the trajectory of cognitive decline. The current study supports the hypothesis that tDCS paired with cognitive training improves both FPCN connectivity and working memory performance. Further, tDCS-related changes in FPCN and working memory appear to be related. Novel methodologies of artificial intelligence to optimally stimulate the FPCN may enhance the efficacy of tDCS to remediate age-related working memory decline in older adults.
Keywords: neurostimulation**,** neuroimaging: functional connectivity**,** aging (normal)

Paper Session 20: Psychiatric

8:00 - 9:30am Thursday, 3rd February, 2022

1 Nicotine and Cannabis Co-Use and Associations with White Matter Health in the Developing Adolescent Brain

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Objective: Cannabis and nicotine co-use is increasingly common among young adults. Co-use has been associated with negative psychosocial consequences including poorer psychological health and increased risk for substance use disorders. Despite the increased prevalence of co-use, little research has been conducted to examine its effects on white matter

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neural tissue integrity and existing research has primarily focused on the diffusion tensor imaging measure fractional anisotropy (FA). The present analysis aims to improve the characterization of the differential effects of cannabis, nicotine, and co-use of these substances on white matter health using neurite orientation dispersion and density imaging (NODDI) parameters.
Participants and Methods: Participants *(*N=103*),* between the ages of 16-22 at study enrollment, underwent a neuroimaging session including anatomical and diffusion tensor imaging scans. Participants were classified as cannabis (CAN; n=37), nicotine and tobacco product users (NTP; n=15), co-cannabis and NTP (CAN+NTP; n=32) users, or non-using controls (CON; n=19). A series of MANOVAs were conducted to examine white matter tissue differences as a function of group status as measured by FA, neurite density (ND), and orientation dispersion (OD) in 15 *a priori* selected white matter regions of interest shown to be implicated in the reward network. Age, ethnicity, and lifetime alcohol use were included as covariates of non-interest.
Results: MANOVA revealed a significant difference in FA within the uncinate fasciculus (UF) as a function of group ($F(3,96) = 3.19$, $p = .027$, partial $\eta^2 = .091$). Specifically, NTP showed significantly greater FA in the right uncinate fasciculus than CAN+NTP ($p = .01$) and CON ($p = .01$) but did not significantly differ from CAN ($p = .097$). Groups also showed significant differences in OD within bilateral UF ($F(3,96) = 3.17$, $p = .028$, partial $\eta^2 = .09$). NTP had significantly lower OD than CON ($p = .035$), but not CAN+NTP or CAN ($ps > .05$), in the left UF. NTP also showed lower OD in right UF than CAN+NTP ($p = .008$), CAN ($p = .016$), and CON ($p = .006$).
Conclusions: This is the first study to use NODDI to examine ND and OD as a marker of white matter health among cannabis and nicotine co-using young adults. In line with previous research, NTP-only showed greater white matter integrity measures as evidenced by higher FA and lower OD than NTP+CAN/CON and NTP+CAN/CON/CAN, respectively. Of note, differences were observed in a bilateral cortico-limbic tract often implicated in addiction-related neural pathways. It is possible early life nicotinic receptor stimulation promotes certain neurobiological processes during emerging adulthood such as glial activity. These altered processes may then interact with cannabis-induced changes to result in a structurally distinct phenotype for nicotine versus cannabis users during early adolescence. Alternatively, those adolescents with preexisting higher FA and OD may be more likely to initiate substance use. Ongoing longitudinal research is needed to understand how this relationship may change and/or be diminished by continued heavy use and co-use of cannabis and NTP products.
Keywords: cannabis**,** neuroimaging: structural**,** adolescence

2 Cannabis, Driving Performance and Users' Perception of Safety: A Double-Blind, Placebo-Controlled Randomized Clinical Trial of Smoked Cannabis

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Objective: With increasing legalization of cannabis for medicinal and recreational use, there are growing concerns regarding cannabis-impaired driving. There remains uncertainty regarding the magnitude and time course of cannabis effects on those most likely to be on the road – regular users smoking to a desired level of intoxication. The appropriate waiting period before driving after smoking is a significant public safety concern, with some suggesting 3-5 hours, and others recommending longer. Since this decision may be self-determined based upon "feeling impaired", it is important to understand the accuracy of these self-evaluations. Lastly, while greater frequency

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of use is associated with increased behavioral tolerance, the relationship to driving remains poorly understood, since individuals may counteract tolerance by ingesting greater amounts to achieve desired psychoactive effects.
The aims of this study were to determine the magnitude and time course of driving impairment produced by cannabis with different THC percentages, concordance between perceived impairment and observed performance, and the effects of use history on driving performance.
Participants and Methods: In this double-blind, placebo-controlled parallel randomized clinical trial, 191 healthy adult cannabis users were randomized to consume a cigarette with either 5.9% THC, 13.4% THC, or placebo (.02% THC) ad libitum. Participants completed a driving simulator assessment prior to smoking and at 4 timepoints post-smoking. Driving performance was summarized using the Composite Drive Score (CDS), comprised of key driving simulator variables. Additional measures included self-reported 1) perceptions of driving impairment and 2) cannabis use intensity (quantity x frequency for the past 6 months).
Results: Participants were 61.8% male with a mean of 16.7 (9.8) days of use in the past month. Compared to Placebo, the THC group significantly declined on the CDS at 30min (Cohen's d=.59) and 1h 30min (d=.55), but not at 3h 30min or 4h 30min. Participants reported feeling less impaired and being more willing to drive at 1h 30min despite performance being similar to that observed at 30min. Many THC participants performed similar to the Placebo group at each timepoint, and post-smoking simulator performance was similar for the high and low THC content groups. Simulator performance in the THC group did not differ by cannabis intensity over the past 6 months (p = .964).
Conclusions: Smoking cannabis ad libitum resulted in significant reductions in simulated driving performance, which resolved over 3h 30min – 4h 30min. However, not all drivers' performance declined. THC content of the cigarettes did not significantly affect outcomes: users self-titrated, resulting in similar performance reductions. The THC group generally showed good agreement between subjective driving impairment and actual performance at 30min. However, at 1h 30min participants increasingly rated themselves as safe to drive, whereas simulator data indicated on-going reduced driving performance. These first few hours may constitute a period of greatest risk, since users may be less likely to refrain from driving or to attempt to compensate for reduced functioning. This is an important topic for public safety messaging, since a goal is to keep impaired drivers off of the road prior to becoming a danger.
Keywords: cannabis**,** driving**,** cognitive functioning

3 Subclinical Neuropsychiatric Symptoms in Typical Aging: An Indication of Amyloid Burden?

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Objective: Neuropsychiatric symptoms (NPS) may be the earliest clinical manifestation of neurodegenerative disease, often present in prodromal disease stages. However, the NPS profiles most predictive of pathologic aging are not well understood. We comprehensively evaluated NPS such as apathy, irritation, psychomotor agitation, and changes in appetite and mood differentially related to cerebral amyloid PET in cognitively normal older adults.
Participants and Methods: 152 participants (49.3% female, age=74.0y ± 6.9, Clinical Dementia Rating=0) completed a Florbetapir F-18 Aβ-PET scan, alongside a self-report measure of mood (30-item Geriatric Depression Scale (GDS)), a study partner interview of NPS (Neuropsychiatric Inventory Questionnaire (NPI-Q)), and a neuropsychological battery within 6 months. Aβ burden was calculated by converting standardized uptake value ratios to the centiloid scale for analyses. NPI-Q queried presence versus absence of 12 NPS subdomains. Of those, we examined the following: agitation or

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aggression, depression or dysphoria, anxiety, elation or euphoria, apathy or indifference, disinhibition, irritability or lability, motor disturbance, nighttime behaviors, and appetite and eating. The six-factor subdimension measurement model for the 30-item GDS was utilized to examine the following subscores: Dysphoric Mood, Withdrawal/Apathy/Vigor, Worry, Hopelessness, Cognitive Impairment, and Agitation. Regression models adjusted for age, sex, and education to examine the relationship between NPS and Aβ-PET. Control models also evaluated the relationship between neuropsychological performance and Aβ-PET. **Results:** 27.6% of the sample evidenced neuropsychiatric change per partner report, and self-reported mood symptoms were low as a group (GDS mean= 2.5, range=0 to 18). Study partner report indicated that endorsed change in one or more NPS subdomain was associated with an increase in Aβ-PET centiloids ($p<0.03$). Among specific NPI-Q subdomains, study partner report of changes in apathy or appetite were associated with increased Aβ-PET centiloids ($ps<0.03$). Inversely, study partner report of change in psychomotor agitation was associated with lower Aβ-PET centiloids ($p=0.03$). None of the other NPI-Q subdomains showed significant associations with Aβ-PET centiloids ($ps>.35$). Similarly, self-report mood (GDS) was not associated with Aβ-PET centiloid values ($β=.008$, $p=.92$). Of the GDS subdomains, only the Cognitive Impairment subscore related to Aβ-PET centiloids. An increase on reported Cognitive Impairment corresponded with an increase of 9.48 ± 2.9 Aβ-PET centiloids ($p<0.01$). In contrast, there was no evidence of a significant association between cognitive measures such as executive function ($β=-.08$, $p=0.32$) or memory ($β=-.06$, $p=0.52$) with Aβ-PET in this cohort of cognitively normal older adults.
Conclusions: In a subclinical cohort, increased rating of both subjective and objective measures of NPS, such as apathy, appetite changes, and subjective cognitive complaints corresponded with Aβ-PET uptake. Low level NPS may appear early in the prodromal disease state and relate to initial AD proteinopathy more strongly than cognitive symptoms. Further investigations examining NPS in typical aging may provide clues into the earliest AD pathophysiology.

Keywords: dementia - Alzheimer's disease, neuropsychological assessment, aging (normal)

4 Association of Cortico-Limbic Volume and Amyloid-β with Accelerated Cognitive Decline in Late Life Major Depression

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Objective: Cognitive dysfunction is a key feature of late life major depressive disorder (LLD), but it remains unclear if LLD is associated with accelerated cognitive decline longitudinally. Additionally, the role of amyloid-β (Aβ), *APOE* genotype, white matter hyperintensities (WMH), and cortico-limbic atrophy in cognitive decline in LLD remains unclear. The purpose of this study was to evaluate longitudinal trajectories of cognitive functioning in LLD relative to nondepressed (ND) older adults matched on Alzheimer's disease (AD) risk and pathology and assess relative contributions of demographic, clinical, and multi-modal neuroimaging characteristics on change in cognition over time.
Participants and Methods: Participants included 120 LLD and 240 ND matched on age, education, sex, Mini Mental State Examination (MMSE), mild cognitive impairment (MCI) diagnosis, and PET amyloid-β (Aβ) burden. Participants underwent genetic testing, MRI, Aβ PET, and comprehensive neuropsychological assessment at baseline. Longitudinal neuropsychological assessments were performed at 12- and 24-month follow-up in ND and 30-month follow-up in LLD. First, group differences in cognition were assessed using linear mixed effects models covarying for depression symptom severity (Geriatric Depression Scale). Second, effects of clinical diagnosis (LLD, MCI) and multi-modal neuroimaging characteristics (Aβ, total WMH, cortico-limbic volume composite consisting of structures associated with LLD in this sample) were assessed for tests showing significant

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group differences after multiple comparison correction. Finally, relative contributions of multi-modal neuroimaging to predict change in cognition were assessed.
Results: LLD showed accelerated cognitive decline on the Preclinical Alzheimer's Cognitive Composite (PACC; β =-0.34, *p*<.001), Alzheimer's Disease Assessment Scale-Cognitive (ADAS-Cog) Total Score (β =0.77, *p*<.001), Trailmaking Test-A (TMT-A; β=0.06, *p*<.001), ADAS Delayed Recall (β =-0.39, *p*=.016), and Logical Memory II (LM II; β =-0.56, *p*=.04). In the overall sample, cortico-limbic volumes in regions differentiating groups were associated with greater decline on the PACC (β=0.17, S.E.=0.04, *p*<.001), ADAS-Cog (β =-1.61, *p*<.001), ADAS-Cog Delayed Recall (β=0.45, *p*<.001), AVLT Learning (β =1.84, *p*=.001), Logical Memory II (LM II; β=0.47, *p*=.024), and TMT-A (β =-0.05, *p*=.005); WMH were associated with greater decline on the PACC (β=-0.09, *p*=.013) and TMT-A (β=0.05, *p*=.001); *APOE* e4 genotype was associated with greater decline on LM II (β =-0.85, *p*=.035), and Aβ positivity was not associated with decline on any cognitive measures (all *p*'s>.05). These results did not differ based on MCI diagnosis, but LLD was associated with additional decline on all tests (all *p*'s<.05) compared to ND. Aβ positivity moderated decline on the PACC, ADAS-Cog, and ADAS Delayed Recall, with accelerated decline in Aβ+ participants.
Conclusions: LLD showed accelerated decline on measures of global cognition, delayed recall, and attention/processing speed over time. In both groups, decline on these measures was largely driven by cortico-limbic volumes in structures associated with LLD in this sample and MCI diagnosis. In contrast, cerebrovascular disease and AD pathology had more limited effects on rate of cognitive change despite equivalent rates of vascular and AD pathology. These findings highlight a possible independent neurodegenerative effect of LLD beyond the impact of Aβ pathology and underscore the importance of identifying other factors contributing to neurodegeneration and accelerated cognitive decline in LLD.
Keywords: depression**,** dementia - Alzheimer's disease**,** neuroimaging: structural

5 Cognitive Phenotypes in Late-Life Depression

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Objective: Executive dysfunction is common in late-life depression (LLD) and has been associated with negative clinical outcomes, including poor antidepressant response, suicidality, and transition to dementia. However, not all individuals with LLD present with executive dysfunction and deficits in other cognitive domains (e.g., memory) are also common. Given these discrepancies, the purpose of the current study was to identify meaningful cognitive phenotypes in LLD and examine whether they differed in demographic and clinical characteristics.
Participants and Methods: Non-demented adults with LLD (*n* = 120, mean age = 66.67 ± 5.35 years, 60% female, mean Montgomery-Asberg Depression Rating Scale (MADRS) = 25.97 ± 5.65, Mini-Mental Status Exam (MMSE) = 29.23 ± 1.11) were recruited for two separate antidepressant trials. Baseline demographic and clinical characteristics were collected and participants completed a standard neuropsychological battery. Cognitive test scores were normed against a sample of psychiatrically healthy elders (*n* = 56). Five empirically-derived cognitive domains were developed (attention / working memory, processing speed, language, episodic recall, executive functions) and examined using hierarchical cluster analyses comprised only of the LLD participants. Dendrograms were visually inspected, as well as the number of cases per cluster. Cluster structure was cross-validated against k-means cluster analysis and membership consensus between these approaches was also examined. The optimal resulting cluster solution was compared on demographic and disease-related variables, as well as various symptom-based questionnaires (e.g., depressive symptoms, apathy, worry). One individual was removed from all analyses due to being an outlier.
Results: A three-cluster solution best reflected the data, consisting of "High Normal" (*n* = 47),

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"Normal" (n = 35), and "Low Executive Function" (n = 37) groups. The "High Normal" group was younger, more educated, predominantly Caucasian, had fewer vascular risk factors, and a higher MMSE compared to the "Low Executive Function" group (p's < 0.003). No group differences were observed on other demographic or disease-related variables, symptom questionnaires, or clinician- and participant-ratings of depression severity. We further explored the "High Normal" group, as the four-cluster solution suggested this group may differ in attention / working memory abilities. The two groups ("Low Attention / Normal" and "High Attention / Normal") significantly differed in performance on attention / working memory (p < 0.001), but not on other cognitive domains. The length of the current depressive episode was significantly less for the "Low Attention" group compared to the "High Attention" group (p = 0.032), but the groups did not differ on any other demographic or disease-related variables or symptom-based questionnaires. When examining response patterns on depression scales, the "High Attention / Normal" group was higher in clinician-rated pessimism and endorsed greater increases in appetite (p's < 0.05). Subgroups did not significantly differ in ratings across other depression items.
Conclusions: This study identified three distinct cognitive phenotypes in LLD that slightly differed in demographic and disease-specific variables, but not in the quality of specific symptoms they are reporting. Future work on these cognitive phenotypes will examine relationships to treatment response and neuroimaging markers to help disentangle the heterogeneity of findings and outcomes often seen in this patient population.
Keywords: depression**,** neurocognition

6 Acute Verbal Learning and Memory Component Effects Following Combined Electroconvulsive Therapy and Venlafaxine Treatment in Older Adults with Major Depressive Disorder

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Objective: Prior research has demonstrated that electroconvulsive therapy (ECT) produces acute adverse neurocognitive effects that can last up to six months in duration and in some cases beyond. Phase 1 of the Prolonging Remission in Depressed Elderly (PRIDE) study evaluated overall neurocognitive effects in older adults with major depressive disorder (MDD) following combined treatment of ECT and Venlafaxine. Our recent findings from the PRIDE study and prior research have indicated that these effects encompass impairment in immediate and delayed recall of verbal information, although the impact of ECT on verbal learning and memory components remains poorly understood. The aim of this analysis was to address this gap in the understanding of ECT's impact on verbal learning and elucidate its repercussions specifically on the underlying components. We explored whether following administration of an acute course of ECT and venlafaxine, if older adults would demonstrate changes in verbal learning and memory components.
Participants and Methods: The PRIDE study was a NIMH funded, multicenter, randomized study of an individualized continuation ECT

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schedule combined with pharmacotherapy to enhance long-term outcomes in older adults (aged 60+) with MDD. Psychiatric diagnosis was established through semi-structured diagnostic interview. During Phase 1 of the study, patients received combined treatment of Venlafaxine and acute right-unilateral ultrabrief pulse ECT 3x weekly. Neurocognitive outcomes were evaluated with the 2nd edition of the California Verbal Learning Test (CVLT-II). The CVLT-II was administered at baseline and within 72 hours of the last ECT session. Demographic-adjusted CVLT-II scores were computed, and descriptive statistics were used to characterize the demographic, neurocognitive, and clinical features of the sample. Comparisons of change from baseline to end were computed with paired t-tests. All statistical tests were two-tailed with alpha=0.05.

Results: The sample had a mean age of 69.9 (SD=7.6), 14.5 (SD=3.3) years of education, 57.5% were female and 95% were Caucasian. Following completion of the treatment course, performance on CVLT-II components worsened. Specifically, there was no improvement in word learning from trial 1 to trial 2 ($t(177) = 0.56$, $p=0.58$), the learning slope from trial 1 to trial 5 flattened ($F(1,173) = 0.82$, $p=0.37$), and there was increased proactive interference ($t(174)=-2.54$, $p=0.01$). Change in CVLT-II components was unrelated to the number of ECT sessions (p-values range: 0.27 to 0.91).

Conclusions: To our knowledge, this is the first study to report the impact of ECT on verbal learning and memory components in older adults with MDD. Compared to pre-ECT scores, the analysis found no improvement in verbal learning from trials 1-2, flattened learning across five learning trials, and increased proactive interference at the end of the acute ECT course. Notably, these effects were unrelated with the number of ECT treatments, suggesting that ECT induces worsening of verbal learning components independent of the number of sessions. Further research is warranted to explicate the effects of ECT on verbal learning and memory components and to better understand their nature and duration.

Keywords: depression**,** neuromodulation**,** learning

Poster Session 05: Epilepsy | Oncology | Genetics | Neuroscience

8:30 - 9:30am
Thursday, February 3, 2022

1 Cognitive Intra-individual Variability in Breast Cancer Survivors: A Systematic Review

David E. Vance[1], Victor A. Del Bene[1], Jennifer S. Frank[1], Rebecca Billings[1], Jennifer Bail[2], Wei Li[1], Karli Martin[1], Jun Y. Byun[1], Kristen Triebel[1], Pariya L Fazeli[1]
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Objective: Breast cancer survivors (BCS) commonly self-report cognitive deficits. Yet, studies focusing on objective measures of cognitive performance yield inconsistent findings, with some investigators finding no cognitive deficits after chemotherapy and radiation treatments while others report significant declines in one or more cognitive domains. In fact, subjective and objective cognitive deficits in BCS often do not correlate. One factory underlying this discrepancy may be the reliance on objective cognitive measures that are mean-based. It is possible that cognitive tests employing measures of intra-individual variability (IIV) may provide important insights into these reported disparities. Cognitive IIV refers to the fluctuation in performance within an individual on one cognitive task or across tasks within a testing session. In general, higher levels of cognitive IIV reflect poorer cognitive function. Converging studies have indicated that lower levels of cognitive IIV are associated with greater white matter integrity in brain regions underlying allocation of executive control of cognitive tasks. Cognitive IIV has been shown to discriminate between healthy older adults and adults with diagnosed neurological conditions (e.g., Parkinson's disease, traumatic brain injury). Thus, cognitive IIV may clarify the inconsistency between subjective and objective cognitive deficits in BCS. The purpose of this

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systematic review was to search for and examine the literature on cognitive IIV in BCS.
Participants and Methods: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach was used to search for all articles related to cognitive IIV in BCS. MEDLINE (via PubMed), Embase, and Scopus databases were searched using the search terms and strategies with the assistance of a librarian. The population was BCS (including all patients post-diagnosis); the problem was cognitive impairment. Altogether, 164 articles were retrieved, including 5 duplicates which were removed; two authors discussed the remaining 159 articles based on titles and abstracts to confirm their appropriateness. Of these, 155 articles were excluded, primarily for not focusing on IIV or BCS. Finally, four articles were included in the systematic review.
Results: BCS differed from healthy controls in similar ways across the four studies, generally demonstrating similar performance but showing increased cognitive IIV on more cognitively demanding tasks both before and after treatment. Differences were enhanced later during chemotherapy/radiation. These results support hypotheses from the non-cancer literature that increases in IIV appear early before the development of cognitive/neurological impairment and reflect increased use of top-down executive control to maintain the attention required for successful performance on both easy and more challenging tasks.
Conclusions: The four reviewed studies provided support for cognitive IIV as a useful approach to detect the subtle objective cognitive deficits often self-reported by BCS but frequently not detected by standard normed-based cognitive testing. Unexpectedly, measures of cognitive IIV were not consistently associated with self-reported measures of cognition. The studies suggested that cognitive deficits in BCS across the spectrum from diagnosis through long-term survival likely result from a combination of etiologic factors including oncogenic inflammation, chemotherapy, anesthesia, hormonal therapy, and others which may impact neural integrity resulting in a disruption of executive control.
Keywords: cancer**,** cognitive functioning**,** cognitive processing

2 Working Memory and Processing Speed Predict Mathematics Performance in Pediatric Brain Tumor Survivors

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[3]Kennedy Krieger Institute, B, MD, USA

Objective: Pediatric neuro-oncology survivors are at risk for cognitive deficits secondary to cancer treatment, particularly working memory (WM) and processing speed (PS), which impacts other cognitive domains. We aimed to investigate the potential relationships between WM and PS on untimed mathematics performance among school-age youth with a history of brain tumor (BT) treatment. The purpose of this study was to (1) characterize rates of impairment in WM, PS, and untimed mathematics in children treated for pediatric BT at least two years post-diagnosis; (2) identify medical/demographic factors are associated with greater deficits in math, WM, and PS outcomes; and (3) quantify the degree to which WM and PS contribute to mathematics performance in pediatric BT survivors.
Participants and Methods: Assessment data were gathered from retrospective record review of all children referred for an outpatient clinical neuropsychological evaluation following a BT diagnosis and treated at this academic medical center. Inclusion criteria included at least age 6 years at time of assessment, diagnosed with a BT before 18 years of age, at least two years post-diagnosis, and completion of either the Wechsler Intelligence Scale for Children, Fourth/Fifth Edition or the Wechsler Adult Intelligence Scale, Fourth Edition, and a measure of untimed mathematics calculation from the Wechsler Individual Achievement Test or Kaufman Test of Educational Achievement. The sample consisted of 72 BT survivors. One-sample t-tests were used to determine how the sample compared to the normative mean. Rates of impairment were calculated using a 1.5 standard deviation cut-off. Correlations were

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used to investigate the association between medical factors and performance-based measures. Given the inter-collinearity between WM and PS, two separate linear regression models were performed to examine whether WM or PS predicted math performance, respectively.
Results: WM, PS, and untimed math calculation were significantly lower than the normative mean, with higher rates of normative impairment. Untimed math calculation was positively correlated with WM and PS. Math calculation was not correlated with any medical factors. PS was negatively correlated with the Neurological Predictor Scale (NPS), and positively correlated with older age at diagnosis. After controlling for NPS and age at diagnosis, both WM and PS were independently associated with untimed math outcomes and accounted for 30.9% and 20.6% of the variance, respectively.
Conclusions: WM and PS contribute to mathematics performance in pediatric BT survivors. This is consistent with other medical populations with marked white matter dysfunction such as leukemia and sickle cell disease with cerebral infarcts. This study contributes to our understanding of the role of white matter related constructs (WM, PS) on downstream cognitive abilities such as academic achievement. Examining mathematics performance should be a part of clinical neuropsychological batteries. Interventions to improve mathematics performance in this population should also focus on working memory and compensatory strategies for slowed processing speed.
Keywords: academic skills**,** mathematics ability**,** working memory

3 Medical decision-making in persons with metastatic cancer

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Objective: To investigate medical decision-making in patients with metastatic cancer.
Participants and Methods: Adults were categorized as being newly diagnosed with brain metastasis (n=113) or non-CNS metastasis (n=41) and demographically-matched healthy controls (n=40). Capacity to Consent to Treatment Instrument (CCTI) and its four clinically relevant consent standards (expressing a treatment choice, appreciation, reasoning, and understanding) was used to assess medical decision-making. Statistically-derived cut off scores determined impairment rating.
Results: Both of the metastatic cancer groups performed significantly below controls on CCTI consent standards of understanding and reasoning.
Conclusions: Over half of participants with metastatic cancer, regardless of whether they have brain disease, have reduced capacity to make treatment decisions.
Keywords: decision-making**,** cancer**,** cognitive functioning

4 The Posterior Fossa Syndrome Questionnaire: Moving Towards Improved Diagnostic Consistency

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Objective: Posterior fossa syndrome (PFS), also referred to as cerebellar mutism syndrome, is a condition that develops in up to 34% of medulloblastoma patients following brain tumor resection with symptoms of delayed onset speech and language difficulties, motor impairments, and emotional lability. While previously considered a transient condition, research now demonstrates greater risk for long-term neurocognitive impairments among children treated for medulloblastoma who develop PFS than those children who do not. There remains lack of agreement in conceptualization and diagnosis of PFS that calls for improvements in diagnostic methods to

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advance clinical care and accelerate research progress. In response to the need for enhanced diagnostic objectivity, that reflects the range of PFS presentations, the current study describes psychometric properties of a new Posterior Fossa Syndrome Questionnaire (PFSQ).
Participants and Methods: The PFSQ was developed by a multidisciplinary team with subject matter expertise and informed by prior research. The PFSQ contains 23 symptom items (with provided definitions) that are rated as “No, never”, “Yes, current”, “Yes, prior”, and “Don’t know”. Severity ratings and dates of symptom resolution are included as appropriate. Participants (N = 164; 63.4% Male; 78.7% White; M_{age} = 10.38 years, SD = 5.09) included patients enrolled in an ongoing prospective clinical trial for newly diagnosed medulloblastoma (SJMB12). A PFSQ was completed by a neurologist within 2 weeks of coming to St. Jude Children’s Research Hospital for adjuvant treatment, irrespective of suspicion for PFS. Forty four patients (26.8%) were classified as having PFS based on attending physician’s post-surgical yes/no report, which was used as the criterion for evaluating the PFSQ.
Results: All patients who experienced mutism eventually had a return of speech with mutism lasting an average of 36 days (SD= 41) but spanning a wide time span (3-244 days). PFSQ items of Ataxia (100.00%), Dysmetria (95.45%), and Speech/Language Changes (79.55%) were most sensitive. However, Ataxia (26.50%) and Dysmetria (46.61%) demonstrated low specificity. Speech/Language Changes (81.36%), Mutism (95.76%), Orofacial Apraxia (98.29%) and Irritability (96.61%) had high specificity. While mutism was highly specific, it was not as sensitive as hypothesized given historical significance, with 32% diagnosed with PFS not having a period of mutism. With respect to speech and language changes, limited prosody, slowed rhythm, and dysarthria were more indicative of PFS than fast rhythm and scanning speech. A principal component analysis found four components: 1) Speech/ Language Changes (loadings .66-.93), 2) Apraxias (including mutism; loadings .62-.89), 3) Motor/Oromotor (loadings .59-.72), and 4) Emotional Lability (loadings .50-.91), which largely overlap with conceptual domains identified in the literature.
Conclusions: The PFSQ is a dimensional diagnostic approach that can be used to improve diagnostic consistency across clinical and research groups to help accelerate understanding of PFS etiology, identify surgical correlates of risk, predict long-term impairments, and develop targeted interventions. Study challenges included finding ways to incorporate multidisciplinary input in ratings and delay in completing the PFSQ as patients transferred from outside surgical centers. Future work to establish inter-rater reliability and additional measure validation, including correlation with neuroimaging and symptom resolution, is required.
Keywords: brain tumor**,** child brain injury**,** cognitive rehabilitation

5 The Role of Processing Efficiency in Outcomes of Survivors of Childhood Cancer

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Objective: Childhood cancer and treatments disrupt brain development, placing survivors at risk for cognitive late effects. Currently, the primary documented cognitive late effects of cancer treatment include impairments in executive functioning (EF), attention, working memory (WM), and processing speed (PS). A frequently reported cognitive late effect is impaired *processing efficiency* (PE); however, this construct remains poorly defined and not yet operationalized for clinical use within the context of childhood cancer survivorship and outcomes research. PE has been described as the “optimal use of mental resources” that impacts ability to learn and coordinate goal-directed behavior. In the current study, PE will be presented as a unique construct that describes the brain’s ability to process information quickly

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(PS) and hold information in mind for a short period of time (WM). It is hypothesized that deficits in PE may serve as a sensitive predictor of neurobiological disruption following cancer treatment, and therefore may serve as a feasible predictor of possible cognitive late effects. The current study aims to characterize PE skills and its relationship to adaptive and academic outcomes in a sample of survivors of childhood cancer.

Participants and Methods: Retrospective data analysis was conducted on 54 survivors of childhood cancer (mean age=14.81 years, average time off treatment=6.58 years, mean FSIQ=89.24, 31 male) evaluated through standard neuropsychological clinical care through the survivorship clinic at Children's of Alabama (CoA). Participants selected from the retrospective database completed either the WISC-V or WAIS-IV, yielding primary measures of PE, i.e., PS Index (PSI) and WM Index (WMI). A subset of these participants also had data on other measures of PE, including verbal semantic fluency (SF) on the NEPSY-II and D-KEFS and BRIEF-2 parent-ratings of EF [Initiation (IN) and Working Memory (WM)]. A series of multiple regressions were conducted, with measures of PE as predictors (PSI, WMI, SF, BRIEF IN and WM), and measures of academic achievement (GORT-5 and WIAT subtests) and parent-ratings of adaptive behaviors (BASC-2/3) as outcome variables.

Results: Outcomes of select measures of PE successfully predicted performance on measures of reading fluency/comprehension (GORT-5 ORQ; $F(5,17)=4.141$, $p<0.05$, adjusted $R^2=0.417$) and written mathematical calculation (WIAT Numerical Operations; $F(5,22)=2.769$, $p<0.05$, adjusted $R^2=0.247$), as well as parent-report of adaptive skills (BASC-2/3 Adaptive Skills Composite; $F(5,27)=7.151$, $p<0.001$, adjusted $R^2=0.490$). Among the measures of PE included in the models, WMI ($\beta=0.43$, $p<0.01$) and SF ($\beta=0.30$, $p<0.05$) emerged as significant predictors of reading ability, WMI predicted mathematical skills ($\beta=0.57$, $p<0.05$), and SF ($\beta=0.247$, $p<0.05$) and BRIEF WM ($\beta=-0.47$, $p<0.05$) predicted BASC-2/3 adaptive behaviors.

Conclusions: A brief routine assessment of PE may be a feasible predictor of cognitive late effects, as deficits in PE are expected to serve as a uniquely sensitive predictor of neurobiological disruption following cancer treatment. Results of the current study indicate that aspects of PE are associated with measures of academic achievement and parent-ratings of adaptive behaviors. These findings provide initial empirical support for the potential clinical utility of the assessment of PE as a screening tool for monitoring outcomes among childhood cancer survivors.

Keywords: cancer, cognitive processing, working memory

6 Temporal changes in treatment exposures across three decades, and long-term chronic health conditions and neurocognitive outcomes in adult survivors of pediatric medulloblastoma: A report from the Childhood Cancer Survivor Study (CCSS)

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Objective: Survivors of pediatric medulloblastoma are at significant risk of long-term physical, neurocognitive, and psychosocial sequelae. Over the past several decades, treatment protocols have aimed to reduce morbidity by reducing craniospinal radiation (CSI) dose. The impact of these changes in treatment exposures and of chronic health conditions on neurocognitive outcomes in medulloblastoma survivors is largely unknown.

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Participants and Methods: 505 medulloblastoma survivors (58% male, median [min-max] 29 [18-46] years of age, 7 [0-20] years at diagnosis) diagnosed between 1970-99, and 727 siblings (44% males, 32 [18-58] years of age) completed the CCSS Neurocognitive Questionnaire assessing domains of task efficiency, emotional regulation, organization, and memory. Impairment was defined as a score greater than the 90th percentile of normative data. Treatment exposures were categorized to reflect temporal changes in therapeutic approaches: historical (surgery + CSI ³ 30Gy, no chemotherapy), high-risk (surgery + CSI ³ 30Gy + chemotherapy), standard-risk (surgery + CSI < 30Gy). Self-reported chronic health conditions were reviewed and graded by the organ system using the National Cancer Institute's Common Terminology Criteria for Adverse Events v4.3 as Grades 1 (mild), 2 (moderate), 3 (severe/disabling) or, 4 (life-threatening). Generalized estimating equations were used to calculate the risk of impairment in survivors compared to siblings, adjusting for age, sex, and race. Among survivors, multivariable modified Poisson regression was used to evaluate the risk of impairment associated with treatment groups and presence of Grade 2+ chronic health conditions (separate models), adjusting for sex, race, age at assessment, age at diagnosis and relapse/second neoplasms.
Results: Compared to siblings, survivors in all three treatment groups were at elevated risk of impaired task efficiency, emotional regulation, organization, and memory (e.g., impaired memory: historical therapy relative risk [RR] 4.3, 95% confidence interval [CI] 3.1-5.9; high-risk therapy RR 5.2, 95%CI 4.0-6.8; standard-risk therapy RR 4.5, 95%CI 3.4-6.1). Among survivors, high-risk therapy was associated with elevated impairment in organization (RR 1.5, 95%CI 1.1-2.2), but no other domains, compared to standard-risk therapy. Sensory motor conditions were associated with elevated risk of impaired task efficiency (RR 1.3, 95%CI 1.1-1.5), emotional regulation (RR 1.9, 95%CI 1.4-2.8), organization (RR 1.9, 95%CI 1.4-2.5) and memory (RR 1.3, 95%CI 1.1-1.6). The onset of seizures following diagnosis was associated with higher risk of impaired task efficiency (RR 1.2, 95%CI 1.0-1.4) and memory (RR 1.4, 95%CI 1.1-1.8]). Respiratory disorders were associated with higher risk of impaired emotional regulation (RR 1.8, 95%CI 1.2-2.7). Auditory deficits were associated with higher risk of impaired task efficiency (RR 1.3, 95%CI 1.1-1.4) and memory (RR 1.3, 95%CI 1.0-1.5).
Conclusions: Despite reduced CSI intensity, long-term adult survivors of pediatric medulloblastoma continue to be at elevated risk for neurocognitive impairment. Treatment-related chronic health conditions are associated with this risk, and may provide intervention targets to mitigate or prevent long-term neurocognitive problems. Future studies should consider the impact of contemporary molecular risk stratification and related changes in CSI dose and modality as well as chemotherapeutic regimens on neurocognitive outcomes.
Keywords: cancer**,** radiotherapy**,** cognitive functioning

7 Cardiorespiratory Fitness is Associated with Hippocampal Functional Connectivity in Women Newly Diagnosed with Breast Cancer

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Objective: Breast cancer and its treatment are associated with aberrant patterns of resting state functional connectivity (rsFC) between the hippocampus and several areas of the brain, which may account for poorer cognitive outcomes in diagnosed patients. In general, higher cardiorespiratory fitness (CRF) has been associated with enhanced rsFC and cognitive performance, however, these associations have not been well studied in the context of breast cancer. Thus, the aim of the

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present study was to examine the relationship between CRF, rsFC of the hippocampus, and cognitive performance among women newly diagnosed with breast cancer.
Participants and Methods: A sample of 34 postmenopausal women newly diagnosed with Stage 0-IIIa breast cancer (M_{age}=63.59±5.73) were enrolled in a 6-month randomized controlled trial of aerobic exercise vs. usual care. Prior to randomization, participants completed baseline rsFC brain imaging and a submaximal CRF test. Whole-brain, seed-based analyses were used to examine the relationship between CRF and hippocampal connectivity at rest, with age, years of education, and framewise displacement included as covariates. Cognitive function was measured with a battery of validated neurocognitive measures, reduced via exploratory factor analysis with orthogonal rotation to 8 composite cognitive factors. Connectivity values of significant clusters were examined as predictors of baseline cognitive performance in regression analyses.
Results: Higher CRF was positively associated with greater rsFC of the hippocampus with six clusters encompassing regions within the dorsomedial frontal cortex (DLPFC and DMPFC, respectively) (Z-max_1=4.37, Z-max_2=3.86, Z-max_3=3.51, Z-max_4=3.44; Z-max_5=3.39, Z-max_6=3.33; all *p*s < .05). Hippocampal connectivity with these clusters were not significantly related to any of the composite cognitive factors (all *p*s > .05).
Conclusions: CRF was positively associated with hippocampal rsFC with regions within the dmFC, comprising a network of connectivity that is often suppressed in breast cancer, and has been implicated in executive control and memory function. Hippocampal connectivity with significant clusters did not predict cognitive performance. However, associations between CRF and hippocampal connectivity may predict long-term cognitive resilience, signifying a need for future longitudinal research.
Keywords: neuroimaging: functional connectivity**,** breast cancer**,** cognitive functioning

8 Cerebral Perfusion is Associated with Cardiorespiratory Fitness in Women with Breast Cancer

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Objective: Women with breast cancer often experience accelerated cognitive decline. Thus, there is a scientific and public health need to find methods for improving brain health and mitigating the cognitive deficits. Higher cardiorespiratory fitness has been associated with better neurocognitive health across the lifespan and in various populations. Cerebral blood flow (CBF) is one metric of brain health that is associated with cardiorespiratory fitness. Unfortunately, no studies to date have examined whether cardiorespiratory fitness is associated with CBF in women with breast cancer. The present secondary analysis examines whether cardiorespiratory fitness levels in postmenopausal women with early-stage breast cancer are related to CBF. We predict that higher cardiorespiratory fitness will be associated with greater CBF. Further, we predict that fitness-related associations will be regionally-specific, such that greater CBF will be localized to the frontal and temporal lobes.
Participants and Methods: Postmenopausal women aged 51-76 (M_{age}=63.76±5.67 years; 85% White; $M_{education}$=16.06±2.82 years) with early-stage (0-IIIa) breast cancer were enrolled in an ongoing randomized controlled trial investigating the effects of a 6-month aerobic exercise intervention on cognitive and brain outcomes (N=153) compared to usual care. Prior to randomization, a battery of baseline assessments was conducted, which included a cardiorespiratory fitness assessment (i.e., a submaximal modified Balke graded exercise test with VO_2). This investigation focuses on the pre-randomization data from a subset of women (N=33) who underwent neuroimaging including a pseudo-continuous arterial spin labeling (pcASL) scan to measure resting CBF. We divided the women into lower-fit (N=16, mean VO_2=14.48 ml/kg/min) and higher-fit (N=17,

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mean VO_2=18.78 ml/kg/min) groups based on a median split of cardiorespiratory fitness (median = 16.63 ml/kg/min). A voxel-wise paired t-test between the lower-fit and higher-fit groups in FMRIB Software Library (FSL) was conducted to test our hypotheses. Two contrasts were produced: 1) higher-fit > lower-fit and 2) lower-fit > higher-fit. Age was included as a covariate in the model. All results were corrected for multiple comparisons using FSL's cluster correction method, which determined that clusters $\geq$ 292 voxels survived whole brain correction at a threshold of $p < .05$ based on the data smoothness parameters. For visualization purposes we created spherical regions of interest around the peak coordinates within significant clusters (radius = 10mm) and extracted the CBF values from these regions.
Results: The higher-fit group had greater CBF compared to the lower-fit group in three clusters, with peaks in the left frontal pole (k = 583; peak MNI x, y, z = 65, 87, 46), lingual gyrus extending into the cerebellum (k = 366; peak MNI x, y, z = 44, 22, 26), and right frontal pole (k = 336; peak MNI x, y, z = 32, 93, 48). No clusters survived correction for the lower-fit > higher-fit contrast.
Conclusions: This study demonstrates that higher cardiorespiratory fitness is associated with greater regional CBF in women with breast cancer. This indicates that exercise interventions designed to increase cardiorespiratory fitness may be able to increase CBF, potentially ameliorating some of the impact of breast cancer on brain health outcomes.
Keywords: cerebral blood flow**,** cancer
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9 Bouncing Back: Resilience and Cognitive Symptoms in Cancer

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Objective: Cognitive symptoms are common for patients with cancer and can greatly impact quality of life. While neurologic mechanisms contribute to cognitive symptoms for some patients, psychological factors such as stress, anxiety, and depression, have been shown to relate to subjective cognitive concerns (SCC). Resilience, defined as the ability to manage stress, reduce allostatic load, and continue to function well despite adversity, may be an individual psychological characteristic that protects against SCC. Improved resilience as a function of therapy has been shown to reduce emotional distress and somatization. We examined the possibility that resilience relates to SCC in cancer survivors, and that improvement in resilience would be associated with reduced cognitive symptoms.
Participants and Methods: Adult cancer survivors participated in the Relaxation Response Resiliency Program (3RP), an 8-week skills-based mind-body intervention that reduces emotional distress and enhances resilience. Participants completed self-report measures of cognition (Patient Reported Outcome Measure Information System – Cognitive function; PROMIS-Cog), resilience (Current Experiences Scale; CES), depression (Patient Health Questionnaire; PHQ-8), and anxiety (Generalized Anxiety Disorder-7; GAD-7) before and after treatment. Eighty-three survivors (M_{age} = 54.3, 89% female, 93% White) completed measures at intake. Thus far, 30 survivors have completed the 3RP program and all questionnaires at follow-up. Pearson correlations evaluated cross-sectional relationships among resilience, cognition, mood, and anxiety both before and after treatment. Paired sample t-tests examined pre-post intervention change in symptom scores and Cohen's d was calculated to determine effect size. Change scores were calculated by subtracting each participant's follow-up score from their baseline score on the same variable and Pearson correlations explored the relationships among change scores
Results: Thirty-two subjects (39%) reported clinically significant cognitive concerns at baseline (scores of <-1.0 SD on PROMIS-Cog compared to normative data). Prior to treatment, there was a small positive correlation between resilience and cognitive function (r=0.34; p=0.001), indicating better cognitive function in those with higher resilience scores. Additionally, both resilience and cognitive function were

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negatively correlated with mood/anxiety measures (r's=-0.22 to -0.58, all p's<0.05). In the 30 individuals with complete data pre- and post-treatment, participants experienced significant treatment gains in resilience ($t(29)$=-3.61, p=0.001; d=0.79) and cognitive function ($t(29)$=-2.31, p=0.028; d=0.36). At follow-up, correlation between resilience and cognition was nonsignificant (r=0.10; p=ns), cognitive concerns were associated with depression, (r=-0.56, p<0.001), resilience significantly correlated with anxiety (r=-0.36, p=0.039), anxiety and depression correlated strongly (r=0.572; p<0.001), and other relationships were non-significant, including a small positive relationship between resilience and cognitive function change scores (r=0.27; p=ns).
Conclusions: This preliminary study demonstrates that SCC's are associated with resilience, depression, and anxiety in a treatment-seeking group of adult cancer survivors. Although the content of 3RP did not focus on cognition, participants reported improvement in cognitive function while simultaneously experiencing gains in resilience. Further work is needed to determine the clinical meaningfulness of this effect and whether improvement in SCC and resilience is related to performance on objective measures of cognition.
Keywords: treatment outcome**,** cognitive functioning**,** cancer
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10 *Self-Evaluation as a Predictor of Neuropsychological Functioning in Pediatric Leukemia Survivors*

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Objective: Children with a history of cancer are at high risk for developing neuropsychological deficits over time, known as neurocognitive late effects, as a result of cancer treatment. Neurocognitive late effects can negatively impact the child's academic learning, health-related quality of life (HRQOL), and ability to achieve functional independence as an adult. Therefore, it is important for pediatric cancer survivors to be monitored and assessed for neurocognitive late effects to determine appropriate services. Generally, previous research has demonstrated zero to moderate associations between objective measures and parent reports of cognitive functioning, indicating that the two assessment methods provide unique insights into the child's functioning. However, research is limited regarding children's own appraisal and associations with their performances on objective measures. To address this gap, we investigated the association between children's self-report of their school functioning with their objective performance scores obtained at the same assessment.

Participants and Methods: The current study utilized cross-sectional data from the baseline assessment of a larger parent-training intervention study consisting of 106 pediatric Latino leukemia survivors (n= 97 acute lymphoblastic leukemia, n=5 acute myeloid leukemia, and n=4 lymphoblastic lymphoma) and their parents at three pediatric cancer centers in Southern California. Pediatric patients (ages 6 to 12 years) underwent neuropsychological testing and completed the Pediatric Quality of Life Inventory (PedsQL™) self-report, which includes a school functioning scale consisting of five items asking about problems in paying attention in class, forgetting things, keeping up with schoolwork, and missing school. Children rated problems on a scale of 0 (never) to 4 (almost always). Items are reverse-scored and transformed to a 0-100 scale, so that higher scores indicate better functioning. Higher scores on cognitive and academic tests also reflect higher functioning. A multiple regression model regressed PedsQL school functioning on four a priori selected criterion variables of

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cognitive and academic function: WISC-V Processing Speed and Working Memory indices; and WIAT-III Math and Total Reading composite scores.
Results: The overall regression was statistically significant [R^2 = .10; F(1, 99) = 2.79, p = .03]. Of the four variables, the WISC-V Processing Speed Index score was significant and contributed largely to the overall model, p =.04. In exploratory single regression analyses, all four variables were either significant at p < .05 or showed trends (p < .10) towards significance.
Conclusions: These results suggest that there is a positive association between children's subjective ratings of their school functioning and their objective test performance. Further research is needed to confirm these findings in ethnically diverse samples, and to place these results within the context of other predictors, such as parent report. Utilizing self-report measures in conjunction with parent-reports may serve as a useful, resource-sparing screening strategy to identify children in need for comprehensive neuropsychological evaluation after cancer treatment.
Keywords: cancer**,** academic achievement**,** self-report

11 Neuropsychological Profile in a High-Grade Primary Central Nervous System Neuroendocrine Carcinoma

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Objective: Neuropsychology in oncology offers the opportunity to evaluate the cognitive, psychiatric, and functional sequelae of cancer and treatment neurotoxicity. The neuropsychological profiles in adult cancer patients vary in severity with type, location, and growth. The occurrence of neuroendocrine carcinomas (NEC) within the central nervous system (CNS) is unique. While there is more known with the development in the gastrointestinal tract, lung, and pancreas, little is known with NEC originating in the brain with prevalence being <1%. We present the neuropsychological profile of an adult woman with a high-grade primary CNS NEC as cases with this anatomical location are very rare and no known case study involving neuropsychology is published.
Participants and Methods: A 43-year-old, right-hand dominant, white woman presented for baseline neuropsychological evaluation to characterize her neurocognitive, neuropsychiatric, and functional status. She had a history of neurocognitive changes in the context of a high-grade primary CNS NEC involving bifrontal and bitemporal regions. She was status-post right temporal craniotomy for open biopsy, bifrontal ventriculoperitoneal shunt placement, and proton radiotherapy. She received at-home rehabilitative therapies and was interested in her return to work. She endorsed a number of cognitive concerns related to word finding, processing speed, attention and concentration, organization, prospective recall, and short-term episodic recall. Some of these predated her diagnosis, being part of a constellation of initial symptoms that drew clinical attention which included confusion, forgetfulness, and severe weight loss. Physically, she acknowledged residual difficulty with manual dexterity and strength. She denied any concerns related to sleep quality or quantity, but did acknowledge daytime fatigue, which necessitated one or more naps per day. Emotionally, she reported feelings of depression and anxiety – particularly regarding the impact of her tumor on her family, daily activities, and her work. She expressed overwhelming support through family, friends, and her faith. Functionally, she remained independent for all basic self-care tasks. However, she did require assistance and oversight for all higher-level instrumental activities due to her cognitive issues and fatigue.
Results: Her neuropsychological findings reflected a mixed profile characterized by deficits in cognitive domains reflecting bilateral frontal and temporal lobe dysfunction. This included confrontation naming, verbal fluency, verbal and nonverbal memory, processing speed, and executive functioning. In the presence of functional decline, her findings met criteria for a Major Neurocognitive Disorder. The etiology of her neurocognitive disorder was most likely multifactorial, with primary contributors being her NEC and associated therapies. That

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said, some further exacerbation was anticipated from daytime fatigue and medication effects. Recommendations included facilitation of disability determination, referral for in-home healthcare services, referral for adaptive aid consultation, and engagement in cognitive compensatory strategies.
Conclusions: Within the oncology setting, a neuropsychological evaluation can provide psychoeducation on other salient factors associated with cancer as cognitive and emotional functioning are often treated as secondary to physical functioning. A neuropsychologist working with an oncology team represents the growth in clinical and research practice. The opportunity to address quality of life and provide psychoeducation is impactful to patients and others essential in patient care and survival.
Keywords: cancer**,** brain tumor**,** cognitive functioning
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12 Cognitive Mediators of Quality of Life in Pediatric Medulloblastoma Survivors: A Comparison of Survivors with and without Posterior Fossa Syndrome

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Objective: Previous research has examined the neurocognitive implications of pediatric posterior fossa tumors and has strongly advocated for outcome measures for cancer treatment to incorporate health-related quality of life (HRQOL) to get a better understanding of factors that negatively affect HRQOL over time. Additionally, surgical resection of posterior fossa tumors may result in a specific type of cerebellar damage leading to posterior fossa syndrome (PFS). Children who develop PFS are noted to experience even lower performance in various neurocognitive domains when compared to medulloblastoma patients who did not have PFS. However, few studies have examined the relationship between neurocognitive functioning and HRQOL into survivorship within the context of individuals with and without a PFS diagnosis. The purpose of this study is to examine neurocognitive variables (i.e., EF, processing speed, verbal fluency) as potential mediators of PFS on HRQOL outcomes in pediatric medulloblastoma survivors with or without a history of PFS.
Participants and Methods: This present study is a retrospective analysis of archival data collected from a larger study. Participants included 35 children (M_{age}= 12.32; SD_{age}=3.12) having been diagnosis with PFS (*N*=9) or Non-PFS (*N*=26) who were administered the *Delis Kaplan Executive Function System* (D-KEFS), and Weschler Intelligence Scale for Children-V (WISC-V) as part of a comprehensive neuropsychological evaluation. Parent report measures such as the Pediatric Quality of Life Inventory (PedsQL) and the Behavior Rating Inventory (BRIEF). A mediation analysis was used in order to examine neurocognitive variables (i.e., EF, processing speed, verbal fluency) as potential mediators of PFS on HRQOL outcomes.
Results: Results suggests that PFS has a deleterious effect of aspects of neurocognitive performance went compared to those who were not diagnosed, with the Non-PFS group outperforming the PFS group on measures of performance-based EF and processing speed (all $p < 0.01$), and verbal fluency ($p<.05$). Additionally, groups differed on the physical functioning domain of the PedsQL with Non-PFS faring better ($p<.05$). However, groups did not differ on rating-based EF, emotional functioning, social functioning, school functioning, or overall HRQOL(all $p >0.05$). While there was no significant mediation effect, PFS group predicted processing speed outcomes (β = -11.58, 95% CI (-22.32, -.85) p=.035) outcomes and performance-based EF ((β = -1.01, 95% CI (-1.68, -.35) p= .004)
Conclusions: There were a few limitations to this study largely sample size, and group portions. Give the low base rate of pediatric brain tumors and to further reduce this to individuals having a PFS created some

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challenges. However, these findings support the need for long-term monitoring of neurocognitive outcomes within the context of PFS with the presence of PFS as an indicator for protentional processing speed and performance-based EF impairment.
Keywords: brain tumor**,** quality of life**,** pediatric neuropsychology

13 Hypertension as a Risk Factor for Lower Neurocognitive Functioning in Women with Newly Diagnosed Breast Cancer

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Objective: Women with breast cancer who have yet to receive any adjuvant treatment have reported and demonstrated neurocognitive dysfunction. Research indicates comorbid health conditions are a contributing factor. While studies on neurocognitive functioning in this population have documented an association of comorbidities with reduced cognitive functioning using various validated comorbidity indices that sum the presence of health conditions (e.g., diabetes, cardiovascular disease), little research has examined the association of specific comorbid disorders. Given their elevated risk for cerebral small vessel disease, we hypothesized that breast cancer patients with hypertension have lower neurocognitive functioning prior to any cancer-related treatment relative to those without hypertension or other comorbid health conditions.
Participants and Methods: The study sample to test our hypothesis consisted of post-menopausal women newly diagnosed with non-metastatic breast cancer who were enrolled in a larger study to evaluate longitudinal cognitive changes. Participants underwent neurocognitive assessment prior to any cancer treatment, including surgical resection. The presence or absence of a hypertension diagnosis was based on review of the patient's medical records at the time of the neurocognitive assessment. The final sample consisted of 124 breast cancer patients, with 85 presenting with no hypertension or other health comorbidities and 39 with comorbid hypertension. One-way analyses of variance (ANOVA) compared these two groups across four cognitive domains: executive functioning, processing speed, working memory, and learning and memory. Executive functioning was measured by averaging Trails 4, Color-Word Inhibition, and Inhibition/Switching from the Delis–Kaplan Executive Function System (D-KEFS). The Hopkins Verbal Learning Test–Revised (HVLT-R) total and delayed recall were averaged for the learning and memory domain score. Processing speed and working memory were measured by their respective indices from the Wechsler Adult Intelligence Scale-Fourth Edition.
Results: ANOVA results showed that compared to breast cancer patients with no comorbidities, breast cancer patients with hypertension had significantly lower performance scores on executive functioning [$F(1, 119) = 7.448$, $p = .007$] and processing speed [$F(1, 105) = 5.404$, $p = .022$]. No significant differences were observed in working memory and learning and memory scores.
Conclusions: This study has attempted to isolate the association between comorbid hypertension and neurocognitive functioning in pre-treatment breast cancer patients by excluding other comorbidities that may have a confounding effect. Findings indicate that comorbid hypertension is related to lower neurocognitive functioning in women with newly diagnosed breast cancer. Research to identify effects of cancer and its treatment on cognitive functioning should control for effects associated with hypertension, and clinicians should consider hypertension as an indicator to screen for cognitive difficulties. Patients in this study had diagnosed hypertension that was being managed by their medical providers and most reported generally good adherence to the treatment (i.e., taking medications as prescribed); however, future studies should include blood pressure readings as a more direct and objective indicator of controlled versus uncontrolled hypertension, as these factors may impact the association with cognition.
Keywords: breast cancer**,** hypertension**,** cognitive functioning

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14 Effects of Sleep, Fatigue, and Screen Time on Emotional Outcomes in Pediatric Cancer Survivors

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Objective: Sleep duration (SD) and other sleep variables mediate the relationship between screen time (ST) and psychological/behavioral symptoms in healthy children. Among pediatric cancer survivors (PCS), daytime sleepiness is associated with worse neurobehavioral outcomes, but minimal research has examined ST in this population. We examined sleep's effect on ST and emotional outcomes (EO) in PCS, hypothesizing that 1) greater ST predicts poorer EO; 2) fatigue, sleep problems, and decreased SD predicts poorer EO; and 3) fatigue, sleep problems, and SD mediates the relationship between ST and EO.
Participants and Methods: Parents of 66 PCS ages 4-19 years completed the Patient-Reported Outcomes Measurement Information System (PROMIS); Behavior Assessment System for Children, Third Edition (BASC-3); and a modified Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) ST questionnaire. Sleep variables were operationalized using HELENA Daily Hours of Sleep and PROMIS Fatigue, Sleep Disturbances, and Sleep-Related Impairment. EO were operationalized with BASC-3 Anxiety, Behavioral Symptoms Index (BSI), Depression, Externalizing Problems, and Internalizing Problems. Twenty mediation analyses were conducted using the PROCESS macro (Hayes, 2013; PROCESS Model 4) in IBM SPSS Version 26. Results were considered statistically significant at $p < .05$.
Results: No significant direct or total effect of ST on EO emerged supporting Hypothesis 1; however, significant direct effects emerged supporting Hypothesis 2. The direct effects from SD to EOs were externalizing problems (B = -4.244, $p = 0.001$) and BSI (B = -4.172, $p = 0.002$). The direct effects from fatigue to EOs were depression (B = 0.415, $p = 0.011$); internalizing problems (B = 0.463, $p = 0.003$); externalizing problems (B = 0.287, $p = 0.052$); and BSI (B = 0.432, $p = 0.003$). The direct effects from sleep disturbances to EOs were anxiety (B = 0.454, $p = 0.005$); depression (B = 0.565, $p = 0.001$); internalizing problems (B = 0.530, $p = 0.001$); and BSI (B = 0.558, $p < .001$). The direct effect from sleep-related impairment to EOs were depression (B = 0.364, p = 0.036) and BSI (B = 0.402, $p = 0.010$). ST and SD were inversely related (B = -0.248, $p = 0.042$, 95% CI [-.487, -.010]. A statistically significant indirect effect emerged for SD on externalizing problems (β = 0.103, Bootstrap 95% CI [.026, 2.730]) and BSI (β = 0.100, Bootstrap 95% CI [.009, 2.686]). However, because the total effect was non-significant across all models, sleep/fatigue was not further considered as a mediator (Hypothesis 3).
Conclusions: Results did not yield a significant total effect of ST, thus precluding the assessment of a mediation effect; however, previous research establishes a mediation effect of sleep variables on ST and EO. Thus, indirect effects of SD on externalizing problems and BSI have theoretical basis. ST and SD were inversely related. Sleep disturbances and fatigue reports accurately predicted all five EO variables, more than SD. Clinicians should consider prioritizing assessment of sleep disturbances and fatigue over SD to facilitate more accurate predictions of EO. Limitations and future directions discussed.
Keywords: sleep, technology, adolescence
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15 Neurocognitive Outcomes and White Matter Microstructure Following Proton Radiotherapy for Pediatric Brain Tumors

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Objective: Emerging research in patients treated with proton radiotherapy (PRT) for pediatric brain tumors suggests reduced neurocognitive risk compared to conventional photon radiotherapy. However, less is known about the potential impacts of PRT on brain tissue, including white matter microstructure. The current study examined neurocognitive outcomes and white matter structural integrity in pediatric brain tumor survivors who received PRT versus matched healthy controls.
Participants and Methods: Twenty-one pediatric brain tumor survivors (mean age = 16.5 years, mean 8.4 years post-diagnosis) who received PRT (15 focal, 6 craniospinal) and 13 healthy controls (mean age = 17.2 years) completed neurocognitive testing measuring IQ, visuomotor integration, and sustained attention. Participants also underwent MRI, including diffusion tensor imaging (DTI) sequences. Fractional anisotropy, mean diffusivity, axial diffusivity, and radial diffusivity were calculated for the right and left uncinate fasciculi, cingulum bundles, and frontal lobe white matter, using region-of-interest-based diffusion tractography. Notably, these tracts contained normal appearing white matter and were not affected by tumor growth or displacement.
Results: PRT focal, PRT craniospinal, and healthy control groups did not significantly differ on any demographic variables. Focal PRT survivors evidenced a significantly different response style from healthy controls (Mean 57.5 v 47; p=.03) but did not differ in any other neurocognitive or DTI metric compared to healthy controls. Craniospinal PRT survivors had weaker motor coordination (Mean 79.6 v 90.5; p=.04) and processing speed (Mean 82.8 v 98.8; p=.04) and more variability in sustained attention (Mean 52.8 v 45.2; p=.01) compared to healthy controls. However, there were no significant differences after adjusting for multiple hypothesis testing (adj P>0.99). No differences between groups were observed on other neurocognitive domains or DTI metrics.
Conclusions: Consistent with previous literature, survivors of pediatric brain tumors treated with focal PRT in this sample did not significantly differ from healthy controls in cognitive function. Survivors treated with craniospinal PRT evidenced more areas of cognitive risk but did not show the global impairment seen historically with photon whole brain radiotherapy. Notably, no significant differences in DTI metrics were observed for either PRT group compared with healthy controls. Further research with larger samples is necessary to determine more definitively whether PRT preserves white matter microstructure and whether this underlies the likely neurocognitive sparing benefit of PRT over photon radiotherapy in the treatment of pediatric brain tumors.
Keywords: brain tumor**,** pediatric neuropsychology**,** neuroimaging: structural

16 Effects of Sleep, Fatigue, and Screen Time on Attentional Functioning in Pediatric Cancer Survivors

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Objective: Frequent screen time (ST) during cancer treatment may foster long-term habits that could exacerbate late effects among pediatric cancer survivors, given existing research on ST and cognitive functioning in healthy populations. The present study was the first to examine ST and related sleep/fatigue effects on attentional deficits among pediatric cancer survivors. We hypothesized 1) greater ST would predict poorer attentional functioning; 2) lower sleep duration, poor sleep quality, and/or greater fatigue would predict poorer attentional functioning; and 3) sleep and/or

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fatigue would mediate the relationship between ST and attentional functioning.
Participants and Methods: Sixty-six pediatric cancer survivors (M=11.35 years) completed the most current version of the Conners Continuous Performance Test (CPT) indicated for their age. Parents completed the Behavior Assessment System for Children, Third Edition (BASC-3); the Patient-Reported Outcomes Measurement Information System (PROMIS) for sleep and fatigue; and a modified version of the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) ST questionnaire. HELENA Daily ST Hours was the predictor variable. Mediating sleep variables were HELENA Daily Hours of Sleep and PROMIS Fatigue, Sleep Disturbances, and Sleep-Related Impairment. Attentional functioning variables were CPT Omissions & Commissions and BASC-3 Hyperactivity & Attention Problems. Sixteen simple mediation analyses were conducted with 95% bootstrap confidence interval and significance at $p<.05$.
Results: Direct effects of ST on Omissions were mediated by Fatigue (B=-3.227, p=.023), Sleep Disturbances (B=-3.096, p=.041), and Sleep-Related Impairment (B=-3.213, p=.037). However, no significant direct effects of ST on other attentional outcomes were observed, partially supporting Hypothesis 1. Regarding Hypothesis 2, Fatigue had direct effects on Omissions (B=.520, p=.002) and Commissions (B=-.264, p=.012). Additionally, Sleep-Related Impairment had a direct effect on Commissions (B=-.261, p=.020). Daily Hours of Sleep had direct effects on both Hyperactivity (B=-3.368, p=.019) and Attention Problems (B=-3.360, p=.010). Finally, Sleep Disturbances had a direct effect on Hyperactivity (B=.364, p=.031) and Attention Problems (B=.354, p=.021). A significant total effect was only observed in the relationship between Daily ST Hours and Omissions (B=-2.972, p=.048); however, there was no indirect effect. Significant indirect effects were observed for Hours of Sleep on Hyperactivity (b=.074, Bootstrap 95% CI [.000, .185]) and Attention Problems (b=.081, Bootstrap 95% CI [.002, .179]), of which the total effects were insignificant. Thus, we could not assume a mediating effect of sleep or fatigue (Hypothesis 3).
Conclusions: Fewer daily hours of sleep and more sleep disturbances predicted worse parent-reported attentional functioning. Greater ST and greater fatigue predicted worse performance-based (CPT) inattentiveness but not parent-reported attentional functioning. This discrepancy suggests that parent reports may not always accurately identify attention problems in pediatric cancer survivors who engage in high levels of ST. Clinicians should inquire about ST when seeing pediatric cancer survivors, as reports of excessive ST might indicate a need for performance-based neuropsychological screening of attentional functioning. Limitations and future directions are discussed.
Keywords: attention, technology, adolescence

17 Rating Scales and Performance-based Measures of Executive Function in Pediatric Oncology Survivors Across Time

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Objective: Cancer-directed therapies result in functional deficits in white matter-related skills, such as executive functions (EF). The Behavior Rating Inventory of Executive Function (BRIEF) is one efficient way to assess the application of EF. While some research has found that rating scales may be associated with performance-based measures of EF, other work suggests that ratings and performance-based measures appear to be separable and assess different constructs. Given the importance of assessing EF in pediatric oncology survivors, this study aimed to describe EF and working memory (WM) in pediatric oncology survivors; examine change in EF and WM across time; and assess the relationship between EF ratings and performance-based measures of working memory (PBWM). It was hypothesized that PBWM will decline across time, rating scales would remain fairly stable across time, and performance-based measures will not correlate with rating scales.
Participants and Methods: Data were acquired from retrospective chart review of 61 youth with

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a history of brain tumor (33) or Acute Lymphoblastic Leukemia (28) referred for neuropsychological evaluation at an academic medical center. Eligible participants were ≤ 18 years at time of diagnosis and had the same BRIEF/2 version at both time points. A composite score was calculated for BRIEF/2 index scores consistent across both versions [Global Executive Composite (GEC), Behavior Regulation Index (BRI), and Cognitive Regulation Index (CRI)/Metacognitive Index(MI)]. PBWM was measured via the Wechsler Digit Span Backwards or DAS-II Recall of Digits Backwards.
Results: Participants (Time 1 Mage=10.15, SD=3.28) were initially assessed on average 3.10 years from diagnosis (SD 2.44), with 1.99 years (SD 0.93) between the evaluation time points. Parent ratings of EF initially were significantly higher (i.e., worse) than the normative mean on CRI/MI (M=55.34; p=.004) and GEC (M=54.90; p=.011), but not BRI (M=52.11; p>.05). PBWM was Average at time 1 [M=9.33] and did not differ from the normative mean (p>.05). At time 2, ratings on GEC (M=57.31; p<.001) and MI/CRI (M=58.51; p<.001) remained significantly above the normative mean. BRI was statistically (M=53.00; p=.03) but not clinically significant. PBWM was lower than expected at Time 2 and statistically significant. (M=7.77; p<.001). Repeated-measures ANOVA showed significant change over time in GEC [F(1,60)=4.57, p=.037], CRI/MI [F(1,60)=6.159, p=.016], and BRI [F(1,60)=1.75, p<.001], such that parents reported more concerns at time 2. While statistically significant, mean scores remained below the clinical threshold (i.e., T=65). PBWM also showed change, with worse performance at time 2 [F(1,60)=16.29, p<.001]. In this sample, PBWM was not correlated with the BRIEF/2 WM subscale at time 1 (r=-.17, p=.18) or time 2 (r=-.13, p=.32).
Conclusions: As expected, both ratings and performance measures of EF worsened over time; differing assessment methods for WM were not correlated. While rating scales have utility in a clinical setting due to ease of administration and speed of completion, results add to existing evidence suggesting that multiple measures of EF should be considered as they measure different constructs. This may be especially critical when providing diagnoses and recommendations to support children's development following treatment for cancer.
Keywords: executive functions

18 Effect of Treatment Type and Cancer Stage on Cortical Gray Matter in Breast Cancer Patients

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Objective: Chemotherapy and hormone therapy are two common adjuvant therapies used in the treatment of breast cancer. Hormone therapy is used to curb tumor growth in hormone-receptor positive breast cancers, while chemotherapy utilizes antineoplastic drugs to inhibit the uncontrolled proliferation of cancer cells. There is growing evidence that chemotherapy is associated with cortical thinning. However, these studies often include patients who have undergone both chemotherapy and hormone therapy, making it unclear to what extent chemotherapy contributes to the observed thinning as opposed to combined effects with hormone therapy. The current study examines differences in cortical thickness between breast cancer patients undergoing chemotherapy alone compared to patients undergoing solely hormone therapy.
Participants and Methods: Structural MR imaging was obtained on a 3T MRI scanner for 27 breast cancer patients who were undergoing hormone therapy without a history of chemotherapy and 16 age-matched breast cancer patients undergoing chemotherapy without a history of hormone therapy. Groups differed by race and participants were scanned on both Trio and Prisma platforms. As such,

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scanner type and race were used as covariates in subsequent analyses. Groups also differed by cancer stage, which was included as a covariate in a second analysis. FreeSurfer was used to process the T1-weighted scans using the Desikan-Killiany atlas parcellation and surface-based cortical thickness estimates were calculated. Smoothing was performed using a 15 mm Gaussian kernel. Groups were compared using two GLMs and multiple comparison correction was done by utilizing the Monte Carlo Null-Z simulation with a vertex-wise cluster threshold of 1.3.
Results: Relative to the hormone therapy patients, the chemotherapy patients had a decreased cortical thickness in the left hemisphere fusiform ($p<0.001$), lateral orbitofrontal ($p<0.001$), superior frontal ($p<0.001$), precentral ($p<0.001$), and precuneus ($p=0.03$) as well as right hemisphere caudal middle frontal ($p=0.03$) and banks of the superior temporal sulcus ($p<0.001$). After controlling for cancer stage, the chemotherapy patients had a decreased cortical thickness in the left hemisphere fusiform ($p<0.001$) and lateral orbitofrontal ($p<0.001$) as well as right hemisphere banks of the superior temporal sulcus ($p=0.001$) in comparison to hormone therapy patients.
Conclusions: Current findings are consistent with studies indicating chemotherapy-related cortical thinning given patients undergoing hormone therapy alone demonstrated greater thickness compared to those with a history of chemotherapy. After adjusting for cancer severity, the left hemisphere precentral and precuneus as well as the right hemisphere caudal middle frontal were no longer significant, suggesting that these regions are uniquely linked to cancer disease processes or other features such as treatment intensity or psychological factors. Findings in the left hemisphere fusiform and lateral orbitofrontal as well as right hemisphere banks of the superior temporal sulcus persisted after controlling for cancer stage, suggesting the differences are driven by treatment. Identifying the ways in which adjuvant therapies differ in their effects on brain structure in breast cancer patients is important for understanding neurologic complaints and developing treatments to improve patient quality of life.

Keywords: neuroimaging: structural**,** breast cancer**,** chemotherapy
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19 A Culturally Sensitive Look at Neuropsychological Late Effects in a Case Study of Glioblastoma Multiforme

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Objective: The attention on childhood cancer by the research community has grown exponentially over the last five decades (Robinson & Hudson, 2014). With research attention growing rapidly, cure rates have increased just as dramatically, with survivorship well over 80% (Ward, et al., 2014). With survivorship on the rise, research has turned to the examination of late effects of survivors of childhood cancer, especially neuropsychological late effects (Krull, et al., 2018). Research shows that pediatric cancer diagnoses most commonly impact non-Hispanic white individuals (Gray, et al., 2018). In turn, the study of late effects has therefore been disproportionately skewed to the perspective of non-Hispanic white survivors. This case study aims to provide a unique viewpoint of neuropsychological late effects of a relatively rare type of pediatric cancer through the lens of a Hispanic survivor. This presentation will take a culturally sensitive approach toward examining treatment and late effects.
Participants and Methods: This individual case study was taken conducted at a cancer treatment center in Southern California within a larger children's hospital. The patient was diagnosed with Glioblastoma Multiforme, an aggressive brain tumor which forms on astrocytes, after presenting to the Emergency Department (ED) with emotional dysregulation and head tilting. The patient was later diagnosed with Glioblastoma Multiforme. During treatment, the patient developed Diabetes Insipidus, which further complicated treatment and potentially

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interfered with neuropsychological development. Neuropsychological functioning was assessed at three time points: at the time of diagnosis, immediately following treatment, and seven years post completion of treatment. The neuropsychological battery included assessment of overall cognitive and intellectual functioning, memory, attention, executive functioning, academic functioning, language abilities, visual-motor skills, sensory and perceptual abilities, and psychological functioning.
Neuropsychological examination results were reviewed by the pediatric oncology neuropsychology team.
Results: Baseline neuropsychological examination revealed that the patient was behind his age-matched peers. At baseline assessment, specific areas for concern included fine and gross motor functioning, expressive and receptive language abilities, and overall cognitive abilities. Neuropsychological assessment at the second time interval revealed an extremely low overall cognitive ability, with noted difficulties in the areas of expressive and receptive language, visual-spatial abilities, and fine motor control. It should be noted that at this instance, emotional control and cognitive flexibility appear to have recovered, placing in an average range compared to age-matched peers. Additionally, behavioral difficulties appear to have also resolved at this time point. The most recent neuropsychological assessment findings revealed global decline. All domains assessed were exceptionally low, including overall cognitive functioning, memory, attention, executive functioning, academic abilities, language functioning, visual-motor abilities, and perceptual abilities.
Conclusions: This case presentation will include assessment considerations such as the socially responsible neuropsychology model (Suarez, et. al., 2016) given the importance of providing equitable assessment services to bilingual and culturally diverse patients. Clinical presentations common to Glioblastoma Multiforme will be addressed and the functional impact related to the neuroanatomical regions of the brain. Finally, treatment recommendations unique to Glioblastoma Multiforme complicated by postoperative Diabetes Insipidus for pediatric bilingual patients in Spanish and English will also be included.

Keywords: cancer, minority issues, language
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20 The Benefit of Assessing Implicit Sequence Learning in Pianists with an Eye-Tracked Serial Reaction Time Task

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Objective: Playing piano professionally has been shown to benefit implicit motor sequence learning. The aim of the current study was to determine whether this advantage reflects generally enhanced implicit sequence learning unrelated to pianists' higher motor and/or visual-motor coordination abilities.
Participants and Methods:
We examined implicit sequence learning using the ocular serial reaction time (O-SRT) task, a manual-free eye-tracked version of the standard SRT, in 29 pianists and 31 controls. Reaction times (RT) and correct anticipations (CA) of several phases describing implicit sequence learning were analyzed. Furthermore, explicit sequence knowledge was compared between the groups, and relationships between implicit sequence learning with explicit sequence knowledge or demographic measures were evaluated.
Results: Pianists demonstrated superiority in all critical phases of implicit sequence learning (RT and CA). Furthermore, pianists acquired higher explicit sequence knowledge, and only in pianists was explicit sequence knowledge related to implicit sequence learning. Our results demonstrate that pianists' superiority in implicit sequence learning is due to a higher general implicit sequence learning ability.
Conclusions: Hence, we can exclude that higher motor and/or visual-motor coordination abilities are related to pianists' higher implicit sequence learning. Furthermore, the significant relationship of implicit sequence learning and

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explicit sequence knowledge suggests that pianists either used explicit strategies to support implicit sequence learning, had better explicit access to sequence knowledge, or both.
Keywords: learning, memory: implicit, motor speed

21 Exploring the Effects of Virtual Reality Game Play on Cognitive Performance

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Objective: Interest in the effects of video game play on cognitive performance has continued to increase over the last several decades. Current literature focuses on traditional gaming platforms (e.g., PC games, and gaming consoles) and has found evidence that suggests that individuals who play action video games demonstrate an increase in cognitive performance. Recently, more advanced and immersive technology has been gaining popularity in the gaming community. This study explored the effects of advanced game play, using immersive virtual reality (VR) on cognitive performance. We hypothesize that those who played VR will demonstrate an increase in cognitive performance (i.e., attention, memory and processing speed) compared to baseline.
Participants and Methods: Twenty-four heathy participants (70.8% female, 19-55 [M = 24.75, SD = 7.80] years of age) were recruited for this study. Participants were randomly assigned into one of two arms: non-intervention control (CTL; n=12) or VR (n=12). Participants in the VR intervention underwent a baseline assessment, prior to the start of their game training (play), followed by 8-hours of game training over the course of 3 weeks (3 hours/week). Twenty-four hours following their final training session, participants underwent a post-intervention assessment. Participants in the CTL arm underwent baseline and post-assessments at similar timepoints to the VR group, but did not receive any intervention. A tablet-based neurocognitive assessment was used for both baseline and post-assessments, with alternative versions utilized when available to minimize practice effects.
Results: Baseline versus post-intervention performances, and neurocognitive assessments were assessed using Wilcoxon sign-ranked tests. Following 8-hours of game training, participants in the VR arm demonstrated significant 6.92-point Age-Corrected Standard Score (SS) improvement in memory ($Z = 2.57$, $p = 0.01$, $r = 0.74$), a 7.34-point SS improvement in attention ($Z = 2.69$, $p = 0.007$, $r = 0.78$), and a 14-point SS improvement in processing speed ($Z = 2.43$, $p = 0.02$, $r = 0.70$) from baseline SS scores. All other SS scores were not significant. Additionally, participants in the CTL arm demonstrated a significant 10.34-point SS increase in processing speed ($Z = 22.26$, $p = 0.02$, $r = 0.65$) from baseline.
Conclusions: Results suggest that playing 8-hours of video games using VR technology improve cognitive performance. These results are consistent with previous gaming literature research and expand our understanding of game play to a more advanced technology. Participants who engaged in 8-hours of game play with a VR platform demonstrated improved neurocognitive performances in memory, attention, and processing speed compared to their pre-intervention scores. Additionally, effect sizes for said findings ranged between medium and large. However, the significant improvement in processing speed for CTL suggests a potential limitation involving practice effects in this particular measurement tool. Therefore, the processing speed outcome for the iVR arm should be interpreted with caution.
Keywords: cognitive functioning

22 The Neural Correlates of Psychological Well-being

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Objective: The objective of this work was to investigate the neural correlates of psychological well-being. Psychological well-being is a complex construct but can be operationalized along six domains: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. These dimensions can also be combined to

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examine total psychological well-being. The current work used a neuropsychological lesion method approach to examine if there is a relationship between the location of brain damage and well-being.
Participants and Methods: Eighty-six participants with stable, focal brain damage were recruited from the Iowa Neurological Patient Registry (49% female; age: M=58.79 [SD=13.66] years). All participants completed a series of self-report questionnaires, including a comprehensive demographics survey, a measure of positive and negative affect, a measure of psychological well-being, and a measure of daily functioning. In addition, all participants previously underwent neuroimaging and neuropsychological testing. Lesion behavior mapping and proportional subtraction analytic methods were used to examine the relationship between lesion location and the various domains of psychological well-being. All analyses were conducted on the full sample of participants and also on a subsample of participants, excluding individuals with an epilepsy lesion etiology.
Results: Lesion behavior mapping analyses revealed no significant relationship between any domain of well-being and lesion location at the voxel level in the full sample. When excluding for epilepsy, however, a significant relationship between lesion location and positive relations with others and purpose in life, respectively, emerged. Specifically, relationships between damage to the right medial prefrontal cortex and higher levels of positive relations with others and purpose in life were evident. Additional relationships between damage to the right dorsolateral prefrontal cortex and bilateral frontoparietal deep white matter and lower levels of purpose in life also emerged. Proportional subtraction maps further clarified these findings, showing that proportionally more individuals with high levels of well-being had brain damage in the right medial prefrontal cortex. Results were more diffuse for those with low levels of psychological well-being.
Conclusions: The current results significantly contribute to the neuroscience of psychological well-being. Results from this study suggest that the relationship between the brain and psychological well-being is complex and that psychological well-being cannot be easily reduced to neural correlates. The most notable finding, however, showed that damage to the medial prefrontal cortex is related to higher levels of psychological well-being, particularly positive relations with others and purpose in life. This finding is in line with past work and provides new insight into our understanding of the brain - well-being relationship.
Keywords: cognitive neuroscience
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24 Findings from the Italian survey for monitoring the state of the art of advanced neuroscientific research post COVID-19

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Objective: This project was devised for evaluating and highlighting the impact of COVID-19 on the management of basic and clinical research activities conducted by the Italian laboratories of neuroscience, neurophysiology, and clinical neuropsychology during the pandemic and post-emergency phases.
Participants and Methods: A total of 254 laboratories/units have been mapped on the Italian territory and clustered based on location, primary research field, and category of institution. A survey was designed including five different sections: i) consensus and introduction; ii) general data con the institution and the respondent and pre-pandemic phase; iii) research activity during Phase 1 – first lockdown (from February to May 2020); iv) research

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activity during Phase 2 – second lockdown (October 2020 to May 2021); and v) summary evaluations of the pandemic period (overall considerations regarding both Phase 1 and Phase 2). The survey was implemented on the Qualtrics XM platform and sent to the mapped centers and disseminated through the main Italian neuropsychological scientific societies.
Results: Focusing on the sample of survey respondents, which almost equally represented primarily healthcare/clinical research professionals (53%) and primarily basic research professionals (47%), it is relevant to note that just about one-fourth of them reported the existence of emergency management guidelines to help strategic decision-making and inform the rearrangement of lab/unit activities in case of a disease outbreak, a percentage that has grown up to 94% after the COVID-19 emergency. This led to a closure rate equal to 92% for purely research laboratories/units during Phase 1, compared to 52% of mixed clinical and research units and 60% of primarily clinical units. A similar –though more restrained– scenario was observed even in Phase 2, with 44% of purely research units still closed, vs. 5% of mixed units and 10% or primarily clinical ones. Another impactful observation emerging from the survey is that, while the number of submitted research articles during phase1 and 2 was almost comparable to a previous reference period (year 2019), the investigated research and clinical institutions reported a remarkable decrease of 23% for planned and submitted projects, a percentage that reaches -40% in mixed clinical-research units.
Conclusions: We suggest that such loss of research projects in the field of basic, clinical, and applied neurosciences, of their potential outcomes in terms of novel theoretical models and technological/methodological progress, as well as of potential by-side discoveries might show its potentially detrimental effects in the next few years. Defining guidelines and new best practices for efficient and sustainable management of these necessary activities in the short and long term is a current critical challenge and might help containing the cost of their interruption on healthcare for the population and on individual/social well-being.
Keywords: neurophysiology**,** cognitive neuroscience**,** assessment

25 How Mindfulness Impacts Response Inhibition and Perception of Affective Words

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Objective: Long-term mindfulness practice decreases reactivity (e.g., enhances response inhibition and diminishes the impact of negative images). Similarly, increased mindfulness disposition (regardless of training) diminishes the accessibility of negative-word meanings. However, the influence of brief mindfulness inductions on response inhibition and perception of affective words remains unexplored. We expected a 15-minute focused-breathing induction to increase the accuracy of inhibitory control and diminish negativity in negative-word ratings, but not positive nor neutral ratings.
Participants and Methods: *Pilot 1*
Eighty students were randomly assigned to the mindfulness group (MG; n = 46; M_{age} = 19.54, SD = 2.21; 69.6% female) or the control group (CG; n = 34; M_{age} = 19.76, SD = 1.92; 74.5% female); no significant differences in demographics. MG listened to Kabat-Zinn's focused-breathing meditation (modified), while CG chose their relaxation technique.
Two outcomes of response inhibition (Go/NoGo accuracy and Simon Effect) and one outcome of affective-word perception (average valance ratings for positive, neutral, and negative words) were examined. Entirely online, participants provided demographic information, general affect (PANAS), and completed the tasks (Go/NoGo, Simon, and word-rating task; administered randomly) before and after the 15-minute intervention. Lastly, participants provided state (TMS) and trait (FFMQ) mindfulness, and previous mindfulness exposure.
Pilot 2
Preliminary analysis showed 77 students randomly assigned to MG (n = 41; M_{age} = 20.02 yrs, SD = 2.85; 69.5% female) or CG (n = 36; M_{age} = 19.72 yrs, SD = 2.26; 80.6% female); no significant differences in demographics. With respect to Pilot 1, the intervention was extended by 15-minutes, and trait and state mindfulness

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assessments were administered twice (before and after the intervention).
Results: *Pilot 1*
There were no between-group differences in general affective, trait mindfulness, nor state mindfulness Curiosity subscale (p's > .05). However, there were significant differences on state mindfulness Decentering subscale, $F(1, 77) = 4.14$, $p = .05$, $\eta^2 = .05$. Response inhibition outcomes had no significant differences in Go/NoGo accuracy nor Simon Effect (p's > .05). Affective perception outcomes revealed no significant differences for negative, neutral, nor positive word ratings (p's > .05).
Pilot 2
Preliminary results reveal insignificant group differences in general affect, trait, and state mindfulness (p's > .05). Response inhibition outcomes revealed no significant differences in Go/NoGo accuracy nor Simon Effect (p's > .05). Affective perception outcomes showed no significant differences for negative nor positive word ratings (p's > .05). However, significant between-group differences emerged for neutral word ratings, $F(1, 21) = 4.67$, $p = .04$, $\eta_p^2 = .18$.
Conclusions: While the behavioral effects of mindfulness on response inhibition and perception of affective words are unimpactful in the current study, do not dismiss them entirely. The main limitation faced was poor participant data quality resulting in a large percentage of discarded cases (e.g., non-genuine responses on self-reports, no response on tasks; Pilot 1 = 36.7%; Pilot 2 = 31.5%); potentially due to online data collection during the pandemic. Further research should consider increased control of administration.
Keywords: cognitive functioning**,** affective processing (normal)**,** computerized neuropsychological testing

26 Rostral Anterior Cingulate Connectivity in Older Adults with Subthreshold Depressive Symptoms

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Objective: Subthreshold depressive symptoms are highly prevalent among older adults and are associated with numerous health risks including cognitive decline and decreased physical health. One brain region central to neuroanatomical models of depressive disorders is the anterior cingulate cortex (ACC). The rostral portion of the ACC—comprised of pregenual ACC and subgenual ACC—is implicated in emotion control and reward processing. The goal of the current study was to examine how resting state functional connectivity in subregions of the rostral ACC relate to subthreshold depressive symptoms in a sample of sedentary community-dwelling older adults.
Participants and Methods: Twenty-eight healthy older adults (aged 60 to 83) completed the Beck Depression Inventory-Second Edition (BDI-II) and underwent functional magnetic resonance imaging at 3T. Seed-based functional connectivity analyses were conducted in AFNI. A 5mm radius sphere was used to extract an average seed time course from midline pregenual and subgenual ACC and was cross-correlated with the time courses of all other voxels in the brain. Cross-correlation values were normalized using the Fisher z-transform, termed Z(CC). Static functional connectivity was conducted by regressing BDI-II scores on Z(CC) to create brain-behavior regression maps. These were thresholded at $r^2 = 0.13$ and clusterized at 20 contiguous voxels.
Results: We found that, as a function of higher depressive symptom severity, the pregenual ACC showed more functional connectivity to some regions of the default mode network (e.g., medial temporal pole, superior and inferior temporal gyri, and angular gyrus) and less functional connectivity to other regions of the default mode network (e.g., middle cingulate cortex, posterior cingulate, multiple subregions of the prefrontal cortex, and angular gyrus). For subgenual ACC, there was a general pattern of less functional connectivity to the default mode network, most notably to dorsolateral prefrontal cortex, for participants with greater subthreshold depressive symptoms.
Conclusions: The current study demonstrates that subthreshold depressive symptoms in older adults are associated with altered rostral ACC connectivity as a function of depressive symptom severity. This pattern of functional

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connectivity in an older adult sample with subthreshold depressive symptoms mirrors the overall pattern across existing studies in primarily younger samples with major depression. Additional research is warranted to focus on how traditional depression treatments and positive modifiers of brain health (e.g., exercise, sleep, diet) can alter ACC functional connectivity and depressive symptoms.
Keywords: anterior cingulate**,** depression**,** aging (normal)
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27 The Effects of Mindfulness on Cognitive Flexibility and Emotion Perception

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Objective: Research evidence suggests that mindfulness influences executive function and emotional perception. Furthermore, mindfulness interventions and mindfulness disposition have been found to have differential effects on these processes. However, the impact of mindfulness disposition on cognitive flexibility and emotional perception, as well as the relationship between mindfulness disposition and alexithymia remain unexplored. We expected higher mindfulness dispositions to display enhanced cognitive flexibility, diminish the negativity of negative word ratings, and predict lower levels of alexithymia.
Participants and Methods: Eighty-seven university students provided data online. Groups were defined using a median split of the Five Facet Mindfulness Questionnaire (FFMQ; M = 122.93, SD = 12.77, Mdn = 122): low mindfulness disposition group (LMG; FFMQ ≤ 122; n = 44; Mage = 19.64, SD = 2.01; 77.3% female) and the high mindfulness disposition group (HMG; FFMQ ≥ 123; n = 43; Mage = 19.91 (SD =2.21; 67.4% female). There were no significant group differences in demographics. Outcomes of cognitive flexibility included percent rule perseveration on a card-sorting task (WCST), while outcomes of emotion perception (WRT) involved average valence ratings for affective word categories (negative, neutral, and positive) and a measurement of alexithymia (TAS20). Data was collected in tandem with a larger project. Participants were assessed on demographic information, mindfulness disposition, levels of alexithymia, and completed the tasks (WCST and WRT) online.
Results: Analysis of cognitive flexibility revealed no significant group differences in percent rule perseveration on the WCST, $F(1, 85) = 1.04$, $p = .31$. Furthermore, no group differences emerged for negative, $F(1, 85) = .71$, $p = .40$, neutral, $F(1, 85) = 3.18$, $p = .08$, or positive affective word ratings, $F(1, 85) = 3.16$, $p = .08$. However, mindfulness disposition levels significantly predicted alexithymia levels, $F(1, 85) = 14.06$, $p = <.001$, $R2 = .14$, with an inverse relationship ($t = -3.75$, $p = < .001$).
Conclusions: While current results of the effect of mindfulness disposition on cognitive flexibility and emotion perception reveal some unimpactful findings, we successfully predicted alexithymia levels from mindfulness disposition levels. It's unsurprising that individuals with higher levels of mindfulness disposition are more keen at identifying and understanding their emotions. A notable limitation was poor participant data quality; 61.3% of the initial sample was excluded for inadequate data (e.g., non-genuine self-report, no response on task). Further research should increase administration control to amplify these effects.
Keywords: executive functions**,** affective processing (normal)**,** computerized neuropsychological testing
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28 Shared Neural Mechanisms of Response Inhibition Across Commonly Used Tasks: A GingerALE Meta-Analysis of fMRI Studies in Healthy Adults

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Objective: Response inhibition allows individuals to suppress habitual or prepotent behaviors in the face of changing environmental demands. This domain of executive function has been widely studied in healthy and clinical populations using both neuropsychological tests and experimental paradigms in fMRI experiments. Neuroanatomical regions of interest (ROI) that are often activated during these tasks include the anterior cingulate cortex, inferior parietal lobule, inferior frontal gyrus, and dorsolateral prefrontal cortex. To better understand the regional activation shared across tasks, we used a meta-analytic approach to investigate ROI activations across commonly used response inhibition paradigms. We hypothesized that the above-mentioned ROIs will be activated in a pooled analysis across tasks.
Participants and Methods: Following PRISMA guidelines, we used a standardized set of search terms querying PubMed, Embase, and Scopus databases, yielding 3,498 possible studies. After screening for duplicates, irrelevant articles, and studies that did not meet inclusion criteria, 71 studies remained (*n*=1,401 participants), comprised of the following tasks: Go/No-Go (*k*=21), Stop-Signal (*k*=15), Stroop (*k*=12), Anti-Saccade (*k*=10), Flanker (*k*=8), and Simon Task (*k*=5). We used BrainMap GingerALE 2.3 to complete the meta-analysis, yielding an activation likelihood estimate based on sample sizes and standardized coordinates for each study. All studies were pooled together to study the shared ROI activations. We then performed random effects modeling to look for ROI agreement across experiment groups. Coordinates are given as X, Y, Z in MNI space with 998 ROI activations included in the model, alpha = 0.01, with 5,000 threshold permutations and family-wise error corrections applied.
Results: We identified four significant clusters: right dorsolateral prefrontal cortex (40, 43, 26; 39,976 mm^3 voxels), left insula (-36, 20, -6; 26,888 mm^3 voxels), right premotor/supplementary motor (2, 14, 48; 19,704 mm^3 voxels), and right supramarginal gyrus (50, -42, 34)/right angular gyrus (46, -45, 38; 11,152 mm^3 voxels).
Conclusions: Consistent with our hypothesis, the right dorsolateral prefrontal cortex was identified as an important region associated with inhibition and was consistently activated across all six tests. Other areas activated included the right supramarginal gyrus/right angular gyrus, located in the inferior parietal gyrus, which is consistent with prior fMRI studies. We also found activation of premotor/supplementary motor cortex, which has role in inhibiting the motor response. In contrast to other studies, we did not find activation of anterior or middle cingulate cortex. Finally, activation of the insula may be due to the role of this region in detection of novel stimuli, which is a crucial component of successful inhibition on these tests of executive functioning. This study represents the first attempt to use a meta-analytic approach to identifying shared neural mechanisms of response inhibition across widely used cognitive tasks.
Keywords: neuroimaging: functional**,** inhibitory control**,** executive functions

29 Role of Occupation on Cognitive Outcomes Across Sex/Gender by Racial/Ethnic Groups

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Objective: Associations between occupation and late-life cognitive outcomes have been widely reported. This study examines whether occupational status differentially contributes to cognitive reserve (CR) across sex/gender and racial/ethnic groups.
Participants and Methods: The cohort comprised 1525 participants who self-identified as non-Hispanic White (White, N=409), Non-Hispanic Black (Black, N=540), and Latinx (N=576) men and women in the Washington/Hamilton Heights/Inwood Columbia Aging Project, aged 65 years and older and without dementia at baseline. Neuropsychological tests were administered at baseline and every 18–24 months for up to 24 years. The average time in the study from baseline assessment was 6.64 years.

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White (67% women), Black (67% women), and Latinx (56% women) participants in WHICAP completed an occupation questionnaire and structural magnetic resonance imaging (MRI). The average time from baseline to when neuroimaging data were collected was 3.86 years. Participants indicated the occupation they had for most of their life, which was then classified into 3 categories: Low (e.g., unskilled worker), Medium (e.g., office worker), and High (e.g., business manager). Latent growth curve modeling estimated memory level (memory at time of scan) and memory decline (rate of memory decline throughout the study). Multiple group latent growth curve models were used to estimate memory trajectories and determine the relationship between occupation status, indicators of brain integrity (i.e., neuroimaging markers of hippocampal volume, cortical thickness, or white matter hyperintensity [WMH] volume) and memory trajectories, across sex/gender by racial/ethnic groups.
Results: Interactions between high occupational status and hippocampal volume were present for Black women (β= -0.259 95% CI [-0.497, -0.021]) on memory level. Interactions on memory decline were found in White women (β= -0.407 95% CI [-0.771, -0.042]), White men (β= 1.01 95% CI [0.14, 1.88]), and Latinx women (β= -0.469 95% CI [-0.828, -0.111]). The relationship between hippocampal volume and memory outcomes was weaker among those with high occupational status than among those with low occupational status.
An occupational status by cortical thickness interaction was also present for Latinx Women (β= 0.292 95% CI [0.05, 0.535]), whereby higher occupational status buffered the negative impact of cortical thickness on memory level.
Interactions on memory decline were found in White men (β= -0.91 95% CI [-1.3, -0.42]) and Latinx Women (β= 0.658 95% CI [0.369, 0.947]). Higher occupational status also buffered the negative impact of WMH on memory level for Black women (β= 0.197 95% CI [0.041, 0.354]) and Latinx women (β= 0.376 95% CI [0.229, 0.524]). Interactions on memory decline were found for White men (β= 1.21 95% CI [0.14, 2.27]) and Black women (β= 0.282 95% CI [0.08, 0.485]), but not for other groups.
Conclusions: Occupational complexity contributed to CR, suggesting an association between higher skilled employment and later-life cognition, but did so differently across sex/gender and racial/ethnic groups. Examining the variability in sex/gender and racial/ethnic groups may provide a more accurate understanding of the life course factors that contribute to CR.
Keywords: cognitive reserve**,** activities of daily living**,** neuroimaging: structural
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30 Alterations of Attention, Memory, and Executive Functioning in Children With History of Child Abuse.

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Objective: Child abuse has negative implications for the nervous system development, and it´s associated to poor social interactions and a lack of cognitive stimulation; all these factors altering the consolidation of processes such as attention, memory, and executive functioning. Also, these processes are important in school age because have an impact on academic performance, as well as on social and emotional development of children. The purpose of this study was to evaluate attention, memory, and executive functions (inhibition, cognitive flexibility and working memory) in children who are under the protection of a foster home due to the existence of previous history of child abuse.
Participants and Methods: Participated 11 children schooled, 3 male and 8 female, aged 8 to 12 years with a history of child abuse in any of its types (physical, psychological, sexual or negligence). All of them are currently under the protection of a shelter. The shelter´s principal approved the study in reason that he is the legal

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responsible of children. The children were identified through the institution's files, and they were invited to participate in the study, and who accepted join it gave their assent for written. Evaluation included a complete neuropsychological evaluation (Infant Neuropsychological Evaluation battery, Matute et al., 2007). Additionally, Neuropsi test (Ostrosky et al., 2019) was used to measure attention and memory (included working memory) and the Five-digit test (Sedó, 2007) to explore inhibition and cognitive flexibility.
Results: The results indicated that 7 of the 11 participants presented significant alterations in attentional process, and 8 of the 11 showed alterations in mnemic process. Regarding executive functioning, it was found that all the participants present significant alterations in cognitive flexibility, 9 of the 11 presented deficits in inhibition and none of them exhibited alterations in working memory. Additionally, the children also presented deficits in other cognitive processes and two of them are illiterate despite to attend to school.
Conclusions: Child abuse has strong repercussions on cognitive development, particularly in the processes of attention, memory, inhibition, and cognitive flexibility. These are cognitive processes involved in school learning, the main activity daily life of children. Therefore, it is necessary to generate programs to of stimulation to attend the delays in those processes and to promote a good prognosis in school and daily life interactions of children.
Acknowledges: CONACYT schoolarship number 998166
Keywords: childhood maltreatment**,** executive functions**,** attention
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31 sEEG Langauge Mapping: A Systematic Review of Language Assessment

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Objective: Electrical stimulation mapping (ESM) of language via stereoelectroencephalography (sEEG) is the gold standard for determining eloquent language cortex in order to plan a brain surgery that does not result in a functional deficit. ESM allows the surgical team a direct measure of localized cortical and subcortical disruption or simulated lesion that is unattainable in other technologies. As such, sEEG is a useful tool for understanding the eloquent language cortex. Precise language mapping requires behavioral evaluation of expressive and receptive language in auditory and visual modalities while conducting the sEEG procedure. Several tasks have been developed aimed to assess expressive (fluency, verbal and visual naming, repetition, and counting) and receptive language (auditory comprehension). However, despite the advances in sEEG for epilepsy surgery mapping, there is currently no standardized method of assessing multiple facets of language during the unique challenges presented by this clinical procedure (i.e., rapid, concise, age-referenced, inpatient setting). Furthermore, there are evidence-based clinical guidelines for pediatric sEEG language assessment, and opportunities for improvement in assessment psychometric properties (i.e., reliability, validity).
Participants and Methods: Searches were conducted in Pubmed, Medline, Ovid, and PsycInfo on 5/19/21 using the following terms: ‘sEEG’ or ‘stereo EEG’ or ‘extraoperative mapping’ and ‘language’ or ‘naming’ and ‘pediatric’ ‘children’ ‘epilepsy’
The search identified a total of 2,026 articles, of which 20 met inclusion criteria. Articles were grouped based on the domain of language, the measure used, the brain region involved, and the age of patients. We review and summarize the cognitive assessments and their associated brain regions.
Results: We describe the strengths and weaknesses of each measure and list psychometric properties when available. Based on this literature, we provide a summary map for the measure, brain region, and expected result of the stimulation. Our review indicates that additional measures need to be developed for an efficient evaluation of relevant language domains that includes consideration for the

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psychometric properties, such as validity and reliability, of the tools used to evaluate language during mapping procedures.
Conclusions: There are limited evidence-based clinical guidelines for pediatric sEEG language assessment, and opportunities for improvement in brief language assessment psychometric properties (i.e., reliability, validity). There is a particular need for more brief language assessments for children who are still developing language. We recommend the development of standardized neuropsychological practice guidelines to help guide language evaluation during sEEG. Relevant limitations and future directions will be discussed, with a focus on considerations for pediatric sEEG language mapping.
Keywords: epilepsy / seizure disorders - surgical treatment**,** neurostimulation**,** language

32 Executive Function Associated with Integrity of the Non-Epileptogenic Hemisphere Based on Intracarotid Amobarbital Test in Persons with Epilepsy

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Objective: Executive dysfunction is common in persons with epilepsy (PWE) and affects their quality of life. Prior work has shown that PWE endorse having executive dysfunction in their everyday lives, especially working memory. We examined whether poorer functional integrity of the non-epileptogenic hemisphere, as assessed using the intracarotid amobarbital test (IAT) and possibly indicating more diffuse brain dysfunction, is associated with worse subjective and objective executive function.
Participants and Methods: Participants were 19 PWE, 18+ years of age evaluated for surgical treatment of medication-resistant epilepsy. Patients were classified based on IAT results as having intact [INF; n = 9] or impaired [IMF; n = 10] contralateral hemisphere function. These also completed a neuropsychological evaluation, including the Behavior Rating Inventory of Executive Function-Adult (BRIEF-A) self-report. Independent samples t-tests were used to compare the groups on the BRIEF-A, performance-based executive function tests, and BDI-II. Significance was set at α = .05, one-tailed, given our directional hypothesis.
Results: Groups were similar for demographics (age, gender, education, handedness), clinically (# of antiseizure medications, seizure focus), and BDI-II score. The IMF group endorsed greater difficulties than the INF group on the Emotional Control [$t(17) = -2.69$, $p = .008$, $d = -1.24$]; Working Memory [$t(17) = -1.9$, $p = .038$, $d = -0.87$]; and Task Monitoring [$t(17) = -2.39$, $p = .019$, $d = -1.03$] scales. With exception of more Failures to Maintain set on the Wisconsin Card Sorting Task in the IMF group [$t(17) = -2.09$, $p = .026$, $d = -0.99$], no group differences emerged for performance-based tests of executive function.
Conclusions: Despite performing similarly on performance-based tests of executive function, PWE having IMF reported having poorer executive function than INF. This suggests that integrity of the contralateral hemisphere to the presumed seizure focus, as assessed by IAT, is associated with executive dysfunction in the everyday lives of PWE. It is possible that this reflects more diffuse brain dysfunction in the IMF group, resulting in greater likelihood of experiencing cognitive problems outside the structured testing environment. Conversely, higher subjective report of executive dysfunction may serve as a possible marker of impaired IAT performance, diminishing the IAT's efficacy in identifying lateralized dysfunction, and highlighting the utility of a performance-based neuropsychological evaluation in assessing the functional integrity of the brain.
Keywords: epilepsy / seizure disorders**,** executive functions

33 The Contribution of Processing Speed and Executive Functioning to Visuospatial Learning and Recall in Presurgical Epilepsy Patients

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Objective: Processing speed and executive functioning are often reduced in patients with temporal lobe epilepsy (TLE). Impairments in these domains might contribute to poorer performance on memory tasks, particularly those with brief exposure to stimuli, such as the Brief Visuospatial Memory Test-Revised (BVMT-R). The primary objective of this study was to investigate whether processing speed and executive functioning contribute to BVMT-R performance in patients with TLE. A secondary objective was to explore these relationships across subgroups of patients with seizures localized to either their language dominant or nondominant hemisphere.
Participants and Methods: Retrospective clinical data were examined from 74 patients with TLE (ages 17-68) who underwent standardized neuropsychological assessment as part of a comprehensive workup for epilepsy surgery, including completion of the BVMT-R, the Coding subtest of the WAIS-IV (CD), and the Wisconsin Card Sorting Test (WCST). Hierarchical multiple linear regression analyses were used to examine effects of processing speed (CD) and executive functioning (WCST: Total Errors) on the immediate and delayed memory indices of the BVMT-R after controlling for age and years of education. Secondary hierarchical multiple linear regression analyses were used to explore the same question in a subset of patients who had also undergone testing of language lateralization as part of their presurgical workup and could be categorized into one of two subgroups according to whether they had an epileptogenic zone ipsilateral to their dominant hemisphere (DTLE; N=27) or an epileptogenic zone ipsilateral to their nondominant hemisphere (NDTLE; N=24).
Results: After controlling for age and years of education in the total sample of TLE patients, slower processing speed (β=0.32, *p*=.001) and poorer executive functioning (β=-0.19, *p*=.039) significantly predicted poorer immediate visuospatial memory, but only slower processing speed (β=0.36, *p*<.001) significantly predicted poorer delayed visuospatial memory. Slower processing speed significantly predicted poorer immediate visuospatial memory across both the DTLE subgroup (β=0.37, *p*=.047) and the NDTLE subgroup (β=0.43, *p*=.036) but significantly predicted poorer delayed visuospatial memory only in the NDTLE subgroup (β=0.49, *p*=.015). Executive functioning was not a significant predictor of immediate or delayed visuospatial memory in either subgroup.
Conclusions: Overall, these findings suggest that it is important to consider processing speed when interpreting results of visuospatial learning and memory test performance in presurgical evaluation of TLE patients, especially those with nondominant TLE. Further research is needed to clarify and expand on the relative contributions of executive functioning.
Keywords: epilepsy / seizure disorders**,** information processing speed

34 Psychometric Properties of the NAB Naming Test in Persons with Epilepsy

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Objective: Persons with epilepsy (PWE) commonly report difficulty with word retrieval and show impairment on tests of visual confrontation naming, most commonly the Boston Naming Test (BNT). The Naming Test of the Neuropsychological Assessment Battery (NNT) was developed as an alternative to the BNT. Prior studies have reported adequate convergent validity between the NNT and BNT. Performance on NNT has been found to be correlated with scores on tests assessing visuospatial skills, semantic fluency, verbal memory, and executive functions. The psychometric properties of the NNT, however, have received little empirical investigation in PWE. The present study examined these properties of the NNT in adult PWE.
Participants and Methods: Participants included 43 PWE, mean age of 38.81 (SD ± 13.56, range = 19-71), 44.19% female, 90.7% right-handed, with an average of 13.60 years of education (SD ± 2.07, range = 9-20), 97.7% of whom identified as white. A subset had EEG

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showing clear seizure onset in the left (n = 25, 58.14%) or right (n = 14, 32.56%) hemisphere, the rest having bilateral or unclear seizure onset. Patients completed a test battery including the NNT and BNT (administered in counterbalance order, one early and one later in the course of a single session), TOPF, subscales from the WAIS-IV (Vocabulary, Digit Span, Coding), CVLT-II/CVLT-III, BVMT-R, D-KEFS Verbal Fluency, and Trail Making.
Results: NNT total correct raw score mean was 29.77 (SD ± 1.52, range = 24-31) and the distribution was negatively skewed. BNT mean total correct raw score was 52.37 (SD ± 4.21, range = 44-60), with a negatively skewed distribution, but less than for the NNT. The two naming tests' total scores were moderately correlated (r = 0.34, p = 0.02). NNT scores were associated with processing speed, while BNT performance was correlated with premorbid estimate and expressive language. Using a cutoff of z ≤ -1.5 for impairment, only one patient (left temporal seizure focus) was impaired on the NNT, while 12 patients were impaired on the BNT (7 left and 5 right seizure focus). Compared to those with intact scores (i.e., z > -1.5), those who were impaired on the BNT had less years of education, as well as lower scores on other measures of expressive language (WAIS-IV Vocabulary, D-KEFS Letter Fluency) and estimated premorbid functioning (TOPF). Neither NNT nor BNT performance differed between PWE having left versus right hemisphere seizure onset.
Conclusions: Consistent with prior studies in other populations, performance on the NNT shows adequate convergent validity with the BNT, as well as less of an association with measures of other cognitive domains. Similar to prior findings, in our sample of PWE the NNT had a highly negatively skewed distribution, with only one patient being considered impaired, in contrast with a larger subset deemed impaired on the BNT. Neither naming test discriminated between patients having left versus right hemisphere seizure focus, although samples sizes in these subgroups were small. Overall, findings suggest limited utility of the NNT for assessing confrontation naming in PWE.
Keywords: epilepsy / seizure disorders**,** psychometrics**,** naming

35 Pediatric Focal Epilepsy Reading Comprehension: Differences Between Subtypes?

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Objective: Research shows that children with epilepsy experience cognitive deficits that are often correlated with seizure type and localization/lateralization of seizure focus. Additionally, research into academic achievement of children with epilepsy indicates that learning disabilities are the norm in this population, with many children experiencing academic deficits above and beyond that accounted for by impaired cognition. Although reading comprehension is a particular area of weakness for children with epilepsy, little is known regarding differential impact of focal seizure activity within reading-specific neural networks and contribution of well-known reading support processes, namely working memory and executive functioning. The purpose of this study was to determine whether focus location (frontal vs. temporal; right vs. left-hemisphere) predicted reading comprehension performance when controlling for decoding. Additionally, this study sought to investigate the contribution of working memory and aspects of executive functioning to reading comprehension in the presence of intact decoding, and whether the contribution was moderated by age.
Participants and Methods: Information regarding demographic and seizure variables as well as performance on measures of cognition, achievement, and executive function was abstracted from neuropsychological evaluation reports contained in the medical records of 93 children and adolescents (ages 8 to 18) diagnosed with focal epilepsy. Analysis of covariance was conducted on two samples, each containing two focal epilepsy groups: Frontal Lobe Epilepsy/Temporal Lobe Epilepsy (FLE/TLE) and right-/left-lateralized seizure foci. Hierarchical linear regression analyses examined the relationship between reading comprehension, language variables, and

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executive function variables, specifically in the domains of attention shifting and working memory.
Results: Location of seizure focus did not significantly predict differences in reading comprehension whether localized to anterior (FLE) or posterior (TLE) brain regions. Similarly, no group differences were found between right- and left-lateralized foci. In the full sample, vocabulary emerged as the best predictor for reading comprehension outcome when controlling for age at seizure onset and decoding ability. Working memory contributed a small amount of variance, however its relationship with reading comprehension was found to be mediated by lower-level reading processes of decoding and vocabulary. No interaction between age and executive function resources recruited was found.
Conclusions: As a whole, these results are aligned with conceptualization of epilepsy as a network disorder, suggesting that children with focal epilepsy are more broadly impaired due to disruption of brain networks that span interconnected cortical areas that are traditionally thought to have discreet functional correspondence. This finding lends support to the movement toward more white-matter based research regarding functional outcomes, classification of dysfunction, and treatment recommendations.
Keywords: epilepsy / seizure disorders**,** academic achievement**,** reading disorders

36 Neuropsychological Profile of a Bilingual Pediatric Epilepsy Patient with Prenatal Stroke and Abnormal Brain Imaging: Findings at 6 Months and 2.5 Years into Seizure Remission

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Objective: Childhood-onset epilepsy is frequently associated with neurocognitive impairment and has been linked to multiple etiologies including genetic syndromes, CNS infection, traumatic brain injury, and stroke. While literature asserts that seizure remission following epilepsy-surgery has been shown to improve cognitive and behavioral outcomes in youth, limited research has explored the impact of seizure remission via anti-epileptic drugs (AEDs) as it pertains to cognitive and behavioral functioning. Additionally, few studies have examined cognitive and behavioral functioning in children at early stages of seizure remission with abnormal brain imaging. Neuropsychological functioning of a 7-year-old bilingual (Spanish-English) female at both 6 months into seizure remission and 2.5 years seizure into remission are presented.
Participants and Methods: Patient's medical history includes prenatal stroke (left frontal-temporal-parietal) with associated cerebral palsy, and seizures. Patient experienced infantile spasms at 9 months old treated with adrenocorticotropic hormone (ACTH) which subsided after 6 weeks. At 4.5 years, seizure frequency increased (e.g., up to three seizures per day). Her last seizure occurred in November 2018. Current medications include: Onfi and Vimpat. Previous medications include: Keppra. Neuropsychological testing at ages 5 and 7 included DAS-2, EOWPVT, WPPSI, WISC, Batería IV, CHAMP, Beery VMI-6, and NEUROPSI as well as behavioral/emotional parent report measures.
Results: During most recent testing, patient demonstrated normative strengths compared to same age peers related to her verbal abilities. Specifically, her expressive one word vocabulary (Spanish SS=101; Combined Spanish/English SS=106), verbal comprehension (T=50), and naming vocabulary (T=46) were all broadly in the average range. Test results also revealed relative improvements in verbal comprehension, naming vocabulary, and spelling as time in seizure remission progressed. Although her abilities in mathematics also improved relative to her previous evaluation, these skills were still in the moderately impaired range compared to same age peers. Compared to previous evaluation, weaknesses were noted in processing speed, non-verbal reasoning, and visual memory tasks when compared to same-aged peers. Relative to previous evaluation, visuomotor integration remained largely unchanged. Socioemotional measures indicated

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relative improvements in anxiety and somatization.
Conclusions: Results suggest that improvements in verbal abilities and specific domains of academic functioning (e.g., spelling, math) may be observed as children experience longer periods of seizure remission. Declines in this patient's visuospatial and nonverbal reasoning abilities, paired with sparing of verbal abilities, indicate that functional reorganization of language may have occurred. These findings are consistent with the crowding hypothesis which suggests that when the left hemisphere is damaged, language can be reorganized and prioritized at the expense of right hemispheric dominant tasks, such as nonverbal reasoning (Filippini et al.,2013; Liegeois et al., 2004). Findings are also consistent with recent perinatal stroke literature suggesting even after large left-sided strokes, retention of language functions and cortical reorganization (atypical localization) may occur (Murias et al., 2014). Improvements were also noted related to socioemotional functioning. Further research exploring the impact of seizure remission on children with epilepsy in a larger sample is required to generalize these findings.
Keywords: epilepsy / seizure disorders**,** stroke recovery**,** bilingualism/multilingualism
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37 Development and Cross-Validation of Personality Assessment Inventory Decision Rules for the Identification of Psychogenic Nonepileptic Seizures

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Objective: The published literature on the Personality Assessment Inventory (PAI) for psychogenic nonepileptic seizure (PNES) diagnosis includes a variety of interpretation methods to distinguish PNES from epileptic seizures (ES) and offers mixed findings. The purpose of this study was to use a cross-validation approach to create and derive new decision rules for the PAI to best differentiate PNES from ES.
Participants and Methods: Data from 773 patients (PNES n = 328, ES n = 445) who underwent long-term video EEG (vEEG) monitoring and completed a PAI were examined. Individuals with invalid PAI profiles were removed, and patients were randomly assigned to the "development" group (DEV) or the "application" group (APP). Receiver operating characteristic (ROC) curves with DEV demonstrated the best cut score for each scale of interest. ROC curves were repeated with APP. Additional analyses examined the utility of sequential decision rules incorporating multiple scales.
Results: Of the individual scales, SOM-C demonstrated the best diagnostic accuracy (sensitivity [SN] = 60.7%, specificity [SP] = 81.3%) at a cut score of $T \geq 75$. Cross-validation with APP confirmed this cut score outperformed other cut scores (positive predictive value [PPV] = 67.2%, negative predictive value [NPV] = 76.1%), as well as other decision rules presented in the literature. Additional analyses examining sequential decision rules with SOM-C ≥ 75 or SOM-C = 70-74 with SOM-S ≥ 65 demonstrated the highest predictive power (PPV = 73.2%, NPV = 79.1%).
Conclusions: The results of this study demonstrate a new and effective method for using the PAI as a screener to distinguish PNES from ES. Utilization of these decision rules can assist clinicians in determining appropriateness of and immediate need for vEEG monitoring for diagnostic certainty.
Keywords: nonepileptic seizures**,** assessment

38 The Role of Neuropsychology in the Identification of Electrical Status Epilepticus of Slow-Wave Sleep in a School-Aged Child with Remote History of Neurological Insult: a Case Report

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Objective: Electrical status epilepticus of slow-wave sleep (ESES) is characterized by excessive interictal spike-wave discharges on EEG during sleep and can occur in the absence of overt clinical seizures. Continuous spike wave during slow wave sleep (CWSW), the epilepsy syndrome associated with ESES, is associated with a plateau/ decline in cognitive development and increases in behavioral and emotional dysregulation. Here we present a case in which serial neuropsychological (NP) assessments in a child led to the identification of subclinical seizure activity and ESES. This case highlights the importance of comprehensive epilepsy care and routine involvement of neuropsychology in the management of complex epilepsy patients.
Participants and Methods: Our patient is an 11-year-old right-handed, English-speaking White female with a history of neonatal cardiac arrest resulting in bilateral cerebral watershed infarcts with a sequela of left spastic hemiplegic cerebral palsy and neonatal seizures. Early language and motor milestones were achieved within the expected time frames. Early medical status was stable, and the patient has not experienced overt clinical seizures since infancy. The patient was initially referred for an NP evaluation at age 8 due to memory and learning concerns. Subsequent neuropsychological re-evaluations were conducted 18 months and 26 months later.
Results: Initial NP evaluation implicated weaknesses in functions typically mediated by the dominant (usually left) hemisphere juxtaposed with her left hemiparesis. EEG was recommended and showed mild diffuse slowing and frequent high amplitude, independent, multifocal spike and sharp wave discharges exacerbated by sleep. She was started on antiepileptic medication. A second NP evaluation completed 18 months post initial evaluation showed appropriate developmental progress on tasks of verbal functioning but a frank loss of skills on tasks of visual-spatial functioning. Increased attention difficulties and a decline in memory performance were also noted. This evaluation led follow-up EEG that showed bifrontal epileptiform discharges while awake with sleep exacerbation and a Spike-wave Index (SWI) of 60%. Aggressive treatment was initiated. The patient was assessed for a third time while on stimulant medication 8 months later and findings showed appropriate developmental progress in all domains with a broadly stable cognitive profile of strengths and weaknesses. Despite significant improvement in her attention, she again demonstrated a persistent, but now more isolated/focal, deficit in visual-spatial skills that was evidenced across a variety of tasks. Dominant (right) hand fine motor dexterity, although still much better than with her left hand, also declined compared to prior testing. This coincided with EEG findings of continued bifrontal discharges in the awake state with right frontal prominence in sleep and SWI of 70%.
Conclusions: In this patient, neuropsychological evaluation initially ordered based on memory and attention concerns led to the identification of subclinical seizure activity and an evolving epileptic encephalopathy. This case demonstrates the utility in neuropsychological evaluation and regular re-evaluations in the identification of subclinical seizure activity and epileptic encephalopathy in otherwise apparently healthy children with remote history of neurological insult.
Keywords: epilepsy / seizure disorders**,** pediatric neuropsychology
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39 Comparing Sex Differences in Cogstate Performance for Newly Diagnosed Focal Epilepsy Patients

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Objective: The Human Epilepsy Project (HEP) is a prospective, observational study in patients with newly treated focal epilepsy where primary study goals include identification of clinical characteristics and biomarkers with respect to predictive of disease treatment response,

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progression, and outcome. Since the HEP aims to address gaps in knowledge through prospective assessment of neuropsychiatric and cognitive comorbidities, this investigation sought to determine potential intersubject cognitive performance differences. As cognition is frequently impaired even at the onset of epilepsy and cognitive problems are particularly common and important concerns in patients with epilepsy. To study intersubject variability this research compared cognitive performance sex differences as other neuropsychological normative data suggests susceptibility to specific cognitive skills based on sex.
Participants and Methods: Subjects were 354 patients enrolled in the HEP study that underwent cognitive testing with the Cogstate battery, which is an array of online computerized tests assessing various aspects of cognitive functioning such as attention, memory, and processing speed. The Cogstate battery was chosen as it has been shown to be sensitive to disease and drug effects. Subjects completed the tests following the enrollment visit and at intervals thereafter for the duration of their participation. The HEP specific Cogstate tasks included: Detection (DET) for psychomotor function, Identification (IDN) for attention, One Back Memory (ONB) for working memory, One Card Learning (OCL) for visual learning, and an overall averaged score for the Cogstate. Outcome variables included speed for DET, IDN and ONB as well as accuracy for OCL. The scores at enrollment were compared for biological sex differences assigned at birth via t-tests.
Results: Subjects were predominately female (*n*=207, 58.5%), White (*n*=292, 82.5%), Non-Hispanic/Latino (*n*=327, 92.4%), right-handed (*n*=316, 89.3%) and held a Bachelor's degree (*n*=91, 25.7%), with a mean age of 32.47 years (*SD*=13.81). The majority of cognitive performance showed no differences between assigned males and females at birth on IDN (p=.761), ONB (p=.990), OCL (p=.396), and overall averaged score (p=.107). Group differences were found solely for DET (p=.002).
Conclusions: On measures of attention, working memory, visual learning, and the overall cumulative battery factor score there were no sex differences in cognitive performance. Results revealed a significant sex difference where females performed slower on a measure of simple reaction time. These data suggest group differences where females with epilepsy may be at greater risk for deficits in processing speed efficiency. Outside of seizure semiology and possible medication effects, there are other demographic variables to include age, race, ethnicity, education level, socioeconomic status, geographical location, and disability that may impact aspects of psychomotor function. Further data collection and analyses will address these potential contributions to this finding.
Keywords: epilepsy / seizure disorders**,** computerized neuropsychological testing**,** cognitive functioning
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41 Combining Well-Established with Emerging Technologies in the Surgical Treatment of a Patient with Right Temporal Lobe Epilepsy with Mesial Temporal Sclerosis

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Objective: Temporal lobe epilepsy (TLE) is the most frequently diagnosed drug-resistant epilepsy and occurs across the lifespan. Surgical candidacy is based on clinical examination and noninvasive techniques, including neuropsychological evaluation, video EEG (vEEG) monitoring, and functional neuroimaging. Intracranial monitoring is sometimes required to define the epileptogenic zone. Intracranial functional mapping using electrocortical stimulation (ESM) and "passive" high gamma activation (HGA) with

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stereoencephalography (sEEG) can be utilized to lateralize language and memory. Our case study exemplifies the utility of combining well-established and newer techniques in enhancing surgical planning in patients with drug-resistant TLE.

Participants and Methods: Patient is a 20-year-old, right-handed female who underwent comprehensive surgical workup for drug-resistant right TLE with hippocampal sclerosis. Seizure onset was age five and oxcarbazepine resulted in intermittent seizure relief. At the time of surgical workup, seizures were occurring monthly. Medical and family history was otherwise unremarkable. She had no history of grade retention or special education and was in her second year of college. Surgical workup included neuropsychological evaluation, vEEG monitoring, MRI, PET, and CT. She also underwent intracranial mapping with sEEG. Patient did not undergo functional MRI.

Results: Presurgical neuropsychological evaluation indicated average intellectual ability (WASI-2 FSIQ SS=105, 63rd%tile) with stronger perceptual than verbal reasoning. Left fine-motor skill was exceptionally low (Lafayette Grooved Pegboard SS=65, 1st%tile) and right was average (SS=106, 66th%tile). Verbal learning and memory were average (California Verbal Learning Test-3, Short and Long Delay). Visual learning and memory were low average to average (Wechsler Memory Scale-3). Abnormal vEEG monitoring indicated right anterior temporal, bi-frontal, and right frontal/central onset, with potential left temporal onset with frontal and temporal semiology. MRI showed right-sided hippocampal sclerosis and stable bilateral periventricular gliosis. PET showed right temporal hypometabolism overlapping hippocampal sclerosis. ESM with sEEG showed mild delays in confrontation naming with stimulation to right and left temporal poles, suggesting bilateral language representation. HGA mapping showed bilateral increased temporal pole activation (right > left) on confrontation naming tasks. Verbal and visual encoding resulted in left-greater-than-right hippocampal activation, whereas right-greater-than-left activation was seen during verbal and visual recall. Given the instantaneous involvement of the right mesial, temporopolar, and lateral temporal regions at onset, the epilepsy surgery team recommended right anterior temporal lobectomy as this would likely offer the best chance of seizure freedom. Prior to resection the patient was counseled about potential impact of surgery on language function. She was also informed that she would need to continue oxcarbazepine post-surgically due to abnormal left-temporal activity on vEEG. Patient underwent an uncomplicated right temporal lobectomy. She returned to college and remains seizure free 6 months post-surgery (Engel Class I).

Conclusions: Overlap of the epileptogenic zone with eloquent cortex can make surgical planning challenging. However, using a combination of traditional modalities including clinical examination, neuropsychological evaluation, vEEG, PET, and MRI in combination with ESM and HGA mapping using sEEG may optimize surgical planning in the hope of producing seizure freedom while minimizing postsurgical cognitive decline.

Keywords: epilepsy / seizure disorders - surgical treatment

42 Pre- and Post-Epilepsy Surgery Mood Trajectories

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Objective: Depression in temporal lobe epilepsy (TLE) is a significant co-morbidity negatively affecting patient quality of life. Significant effort has been dedicated in recent years to investigating depression in epilepsy, generally finding surgery improves depressive symptoms in seizure-free patients. Furthermore, data suggests high levels of pre-surgical depression lead to worse cognitive and emotional outcomes following resection. The objectives of this study were to compare epilepsy patients' pre- and post-surgical levels of depression and to identify whether those patients both with and without elevated pre-surgical depression scores experience comparable post-surgical depression outcomes.

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Participants and Methods: As part of a pre- and post-surgical neuropsychological evaluation, 50 well-characterized medically refractory TLE patients (26 left TLE; 24 right TLE) were administered a self-report depression inventory (Beck Depression Index; BDI-II) to evaluate mood symptomatology. Paired t-tests were used to examine whether there was a significant change in BDI scores pre to post-surgery at the group level.
Results: Across the full sample, there was no significant difference between pre-surgical and post-surgical BDI scores. However, when patients were categorized pre-surgically as either “depressed” (n=24) or “not depressed” (n=26) using a cutoff score of 11, those who were depressed showed a significant mean reduction in BDI scores of 5.58 points (p<.05; d=*.42*). Significant changes in mood were not identified in the “not depressed” group (p=.17; d=.28) post-surgically, despite a mean increase of 2.92 points on the BDI.
There was no significance when controlling for sex, side of seizure focus, or 1-year post-surgical seizure outcome. Yet when controlling for the presence of mesial temporal sclerosis (MTS), only depressed patients without MTS (n=14) experienced a significant decrease in symptoms (9.78 points, p=.013; d=*.77*). Patients with MTS showed no significance in BDI difference.
Conclusions: Based on this well-characterized sample, TLE patients experiencing depression symptoms may experience a reduction in depressive symptoms following surgery. Unlike depressed patients, non-depressed patients do not appear to experience a decline in depression symptoms following surgery. The use of self-reported mood scores may help inform risk for reduced quality of life when considering surgical intervention. Future research examining associations between mood, clinical, demographic, and social influences on mood outcomes following surgical interventions is warranted.
Keywords: epilepsy / seizure disorders - surgical treatment**,** depression**,** quality of life
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43 ESES on Neurocognitive Functioning

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Objective: Electrical Status Epilepticus in Sleep (ESES) is marked by epileptic activity during non-REM (NREM) sleep. It is quantified by the spike-wave index (SWI), the percentage of NREM sleep that contains spike waves. Cognitive deficits, including regression, are common in ESES; however, findings are heterogeneous and there is no distinct neuropsychological profile. Given the disruption to sleep, specific domains may be at higher risk including memory, attention, and executive control. It is unclear whether SWI correlates with neuropsychological outcome. We used an inclusive definition of ESES (SWI>50%) to define active ESES (ESES+). We examined ESES impact on cognition broadly by comparing neuropsychological performance of children with active ESES to those with resolved or reduced ESES (ESES-) with the expectation that ESES+ would perform worse. We further expected that greater SWI values would be correlated with lower neuropsychological scores.
Participants and Methods: Participants were retrospectively selected through the following inclusion criteria: 1) documented history of ESES 2) formal neuropsychological evaluation and 3) EEG within three months prior to their neuropsychological evaluation. Our sample consists of 30 individuals (12 female, mean age=8.0 years, range=4.5-15.2 years), across 32 neuropsychological evaluations. Most (n=22) children were ESES+ at testing; two patients were included in both groups as testing was conducted when ESES+ and ESES-. 91% of participants were taking ASMs at the time of testing with 43.8% of them on one ASM (range 0-3). We conducted independent samples t-tests to determine the effects of ESES group on cognition and Pearson correlations to assess if SWI is related to neuropsychological performance.
Results: Children with ESES+ were younger than children in the ESES- group, and overall had many skills that were no different than

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children with ESES-. The few differences were that ESES+ had higher verbal IQ, less cognitive dysregulation, less internalizing problems, and better motor dexterity. Similarly, correlations showed significant relationships between SWI and some cognitive skills such that higher SWI was correlated with lower cognitive dysregulation and higher verbal IQ.
Conclusions: Children with ESES are a heterogeneous clinical population. While there appears to be an overall depression of neuropsychological performance similar to other epilepsy populations, processing speed, motor, language and working memory skills appear at most risk. The relationship between SWI and performance remains unclear given that higher SWI was associated with both better and worse cognitive skills. Future studies need to account for other factors such as EEG characteristics, time of EEG in relation to neuropsychological evaluation, or specific medications.
Keywords: epilepsy / seizure disorders**,** cognitive functioning

44 Visual Naming is Spared in Surgery for Medial Temporal Lobe Epilepsy if Restricted to the Amygdalar-Hippocampal Complex

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Objective: In recent years, minimally invasive procedures have led to better cognitive outcomes in medial temporal lobe epilepsy (mTLE) patients requiring surgery for seizure control. We compare the largest prospective, consecutive cohort of mTLE patients undergoing stereotactic laser amygdalohippocampotomy (SLAH) or a traditional open resection (OR) involving a selective transcortical approach. We hypothesized visual naming outcome following SLAH would be superior as compared to OR, with both greater rates of improvement and fewer instances of decline.
Participants and Methods: We present pre- and postsurgical Boston Naming Test (BNT) data using reliable change index (RCI) scores for 80 of the first 109 (38 left-sided/42 right-sided) SLAH patients who reached initial post-surgical follow-up at Emory University. We also present data for 20 *consecutive* MTLE patients who underwent OR (10 left-sided/10 right-sided). All patients had left TL language lateralization on the basis of fMRI. Left and right hemisphere SLAH and OR subgroups did not differ significantly in age of seizure onset, education level, age at surgery, or number of prescribed antiseizure medications. Pre and postsurgical BNT scores were examined to determine if significant change occurred in performance using RCI metrics, and Fisher's Exact Tests were used to determine if the proportional rate of decline on the BNT differed in our Emory sample by surgical subgroup and side of surgery.
Results: Decline on the BNT following SLAH was significantly less frequent than following OR. This was true for total sample comparisons (SLAH = 3.8% versus OR = 35%, $p<.001$) and for the left MTLE samples (L SLAH = 5.3% versus L OR = 70%, $p<.001$). Two of three SLAH patients who declined had comorbid neurological diseases (e.g, dementia, Parkinson's disease). We found that 8 of 38 (21.1%) left SLAH patients improved at post-surgical follow-up and 5 of 42 (11.9%) right SLAH patients. In our OR sample, no left or right MTLE patients improved significantly after surgery ($p<.001$). We also examined the group means for pre- and post-surgical BNT performance for the SLAH subgroups. The left SLAH group [$Z = 344.5$, $p<0.020$] and the right SLAH group [$Z = 597.0$, $p< 0.001$] improved significantly following surgery, which was demonstrated using the Wilcoxon Sign Rank Test due to the non-normal distribution of the BNT data. Our left OR group declined significantly following surgery [$Z = -1.5$, $p<0.013$], but there was no significant change in the right OR group. Finally, no surgical subgroups differed on the variables of presence of MTS or Engel post-surgical seizure

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classification, and these variables were not significantly correlated with the BNT metrics. **Conclusions:** We demonstrated far superior visual naming outcome when the surgical approach was restricted to the amygdalar-hippocampal complex in MTLE patients undergoing surgery to control their seizures. Patients undergoing SLAH rarely declined following either right or left procedures, while significant decline occurred in the majority of patients undergoing a left OR approach. Some evidence suggests that decline in BNT performance is rare following SLAH, and likely more apt to occur when MTLE patients have comorbid conditions which broadly affect the brain.

Keywords: epilepsy / seizure disorders - surgical treatment**,** naming

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45 Bilingualism a Potential Neuroprotective Factor in Pediatric Refractory Temporal Lobe Epilepsy of the Language Dominant Hemisphere– A Case Study

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Objective: Drug-resistant temporal lobe epilepsy (TLE) is the most common focal seizure disorder in children, with earlier age of onset associated with structural connectivity abnormalities. Although children with refractory TLE often display cognitive deficits, others display intact functioning hypothesized to be related to neural plasticity. Additionally, among bilingual individuals, imaging data has provided inconsistent findings related to the functional organization of language, with representation in either one or both hemispheres. Due to the effects of neural plasticity in childhood and potential interhemispheric representation of language dominance in bilingual individuals, we explored the potential neuroprotective factor of bilingualism in an adolescent patient with refractory TLE with onset at two years of age. **Participants and Methods:** A comprehensive workup involving neuroimaging, EEG, and neuropsychological testing occurred during a week-long inpatient stay. As part of a larger neuropsychological battery, learning and memory was assessed using the Child and Adolescent Memory Profile (ChAMP), executive functioning with select subtests of Delis-Kaplan Executive Function System (D-KEFS), and language functioning with Clinical Evaluation of Language Fundamentals, 5th Edition (CELF-5). **Results:** Functional neuroimaging findings revealed unilateral language dominance to the left hemisphere. Additional EEG data localized focal epileptiform discharges to the left temporal lobe and generalized inter-hemisphere activity. Structural imaging was largely unremarkable. Neuropsychological results revealed robustly developed language functioning and intact cognitive abilities with better verbal than nonverbal abilities. However, although a lateralizing profile of neurocognitive dysfunction to the non-dominant hemisphere emerged, neuroimaging/EEG findings were discordant. **Conclusions:** Our findings extend previous data that suggests language functioning can remain intact with unilateral TLE of the language dominant hemisphere and lack functional re-organization in a pediatric patient. Thus, although a body of literature has emerged and supports functional neural plasticity in children with unilateral TLE of the dominant hemisphere (such as the *crowding hypothesis* of TLE) alternative factors like bilingualism may contribute to a unique neurocognitive profile. We hypothesize that the patient's early language milestones, bilingual abilities, and social pressures for use of two languages in his everyday environment has assisted with the maintenance of his linguistic abilities.

Keywords: bilingualism/multilingualism**,** epilepsy / seizure disorders**,** pediatric neuropsychology

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46 Examination of the Crowding Effect Hypothesis in a Diverse Clinical Sample of Patients with Epilepsy

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Objective: Atypical language laterality, secondary to refractory epilepsy, presents complications to surgical planning/cognitive outcomes. Extant research shows the non-dominant hemisphere reallocates neural resources for language compensation in response to left-sided lesions resulting in decreased visuoperceptual/visual memory. This study investigated the crowding effect hypothesis in adults with epilepsy, placing particular emphasis on utilization of a transdisciplinary framework to assess the nuances of this hypothesis in a racially/ethnically diverse clinical sample.
Participants and Methods: Retrospective data on patients had a mean age of 37.2 (*SD*=11.9), mean education of 12.3 (*SD*=3.7), with refractory epilepsy undergoing interdisciplinary pre-surgical workup (N=101) comprised of non-lesional (n=48), left (n=26), right (n=21) or bilateral (n=6) mesial temporal sclerosis (MTL), confirmed by neuroradiologists via functional Magnetic Resonance Imaging (fMRI) scans for language laterality were analyzed. The sample was relatively diverse with 56% (*n* = 67) Caucasian, 20% (*n* = 22) Hispanic, 15% (*n* = 18) African-American, and 4% (*n* = 4) other ethnic backgrounds. Eleven percent (*n* = 12) were monolingual Spanish and five percent were English/Spanish bilingual. Comparisons between the L MTS R language laterality (e.g., risk for crowding effect) with pseudo controls (i.e., nonlesional patients with R language laterality as well as L MTS and left language laterality). Independent samples T-tests were utilized to compare difference in standardized scores between comparison groups broken down by lesional status/lateralization as well as language laterality. Next, receiver operator characteristic (ROC) curve analyses were conducted to assess the diagnostic accuracy and sensitivity/specificity of the measures which identified the largest group differences for predicting lesion laterality.
Results: The L MTS/Left language laterality group, when compared to the Nonlesional/Right language laterality comparison, performed significantly worse on dominant hand performance on the GPB (F=-4.61, p <.001, eta squared=-.49) followed by the BNT-2 (F=-2.51, P <.05, eta squared=-.14) and the RCFT Immediate Recall (F=-2.21, p < .05, eta squared=-.17). A similar pattern of performance differences were observed within the L MTS/Left Language laterality vs. the L MTS/Right Language laterality groups, with the addition of the RCFT delayed recall showing group differences (eta squared=.19) and nearly equivalent findings for both dominant (eta squared=.17) and nondominant (eta squared=.35) hand performance on the GPB. ROC analyses examined classification accuracy for predicting L MTS, R language dominance. The optimal T-score cutoff for the RCFT Immediate recall was ≤25 (50% sensitivity; 87% specificity), T-score ≤29.5 for semantic fluency (67% sensitivity, 84% specificity), ≤26 and ≤25 for the dominant/nondominant hand T-score for the GPB both producing 83% sensitivity and 82% specificity.
Conclusions: Organization of language in epileptic populations presents atypically in conjunction with left-sided lesions. The crowding effect risk group performed significantly worse on tasks of verbal naming, immediate visual memory, and semantic verbal fluency when compared to the language control group. Similar findings were demonstrated with the notable addition of significantly decreased performance on the delayed visual memory task when compared to the crowding effect risk group to the lesion control group. Further research is planned to compare between performance on neuropsychological tasks with cognitive testing during fMRI.
Keywords: neuroimaging: functional**,** epilepsy / seizure disorders

47 Atypical Language Reorganization Without a Lateralizing Neuropsychological Profile in Pediatric Intractable Frontal Lobe Epilepsy: How

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Functional and Structural Imaging Can Help Solve The Puzzle

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Objective: It is well established that language reorganization can occur in temporal lobe epilepsy, yet evidence of similar processes occurring in frontal lobe epilepsy (FLE) is scarce. Cognitive skills impacted by FLE may include expressive language, attention, working memory, and executive function. Presented is a 16-year-old male with intractable FLE to identify correlates between neuropsychological, functional magnetic resonance imaging (fMRI), and diffuse tensor imaging (DTI) findings.
Participants and Methods: The patient has a complex perinatal and medical history that includes premature birth (31 weeks), extremely low birth weight (1lb 13 oz), global developmental delay, autism spectrum disorder, left lateral ventricle dilation, and intractable FLE. His seizures began at age 12, and have since consistently occurred once per week for about ten seconds per event. The typical semiology includes staring, unresponsiveness, and left eyebrow twitching with post-ictal headache, fatigue, and social withdrawal. The patient had one known episode of status epilepticus about one year prior to evaluation. Current anti-seizure medications include Fycompa, Aptiom, Jornay and he receives weekly speech-language services. As part of a comprehensive pre-surgical evaluation, fMRI and DTI were performed. Measures such as WISC-V, Peabody Picture Vocabulary Test-5, Woodcock Johnson-IV Tests of Oral Language, DKEFS Verbal Fluency subtest, Brief Visual Motor Test-R, California Verbal Learning Test-C, WRAT-5, and Lafayette Grooved Pegboard were completed in the context of a larger neuropsychological battery.
Results: fMRI showed the patient has immature connectivity of the left-frontal region, resulting in atypical transmodal activation. Expressive language activation was abnormally dispersed across known ancillary regions and lacked involvement of canonical language hubs (e.g., Broca's area). Additionally, the anterior default mode network was found to have atypical co-activation during a visual and auditory attention task. DTI found a decreased number of fronto-lateral connections in the left-frontal region, corresponding to the anterior terminus of the dominant arcuate fasciculus, and aberrant connections across the entire right hemisphere. Likewise, the cognitive profile revealed considerable intra-domain variability. Although there was no clearly lateralized pattern of cognitive deficits, fine motor dexterity was significantly worse in the patient's right hand. Otherwise, performance on language measures was variable (e.g., picture vocabulary SS=94, rapid picture naming SS= 84, oral comprehension SS=71, semantic fluency ss=4, phonemic fluency ss=11, word reading SS=105). The patient also had notable difficulty on both verbal and visual learning paradigms, with poor delayed recall, but intact recognition.
Conclusions: This case illustrates an example of atypical language reorganization in the context of pediatric intractable FLE and provides additional considerations for language preservation in pre-surgical evaluations. Despite immature fronto-lateral connectivity and lack of involvement of Broca's area as evidenced on functional and structural imaging, the patient's expressive language skills were generally intact and relatively consistent with receptive language skills on neuropsychological measures. It is possible that left-frontal reorganization resulted in inefficient and non-conforming connections across both hemispheres, and likely accounts for the patient's considerable intra-domain variability. Interestingly, right hemispheric dominant skills were intact. Considerations for the potential impact of atypical anterior default mode network co-activation on both verbal and visual learning are also discussed.
Keywords: epilepsy / seizure disorders - surgical treatment**,** epilepsy / seizure disorders**,** neuroimaging: functional
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48 The Relationships Among Decision-Making, Medication Adherence, and

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Medication Beliefs Within an Epilepsy Sample

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Objective: Individuals with epilepsy are estimated to have medication nonadherence rates of approximately 40% (Malek et al., 2016). Poorer adherence to antiseizure medications is associated with earlier death, increased physician visits, and decreased quality of life (Hovinga et al., 2008). There has been limited research on the possible role cognitive decision-making has on the level of nonadherence and beliefs around taking prescribed medications, although medication beliefs are known to affect adherence (Chapman et al., 2013). The current study examined the relationship between omission neglect (a specific aspect of decision-making bias in which individuals make overly confident decisions because they are unaware of missing information), medication adherence, and medication beliefs. We hypothesized that individuals with epilepsy who demonstrated greater omission neglect would endorse poorer adherence and more negative beliefs about medications. We also hypothesized that greater medication adherence would correlate with more positive beliefs surrounding medications.
Participants and Methods: Within a clinical sample of individuals with video-EEG verified medically refractory epilepsy, 17 participants (mean age=37.8, mean education=15.2, 82.4% White, 70.6% female) were administered an omission neglect decision-making paradigm, the Beliefs About Medicines Questionnaire (Horne et al., 1999), and the Morisky 8-Item Medication Adherence Questionnaire (Morisky et al., 1986). The omission neglect paradigm consisted of two advertisements that included positive features associated with each advertisement (e.g., insurance coverage at a pharmacy). Participants rated their preference for each presented feature and other features not present in the initial advertisement. Omission neglect was measured by comparing preferences for initially presented features versus more negative features initially withheld from the original advertisement. A larger sample was planned, but data collection was affected by the pandemic.
Results: In this sample, 17.6% reported high adherence (no missed doses), 47.1% reported medium adherence, and 35.3% reported low adherence to their prescribed antiseizure medications. There were no significant demographic differences in adherence level. Omission neglect was invoked to a significant degree ($p < .001$), but this effect was not related to medication adherence or medication beliefs (all p's > .05). Poorer self-reported medication adherence was significantly associated with greater concerns about taking antiseizure medication ($r(17) = -.62$, $p < .01$) and increased beliefs that prescribed medications are harmful ($r(17) = -.65$, $p < .01$). Similarly, individuals who expressed greater concerns about antiseizure medications were more likely to perceive other prescribed medications as more harmful ($r(17) = .72$, $p < .01$) and overused by prescribing providers ($r(17) = .57$, $p < .05$).
Conclusions: This preliminary study identified strong relationships between negative medication beliefs and nonadherence. The results highlight the critical importance of exploring medication beliefs when making clinical care decisions in patients for whom medication compliance is essential to safety. Moreover, shared medication beliefs by patients could be a guide to help determine those at greater risk for nonadherence. Although the hypothesized relationship between decision-making and adherence was not supported in this small sample, we only evaluated a single aspect of this cognitive construct (omission neglect), and it is possible that different components of decision-making would be more strongly related to medication compliance.
Keywords: epilepsy / seizure disorders**,** decision-making

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49 The Unique Contribution of Possible Cognitive Impairment on Quality of Life in People with Epilepsy

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Objective: Quality of life (QOL) is a person's perception of their position in life within a complex system of interacting factors (World Health Organization, 2020) and is regarded as the ultimate rehabilitation outcome (Heinemann & Mallinson, 2010). Research demonstrates that people with epilepsy (PWE) report lower QOL than healthy controls (Liou et al., 2005). Several factors may impact overall QOL, including seizure control (Alexander et al., 2018; George et al., 2015) and possible cognitive impairment (Perrine et al., 1995). While research demonstrates that number of anti-epileptic drugs (AEDs) is inversely related to cognitive functioning (Gillham et al., 1991), less is known about how possible cognitive impairment impacts QOL while controlling for epilepsy-related factors. The purpose of this study was to examine the unique impact of possible cognitive impairment on QOL, over and above demographic and epilepsy-related variables such as seizure frequency and number of AEDs. Hierarchical regression analysis was used to examine these associations.
Participants and Methods: All participants (N = 217) were diagnosed with epilepsy. Participants ranged from ages 19 to 95 (M = 51.7, SD = 19.7). Data were collected during routine follow-up visits to a neurology outpatient clinic. Data were screened for outliers and missing data. Hierarchical regression was used to examine the incremental contribution of variance of predictor variables on QOL. QOL was measured using self-reported scores on the Quality of Life In Epilepsy 10-item weighted questionnaire (QOLIE-10-P; Cramer et al., 1996). In the first block, age, gender, and years of education were entered. In the second block, number of seizures in the past year and number of current AED medications were entered. In the final block, possible cognitive impairment, as measured by scores obtained on the Short Test of Mental Status (STMS; Kokmen et al., 1987) was entered.
Results: Results demonstrated that number of AEDs and possible cognitive impairment were significant predictors of QOL. In the first step, gender, age, and years of education were entered, with higher education predicting greater QOL (β = .23, p < .01). In the second step, number of AEDs and number of seizures in the past 12 months were entered, with greater number of AEDs (β = -.17, p = .01) and greater seizure frequency (β = -.16, p = .02) predicting lower QOL. Education level was still significant. In the final step, STMS total score was entered, with better scores predicting greater QOL (β = .19, p = .01). In the final model, only number of AEDs and possible cognitive impairment were significant predictors (p < .001). The final model accounted for 16% of the variance in QOL.
Conclusions: Findings suggest that possible cognitive impairment uniquely contributes to lower QOL in PWE while already accounting for seizure-related variables. While a focus on seizure management is always warranted, providers should consider how other recommendations, such as cognitive rehabilitation or support groups for those with cognitive difficulties, may maximize QOL in PWE.
Keywords: quality of life**,** cognitive functioning**,** epilepsy / seizure disorders
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50 Neuropsychological Investigation into Rate of Forgetting for Patients with Temporal Lobe Epilepsy

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Objective: Temporal lobe epilepsy (TLE) plays a significant role in an individual's cognitive functioning, particularly memory. Over the past few decades, research has identified a specific type of memory impairment in TLE, known as accelerated rate of forgetting (ALF), where individuals forget newly learned information over a period of days to weeks (Tramoni-Negre et al., 2017). While there is evidence of ALF beginning over a period of days to weeks, more recent research has indicated that individuals with TLE may exhibit forgetting beginning as early as 20-30 minutes after learning (Miller et al., 2017). The purpose of this study was to examine whether participants with TLE exhibited ALF

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after approximately a 20–30-minute delay across visual memory tasks and whether frequency of seizure activity is associated with ALF.
Participants and Methods: The current study utilized archival data collected as part of a larger study at an outpatient cognitive neurology unit at Beth Israel Deaconess Medical Center. The current study sample was comprised of adult patients who were seen at the cognitive neurology unit for neuropsychological testing and had consented to having their neuropsychological data included in the larger study. Assessment data included the Wechsler Test of Adult Reading (WTAR), Wechsler Memory Scale-IV: Logical Memory (WMS-IV), and the Face-Name (F-N) and Face-Occupation (F-O) Task. There were 32 participants in the TLE group and 11 in the control group who ranged from ages 20 to 69 years, with a mean age of 43 years (*SD*=12.82) and a mean completed education level of 14 years (*SD*=2.34). The average performance on the WTAR was 40.81 (*SD*=6.22). Frequency of seizure activity had a mean of 83.59 seizures per year (SD=67.61) and average age onset of seizures was 22.41 years (*SD*=13.27).
Results: Independent samples T-test revealed no significant relationship between TLE and performance on the F-N phase of the task (p=.209). Analyses did reveal a significant relationship between TLE and performance on the F-O phase of the task (p=.046), with the TLE group displaying poorer performance. Linear regression analyses for the relationship between frequency of seizures and performance on the F-N and F-O task revealed no significant relationship between frequency of seizures and ALF in TLE.
Conclusions: The current study is one of few studies to specifically examine associations between TLE and ALF beginning at 20-30 minute delays. No significant relationship was found between TLE and performance on the Logical Memory task, nor was there a significant relationship between frequency of seizures and ALF in TLE. Results also revealed no significant relationship between F-N recall and TLE. However, analyses revealed a significant difference in F-O recall, indicating the presence of ALF within TLE. Additional research is still needed to have a more comprehensive understanding of the impact TLE can have in relation to ALF and the cognitive health of individuals.
Keywords: neuropsychological assessment**,** temporal lobes**,** epilepsy / seizure disorders
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51 A Systematic Review of Host Genomic Variation and Neuropsychological Outcomes for Pediatric Cancer Survivors

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Objective: Pediatric survivors of brain tumors and acute lymphoblastic leukemia (ALL) are at risk for long-term deficits in their neuropsychological functioning. Researchers have begun examining associations between germline single nucleotide polymorphisms (SNPs), which interact with cancer treatment, and neuropsychological outcomes. This review synthesizes the impact of treatment-related toxicity from germline SNPs by neuropsychological domain (i.e., working memory, processing speed, psychological functioning) in pediatric survivors. By focusing on specific neuropsychological domains, this review will examine outcome measurement and critique methodology.
Participants and Methods: Thirteen studies were identified and included in this review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). All studies were published in peer-reviewed journals in English between 2000 and May 2021. Seven of the studies included pediatric acute lymphoblastic leukemia (ALL) survivors, and six of the studies included pediatric brain tumor survivors. Twelve of the studies had patients that underwent chemotherapy, and nine had patients who received radiation. Studies had a broad range of sample sizes from 18 to 545 survivors. Reviewed studies were not of sufficient quality for a meta-analysis due to varying measurement strategies, gaps in reported descriptive variables, and low power.

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Results: All neuropsychological domains evaluated in this review had associations with SNPs, except fine motor and visual integration abilities. Select targeted SNPs had significant associations in multiple studies or cohorts, particularly *NOS3* polymorphisms with intelligence quotient (IQ), *MTR* polymorphisms with executive functioning, and *CACNB2* polymorphisms with working memory. Additional genes had polymorphisms with significant results without a second study to validate the findings (i.e., *PPAR* with IQ and executive functioning, *SLCO2A1/SLCO2B1* with IQ, attention, working memory, and executive functioning, *MTHFR* and perceptual speed and executive functioning, *GSTP1* and adaptive functioning for female survivors). These polymorphisms span separate mechanistic pathways (i.e., defense against oxidative stress, neurotransmission, and folate metabolism), which provides evidence for investigating the additive effect of SNPs across mechanism categories. Thus far, only one pediatric ALL study has considered the additive risk of polymorphisms within a single pathophysiological pathway (folate metabolism). Two variants were identified that confer resiliency in neuropsychological functioning (on the *MS* and *CBS* genes). Conclusions were limited by reliance on unitary neuropsychological scores, inconsistent measurement specificity of neuropsychological skills, and the lack of consideration for multiple task demands. The inconsistent measurement of neurocognitive skills was most prominent for attention and working memory, which coincides with conflicting SNP mechanism category results in both domains.
Conclusions: Future research and replication studies should use validated measures of discrete skills that are central to empirically validated models of survivors' long-term outcomes (i.e., attention, working memory, processing speed). Guidelines for time since treatment, hearing and vision screenings, and exclusion criteria for neurodevelopmental disorders or prior brain trauma are critical to ensure consistency in methods across studies. Researchers should examine SNPs across pathophysiological pathways to investigate additive, genetic risk in pediatric cancer survivors. Future work should investigate resiliency genotypes and their underlying biological mechanisms.
Keywords: neurocognition**,** pediatric neuropsychology**,** cancer
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52 Prospective memory abilities of children with Down syndrome in comparison to typically developing children: Relations with social abilities.

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Objective: Down syndrome (DS), the most common form of intellectual disability with a known genetic etiology, is associated with specific memory impairments that exceed overall cognitive functioning (Godfrey & Lee 2018), as well as relative strengths of social skills (Fidler, Most, Booth-LaForce, Kelly, 2008). Only one study has examined prospective memory (PM), memory that requires remembering to carry out a future action, within this population and found that PM abilities of youth with DS fall below mental-age expectations (Godfrey & Lee, 2020). The current study sought to further characterize PM abilities and how they vary as a function of social functioning in youth with DS.
Participants and Methods: A total of 20 children with DS between the ages of 6 to 17 were recruited for the current study (M CA=12.52). Children with DS (n=15, M CA =10.99) were matched to typically-developing (TD) children (n=13, M CA=4.62) between the ages of 3 to 7 years old on raw scores from the Kaufman Brief Intelligence Test. Parents completed the Children's Communication Checklist, 2nd Edition. Participants completed PM tasks, which included instructions, a 25 minute delay with filler tasks, and a cue. The PM Standard instructions were neutral, and the PM Social instructions elicited social engagement by indicating that the examiner needed the child's help. The outcome variable included reverse-

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scored response times (higher scores indicating greater performance).
Results: A Mann Whitney U Signed Ranks Tests examining the PM Standard condition indicated a significant difference with a large effect size (U=40.00, p=0.008, r=0.51), as the DS group's scores (Mdn=41, IQR=22-54) were significantly below those of the TD group (Mdn=70, IQR=50-72). A second Mann Whitney U compared the PM Social condition between the groups, indicating no significant difference between the groups, with a small effect size (DS Mdn=55 IQR=40-73; TD Mdn=64, IQR=45.5-73; U=81.00, p=0.45). Lastly, to examine if the DS group's parent-reported social skills were associated with their PM performance, a linear regression was completed, which indicated that the CCC-2 Social Relations scaled score was significantly associated with the PM Social condition performance within the DS group (F(1,19)=4.382, p=0.05, R2=0.187).
Conclusions: Overall, children with DS demonstrated significantly weaker performance on a standard PM task in comparison to developmentally-matched TD children. However, when provided with social instructions, children with DS show comparable PM performance to TD peers, and this performance was significantly related to parents' report of general social skills. These results tentatively suggest PM skills of youth with DS may be supported through social engagement.
Keywords: intellectual disability**,** memory: prospective**,** social cognition

53 Heme oxygenase-1 (HO-1) Promoter Genotype and Neurocognition in Youth with and without Perinatally Acquired HIV in Thailand

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Objective: Neurocognitive impairment (NCI) is common in youth with perinatally-acquired HIV (YPHIV), including those with sustained viral suppression. Although mechanisms of NCI in YPHIV are not fully understood, oxidative stress and neuroinflammation may be contributing factors. Heme oxygenase-1 (HO-1) is a cytoprotective enzyme that protects against oxidative stress, inflammation, and cellular injury in the CNS. HO-1 transcription is regulated by a promoter polymorphism (dinucleotide (GT)n repeat length variation). Short HO-1 (GT)n repeat length alleles are associated with higher HO-1 expression and better outcomes in inflammation- and oxidative stress-related illnesses, including lower rates of global NCI in adults with HIV. To date, associations between HO-1 genotype and NCI have yet been examined in YPHIV of Asian ethnicity. This study examined associations between HO-1 genotype and neurocognitive functioning in 49 Thai YPHIV and age-matched uninfected peers (13-23 years).
Participants and Methods: 25 YPHIV and 24 controls (M_{age}=18.29 years; 53.1% female) from Chiang Mai, Thailand completed neurocognitive tests of processing speed, executive functioning, working memory, and motor dexterity and provided blood samples for genotyping. Neurocognitive test scores were converted to demographic-adjusted standard scores. HO-1 allele genotypes were determined by PCR amplification of the HO-1 promoter (GT)n repeat and fragment size determination on a capillary sequencer in blood-extracted DNA. Alleles were classified by number of (GT)n repeats: <27 (Short [S]); 27-34 (Medium [M]); >34 (Long [L]). Correlations assessed relationships among continuous variables in both the total sample and YPHIV only. General linear models (GLMs) examined associations between genotypes and neurocognitive measures. No genotype by HIV status interactions were found; thus, GLMs used the full sample entering HIV status as a covariate.
Results: Repeat length of participants' longest HO-1 (GT)n allele (i.e., length of the repeat in their least expressive/inductive HO-1 promoter) was associated with poorer performance in simple processing speed (Total sample: r=-.36, p=.011, medium effect; YPHIV only: r=-.61, p=.001, large effect). Comparing genotype

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groups and controlling for age, sex, education, and HIV status, participants with the 'S' genotypes (SS/SM) performed better in simple processing speed (t=-2.54, p=.016, $par.\eta^2$=.13) and poorer in complex processing speed (t=-2.08, p=.04, $par.\eta^2$=.09) compared to peers (SL/MM/ML). Participants with two 'S' alleles (SS) performed worse than all other genotypes in simple working memory (t=3.42, p=.009, $part.\eta^2$=.21). No differences were found between those grouped solely by the presence or absence of an 'S' allele (SS/SM/SL vs. MM/ML).
Conclusions: Although the presence of a single short 'S' HO-1 promoter (GT)n allele associates with a lower prevalence of NCI in adults with HIV, this relationship may be different in young people with HIV. In this pilot sample of Thai youth, we found unexpected associations: *i)* although the short 'S' HO-1 genotypes SS and SM associated with better simple processing speed, they associated with poorer complex processing speed; and *ii)* the SS genotype associated with poorer working memory. Oxidative stress and neuroinflammation may contribute differentially to different neurocognitive domains. Additional studies are needed to determine how the HO-1 (GT)n promoter genotype influences neurocognitive functioning across the lifespan and within different ethnic backgrounds.
Keywords: HIV/AIDS**,** genetics**,** transdisciplinary research
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54 Children with a Fragile X Premutation Show Elevated Parent-Reported Executive Function Problems

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Objective: Children with fragile X syndrome (an X-linked genetic disorder associated with >200 CGG repeats in the *FMR1* gene) present with neurodevelopmental disability, including significant deficits in executive skills. Whether those with a fragile X premutation allele (PM; defined as 55-200 CGG repeats in the *FMR1* gene) have executive skill deficits is uncertain. In adults with a PM allele, there is an increased risk of neuropsychiatric disorders including ADHD, as well as a risk of late onset fragile X-associated tremor/ataxia syndrome (FXTAS), a neurodegenerative disorder involving executive function deficits. To date, reports in children with a PM suggest an increase in ADHD compared to controls, but these findings have been in relatively small, biased samples. To determine whether there is a higher frequency of attention-related problems in children with a PM, parent-reported attention and executive function were examined in a sample of non-referred children carrying a PM.
Participants and Methods: Children ages 3 to 11 were identified as PM carriers or controls through fragile X prenatal studies. Parents reported 'yes' or 'no' to existing attention or hyperactivity problems (PM males n = 91, non-carrier males n = 111, PM females n = 73, non-carrier females n = 98). Parent-reported executive function was measured with the Behavior Rating Inventory of Executive Function preschool and school-aged editions (BRIEF-P and BRIEF-2; PM males n = 70, non-carrier males n = 60, PM females n = 46, non-carrier females n = 62). Shared scales were combined, including the global scale (Global Executive Composite) and 5 subscales (Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize). T-scores were computed for each scale and transformed to dichotomous variables (t < 60; t ³ 60). Fisher's exact tests were performed to explore whether parents reported higher frequencies of problems in PM carriers versus non-carriers. Exploratory correlational analyses were run between significant findings and CGG repeat size.

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Results: Results showed that in males, PM carriers were reported to have significantly greater incidence of hyperactivity than non-carriers (7.69% versus 0.90%, respectively; p = .024; odds ratio = 9.17, 95% CI [1.11, 75.95]). On the BRIEF, male PM carriers showed significantly elevated scores compared to non-carriers on the Inhibit subscale (27.14% compared to 8.33%; p = .006, odds ratio = 4.10, 95% CI [1.43, 11.78]), the Shift subscale (24.29% compared to 8.33%; p = .019,; odds ratio = 3.53, 95% CI [1.22, 10.25]), and the Plan/Organize subscale (24.29% compared to 8.33%; p = .019; odds ratio 3.53, 95% CI [1.22, 10.25]. No significant differences were identified for females. No significant correlation was found with any significant BRIEF scale and CGG repeat length.
Conclusions: Our findings suggest elevated attention and executive function problems in male children with a PM. However, these problems may be more subtle than previous studies have indicated. Future longitudinal studies are necessary to observe whether these increased problems in childhood are associated with a greater risk of developing FXTAS later in life.
Keywords: fragile X syndrome**,** executive functions**,** attention

55 Gender- and Age-Specific Differences in Problem Behavior in Children with a Fragile X Premutation

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Objective: The fragile x premutation (PM) (defined as 55-200 expanded CGG repeats in the X-linked *FMR1* gene) is present in approximately 1.5 million people in the US. The PM may expand to the >200 repeats and fragile X syndrome (FXS) when passed to the next generation. Adults who carry a PM are at risk for fragile X-associated neuropsychiatric disorders (FXAND – including anxiety, attention deficit hyperactivity disorder, and poor social skills), fragile X-associated primary ovarian insufficiency (FXPOI), and in later life may develop fragile X-associated tremor/ataxia syndrome (FXTAS). However, research on the neuropsychological profile of the PM is limited in children and largely relies on convenience sampling. This study aims to explore behaviors in a non-referred sample of children who carry a fragile X PM.
Participants and Methods: 265 families who underwent routine prenatal FXS studies performed at the NYS Institute for Basic Research in Developmental Disabilities Molecular Diagnostics lab were recruited. Parents completed the Child Behavior Checklist (CBCL), a standardized parent-report questionnaire assessing child behavior, for 122 PM carriers (ages 3 – 10, $\bar{x}$ = 5.77 ± 1.92, 59.0% male) and 143 non-carrier controls (ages 3 – 10, $\bar{x}$ = 5.92 ± 2.10, 51.8% male). Parents completed an additional survey assessing their child's use of special education services. T-scores were computed for each scale and transformed to dichotomous variables (T < 60; T $\geq$ 60). Fisher's exact tests were performed to explore whether parents reported higher frequencies of problems in PM carriers versus non-carriers. Exploratory correlational analyses were run between significant findings and CGG repeat size.
Results: On the CBCL, parents endorsed significantly more attention problems and anxiety problems in PM boys (n=72) than non-carriers (n=74) (Attention Problems: 15.28% vs 1.35%, respectively; p= 0.002; odds ratio = 13.16, 95% CI [1.65, 104.83]. Anxiety Problems: 18.06% vs 5.41%, p= 0.021; odds ratio = 3.86, 95% CI [1.19, 12.46]). Among females, one finding approached significance; parents endorsed more depressive problems in PM girls (n = 50) than non-carriers (n = 69) (20.00% vs 7.25%; p= 0.051, odds ratio = 3.20, 95% CI [1.02, 10.05]). Moreover, when compared to controls, boys under 6 years old with a PM (PM

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n = 41; controls n = 42) had significantly more internalizing problems on the CBCL (12.20% vs. 0%; *p*= 0.026, odds ratio = undefined). More PM carriers under 6 years old used special education services than non-carriers (8.42% vs. 1.77%; p= 0.027, odds ratio = 5.11, 95% CI [0.96, 27.19]), but these differences were not present in school aged participants. No correlations were found between CGG repeat length and behavior.
Conclusions: The present study found subtle gender- and age-specific differences between PM carriers and controls, including increased attention and anxiety problems in PM boys and increased depressive problems in PM girls. The rates of problem behaviors in this large sample of non-referred PM carrier children found in this study are lower than previously reported. This study suggests children with a PM are at risk for having more behavior problems than the general population.
Keywords: genetic neuropsychology**,** attention**,** anxiety
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56 Social Communication and Interaction Deficits in Boys with a Fragile X Premutation

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Objective: Approximately 14% of males and 5% of females with Fragile X Syndrome (defined as >200 CGG repeats on the X-linked FMR1 gene) are diagnosed with Autism Spectrum Disorder (ASD). Less is known about phenotype of children with a fragile X premutation (CGG expansions between 55 and 200 repeats). Many studies have found an increased prevalence of ASD in children with the PM compared to controls, but interpretation is limited by ascertainment bias (i.e., those who present with symptoms are evaluated) and small sample size. The current study is designed to examine social communication behaviors in a large sample of non-referred children with the premutation.
Participants and Methods: Participants included children ages 3-11 who were identified prenatally as acarrying PM or normal allele. Parents reported 'yes' or 'no' to existing ASD diagnosis (PM carrier males n = 2, non-carrier males n = 1, PM carrier females n = 0, non-carrier females n = 0). Parent-reported social communication was measured with the Social Responsiveness Scale, Second Edition (SRS-2 preschool and school-age editions). The SRS-2 consists of 5 subscales (social motivation, social awareness, social cognition, social communication, and restricted interests and repetitive behavior), two DSM-5 compatible composite scores (social communication and interaction and restricted interests and repetitive behavior), and a total score. Data from 254 participants were collected (PM carrier males n = 74, non-carrier males n = 66, PM carrier females n = 49, non-carrier females n = 65). T-scores from each scale were transformed into dichotomous variables based on cutoffs (t < 60; t ³ 60). Fisher's exact tests were conducted to compare social communication in PM carriers versus controls. Exploratory correlational analyses examined association of CGG repeat size with significant findings.
Results: Results demonstrated there was no between-group difference on parent-report of ASD. On the SRS-2, male PM carriers showed significantly elevated scores compared to non-carriers on the Social Communication subscale (1.52% compared to 10.81%; *p* = .036, Fisher's exact test; odds ratio = 7.88, 95% CI [0.96, 64.78]), Social Communication and Interaction DSM-5 compatible composite score (1.52% compared to 12.16%; *p* = .019, Fisher's exact test; odds ratio = 9.00, 95% CI [1.11, 73.09]), and the Total score (1.52% compared to 12.16%; *p* = .019, Fisher's exact test; odds ratio = 9.00, 95% CI [1.11, 73.09]). No significant

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differences were identified on any of the SRS-2 scales for females. Further, CGG repeat size was not associated with SRS-2 findings.
Conclusions: Findings indicate that in a non-referred PM sample, there is no increased report of ASD diagnosis. On the standardized questionnaire, parents endorsed elevated social communication problems in male PM carriers compared to controls, although the magnitude of social communication challenges observed are more subtle than those reported in prior studies. Given that our sample is the largest, non-referred sample of PM children to date, the data confirm that social communication problems do exist in PM boys, but in lower rates than previously reported.
Keywords: fragile X syndrome

57 The Relationship Between Executive Functioning and CAG Repeat in Juvenile Huntington's Disease

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Objective: Executive dysfunction is common in both the prodromal and manifest stages of Huntington's disease (HD). Prior research demonstrated a positive relationship between CAG repeats and executive dysfunction in adults. Conversely, studies with individuals with Juvenile Huntington's disease (JHD) found a negative relationship between CAG repeats and executive dysfunction for children with CAG repeats under 44. However, further investigation is needed to assess if this relationship exists for children with CAG repeats over 44. Investigating the relationship between specific facets of executive functioning and number of CAG repeats is warranted to predict functional limitations that may be present in JHD. The current study investigated the relationships between executive functioning and CAG repeats in children with CAG repeats greater than 44 and assessed the impact of age on the relationship between variables.
Participants and Methods: Data was analyzed from the Kids HD study and included 56 participants (mean age = 15.54, SD = 5.3, mean CAG repeat = 70.45, SD = 15.39, GAI =72.09, SD =19.16). The Behavior Rating Inventory of Executive Functioning-Parent Form (BRIEF) assessed facets of executive functioning and included the following subscales: Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. Bivariate partial correlations and regression analyses examined differences in executive functioning across CAG repeats and assessed for moderating effects of age. Regression models used mean-centered values of CAG repeats, age, and GAI (covariate) to probe their predictive ability on individual subscales.
Results: Partial correlations revealed a significant negative relationship between CAG repeat length and executive dysfunction on the BRIEF including inhibition (r = -0.29, p = 0.03); initiation (r = -0.56, p = <0.01); working memory (r = -0.50, p = <0.01); planning/organization (r = -0.46, p = <0.01); orderliness (Organization of Materials) (r = -0.54, p = <0.01) and monitoring (r = -0.37, p = <0.01). Regression analysis revealed CAG repeat length significantly predicted lower T-scores on the Inhibit, Emotional Control, Working Memory, and Organization of Materials subscales at $\alpha \leq .05$. The addition of age as a moderator yielded a statistically significant interaction for T-scores on the Organization of Materials subscale [B = .426, $t(1, 51) = .890$]. The overall model was significant [$R^2 = .387$, $F(4,51) = 8.045$, $p < .001$], with the interaction term [$\Delta R^2 = .049$, $F(1,51) = 4.086$, $p < .05$] accounting for significantly more variance than age or CAG repeat alone.
Conclusions: The current study expanded on prior research, finding similar to children with CAG repeats below 44, there is a negative association between executive dysfunction and CAG repeats for children above 44. Subscale level data suggested several domains demonstrated this relationship. CAG repeats were most strongly related to initiation, while no relationship for emotional control or shifting were found. Finally, age moderated the relationship between orderliness and CAG repeats, with a stronger negative relationship found between disorderliness and CAG repeats for children over age 15 compared to children under 15,

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supporting prior theories that the mutant HTT gene may play a role in neurodevelopment.
Keywords: executive functions**,** Huntington's disease**,** pediatric neuropsychology
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58 Population-Based Assessment of Neurodevelopmental and Mental Health Outcomes Among 2,145 Pediatric Patients with Turner Syndrome

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Objective: Previous literature has identified various areas of neurocognitive and psychosocial risk in individuals with Turner Syndrome (TS), but the majority of studies have focused on small clinic samples. Using a large, multi-site sample drawn from the PEDSnet Data Network, we sought to examine the odds of neurodevelopmental and mental health disorders among individuals with a diagnosis of Turner Syndrome compared to controls.
Participants and Methods: The PEDSnet Data Network is a large, multi-site, multi-specialty network that includes electronic medical record (EMR) information from >6 million children at US children's hospitals (www.pedsnet.org). PEDSnet was used to identify individuals with recorded diagnosis of TS (N=2,145) from 6 sites in the US (2009-2019) who were then matched 1:4 to female controls without TS on seven demographic variables (N=8,579). Codes from SNOMED CT, an international, multilingual classification system developed with the goal of creating a common global healthcare language, were extracted from patient problem list or billing diagnoses and categorized by system. Odds ratios (OR) and 95% confidence intervals (CI) for each outcome were calculated from generalized estimating equations adjusting for duration of follow up and most recent age. To account for multiple comparisons, significance was set at 0.005.
Results: Of individuals with TS, 24.2% had a diagnosis falling under the neurodevelopmental disorder composite compared to only 11.9% of controls, representing a higher odds of having a neurodevelopmental disorder in TS (OR 2.47, 95% CI: 2.19, 2.79, p<0.0001). Specifically, individuals with TS had a higher odds of developmental delay (OR 3.67, 95% CI: 3.02, 4.47, p<0.0001), intellectual disability (ID; OR 1.71, 95% CI: 1.22, 2.40, p=0.002), attention-deficit/hyperactivity disorder (ADHD; OR 1.76, 95% CI: 1.47, 2.12, p<0.0001), learning disorder (LD; OR 3.13, 95% CI: 2.39, 4.09, p=0.0008), and autism spectrum disorder (ASD; OR 2.29, 95% CI: 1.62, 3.23, p<0.0001). In contrast, individuals with TS did not have an increased odds of diagnoses falling under the mental health composite, such as anxiety disorders, adjustment disorder, mood disorders or personality disorders. In fact, individuals with TS appeared to have lower rates of anxiety (OR 0.78, 95% CI: 0.66, 0.93, p<0.005) and depression (OR 0.38, 95% CI: 0.29, 0.50, p<0.0001) compared to matched peers.
Conclusions: In this population-based study, pediatric patients with a diagnosis of TS have a higher odds of neurodevelopmental disorders compared to controls. Consistent with previous literature, individuals with TS had a higher rate of ADHD and LD. There were also higher rates of ID and ASD in this sample than have previously been documented, supporting the need for standardized neuropsychological and psychological evaluations as recommended by clinical care guidelines. Interestingly, there was not an elevated risk for mental health disorders, and in fact a decreased risk for some disorders such as anxiety, which has been historically identified to occur at a greater rate in individuals with TS. Future directions include examining risk

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and protective factors for neurocognitive and mental health conditions in this population.
Keywords: Turner syndrome**,** child development disorders**,** genetic disorders
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59 Neuropsychological Findings in Adolescent-Onset Spinocerebellar Ataxia Type 7 (SCA7)

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Objective: Spinocerebellar ataxia (SCA) refers to a heterogeneous set of autosomal dominant neurodegenerative ataxias. SCA Type 7 accounts for 2% of all SCAs and is the only one accompanied by retinal degeneration. The literature for cognitive profiles with adolescent SCA is very limited; most SCAs have onset in adulthood or studies focus on more common types. All SCAs include progressive cerebellar atrophy with varying degrees of severity, extracerebellar involvement, and age of onset. Evaluation for SCA7 must account for changes in color vision in addition to motor symptoms (e.g., dysarthria, dysmetria, ataxia). The current case study addresses gaps in the SCA literature by focusing on neuropsychological assessment of adolescent onset SCA, within the unique considerations of SCA7's visual impairment.
Participants and Methods: The patient is a 14-year, 11-month-old male with diagnosis of SCA7 four months prior to evaluation. Genetic testing revealed 61 CAG repeats; adolescent onset is associated with CAG repeat sized 60-100. He was typically developing and grades were As in regular classes prior to disease onset. Vision issues began approximately 5 years prior and he has a 504 plan for cone-rod dystrophy. Motor skills began deteriorating over the past 2 years, with accelerated symptoms in the past year. He has ataxic gait, fine motor difficulties, and mild dysarthria. Head CT scan from 2018 was normal, whereas brain MRI in 2020 showed mild to moderate atrophy of cerebellum and pons. Concerns included decreasing attention, processing speed, executive functioning, and failing grades, as well as increased mood lability and anxiety. A comprehensive neuropsychological evaluation was completed to assist with treatment recommendations.
Results: Neuropsychological testing demonstrated average performance of auditory verbal tasks, including verbal comprehension, verbal memory, and listening comprehension. Fine motor and visual motor integration were impaired (<1st percentile). Visual tasks were variable; he performed best on tasks with fewer colors/high contrast and pictures. WISC-V Visual Puzzles and Picture Span were average, whereas Matrix Reasoning and NEPSY-II Memory for Designs were discontinued due to poor color discrimination. Processing speed was below average for oral tasks and well below average/impaired for motor tasks. Cerebellar associated cognitive deficits included sustained auditory attention and executive skills, including set initiation, inhibition, planning efficiency, and emotional regulation.
Conclusions: The SCA7 literature is sparse, particularly for neurocognitive expectations with adolescent onset. This case study provides guidance for neuropsychological findings, measure selection, and recommendations for adolescent SCA7. The symptom onset was typical, with visual impairment prior to motor degeneration. Motor functioning was significantly impaired within 2 years of motor symptoms. Cognitive deficits included attention, processing speed, executive functioning, and emotional regulation. The use of colored visual tests was variable due to moderate retinal degeneration. Future evaluations will require black/white stimuli while vision remains, rendering many standard visual and nonverbal tests inaccessible for the patient. Verbal/auditory skills were preserved, which will become increasingly important as motor and visual deficits progress. Given the recent diagnosis and anticipated disease progression, family factors and adjustment were also essential considerations in treatment planning for adolescent onset SCA7.

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Keywords: ataxia, cerebellum, assessment
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60 Longitudinal Intellectual Functioning in a Boy With Trisomy 8 Mosaicism and Partial Agenesis of the Corpus Callosum

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Objective: Trisomy 8 mosaicism is a chromosomal abnormality caused by having three copies of chromosome 8 and is associated with stunted growth and cognitive impairment. Agenesis of the corpus callosum (AgCC), a structure formed by billions of axons traversing from each brain hemisphere to the other, reflects a failure of in utero neural development that results in compromised interhemispheric neural communication. The cause of AgCC is multifactorial, and Trisomy 8 mosaicism is found in a subset of cases. A neuropsychological profile of AgCC typically reflects deficits due to limited/absent inter-hemispheric transfer of sensory-motor information, manifesting as slow processing speed and compromised learning and complex problem-solving difficulties. There are few longitudinal neuropsychological studies assessing individuals with Trisomy 8 and AgCC. This case study evaluates the intellectual development of a child with Trisomy 8 and AgCC over a 2-year span.
Participants and Methods: This case study presents a 9-year-old boy with a history of trisomy 8 mosaicism and AgCC. He sustained a fall at age 3 month, striking his head with superficial injury; CT brain imaging at a local ER revealed no evidence of intracranial brain injury. However, an incidental finding of AgCC was noted -- but not communicated to his parents. He struggled academically and had an IEP providing academic supports. He underwent 2 comprehensive neuropsychological evaluations, the first at age 7 (prior to the diagnosis of trisomy-8 mutation) for academic intervention planning and again at age 9 to evaluate progress. His parents were informed about the possible AgCC during the second assessment, and subsequent MRI studies confirmed it. The WISC-V was administered on both occasions and is the focus of statistical study here.
Results: Regression-based reliable-change scores were calculated, with statistically significant change being conceptualized as +/- 1.5 SDs between WISC-V subtest scale scores and composite index standard scores. Statistically significant differences between pre and post-test scores were observed, reflecting a significant *decrease* on the Fluid Reasoning Index and on the Block Design and Figure Weights subtest scores. There were no statistically significant improvements in performance noted between first and second testing on any WISC-V subtest or index.
Conclusions: This case highlights the importance of neuropsychological evaluations for monitoring treatment progress and recommendations, and the importance of examining and addressing the root cause of limited improvement in intellectual / academic abilities over time despite interventions and academic support. In this case, limitations on academic progress are thought to be attributable to inefficient interhemispheric neural information transfer due to AgCC -- as reliance on efficient interhemispheric transfer through the CC increases with development and academic progress. It is not that this child is regressing, but rather that his rate of cognitive and academic development is hindered by the AgCC and as a result he is falling farther behind expectations for his age. Since cognitive deficits in children with AgCC can be mild to moderate in nature, future research should focus on high- and low-functioning cases with AgCC for differences in their developmental cognitive / academic trajectory in order to better inform clinical decisions about appropriately targeted therapeutic and academic interventions.
Keywords: corpus callosum, intellectual functioning, genetic disorders

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61 Neuropsychological Profile and Behavioral Characteristics Associated with Wiedemann Steiner Syndrome: A Case Series

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Objective: Wiedemann Steiner Syndrome (WSS) is a rare Mendelian disorder of the epigenetic machinery caused by heterozygous loss of function in KMT2A, a histone methyltransferase that impacts transcription of multiple genes. While recent investigations have associated the WSS clinical phenotype with intellectual disability or developmental delay, the specific neurocognitive profile of strengths/weaknesses and behavioral presentation of this syndrome remain unknown. Accordingly, this case series will provide cognitive, psychosocial, and neurobehavioral profiles of 5 pediatric patients with WSS who underwent neuropsychological evaluation.
Participants and Methods: This study involves a retrospective medical chart review of 5 pediatric patients (ages 6 to 13 years; 2 females), who underwent an outpatient neuropsychological evaluation at an academic medical center. Four patients completed the assessment through a home-based telehealth format whereas one patient tested in-person in clinic. Two patients completed tests from the DAS-II that yield Verbal and Nonverbal Indexes. The other three completed the WISC-V that yielded Verbal Comprehension and Non-motor Nonverbal Index. Visual Memory (Immediate and Delayed Recall) were indexed by tests from the ChAMP or DAS-II. Verbal Memory (Immediate and Delayed Recall) was measured by ChAMP Lists. Sight word reading and math calculation skills were measured by KTEA-3 Letter and Word Recognition and Math Computation, or WIAT-III Word Reading and Numerical Operations. Caregivers completed the Conners Behavior Rating Scale (CBRS) or Connors Early Childhood (CEC) inventories, in addition to the BRIEF-2 and ABAS-3. Standard scores on performance-based measures were converted to percentile ranks and coded for broadly average (≥16th percentile), low average (9th to 15th percentile), or below average to impaired (≤8th percentile). Mean caregiver ratings were coded as within normal limits, at-risk, or clinically significant, based on the inventory's interpretive manual.
Results: Of our sample, over half were within normal limits on the Verbal Index (3/5), receptive vocabulary (3/4) and verbal memory (4/4, 2/4, 3/4 for immediate recall, delayed recall and delayed recognition). In contrast, most performed below average to impaired on the Nonverbal Index (4/5), visual perception (3/4), and visual memory (3/5, 3/5 for immediate and delayed recognition). All showed intact sight word reading (5/5) but below average to impaired math calculation skills (5/5). A majority of the sample showed below average to impaired basic auditory attention (3/5) and working memory (3/5). Caregiver ratings reflected clinically significant concerns with ADHD inattentive symptoms (3/4), social functioning (4/4), low mood (3/4), anxiety (3/4), and executive functioning (3/5). Ratings on the ABAS-3 indicate 3/5 or more of the sample were below average to impaired on most adaptive skills, with the exception of Communication and Social Skills (3/5 and 4/5 were intact).
Conclusions: Non-verbal reasoning/memory, attention, working memory and math skills are weaker areas among those with WSS; whereas, sight word reading, verbal reasoning, and verbal learning/memory are relative strengths. Executive functioning, low mood, anxiety and peer relationships are areas of greater risk among those with WSS. These results will be discussed in the context of recent literature on loss of function or knockdown of KMT2A in the downregulation of hippocampal neurogenesis and maturation of prefrontal cortex in animal models.
Keywords: genetic disorders**,** genetic neuropsychology**,** genetics

Poster Symposium: Neuropsychological Outcomes for

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Pediatric Brain Tumor Survivors: An Exploration of Proton and Photon Radiation Therapy

8:30 - 9:30am
Thursday, February 3, 2022

12 Neuropsychological Outcomes for Pediatric Brain Tumor Survivors: An Exploration of Proton and Photon Radiation Therapy

Chair

Iris Paltin
The Children's Hospital of Philadelphia; University of Pennsylvania, Philadelphia, USA

Pediatric brain tumors and treatment are associated with lasting neuropsychological effects that can limit functional independence in adulthood. There have been significant advances in the treatment of pediatric brain tumors including surgical approaches, chemotherapy protocols, and management of medical comorbidities, that contribute to improved patient and family outcomes. Proton radiation therapy is an exciting technological innovation that may also reduce the cognitive impact of treatment due to reduced entrance dose, eliminated exit dose, and reduced treatment volumes. This structural sparing is expected to result in preserved neurocognitive functioning compared to those treated with conventional photon radiation therapy.
At the same time, proton radiation therapy is not equally available to all children. It is more expensive and requires significant family sacrifice, such as family separation, geographic relocation, and increased financial burden, compared to photon treatment. We must therefore develop a greater understanding of the neurocognitive outcomes associated with proton radiation therapy. This symposium will explore the outcomes of infants, children, and adolescents treated with cranial radiation therapy, either proton or photon, within the modern treatment environment.
The symposium will include an introduction (10 minutes), four data-driven talks (15 minutes each), a concluding summary (5 minutes) and time for questions and discussion (15 minutes). The first presentation (Nielsen) will explore domains of neuropsychological functioning that are preserved, versus at risk, in a cohort of children, adolescents, and young adults who participated in neuropsychological evaluations at baseline and several years after proton radiation therapy. The second talk (Conklin) will investigate the trajectories of infants treated for brain tumors, comparing those treated with proton and photon radiation therapy. The third talk (Warren) will examine associations between cognitive and social functioning and differences in outcome by radiotherapy modality (proton vs. photon) in pediatric brain tumor survivors. The final presentation (Walsh) will apply a patient-centered approach to monitoring cognitive late effects in children who underwent proton, photon, or no radiation therapy and explore how utilizing reliable change methodology to analyze individual neurocognitive patient trajectories allows for more precise, empirically-driven, individualized neuropsychological care for brain tumor survivors.
Proton radiation therapy continues to be a limited resource. A better appreciation of the risk and resiliencies experienced by patients and their families prior to the initiation of radiation therapy, and a more nuanced understanding of outcomes, is important information for both families and treatment teams as they navigate new diagnoses and required treatments. Consistent with the 2022 conference theme of “Cultivating a New Ethos”, this symposium will help attendees identify universal, potentially modifiable factors, including social disparities, that influence long term neurocognitive abilities and quality of life. It will also prompt the hypothesis-driven identification of those at greatest risk for change in neuropsychological functioning after pediatric brain tumor treatment, considering both medical and social determinants of health.
Keywords: pediatric neuropsychology**,** brain tumor*,* radiotherapy

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269 Neuropsychological Outcomes of Pediatric Brain Tumor Survivors Following Proton Radiation Therapy

Johanna Nielsen[1], Madison Stein[1], Lamia Barakat[1,2], Michael Fisher[1,2], Christine Hill-Kayser[2], Robert Lustig[2], Jane Minturn[1,2], Iris Paltin[1,2]
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Objective: Pediatric survivors of brain tumors are at risk for long term cognitive difficulties related to both disease processes and medical treatment. Radiation treatment can impact neurodevelopment and lead to cognitive “late effects” that worsen over time. Proton Radiation Therapy (PRT) is proposed to minimize cognitive effects by limiting radiation to the tumor site, but few studies to date have examined whether PRT is associated with improved cognitive outcomes. This study examines long-term neuropsychological (NP) outcomes following PRT.
Participants and Methods: Medical record review identified 56 patients who received PRT at the Children’s Hospital of Philadelphia (CHOP)/the Penn Abramson Cancer Center and completed a NP evaluation *both* at baseline (before or during PRT treatment) and at least two years later. Youth were on average 10.6 (SD=5.1) years old at baseline and 14.7 (SD=5.01) at follow-up and were mostly male (73%). NP battery varied based on age and clinical presentation. One-sample t-tests compared NP functioning to normative sample means. Paired sample t-tests examined differences in NP functioning over time.
Results: NP performance at follow-up was in the average range and was *not* significantly different from the normative sample mean in most domains including overall IQ (m = 97.2, p = 0.25), verbal IQ (m = 98.8, p = 0.61), non-verbal IQ (m = 97.6, p = 0.31), working memory (m = 9.48, p = 0.27), attention (m = 52.2, p = 0.14), impulsivity (m = 53.0, p = 0.052), problem solving (accuracy: m = 97.4, p = 0.28; efficiency: m = 96.5, p = 0.17; speed: m= 95.5, p = 0.09), semantic fluency (m = 0.09, p = 0.61), parent-reported quality of life (m = -0.31, p = 0.20), emotional/behavioral functioning (m = 49.0, p = 0.63), and executive functioning (m = 52.8, p = 0.08). Performance was below the normative sample mean, but in the average range, on measures of memory (free recall: m = -0.59, p = 0.009; cued recall: m = -0.54, p = 0.01), phonemic fluency (m = -0.50, p = 0.009), and parent-reported adaptive functioning (m = 91, p < 0.001). Performance was in the low average range on measures of processing speed (m = 87.0, p < 0.001) and visual-motor integration (m = 84.6, p < 0.001), while fine motor speed and dexterity was in the exceptionally low range (m = 66.4, p < 0.001). Follow-up NP functioning differed from baseline for nonverbal IQ (p = 0.01), visual-motor integration (p = 0.03), and fine motor speed/dexterity (p = 0.03).
Conclusions: Youth who received PRT performed within in the average range on most NP measures years later. Areas of long-term risk include processing speed, visual-motor integration, and fine motor speed/dexterity. NP test performance was largely stable over time, suggesting that cognitive difficulties may be related to early medical factors (e.g., tumor type/location, surgery) rather than additive effects of PRT. Future research exploring individual differences in NP trajectories following PRT will be important to identify youth at greatest cognitive risk and guide prevention/intervention efforts.
Keywords: pediatric neuropsychology**,** brain tumor**,** radiotherapy

270 Cognitive Outcomes among Infants Treated for Brain Tumors: Consideration of Proton versus Photon Radiation Therapy

Heather M Conklin[1], Jeanelle S Ali[1], Jason M Ashford[1], Michelle A Swain[2], Lana L Harder[3], Bonnie L Carlson-Green[4], Jonathan M Miller[5], Joanna Wallace[6], Ryan J Kaner[7], Catherine A Billups[1], Arzu Onar-Thomas[1], Amar Gajjar[1], Thomas E Merchant[1]
[1]St. Jude Children's Research Hospital, Memphis, TN, USA. [2]Queensland Children's Hospital, Brisbane, Australia. [3]Children's Medical Center Dallas, Dallas, TX, USA. [4]Children's Minnesota, Minneapolis, MN, USA. [5]Pediatric and Developmental

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Neuropsychological Services, Eagan, MN, USA. [6]Lucile Packard Children's Hospital at Stanford, Palo Alto, CA, USA. [7]Rady Children's Hospital, San Diego, CA, USA

Objective: Infants treated for brain tumors are at significant risk for cognitive late effects of their disease and treatment due to increased vulnerability of a developing brain and prolonged disruptions to the early learning environment. Contemporary treatment approaches strive to improve survival rates for infants while minimizing treatment-related morbidity including eliminating, delaying, or reducing the dose of radiation therapy (RT). Use of proton RT is one potential strategy to mitigate neurocognitive risk by reducing the dose to normal brain tissue as compared to photon RT. The literature is limited and inconsistent regarding cognitive outcomes among infants treated for brain tumors due to small sample sizes, dissimilar treatment approaches, cross-sectional data, and short follow-up. Accordingly, we investigated clinical and treatment predictors of cognitive outcomes in children treated for brain tumors during infancy (including proton versus photon RT) as part of a large, prospective, multi-site, longitudinal trial.
Participants and Methods: One hundred and thirty-nine infants with a newly diagnosed brain tumor (59% Male, 75% White, mean age at diagnosis of 1.7 ± 1.0 years; 60% infratentorial tumor location, 72% gross total resection) were treated with chemotherapy, with or without focal photon or proton RT. RT groups (photon n= 37; proton n= 41) were well-matched in sex, age at diagnosis, socioeconomic status (SES), tumor location, number of surgeries, surgical extent and need for CSF diversion. Cognitive assessments were conducted at baseline, six months, one year, and then annually for five years. Median length of follow-up was 816 days (26.8 months). Neurocognitive testing included assessment of intellectual functioning (intellectual quotient [IQ]), as well as parent ratings of executive functioning and emotional/ behavioral functioning.
Results: At baseline, IQ, parent-reported working memory, and parent-reported adaptive functioning were worse than normative expectations. Baseline cognitive difficulties were associated with younger age at diagnosis and lower SES. Linear mixed models did not demonstrate a change in IQ over time. There were increased parent-reported attention and executive problems over time. Increased concerns were related to supratentorial tumor location and need for CSF diversion. There were no differences in cognitive outcomes based on treatment exposure (chemotherapy only versus chemotherapy with RT, proton versus photon focal RT).
Conclusions: Findings indicate infants with brain tumors have a different trajectory of neurocognitive functioning when compared to their older counterparts with change in cognition seemingly unrelated to treatment type. These young children demonstrate an early (prior to adjuvant therapy) impact on IQ and then remain relatively stable over time, which may reflect increased vulnerability to tumor and surgery and/or increased neuroplasticity. The failure to find benefit of proton over photon RT may be related to delivery of RT being entirely focal for tumors that were largely infratentorial in location. Further, attrition limited exploration of longer term cognitive outcomes. This sample is the largest to date to prospectively explore cognitive functioning of infants with brain tumors, and those treated with proton versus photon RT. These findings may serve to guide treatment planning and indicate targets for cognitive monitoring and intervention.
Keywords: pediatric neuropsychology**,** brain tumor**,** radiotherapy

356 Cognitive Predictors of Peer Relations and Social Skills in Pediatric Brain Tumor Survivors Treated with Photon Versus Proton Radiation Therapy

Emily A Warren[1], Kimberly P Rahugbar[1], Paul T Cirino[2], Amanda E Child[3], David R Grosshans[4], Arnold C Paulino[4], Fatih Okcu[5], Charles Minard[6], Douglas Ris[1], Anita Mahajan[7], Andres Viana[2], Murali Chintagumpala[5], Lisa S Kahalley[1]
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Objective: Pediatric brain tumor survivors are at risk for poor long-term social outcomes, making the identification of determinants of social impairment a critical area for survivorship research. Given the known interrelationship of cognitive and social functioning, investigation into cognitive skill deficits and the potential impact of these deficits on specific aspects of survivor social functioning is warranted. It also remains unknown whether cognitive sparing with proton radiotherapy (PRT) supports better social outcomes relative to photon radiotherapy (XRT). We hypothesized that survivors treated with PRT would outperform those treated with XRT on cognitive measures and would be rated by caregivers as having better social outcomes.
Participants and Methods: Survivors who underwent PRT (n = 38) or XRT (n = 20) participated in a comprehensive neurocognitive evaluation >1 year post-radiotherapy. Group differences in cognitive and social functioning were assessed using ANCOVA. Regression analyses examined predictors of peer relations and social skills. Frequency data on the number of participants rated as having impaired social outcomes were also examined.
Results: Age at evaluation, radiation dose, tumor diameter, and sex did not differ between radiation groups (all p > 0.05). However, XRT participants were younger at diagnosis (XRT M = 5.0 years, PRT M = 7.6 years) and further out from radiotherapy (XRT M = 8.7 years, PRT M = 4.6 years). The XRT group performed worse than the PRT group on measures of processing speed (p = .01) and verbal memory (p < .01); however, social outcomes did not differ by radiation type. Survivors had more peer relation difficulties relative to normative standards, $t(57)$ = 3.03, p < .01, and verbal memory significantly predicted peer relations (t = -2.01, p = .05). Maximum tumor diameter significantly predicted social skills (t = -2.23, p < .05). Item level review indicated that 9% of survivors were rated as having no friendships and not knowing how to make friends, while 22-27% experienced social exclusion (e.g., not being invited to play, selected last for team games).
Conclusions: Survivors are at risk for social challenges, with peer relationships emerging as an area of particular concern at long-term follow-up. Cognitive impairments, particularly in verbal memory, may place survivors at heightened risk for social difficulties. Social outcomes did not differ based on radiation modality, although significant differences in cognitive outcomes between survivors treated with XRT versus PRT extend previous findings suggesting a potential neuroprotective benefit of PRT for cognitive skills. Results support continued monitoring of cognitive and social functioning throughout survivorship. Further investigations will benefit from consideration of specific treatment factors as well as broader aspects of brain tumor diagnosis and treatment as potentially meaningful influencers of survivor social outcomes.
Keywords: pediatric neuropsychology**,** brain tumor**,** radiotherapy
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602 Patient-Centered Monitoring of Cognitive Late Effects in Pediatric Brain Tumor Survivors.

Karin S Walsh[1,2], Katilyn M Tiplady[1], Shawna S van Scoyoc[1], Hannah Weisman[1], Kristina K Hardy[1,2]
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Objective: With increasing survival in pediatric brain tumor patients, long-term functioning and quality of life is an important standard of care. Extant literature highlighting the risks of cognitive late effects in children with brain tumors exists. However, the heterogeneity of this patient group and treatment protocols limit generalizability and create missed opportunities

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to understand unique patient experiences. The establishment of patient-centered approaches that allow for empirically-derived meaningful change in the years following tumor diagnosis and treatment can significantly improve patient care. Clinical neuropsychology is tasked with predicting and evaluating meaningful change in *individual* children with brain tumors, typically through repeat assessment with standardized cognitive tests and questionnaires. Clinical judgement is typically used in determining if a change is significant or meaningful in a particular patient. However, this imprecise method carries risk for over- and under-interpreting changes. Applying an empirical method such as reliable change analysis allows investigation of whether clinically significant change has occurred. Applying this approach to monitor late effects in pediatric brain tumor survivors is the primary objective of this project. We compared those who have received proton radiation, photon radiation, or no radiation.
Participants and Methods: 72 consecutive patients diagnosed with a brain tumor and evaluated by neuropsychology with at least 2 assessments were included (first and most recent). The primary outcomes were processing speed (Wechsler PSI; BRIEF Initiate Scale) and working memory (Wechsler WMI; BRIEF Working Memory Scale). Reliable change indices (RCIs) for each test score were computed (Chelune et al., 1993). Using an 80% CI, 10% would be expected to decline, while 90% would stay stable or improve.
Results: The mean age at T1 was 10.1 years for the entire sample and 13.7 years at T2, with an average of 3.6 years between assessments. Males made up 54.2% of the sample overall. The majority were supratentorial tumors (58.3%; posterior fossa tumors 41.7%). The percentage of patients receiving no radiation that showed declines in processing speed was higher than the expected 10% on performance tasks (PSI=18.2%) but not on parent report (Initiate=10%). For working memory, it was higher than the expected rate (PSI=27.3%, Initiate=30%). Patients treated with photon xrt showed similar or lower rates of significant change in processing speed (PSI = 0%, Initiate=12.5%). However, working memory declines occurred in a higher than expected number in the photon group (WMI=33.3%, WM=33.3%). In patients treated with protons, a higher number than expected showed declines on performance-based processing speed tasks (PSI=33.3%) and parent-ratings (Initiate=18.1%). Working memory declines were also higher on performance tasks (WMI=27.3%) and parent ratings (WM=36.4%).
Conclusions: These results highlight the utility of individualized analysis of change in cognitive functioning in pediatric brain tumor survivors. RCI provides an objective, data-driven decision-making approach for monitoring cognitive late effects and addresses the heterogeneity of the population of brain tumor survivors, supporting individualized neuropsychological care. This ensures that all children receive the care they need regardless of their treatment history, which my erroneously suggest that some children require less monitoring and care.
Keywords: brain tumor**,** pediatric neuropsychology
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Live Program Open

9:55 - 10:00am
Thursday, February 3, 2022

LIVE Plenary B: Open Science and Digital Neuropsychology

Presenter: Laura Germine

10:00 - 10:55am
Thursday, February 3, 2022

Abstract & Learning Objectives:
This talk will be focused on scientific and ethical considerations at the intersection of digital neuropsychology and open science. This includes basic questions of what it means for data and methods to be ‘open’ in neuropsychology, who openness benefits, and the difference between openness and

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accessibility. The talk will also include an overview of digital neuropsychological methods, more generally, in the covid and post-covid era.

Upon conclusion of this course, learners will be able to:
- Describe the different levels of open science / open source as they apply to methods and data in digital neuropsychology
- Explain the difference between openness and accessibility as it applies to both assessment tools and data
- Identify when the use of open source software tools may confer advantages or disadvantages in clinical practice

LIVE INS Student Liaison Committee Panel 01: LGBTQ Issues in Neuropsychology

Presenters: Dr. Anthony Correro, Dr. Jason Flatt

11:00am - 12:30pm
Thursday, February 3, 2022

Memorial for Muriel Lezak and Mortimer Mishkin

11:00am - 12:30pm
Thursday, February 3, 2022

Presenters for Dr. Muriel Lezak:

Kathleen Y. Haaland, Ph.D., ABPP-CN, Professor of Psychiatry & Behavioral Sciences, University of New Mexico School of Medicine, Albuquerque, New Mexico USA

Diane Howieson, PhD, ABPP-CN, Assistant Professor Emeritus, Neurology Department, Oregon Health Sciences University, Portland, Oregon, USA

Prof Jennie Ponsford, AO, PhD, Professor of Neuropsychology, School of Psychological Sciences, Monash University, Director, Monash Epworth Rehabilitation Research Centre, Melbourne, Australia, Department of Psychology, Monash University,

Erin D. Bigler Ph.D., ABPP-CN, Professor Emeritus of Psychology and Neuroscience, Founding Director, Magnetic Resonance Imaging (MRI) Research Facility, Brigham Young University, Provo UT, USA

Presenters for Dr. Mortimer Mishkin:

Rus Bauer, Ph.D., Preeminence Professor, University of Florida

Alex Martin, Ph.D., Chief, Section on Cognitive Neuropsychology, NIH

Faraneh Vargha-Khadem, Ph.D., Professor of Developmental Cognitive Neuroscience, University College, London

Elisabeth (Betsy) Murray, Ph.D., Chief, Section on the Neurobiology of Learning and Memory; Chief, Laboratory of Neuropsychology, NIMH

Muriel Lezak

Muriel Lezak obtained her Bachelors and Masters degrees from the University of Chicago, and her Ph.D in Clinical Psychology from the University of Portland, in 1960. Muriel joined the staff of the Veterans Administration Medical Center in Portland in 1966, where she worked with brain injured patients on both the acute

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wards and in rehabilitation. This led to research which evolved into a broader study of the emotional and psychosocial of traumatic brain injury. In 1979 she was appointed Assistant Professor of Neurology in what is now the Oregon Health and Sciences University. This was followed in 1985 by joint appointments in Neurosurgery and Psychiatry. She remained active in these positions until her retirement in 2005, when she became Professor Emerita. She was a Diplomate of the American Board of Professional Psychology in both Clinical Psychology and Clinical Neuropsychology, as well as a Fellow of the American Psychological Association.The first edition of Muriel's seminal contribution to neuropsychology, simply entitled Neuropsychological Assessment, was first published in 1976. Her book focused on the heterogeneity in the behavioral expression of neurologic disease and approaches to neuropsychological assessment. This was truly a revolutionary contribution since, at the time that it initially appeared, the concept of neuropsychological assessment was considered by some simply to be equivalent of using a single test to determine "organicity," while others believed that an extended and fixed battery was the only appropriate method for the determination of "brain damage." Her book presented a wide variety of techniques not only to quantitate patient performances, but also to aid clinical conceptualization and case formulation. This single volume continues to be emblematic of the scientist - practitioner of model of neuropsychology, and is a vital reference for all neuropsychologists ranging from the beginning students in the field to seasoned researchers and practitioners. Muriel was also a leader at INS, serving as its president from 1987 to 1988. Throughout her career, she was generous with her opinions, passionate in advocacy for better understanding of emotional and psychosocial consequences of brain injury, and always willing share her expertise and wisdom with more junior members of our society.

Mortimer Mishkin

It is with great sadness, but profound gratitude for a career of outstanding accomplishments, that we note the passing of renowned neuroscientist Mortimer Mishkin on October 2, 2021. Mishkin's work has led to a greater understanding of memory, perceptual function, and the functional anatomy of cognition. Mishkin spent over 60 years at the National Institute of Mental Health, where he served as Chief of the Laboratory of Neuropsychology and where he, along with colleagues and protégés, made some of the most important and seminal discoveries in the history of our field. Unlike his predecessors, who tended to focus on the localized function of specific brain regions, Mishkin's discoveries enabled a broader understanding of distributed neural circuits involved in various cognitive processes. He can truly be regarded as a forerunner of network neuroscience, though his work was tightly grounded in the lesion approach. A distinctive feature of his work is its high degree of clinical relevance and the degree to which his discoveries have had impact all along the science-practice continuum.
Mishkin obtained a Bachelor's degree in Business Management from Dartmouth College in 1947. After serving in the Navy in Japan, he enrolled at McGill University and obtained his Ph.D. in 1951. He began his work at NIMH in 1955, retiring in 2016 at age 90, but returning the next year as a scientist emeritus. He is the recipient of numerous awards and honors, including the National Medal of Science, awarded in 2010 by President Barack Obama. He was inducted into the National Academy of Sciences in 1984 and the National Academy of Medicine in 1990.
The publication of Scoville & Milner's (1957) famous description of Patient H.M. stimulated

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decades of basic science and clinical research on the anatomic basis and clinical characteristics of the human amnesic syndrome. Mishkin's lab went to work on understanding the necessary and sufficient components of anatomic damage needed to produce amnesia, and in 1978, published the first articulated animal model of amnesia using the delayed nonmatching-to-sample paradigm (Mishkin, M. [1978]. Memory in monkeys severely impaired by combined but not by separate removal of the amygdala and hippocampus. *Nature, 273,* 297-298.) Mishkin argued that damage to two medial temporal lobe circuits, one involving the hippocampus, the other involving the amygdala, was a necessary prerequisite of profound amnesia, and decades of subsequent work on this "two-circuit" theory has provided an integrated view of memory disorders resulting from damage to temporal lobe, diencephalon, and basal forebrain.

Four years later, Mishkin (with Leslie Ungerleider) introduced the critical concept of "two cortical visual pathways" based on their lesion work with macaque monkeys (Ungerleider, L.G. & Mishkin, M. [1982]. Two cortical visual systems. In D.J. Ingle, M.A. Goodale, and R.J.W. Mansfield (Eds.) *Analysis of Visual Behavior*, pp. 549-586. Cambridge, MA: MIT Press.). This work, cited thousands of times, revealed functional and anatomic separation between a ventral (occipitotemporal) visual circuit important for object recognition, and a dorsal (occipitoparietal) visual circuit important for spatial and action-oriented cognition. This seminal contribution has motivated literally hundreds of clinical and cognitive neuropsychology investigations that used the two-pathway concept in understanding diverse neuropsychological syndromes, including visual agnosia, optic ataxia, apraxia, and spatial disorientation.

A third critical contribution followed shortly thereafter in which Mishkin and colleagues provided a clinic-anatomical explanation of spared skill learning in amnesia by suggesting that episodic memory depended on connections between the cortex and the temporal lobe, while skill/habit learning depended on cortical interactions with the striatum/basal ganglia (Mishkin, M., Malamut, B., & Bachevalier, J. [1984]. Memories and habits: two neural systems. In G. Lynch, J.L. McGaugh, & N.M. Weinberger (Eds.), *Neurobiology of Human Learning and Memory,* pp. 65-77. New York: Guilford Press). This framework has been expanded to appreciate that skill/habit learning is a subset of nondeclarative memory, which also includes perceptual learning, habituation/sensitization, and other behavioral phenomena, each of which has a distinct but overlapping neuroanatomic substrate.

In addition to his scientific contributions, Mishkin trained and mentored some of the outstanding neuroscientists of our time, including Leslie Ungerleider, Elisabeth Murray, John Aggleton, Charles Butter, and Robert Desimone. In a 2011 interview for the Dartmouth Alumni Magazine, Mishkin reflected on the process of scientific discovery in neuropsychology: "Studying the brain is both horribly and wonderfully complicated. It's so frustrating it takes such a long time to figure out even a few of the thousands of circuits, but every discovery is a fantastic high."

The field of neuropsychology owes a profound debt of gratitude to Dr. Mishkin, a neuroscience giant who produced so many exhilarating discoveries and scientific "highs" throughout his career.

Symposium 03: Moderate-Severe TBI as a Chronic & Progressive disorder: Latest Findings from the Toronto Rehab TBI Recovery Study and Implications for Neurorehabilitation

11:00am - 12:30pm
Thursday, February 3, 2022

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10 Moderate-Severe TBI as a Chronic & Progressive disorder: Latest Findings from the *Toronto Rehab TBI Recovery Study and Implications for Neurorehabilitation*

Chair

Robin Green

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University of Toronto/University Health Network, Toronto, Canada

Discussant

Huw Williams
University of Exeter, Exeter, United Kingdom

Research from the *Toronto Rehab TBI Recovery Study* and elsewhere has revealed that moderate-severe TBI is both a chronic *and* progressive disorder. Not only does moderate-severe TBI increase later dementia risk, but there is now extensive evidence of neurodegenerative brain changes and cognitive declines in the months and early years post-injury, regardless of a person's age. A better understanding of these deleterious, progressive changes, including mechanisms and risk factors, will better position us to develop treatments to offset these changes.
This symposium will present recent developments from the *Toronto Rehab TBI Recovery Study,* in which we have been longitudinally following patients with moderate-severe TBI with MRI, neuropsychological and neuropsychiatric assessments for over a decade. Papers will focus on our latest structural, functional and behavioural findings plus a systematic review of neurodegeneration in TBI.
The Chair (RG) will open and contextualize the symposium with a brief overview of the parent study. This will be followed by four papers.
Papers 1 and 2 will focus on the scale and severity of neurodegeneration in moderate-severe TBI. The first paper, *Estimating the proportion of patients with progressive brain volume loss in the early and later chronic stages of moderate-severe TBI as well as respective rates of loss,* will present the application of novel growth curve modelling techniques to manually segmented brains (ventricle-to-brain ratio, hippocampi and sub-structures, corpus callosum and sub-structures). Here, the presenter (Colella) will discuss the proportion of patients who show atrophy in the early (5 to 12 months) and later (1 to 2+ months) chronic stages post-injury, and the annual rates of atrophy (i.e., 2.5-5%, 5-10%, >10%) of patients. The second of these two papers, *The Scale and Timelines of Neurodegeneration in Moderate-Severe Traumatic Brain Injury: A Systematic Review,* will broaden the scope of this topic. Here, the presenter (Sharma [recently graduated PhD student]) will share systematic review findings on 23 cross-sectional and longitudinal studies of moderate-severe TBI that quantitated total brain volume, white matter volumes and grey matter volumes. This paper will also discuss predictors of neurodegeneration.
Paper 3 - *Longitudinal Patterns of the Default Mode and Central Executive Networks in Moderate-Severe Traumatic Brain Injury* - will move on to our longitudinal *functional* MRI findings. Here, the presenter (So [MSc student]) will discuss functional connectivity changes from 5 to 12 to 24+ months post-injury, focusing in particular on the Default Mode and Central Executive Networks.
Paper 4, *Trajectories of Depression and Anxiety from 2-24+ Months Following Moderate to Severe Traumatic Brain Injury,* the presenter (Heath [PhD student]) uses latent class growth mixture modelling to illustrate (sub)trajectories of depression and anxiety across time.
Following the papers, Dr. Williams, as Discussant, will provide a summary and synthesis, and discuss neurorehabilitation implications.
Lastly, Dr. Williams will facilitate a panel discussion (with the Chair and presenters) plus audience Q&A. This will focus on moderate-severe TBI as a neurodegenerative disorder and future directions for research and treatment.
Timing: Chair (5 mins); papers 15 mins each plus 2 mins questions; discussant (5-7 minutes); panel discussion (10-12 mins).
Keywords: neuroimaging: structural**,** mood disorders*,* neuroimaging: functional connectivity

997 Introduction - Symposium 03: Moderate-Severe TBI as a Chronic & Progressive disorder: Latest Findings from the Toronto Rehab TBI Recovery Study and Implications for Neurorehabilitation

Robin Green
University of Toronto/University Health Network, Toronto, Canada

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592 Estimating the Proportion of Patients with Progressive Brain Volume Loss in the Early and Later Chronic Stages of Moderate-Severe TBI (5-12 months; 1-2+ years) as well as the Respective Rates of Loss

Brenda Colella[1], Georges Monettes[2], David R Mikulis[3], Robin Green[1]
[1]UHN-KITE, Toronto, Ontario, Canada. [2]York University, Toronto, Ontario, Canada. [3]UHN-Toronto Western, Toronto, Ontario, Canada

Objective: Primary: To estimate the *proportion* of patients showing progressive volume loss across brain structures, and the *rates of volume loss* as compared to controls. Secondary: To compare these proportions and rates in the earlier chronic stages (i.e., from 5-12 months post-injury) vs. the later stages (i.e., 1-2+ years post-injury).
Participants and Methods: N=123 adults with moderate-severe TBI (mean years age=38.8, education=13.9) referred for in-patient neurorehabilitation, and 32 healthy adult controls (mean years age=41.5, education=15.6) underwent prospective, longitudinal MRI. Patients were scanned at approximately 5, 12 and/or 24+ months post-injury; controls were scanned twice. Manually segmented structures comprised: ventricle-to-brain ratio (VBR), left and right hippocampi (HPC, including head, body, tail), and corpus callosum (CC, including genu, body, splenium). Growth curve models estimated magnitude and rate of change of the gap between patients and controls, controlling for age at injury and expected effects of aging. Models posit existence of an individual true trajectory per subject, from which we obtained measurements with a degree of error whose variability is estimated in the model. The estimated proportions were obtained by using normal approximations for the variability of random effects in the mixed models used to analyze the data. Rate of change windows presented were: 2.5-5%, 5-10% and >10%.
Results: *Key findings*
Wald statistics showed significantly steeper trajectories of decline in patients vs controls (p<.0001) for VBR, CC and bilateral HPC from 5-12 months post-injury, and for VBR and CC for 1-2+ years. For HPC, the difference from 1-2+ years was significant at p<.05.
VBR
From 5-12 months vs. 1-2+ years post-injury, the proportion of patients with an annual rate of volume loss at least 2.5% greater than that of controls was 87.3%vs 76.3%. From 5-12months, the majority of patients (73.3%) showed the fastest rate of decline (>10%) whereas from 1-2+ years, the majority (42.2%) fell in the middle window (5-10%).
CC
From 5-12 months post-injury, 78.4% of patients showed a rate of loss of at least 2.5% greater than controls, with 52.4% falling in the highest rate of change window (>10%). From 1-2+ years, 65.5% continued to show a rate of decline of at least 2.5%, but the majority (33.1%) fell in the 5-10% range and 21% in the 2.5-5% range.
Bilateral HPC
Again, more patients showed decline from 5-12 months vs 1-2+ years: 66.7% vs 33.3% showed more than 2.5% rate of loss. From 5-12 months post-injury, 20.5% of patients fell in the fastest annual rate of change window (>10%) and 30% fell in the middle window (5-10%). From 1-2+ years post-injury, the majority (23.3%) fell in the slowest rate of change window (2.5-5%).
Conclusions: In the early months and years following moderate-severe TBI, most patients show a rate of volume loss greater than even that of people with Alzheimer's Disease. By 1-2+ years post-injury, there was evidence of attenuation, with a smaller proportion of patients showing losses, and at a slower rate of decline. Nonetheless, these numbers and rates were sizeable. A greater understanding of the mechanisms of loss is needed. Preventing volume loss in the chronic stages of injury should be considered as a target of therapy given negative implications for brain reserve and for dementia.
Keywords: neuroimaging: structural

128 The Scale and Timelines of Neurodegeneration in Moderate-Severe

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Traumatic Brain Injury: A Systematic Review

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Objective: In recent years, there has been a paradigm shift in our understanding of moderate-to-severe traumatic brain injury (ms-TBI). The conventional understanding of ms-TBI was that the injury is associated with a circumscribed period of recovery and subsequent neurological stasis. This been challenged by observation of progressive and neurodegenerative atrophy in the months and years post-injury, long after the acute effects of the injury have resolved. While there is extensive evidence that such neurodegeneration occurs, these data have not been consolidated through systematic review. Such a review is needed to better characterize the scale, pattern, and timelines of neurodegeneration following ms-TBI to inform subsequent intervention research and better understand periods of neurological vulnerability following ms-TBI.
Participants and Methods: We performed a systematic review of six electronic databases (from inception to June 2021, including MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, PsycINFO, CINAHL, SPORTDiscus) using a health-sciences librarian guided search strategy. Studies were required to include ms-TBI patients (aged 18-65, GCS<13) who were at least 2 months post-injury; studies focused exclusively on milder brain injuries (e.g., concussion) were excluded. Our primary outcome was gross structural neuroimaging (for changes in white and/or gray matter at a whole-brain or regional level), and our secondary outcome was diffusion tensor imaging for detection of post-injury white matter change. Prior to any data collection, our review was registered with the International Prospective Register of Systematic Reviews (PROSPERO CRD42019117548) and our review protocol was published.
Results: A total of 23 unique articles met our inclusion criteria. Data were analyzed and reported on based on study design. Across all cross-sectional studies (n=13), degenerative changes were consistently reported across a broad window wherein patients were 6-152 months post-injury. Compared to controls, total brain volume (TBV) reductions ranged from 2.85%-10.8%, which is similar to the magnitude of volume reductions reported for grey matter (GMV) and white matter (WMV) which ranged from 2.8-9.60% and 2.1-18.3%, respectively. Similarly, longitudinal studies (n=17) that measured degenerative changes (on average, 3-24 months post-injury) reported progressive and significant atrophy in TBV, WMV and GMV. In uncontrolled longitudinal studies (per within-subject analyses), the range of degeneration was 2-4%, on average, 2-12 months post injury. Likewise, in controlled studies (between-group comparisons), the range of degeneration was 2-10.5%, on average, 2-108 months post injury. Across all the studies, the limbic system structures showed notable volume reductions with particularly pronounced degenerative changes reported for the hippocampi.
Conclusions: Understanding the scale of atrophy and when it occurs has important clinical implications for planning the time course of interventions. Discerning whether some substructures of the brain are more vulnerable to decline in the post-acute phase of recovery may also inform future intervention research.
Keywords: traumatic brain injury**,** neuroimaging: structural**,** cognitive course

131 Longitudinal Patterns of the Default Mode and Central Executive Networks in Moderate-Severe Traumatic Brain Injury

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Objective: Moderate-severe traumatic brain injury (TBI) can lead to progressive neurodegeneration in the chronic stages of injury; both volumetric losses on MRI and cognitive declines have been observed in longitudinal studies by our group and others. Functional connectivity studies have shown *increases* compared to controls in networks involved in cognition during the early chronic stages (e.g., default mode [DMN], central executive network [CEN], and salience networks at 3-6 months post-injury), and during the later chronic stages (e.g., DMN at 2.5-3 years post-injury). However, there are few longitudinal studies of functional connectivity in this population. The overarching aim of our research program is to better understand patterns and mechanisms of neural and cognitive changes across time in moderate-severe TBI. The objective of the current study was to characterize functional connectivity changes from 5 to 24+ months post-injury, with a focus on networks involved in executive functioning (the DMN and CEN), where our team has previously observed a pattern of early recovery but later cognitive decline. The DMN and CEN were predicted to show functional connectivity increases during the first year post-injury, but show decreases thereafter.

Participants and Methods: This prospective, longitudinal study examined resting-state fMRI and executive function at at multiple time points from 5 to 24+ months post-injury in 40 adults with moderate-severe TBI (mean age=39.5 years, education=13.9 years, Glasgow Coma Scale score=6.6; sex=70% male). A group independent component analysis was used to identify resting-state imaging networks, and a dual regression was performed with the DMN and left and right CENs to identify levels of activation at the timepoints. A linear mixed-effects model with a spline at 18 months was used to examine relationships between functional connectivity changes in the networks over time.
Results: The DMN showed increased functional connectivity from 5 to 18 months post-injury (location of the spline; p=0.01), and decreased connectivity beyond 18 months post-injury (p=0.01). These patterns remained significant when examining only the n=27 patients with functional connectivity data at all 3 timepoints: p=0.02 and p=0.02, respectively. The right CEN showed marginally increased activity from 5 to 18 months post-injury (p=0.0835), and marginally decreased activity beyond 18 months post-injury (p=0.0813). Age, sex, and years of education were insignificant predictors of functional connectivity changes over time.
Conclusions: From 5 to 18 months post-injury, there was evidence of continuously increasing functional connectivity across the chronic stages of injury in neural networks involved in executive function (i.e., DMN and right CEN), followed by subsequent decreases at 18+ months. The increases in DMN and right CEN functional connectivity at up to 12 months post-injury, as well as the decreases from 18+ months post-injury, were in line with our hypotheses. However, the increased connectivity observed from 12 to 18 months post-injury contradicted our hypotheses. Whether increases represent executive function improvement and decreases represent decline requires further research, ideally employing correlation of connectivity changes with changes in cognitive outcomes across the same time points.
Keywords: neuroimaging: functional connectivity**,** executive functions**,** brain function

129 Trajectories of Depression and Anxiety from 2-24+ Months Following Moderate to Severe Traumatic Brain Injury

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Objective: One of the most disabling consequences of traumatic brain injury (TBI) is the increased risk of psychiatric disorders. Depression and anxiety can compound the effects of brain injury and have a major impact on functional outcome and quality of life. While several cross-sectional studies have examined the general prevalence and clinical impact of

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psychological symptoms in patients with moderate to severe TBI, longitudinal studies aimed at understanding the evolution of depression and anxiety from the sub-acute to chronic stages of injury are limited and may neglect more nuanced information about how specific subgroups of individuals with TBI experience anxiety and depression post-injury. Trajectory analysis is an underutilized tool in the TBI literature that has been used commonly to examine the path of health outcomes in other populations. The primary aim of this study was to investigate trajectories of depressive and anxiety symptoms from the sub-acute to the chronic stages of moderate to severe TBI in a longitudinal study.
Participants and Methods: This was a prospective analysis of findings from the *Toronto TBI Recovery Study* database (n=193). Adults with moderate to severe TBI completed the Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI), self-report questionnaires of anxiety and depressive symptom severity, respectively, at 2, 5, 12, and 24+ months post-injury. Latent class growth mixture modeling of BAI and BDI scores was performed using Mplus version 7 to identify homogenous sub-groups with distinct longitudinal trajectories.
Results: Model fit indices of Bootstrapped Likelihood Ratio Test and Bayesian Information Criterion determined 3-group models of both depression and anxiety trajectories to have the best model fit. The depression model had the following trajectories: 1) consistently low depression (81%); 2) worsening depression (sub-acutely low and chronically increasing; 15%); 3) improving depression (sub-acutely high and chronically decreasing; 3%). Anxiety showed a similar 3-group model: 1) consistently low anxiety (84%); 2) worsening anxiety (sub-acutely low and chronically increasing; 13%); 3) improving anxiety (sub-acutely high and chronically decreasing; 3%).
Conclusions: Latent class growth mixture modeling is a clinically meaningful way to characterize distinct courses of depression and anxiety from the sub-acute to chronic stages of moderate to severe TBI. By allowing for different groups of individual growth trajectories to vary around different means, we are not losing important information about smaller sub-groups of individuals who may otherwise be collapsed to the mean. It is important to identify this group of individuals who are not experiencing depression or anxiety during the sub-acute stage post-injury, but develop moderate to severe depression and/or anxiety by two years post-injury, when they are likely no longer being monitored and are at risk for poorer outcomes. This line of research may improve our ability to predict prognosis and inform the targeting of early prophylactic treatment to certain patient groups.
Keywords: traumatic brain injury**,** emotional processes**,** brain disorder

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996 Discussion - Symposium 03: Moderate-Severe TBI as a Chronic & Progressive disorder: Latest Findings from the Toronto Rehab TBI Recovery Study and Implications for Neurorehabilitation

Huw Williams
University of Exeter, Exeter, United Kingdom

Symposium 05: From Evidence-Based Guidelines to Clinical Practice: The Case for Pediatric Neuropsychology Care in Multidisciplinary Settings

11:00am - 12:30pm
Thursday, February 3, 2022

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21 From Evidence-Based Guidelines to Clinical Practice: The Case for Pediatric Neuropsychology Care in Multidisciplinary Settings

Chair

Christa Hutaff-Lee
Children's Hospital Colorado, Aurora, USA
Kelly Wolfe
Children's Hospital Colorado, Aurora, USA
Greta Wilkening

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Children's Hospital Colorado, Aurora, USA

Discussant

Elise Turner
Children's Hospital Colorado, Aurora, USA

Serial neuropsychological monitoring is becoming increasingly recognized as an important care service for a variety of pediatric medical populations. Population specific standard of care guidelines as well as U.S. News Hospital Ranking Criteria now incorporates routine pediatric neuropsychological evaluation within different medical specialties. Furthermore, emerging models of pediatric neuropsychological care focus on preventative services with tiered levels of care that include 1) universal screening, 2) targeted evaluations, and 3) comprehensive evaluations. With the increasing demand for neuropsychological care across patient populations, this preventative model provides several advantages including tailored and cost- and time-efficient evaluation methods that allow for early access to intervention services. Integration of neuropsychological care within multidisciplinary clinics (MDCs) provides an ideal setting for developing a preventative and tiered service model. This symposium will offer perspectives from a diverse set of speakers that illustrate the implementation of various service models within pediatric MDCs.
Dr. Greta Wilkening will provide an overview of current standard of care guidelines and their impact on demand for neuropsychological services. Neuropsychological care models that inform preventative and tailored services within pediatric MDC settings will be discussed as effective ways for meeting care demands while reducing financial burden and time constraints. Dr. Elise Turner will describe real-world applications of these care models across a variety of MDCs, including genetic, oncology, cardiology, epilepsy, and other neurological populations. This presentation will primarily focus on examples of both universal screening and targeted evaluations within MDCs. Details provided will include provider caseload, cognitive and psychosocial domains assessed, assessment tools utilized, and triage strategies for determining what patients receive neuropsychological services. Patient completion rates for neuropsychological screening within MDCs will be highlighted as well as data regarding follow-up for outpatient comprehensive evaluations. Dr. Christa Hutaff-Lee will discuss advantages of neuropsychological involvement in MDCs from a variety of stakeholders perspectives (e.g., neuropsychology trainees and supervisors, other healthcare professionals in clinic). Survey data will include metrics of provider satisfaction with neuropsychological consultation in MDCs and elucidate how this consultation directly and indirectly informs other health professionals' patient care. Benefits of training within MDCs will also be discussed from trainee and supervisor viewpoints. Last, Dr. Kelly Wolfe will provide logistical and actionable recommendations for the development of MDCs within an academic medical center. Primary topics will include clinic development through identification of appropriate team members as well as strategies for effective team communication. Cost-effectiveness data will be presented in addition to practical guidance around insurance and billing issues. This presentation will also highlight the clinical effectiveness of MDCs through patient and family satisfaction data focused on both broader medical services as well as neuropsychological care provided in MDCs.
The overall objective of our symposium is to advance audience knowledge of innovative neuropsychological care models and how to implement them in multidisciplinary settings. We plan to share relevant resources and clinical tools for use during screening or targeted evaluation methods within MDCs based on evidence-based research.

Keywords: cognitive screening**,** pediatric neuropsychology*,* medical disorders/illness

621 Standard of Care Guidelines in Practice: Use of Preventative Models and Multidisciplinary Settings

Greta Wilkening, Elise Turner, Christa Hutaff-Lee, Kelly Wolfe
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Objective: Pediatric neuropsychologists are involved in and integrated into the care of children treated for a variety of medical disorders, aiding with longitudinal assessment, treatment planning, and educational and emancipation guidance to providers and families. Many disease-specific associations have published standards of care suggesting specific schedules for neuropsychological evaluation, including for children with congenital heart disease, stroke, cancer, craniofacial disorders, epilepsy, multiple sclerosis, neurofibromatosis, and Turner syndrome, among others. However, guidance recommending specific timelines for assessment does not reliably acknowledge issues such as limited access to neuropsychologists, difficulties with funding, and constrained availability of time, the families' and providers' alike. Though the historical expectation has been completion of comprehensive evaluations, these are financially burdensome, and often inaccessible, with waitlists up to 12-months to see a neuropsychologist. We aim to provide a brief overview of how to address these guidelines with an emerging care model that addresses neuropsychological service demands across pediatric populations.
Participants and Methods: We will discuss a prevention-based model of pediatric neuropsychological care within the context of meeting population-specific guidelines. This model recommends three, gradated levels of care: 1) universal screening, 2) targeted evaluations, and 3) comprehensive evaluations. Advantages around each level of care as well as published recommendations for implementation will be discussed.
Results: Utilization of a tiered assessment approach allows for adherence to published standards of care, while acknowledging constraints that present as barriers to care. Universal screening assures that consideration of neurodevelopment is a part of all children's care, providing early detection of cognitive impairment in a cost- and time-effective manner. Referrals for follow-up assessment can be tailored to meet specific, targeted needs, when appropriate. Targeted batteries, limited in focus, allow for circumscribed assessment based upon published patterns of performance associated with specific diseases, e.g., memory disorders in germinomas, executive function disorders in neurofibromatosis, slow speed of processing in children treated for leukemia, and limited assessment when making decisions about the need for guardianship. Comprehensive assessment is reserved for those children for whom screening or targeted assessment is insufficient to answer concerns and questions. This model is illustrated in our neuropsychology program within the Section of Neurology at Children's Hospital Colorado, which utilizes multidisciplinary clinics (MDCs) in addition to comprehensive evaluations to align with published standards of neuropsychological care for various pediatric medical populations, answer questions about clinical management or treatment effectiveness, and optimize the neuropsychological trajectories of our patients.
Conclusions: Standard of care guidelines across various pediatric populations place high demands on neuropsychological care which are not often practical given clinic wait times, cost, and time constraints. Preventative and tiered models of care provide a feasible framework for meeting these demands while providing efficient and individualized care.
Keywords: cognitive screening**,** pediatric neuropsychology**,** assessment

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625 Models of Neuropsychological Screening and Targeted Evaluations through Pediatric Multidisciplinary Clinic Integration

Elise Turner, Greta Wilkening, Kelly Wolfe, Andrea Miele, Arianna Martin, Christa Hutaff-Lee
Children's Hospital Colorado, Aurora, CO, USA

Objective: Neuropsychologist involvement in pediatric multidisciplinary clinics (MDCs) presents many advantages, including improving cost- and time-efficient access to care for a wide-ranging number of patients. These clinics allow for the application of several assessment care models and tools that can be tailored for population- and clinic-specific needs. We aim to describe real-world demonstrations of these different neuropsychological assessment and

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screening methods within MDCs, including reviewing evidence-based research supporting these strategies within the context of clinical examples.
Participants and Methods: To achieve this aim, we will describe the following 1) pediatric patient populations with neuropsychologists in MDC settings at our institution, 2) clinic flow and triage strategies, 3) the range of tools used that are based in evidence-based research, and 4) completion rates for select clinics utilizing either screening questionnaires or performance-based testing.
Results: Neuropsychologists provide care in 15 multidisciplinary clinics (MDC) at our tertiary care institution focused within genetics, cardiology, hematology/oncology, epilepsy, neurology, and neurosurgery. Assessment methods used in these MDCs include interview only (n=2; Neurofibromatosis, Tuberous Sclerosis clinics), screening questionnaires (n=5; Turner syndrome; Neuro-Oncology, Oncology Survivorship, Charcot-Marie-Tooth Syndrome, and Fontan clinics), performance-based measures (n=5; Neuro-Immunology, New Onset Epilepsy, Cardiac Neurodevelopmental Clinic, Batten and Neurodegenerative Disease, and 8p and Ring14 clinics), and team-based discussion and review of previous evaluations only (n=1; Epilepsy Surgery clinic). Neuropsychologists participate in 2-3 MDCs (*M=2.60, SD=0.52)* that meet monthly. In 60% of MDCs, neuropsychologists see all patients presenting to clinic whereas the other 40% see a targeted subset of patients that were determined to need neuropsychological care. Neuropsychology providers report seeing an average of 3.70 patients (*SD*=1.42; Range=0-5) per MDC for a total of 79.50 minutes (*SD*=68.57; Range=0-240) per clinic. Neuropsychology providers in MDCs use broad-based (e.g., Colorado Learning Difficulties Questionnaire) as well as population- (e.g., Pediatric Epilepsy Side Effects Questionnaire) and symptom-specific questionnaires (e.g., ADHD Rating Scale, Behavior Rating Inventory of Executive Functioning, Second Edition, Multifactorial Memory Questionnaire) to assess cognitive and academic functioning. Additional questionnaires targeting psychosocial functioning are also used within MDCs, including the Behavior Assessment Scale for Children, Third Edition and Pediatric Quality of Life Inventory. Performance-based batteries assess several domains of cognitive function that are tailored by age, primary language, and patient population, including intellectual function, memory, executive function, processing speed, language, motor abilities, and academic achievement. In a select sample of MDCs (n=4), 246 patients underwent cognitive screening using questionnaires over a two-year period with 37% (n=92) presenting for follow-up comprehensive neuropsychological evaluations. The Neuro-Immunology MDC presents as an exemplar performance-based care model that follows 40-50 patients annually.
Conclusions: Neuropsychological care can be incorporated into MDC settings utilizing a variety of assessment models and tools. Care provided in these settings prove as an efficient way to screen large portions of a patient population in order to provide tailored referrals for comprehensive outpatient evaluations.
Keywords: cognitive screening**,** assessment**,** pediatric neuropsychology

626 Training Benefits and Neuropsychology/Other Professional Satisfaction within Multidisciplinary Clinics

Christa Hutaff-Lee, Elise Turner, Kelly Wolfe, Arianna Martin, Andrea Miele, Greta Wilkening
Children's Hospital Colorado, Aurora, CO, USA

Objective: Multidisciplinary clinics (MDCs) offer opportunities for collaboration between neuropsychologists and other professionals within an academic medical setting. These opportunities for coordinated care, with a focus on patient education, can improve patient outcomes and satisfaction with medical services. These clinics also offer neuropsychology learners exposure to a number of different patients with similar medical backgrounds. We reviewed provider and learner satisfaction with neuropsychological services within MDCs at our pediatric institution.
Participants and Methods: A survey focused on neuropsychological care within MDCs was

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administered to both neuropsychologists (n=5) and other health care providers (n=32) at Children's Hospital Colorado. Other health care providers included medical physicians (n=18), advanced practice providers (n=4), nurses (n=4), clinic coordinators (n=2), therapy providers (n=1), and social work (n=1). Additionally, results from surveys completed by previous neuropsychological fellows (n=4) were assessed for comments regarding training experiences in MDCs.
Results: The majority of neuropsychologists felt that their participation in MDCs enhances neuropsychological care for their patients (90%), and also indicated that working in an MDC expands their knowledge of medical and functional needs of their patient population (90%). A large portion of neuropsychologists (70%) have the opportunity to share their impressions with other health care providers in clinic. The other health care providers surveyed reported that neuropsychology consultation provides a unique contribution in the MDC (97%), helps expand their knowledge of cognitive/psychosocial functioning within their patient population (94%), and improves individual patient care (97%). Some concern that neuropsychology consultation overlaps with information gathered by other specialties was shared by neuropsychology providers (50%), but less by other health care providers (2%). The majority of other health care providers (97%) reported that information and guidance from the neuropsychologist in MDCs is used to inform their services. More specifically, they shared that neuropsychological consultation informs guidance provided to families (90%), monitoring for longitudinal follow-up (71%), approach with patients (68%), referrals (58%), treatment decisions (55%), and guidance given to other providers (48%). Trainees are supervised in 5 different MDCs, and all of these neuropsychology supervisors report that these MDCs are a valuable training experience for externs, interns, and fellows. Fifty percent of previous neuropsychological fellows spontaneously identified participation in MDCs as one of the most valuable aspects of their training.
Conclusions: MDCs provide neuropsychologists, physicians, and allied health professionals unique opportunities to collaborate on both clinical care needs of patients, as well as research and patient advocacy activities. These clinical experiences also offer neuropsychologists-in-training exposure to many patients with the same diagnosis, insight that can be especially important in disorders in which the cognitive outcomes of patients vary significantly. MDCs allow neuropsychologists and neuropsychology learners a chance to make efficient, informed decisions based upon published data, and careful, albeit brief, exams, while participating in coordinated care of patients with complex medical conditions.
Keywords: pediatric neuropsychology**,** medical disorders/illness**,** cognitive screening

627 Practical Considerations and Patient and Family Satisfaction in Pediatric Multidisciplinary Clinics

Kelly Wolfe, Elise Turner, Greta Wilkening, Christa Hutaff-Lee
Children's Hospital Colorado, Aurora, CO, USA

Objective: Pediatric multidisciplinary clinics (MDCs) are an increasingly-utilized format to provide comprehensive subspecialty care for complex pediatric medical populations. Neuropsychologists are often integral to the MDC team, and should be involved in developing an MDC from the beginning. We will present data regarding cost-effectiveness, insurance billing, and patient/family satisfaction, while also weaving in information about "lessons learned" after launching 15 MDCs that include neuropsychologists at our institution.
Participants and Methods: We will discuss considerations for developing a MDC as well as data regarding cost-effectiveness, insurance and billing processes, and patient/family satisfaction from our institution. Published research on MDC cost-effectiveness and clinical outcomes will also be reviewed, to demonstrate the potential generalizability of MDCs across pediatric medical settings.
Results: Neuropsychologists should collaborate with primary specialty physicians and other key stakeholders based on the specific population

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(e.g., with neurologists for epilepsy patients) to design MDCs. The composition of the MDC team is customized to the population based on research demonstrating comorbidities in specific organ systems, and often includes physicians, psychologists, allied health professionals, and a clinic coordinator. Published and institutional data support the cost-effectiveness of pediatric MDCs, with estimates ranging from breaking even, to net-positive margins exceeding $300,000 annually. The variability likely reflects a number of factors, including associated testing and procedures and the payer mix of the sample. At our institution, pre-authorization for all subspecialty providers in the MDC, including neuropsychology, is completed simultaneously. Neuropsychology bills the same medical diagnosis codes as physicians, which aids reimbursement. Considerations for when to bill for a neurobehavioral exam versus developmental or neuropsychological testing codes will be presented based on our program's experiences. Beyond cost-effectiveness, published research also supports the clinical effectiveness of MDCs including higher integration of subspecialty care and patient adherence to recommendations compared to traditional separate appointments.

Patient/family satisfaction data for the Fontan MDC at our institution over a 3-year period illustrates a strong preference for the MDC approach compared to separate appointments. Ninety-six percent of families rated the MDC as "much more convenient" and 4% rated the MDC as "somewhat more convenient" compared to seeing subspecialties individually. Furthermore, families perceived the MDC approach as having either a "very positive" (93%) or "somewhat positive" (7%) effect on communication among subspecialty providers regarding their child's care, and the providers' ability to think about the "big picture" or the "whole child" ("very positive [82%], "somewhat positive" [18%]). When asked to consider the helpfulness of each of the five subspecialty consultations, neuropsychology received the second-highest rating, after cardiology, with 68% of families rating neuropsychology as "very helpful". Perhaps most importantly, all families said they were either "very likely" (81%) or "likely" (19%) to recommend the MDC to other families of children with Fontan.

Conclusions: Pediatric MDCs can provide financial and non-financial benefits to institutions, patients, and families, and can elevate care for the complex patient. Neuropsychologists should be involved in designing and implementing MDCs. Patient/family experience surveys are a helpful tool to demonstrate the multifaceted value of pediatric MDC care.

Keywords: pediatric neuropsychology**,** medical disorders/illness**,** assessment

Paper Session 04: Cultural 1

11:00am - 12:30pm
Thursday, February 3, 2022

1 American Indian and Alaska Native Disparities in Trajectories of Cognitive Aging

Micah J Savin[1], Desiree Byrd[2], Tedd Judd[3], Steve Verney[4], Kylie Radford[5], Lucette A. Cysique[6], Sean B. Rourke[7], Richard F. Armenta[8], Donald Franklin[9], Thomas D. Marcotte[9], Heining Cham[1], Monica Rivera Mindt[1,10]
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Objective: Cognitive aging is a dynamic and variable process, wherein changes inherent to aging influence cognitive function across time. Little is known regarding cognitive aging among American Indian and Alaska Native (AI/AN) adults, both within and outside the context of clinical conditions (e.g., HIV). AI/AN health disparities have been described in HIV that may accentuate trajectories of cognitive aging (e.g., immunosuppression). This longitudinal study

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aimed to describe trajectories of cognitive aging among a cohort of HIV-/+ AI/AN adults.
Participants and Methods: A cohort of 702 adults (86% Male; *M* age = 46.7 ± 10.6 [16-77yo]; *M* education = 13.3 ± 2.9), including 351 AI/AN (26.6% Latinx) and 351 Non-Latinx White (NLW) adults, across seven sites in the United States, completed annual comprehensive cognitive assessments, psychiatric/alcohol/substance use interviews, and neuromedical evaluations for up to 20 years (*Mdn* = 4 annual follow-up evaluations). A series of linear growth curve models, adjusted for sex, education, and comorbidities, tested the interactive effects of age (continuous time effect), ethnoracial identity (AI/AN vs. NLW), and HIV status (HIV- [17.23%] vs. HIV+ [30.56%] vs. AIDS [nadir CD4 cell count <200; 52.72%]) upon 25 raw cognitive test scores.
Results: At baseline, AI/AN adults performed worse on all cognitive tests (25/25) compared to NLW adults (*p*s < .01). In comparison to NLW adults, AI/AN adults demonstrated worse trajectories in cognitive aging across 18/25 test scores (primarily on tests of processing speed, attention, and executive functioning; *p*s < .03). HIV status significantly influenced trajectories in cognitive aging on 11/25 test scores (primarily on tests of executive functioning; *p*s < .05). Specifically, AI/AN adults with HIV+ and/or AIDS status demonstrated significantly worse trajectories in cognitive aging, while only AIDS status significantly steepened cognitive aging trajectories in NLW adults (*p*s < .05). The duration of follow-up evaluations did not differ as a function of HIV status (*p*s > .23) but did differ in terms of ethnoracial identity and age (*p*s < .05) such that older AI/AN adults had fewer follow up evaluations compared to other age/ethnoracial groups.
Conclusions: Trajectories of cognitive aging are steeper in AI/AN compared to NLW, especially in tests assessing processing speed, attention, and executive functioning. This effect was evidenced for both the HIV- and HIV+ groups, although a dysexecutive profile was more pronounced in the HIV+ group. Accentuated cognitive aging occurs earlier and with less advanced disease among AI/AN adults with HIV than their NLW peers. Moreover, the reduced duration of evaluations for older AI/AN adults highlights potential concerns for retention in research and increased mortality. The biopsychosociocultural disparities relevant to AI/AN should be investigated to contextualize these findings and identify areas for possible intervention.
Keywords: aging (normal), HIV/AIDS, ethnicity

2 Perceived Stress and White Matter Hyperintensities: The Role of Race

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Objective: Prior work indicated Black Americans (BAs) experience higher levels of stress compared with non-Hispanic Whites (NHW), largely attributed to social and economic determinants (e.g., racism/discrimination, income disparities, quality of life). Stress is perceived differently across racial groups, further highlighting the need to evaluate racial stress. Chronic stress increases blood pressure and inflammation, yet the physiological ramifications of race related chronic stress and discrimination are unknown. Studies have suggested that BAs who experience chronic stress may have higher white matter hyperintensity (WMH) volumes than White adults. Thus, our objective was to investigate

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whether regional WMH volumes are related to perceived stress and whether the relationship differs by race. We hypothesized that larger WMH volumes would be related to greater perceived stress levels, and that this relationship would be stronger in BAs than in NHWs.
Participants and Methods: Participants included 36 cognitively-normal, middle age (M = 57.06 years) individuals (8 BAs, and 28 NHWs). Data collection included a one-hour neuropsychological battery, a one-hour perceived discrimination inventory, a one-hour perceived stress inventory, and magnetic resonance imaging (MRI). Perceived stress and perceived discrimination scores were calculated as the sum of all responses in the perceived stress scale, and perceived discrimination scales, respectively. Fluid attenuated inversion recovery (FLAIR) MRI data were analyzed to obtain lobe specific WMH volumes (frontal, temporal, occipital, parietal, cerebellar). We first compared perceived stress and discrimination scores between races, and then constructed linear regression models with the perceived stress and discrimination scores as independent variables and the WMH volumes as outcome variables, including race × perceived stress and discrimination interaction terms.
Results: BAs did report higher mean perceived discrimination scores (t (1,22) = 2.71, p = 0.13), but there was no difference in perceived stress scores. There was a race × perceived stress interaction term such that within BAs, higher perceived stress was associated with larger parietal lobe WMH volumes (B = 0.004, t(2,31) = 3.16, p = 0.003), and there was not a statistically significant relationship observed in NHWs.
Conclusions: Higher perceived stress levels correlated with higher WMH volumes within the parietal lobe in BAs, but there was no such relationship in NHWs. Prior research supports our results that stress may particularly target the parietal lobe and could be a marker of posterior small vessel disease. Our findings suggest perceived stress disproportionately affects BAs, resulting in worse health outcomes at similar levels of WMH volumes.
Keywords: chronic stress**,** neuroimaging: structural connectivity**,** cross-cultural issues

3 The Effects of Acculturation and Perceived Discrimination on Neurocognitive Functioning in Immigrants and U.S. born Individuals with HIV

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Objective: Greater U.S. acculturation is associated with better cognitive outcomes in Latinx people with HIV (PWH). Further, ethnocultural discrimination has been associated with worse cognitive outcomes in people with and without HIV and anti-immigrant sentiment is associated with delayed access to healthcare. Delayed healthcare access, common among the immigrant community with HIV, may result in increased risk for advanced disease progression and subsequent cognitive impairment. However, little is known regarding the effects of perceived discrimination and immigration status on neurocognitive functioning, beyond acculturation, in Latinx PWH. This study aimed to examine these effects in a sample of immigrant and US-born Latinx PWH.
Participants and Methods: The sample included 22 Latinx immigrant PWH (M_{age} = 44.4, SD=6.8) and 44 US-born Latinx PWH (M_{age} = 45.3, SD = 8.3), who completed a comprehensive neurocognitive (NC) battery, as well as a series of ethnocultural questionnaires: the Abbreviated Multidimensional Acculturation Scale (AMAS: US and Latinx Acculturation Summary Scores) and the Perceived Ethnic Discrimination Questionnaire (PEDQ: Threat and Stigma Subscale Scores), a lifetime acculturation and perceived racism and ethnic discrimination measure, respectively. The AMAS and PEDQ subscales have displayed robust internal consistency for Latinx samples (α = 0.9 – 1.07). Demographically adjusted norms were used to compute average global NC and domain

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T-scores (e.g., attention, executive function, learning, memory, motor and global scores). A series of hierarchical multiple regressions were computed to predict global and domain NC T-scores. AMAS US and Latinx Summary scores were entered at Step One and Immigration Status, PEDQ subscales (Threat and Stigma subscales), and the centered interaction term (Latinx Acculturation*Immigration status) were entered at Step Two.
Results: Results revealed that the omnibus model was significantly associated with Attention (R^2 = 0.3; *ps*< .05). Notably, Step Two of the model significantly contributed to the association of Attention (R^2_{Δ}= 0.2; *ps*<.05) above and beyond the effects of Step One. For Attention, Latinx Acculturation, the interaction term, and immigration status were significantly associated with attention (βs = .00-.04, respectively; *ps*<.05). Such that, each increase in Latinx acculturation decreased the associated value of attention score by 1.4 units, the acculturation effect is stronger on US born Latinx than immigrants by .04, and the associated attention score for US born Latinx is 25 units lower than for Latinx immigrants when acculturation is 0, respectively. No other models were significant.
Conclusions: Findings suggest that in addition to acculturation, perceived discrimination and immigration status are important for understanding attention among Latinx PWH. These results highlight the need to assess sociocultural factors to provide culturally-informed interventions and appropriate resources for optimal cognitive health outcomes in this population. Future research on acculturation and perceived discrimination should assess protective factors (i.e., immigrant health paradox, bilingualism) and their role in optimizing cognitive health among ethnoculturally diverse PWH.
Keywords: neuropsychological assessment**,** diversity**,** HIV/AIDS

4 Code Switching and Cognitive Performance Among Bilingual Latinx Adults

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Objective: Code switching involves spontaneously alternating between two or more languages, during spoken and/or written communication. Some studies find that code switching is associated with better cognitive outcomes, specifically across aspects of executive functioning, while others do not. Methodological differences such as the use of convenience samples and inconsistent accounting for potential confounds may explain discrepant results. We investigated the association between code switching and executive functioning among Spanish-English bilingual middle-aged Latinx adults. We hypothesized that code switching would be associated with better executive functioning, even after accounting for environmental and sociocultural factors (i.e., education, immigrant status, childhood socioeconomic status [SES]).
Participants and Methods: We assessed 251 community dwelling Latinx adults from the Offspring study (*M* age=53.63(10.37); *M* education=13.51(2.36); 70.4% women, 57% tested in English). Bilingualism was determined by self-reported language history of use of English and Spanish. Participants self-reported the frequency of code switching during conversations with bilingual family members and friends using a multiple item scale. Higher scores reflected greater code switching (0= never; 5 = constantly; two item scales were summed to create a total score). A neuropsychological evaluation which included the NIH Toolbox Cognition battery assessed the cognitive domains of processing speed, set shifting, working memory, inhibition/attention, and letter and semantic fluency. General linear models evaluated the association of code switching on cognition adjusting for age, education, sex/gender, immigrant status, parental education, and language of test administration.
Results: The mean total frequency of code switching was 5.26 (3.23; range = 0-10). Women

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reported more code switching, as did those who were born in the U.S., had higher years of education, were younger, and were tested in English. Unadjusted results indicated that code switching was positively associated with working memory, processing speed, letter, and semantic fluency. After adjustments, frequency of code switching was not significantly associated with performance on any of the cognitive measures (all *p's* > .05). However, estimates were still positive for letter (B=0.12, 95%CI[-0.05,0.29]), and semantic fluency (B=0.13, 95%CI[-0.03,0.28]).
Conclusions: Among a community-based sample of bilingual middle-aged Latinx adults, self-reported code switching was not robustly associated with measures of executive functioning. Results of this study provide support for the inclusion and detailed characterization of sociocultural factors in evaluating the bilingual cognitive advantage. Future studies should incorporate objective assessments of code switching, and evaluate the relationship of code switching to other aspects of bilingualism (e.g., age of acquisition, proficiency).
Keywords: cognitive functioning**,** bilingualism/multilingualism**,** cross-cultural issues

5 Second language proficiency, balanced bilingualism, and cognition in middle-aged Latinx

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Objective: Studies comparing the cognition of bilinguals and monolinguals have shown mixed results, with some supporting a bilingual advantage and others not. Within-bilingual differences such as language use and second language (L2) proficiency remain largely overlooked among studies of bilingualism and cognitive aging. We investigated the role of bilingual language use (using primarily two languages versus one across environments) and L2 proficiency on cognition. We hypothesized that balanced language use and higher L2 proficiency would be associated with better cognition compared to unbalanced language use and lower L2 proficiency. Additionally, due to the increased cognitive demand of using two languages with high proficiency, we hypothesized a moderation between bilingual language use and L2 proficiency such that bilinguals with balanced use and high L2 proficiency would perform better than all other groups.
Participants and Methods: Participants consisted of 106 middle-aged, immigrant Latinx English-Spanish bilinguals (*M*age=57.4, *SD*=8.97; 72.6% women, 24% tested in English). Balanced bilingualism was determined by self-reported use of English and Spanish across 8 environments (e.g., at home, at work, to watch TV). Participants were defined as balanced (n=60, using 33.3%-66.6% Spanish) or Spanish-dominant (n=46, using >66.6% Spanish). English-dominant participants were excluded. Participants reported Spanish as their first language, therefore L2 proficiency was the average self-reported English proficiency across speaking, reading, writing, and understanding. L2 proficiency was dichotomized as high or low based on median split. Participants completed a neuropsychological evaluation which assessed verbal fluency (letter and animal fluency), attention and working memory (Digit Span Test), episodic memory (Selective Reminding Test), and aspects of executive functioning (NIH Toolbox Cognition Battery). Separate general linear models evaluated the effect of balanced bilingualism and proficiency on cognition. Stratified models by proficiency evaluated the effect of balanced bilingualism on cognition. All models adjusted for age, sex/gender, years of education, parental education, and language of administration.
Results: Balanced bilinguals were more likely to be tested in English but did not differ in sociodemographic factors compared to Spanish-dominant bilinguals. Balanced bilinguals performed better on immediate memory compared to Spanish-dominant bilinguals (B=7.487, 95%CI [0.544-14.430]) but did not differ in any other cognitive domains (all

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p's>.10). High L2 proficiency was associated with better performance on immediate memory (B=6.886, 95%CI [1.757-12.014]), delayed recall (B=1.132, 95%CI [0.060-2.203), and auditory working memory (B=1.191, 95%CI [0.026-2.355]) compared to low proficiency bilinguals. Proficiency was not associated with performance on any other cognitive domains (all *p*'s>.10). Proficiency stratified analyses did not reveal a robust association between balanced bilingualism and cognition.
Conclusions: Balanced bilingualism was associated with better episodic memory, and greater L2 proficiency was associated with better episodic memory and working memory. We did not find support for an interaction between proficiency and balanced bilingualism on cognition. Results suggest that L2 (in this case, English) proficiency may be more robustly associated with cognition, rather than a bilingual's balanced language use. Future studies should replicate these results with objective assessments of bilingualism. This work should also be extended to longitudinal data, to evaluate the association of proficiency and bilingual language use with rate of cognitive decline and incident dementia risk.
Keywords: bilingualism/multilingualism**,** language: second/foreign**,** cognitive functioning

6 Rationale and Results of an Advanced Cross-Cultural Initiative Recently Completed

Sharon Truter, Ann B Shuttleworth-Edwards
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Objective: In South Africa, most cognitive tests employed for neuropsychological evaluation are those developed for English speaking, educationally and socio-economically advantaged populations predominantly in the US. Accordingly, the normative data accompanying the tests are unsuitable for use with a large number of South African examinees who are relatively socioeconomically disadvantaged, have a poor quality of education, and/or whose primary language is other than English. Over the years many research studies have been carried out to produce child and adult normative data on commonly employed, typically US-based tests, for nonclinical samples of South Africans, and to a lesser extent for other African countries, with stratification for some or all of these critical demographic factors. Unfortunately, however, these test norms have limited accessibility for use in clinical settings, being unpublished dissertation data housed in university libraries, or isolated sets of published data in journals not necessarily of local derivation. The aim of the present initiative was to produce a collation of such existing data in a single text, for the purposes of easy clinical reference. A further aim was to enhance the volume with newly acquired normative data collected by the authors, targeting tests considered to be particularly suitable for use with the economically and educationally disadvantaged, and/or non-English individuals in question.
Participants and Methods: Over a period of six years, an extensive literature search was done to identify suitable Africa-based cognitive test normative data that were stratified for language, age, level of education, quality of education if available and/or socio-economic status (SES) and sex (where relevant), for collation in an integrated book form. At the same time, additional normative data were collected to extend the comprehensiveness of the collation, following study approval from the authors' university ethical screening committee. For inclusion, norming data for nonclinical samples (or clinical samples for tests of effort) had to have sufficient stratification for the demographic factors indicated. Test norms were organized within the categories of: cognitive test batteries; hand motor function; language ability; visuospatial function; verbal and visual memory; executive function and effort tests. Data tables were clearly labelled to highlight the core demographic features of each study. A summary table of tests and data within each cognitive function was provided.
Results: Following exclusion, normative data were collated from 19 countries in Africa for 77 tests, representing 22 languages. Most of the normative data were for young adults. The overall age range represented in the collection was from 50 months to 91 years.

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Conclusions: The collation of Africa-based cognitive test data provides a scholarly, yet user-friendly advance for valid assessment practices with relatively socio-economically and educationally disadvantaged and/or non-English examinees, and a rich basis for research insights. The broad spectrum of norms reveals comparative themes of significant cross-cultural relevance, the most striking of which is the pervasive deleterious effect of poor quality of education and/or low SES on cognitive test performances compared with norms for relatively advantaged South Africans and/or US-based norms, with rare exceptions across all test categories, regardless of ethnicity or geographical affiliation.
Keywords: normative data**,** assessment**,** cross-cultural issues

Poster Session 07: Movement | MS | Cognitive Rehab | Neurostimulation

11:00am - 12:00pm
Thursday, February 3, 2022

1 Measures of Vertical Attention Predict Gait Performance

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Objective: Falls are a leading cause of injury and death among older adults. Successfully walking relies on several cognitive functions including the allocation of attention to lower visual-space and coordination of gait to avoid tripping over obstacles. We present early data from our study examining the relationship between allocation of attention in the vertical plane and gait performance.
Participants and Methods: Participants were 18 community-dwelling older adults with 33% female, mean age 73.4 (SD 5.6), and mean education 16.5 years (SD 3.2). Participants walked a 10-meter course of small foam obstacles and were instructed to walk at their fastest safe speed while avoiding obstacle strikes. Participants held a tray that obstructed their view of the lower portion of the vertical plane (i.e. obstructed view of the floor directly in front of them). Three trials of this task were performed. Performance was scored for speed and number of obstacle strikes. Improvement over trials was measured by taking the score on the final trial and subtracting it from the score for the first trial. Allocation of vertical attention was measured with a set of vertical line bisections including both solid 24 cm lines and compound lines composed of a thin 16 cm and thick 8 cm segment. Participants were asked to find the center of either the whole line or the thin segment only. We also measured reaction times in a vertical preparation of the Posner paradigm, where participants responded to stimuli appearing above or below a central fixation by pressing the up or down arrow respectively on a keyboard following congruent, incongruent or neutral cues.
Results: Worse performance on our gait task was predicted by higher line bisection error (Pearson's $r = 0.55$, $p < 0.05$). Better performance on our gait task was correlated with faster reaction times on the Posner incongruent down stimulus (Pearson's $r = 0.34$, $p > 0.05$) and up stimulus (Pearson's $r = 0.42$, $p > 0.05$) conditions although they were nonsignificant in our sample size. Greater improvement over gait trials predicted by slower reaction times across Posner conditions with the strongest correlations with the incongruent down stimulus (Pearson's $r = 0.67$, $p < 0.05$) and incongruent up stimulus (Pearson's $r = 0.69$, $p < 0.05$) conditions.
Conclusions: We present data suggesting that measures of allocation of attention in the vertical plane are predictive of gait performance. Greater upward distractibility of attention, as measured by our line bisection task, appears to predict worse performance on a difficult gait task. Faster shifting of attention in the vertical plane did not have a significant association with gait performance in our small sample but did have a large association with improvement with practice, where persons who performed well at shifting attention improved less with practice. This suggests that people with more intact attentional networks perform as well as they are capable on the first trial while persons with less

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intact attentional networks benefit more from repetition. Measures of attention in the vertical plane are promising for predicting gait performance and capacity for improvement with training.
Keywords: attention**,** movement**,** reaction time

2 Perceived Effects of Individualized Cognitive Training in Adults with HAND

Wei Li[1], Victor Del Bene[1], Ge Wang[2], Kristen Triebel[1], Karli Martin[1], Jun Byun[1], Andres Azuero[1], Pariya L Fazeli[1], David E Vance[1]
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Objective: People living with HIV (PLWH) are vulnerable for developing HIV-Associated Neurocognitive Disorders (HAND). Individualized cognitive training may be an effective way to improve objective and subjective cognitive functioning, which can impact their quality of life. This study investigated how people with a diagnosis of HAND perceived the effects of an individualized, targeted cognitive training. In addition, their experience with using the training was evaluated.
Participants and Methods: In a sample of 109 PLWH with HAND, these participants were randomized into two groups: no-contact control group (n=45) and cognitive training group (n=64). All participants completed the baseline/pretest. For the no-contact group, only 40 participants completed the posttest. By contrast, 41 participants in the cognitive training group completed the cognitive training and posttest. Participants in the treatment group received 20 hours of domain-specific cognitive training, 10 hours of training in two cognitive domains in which their diagnosis of HAND was based. Cognitive training occurred in the following domains: (Speed of processing, Attention, Verbal Learning and Memory, Delayed Verbal Memory, Executive Functioning, Spatial Learning and Memory, Delayed Spatial Memory, and Spatial Visualization). A training satisfaction questionnaire was used to assess the participants' perceptions about whether the cognitive training improved their cognitive functioning and evaluate their experience with the training protocol.
Results: Participants in the training group were asked to rate their perceptions of the effects of individualized cognitive training on their: (a) mental abilities; (b) memory; (c) speed of processing (SOP); (d) attention; and (e) ability to do everyday activities such as driving or cooking. Most participants reported that they felt the training had at least a moderate or greater improvement on their mental abilities (91.11%), memory (86.66%), SOP (86.66%), and attention (88.88%). Most participants reported that they felt the training had "*moderately" to "very much"* improved their everyday functioning (n = 45; M = 3.4, SD = 1.23). Participants in the training group were also asked how much they enjoyed these games/exercises ranging from 1 (not at all), to 3 (moderately), to 5 (extremely); most participants (95.55%) responded moderate or greater enjoyment.
Conclusions: With the targeted, individualized cognitive training, most participants with HAND perceived improved cognitive abilities. It is equally important that most participants enjoyed the trainings as this may improve cognitive training adherence. This study provides evidence that simply engaging in cognitive training (regardless of actual improvement in cognitive performance) improves subjective cognitive ability; this approach can potentially assuage fears and concerns of cognitive loss, thus improving quality of life.
Keywords: cognitive functioning**,** everyday functioning**,** cognitive rehabilitation

3 Instrumental Activities of Daily Living After Working Memory Training

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Objective: The aim of the current study was to investigate whether working memory training can improve instrumental activities of daily living after ischemic stroke
Participants and Methods: This is a randomized controlled clinical trial. This study followed the Consolidated Standards of Reporting trials for social and psychological interventions CONSORT-SPI 2018. 32 individuals from Instituto Neurológico de Colombia clinically diagnosed with ischemic stroke were randomized either to an adaptive working memory training (n=16) or an active control group (n= 16). Participants were between 50 and 75 years old who had a stroke 12 months to 5 years ago. The intervention and active control group consisted of 25 one-hour sessions within 12 weeks. The primary outcome measures were daily living (instrumental activities of daily living), working memory questionnaire. Secondary outcome measures were the working memory index and corsi block tapping test.
Results: All groups improved on instrumental activities of daily living and the working memory questionnaire, the working memory index but the active control group did not improve in the corsi block tapping test. These cognitive and improvements remained stable 12 weeks after training completion. However, the intervention group did not improve more than the two control groups. The only secondary measure that showed significan differences was the working memory index. On the other hand, when assessment was performed according to the injured hemisphere, results suggest that working memory training is meaningful in participants with right hemisphere injury. They showed improvements both in primary and secondary outcome measures
Conclusions: We, therefore, conclude that working memory training can impact instrumental activities of daily living after stroke, however, future studies should control time after stroke, depression and ongoing physical interventions.
Keywords: activities of daily living**,** cognitive rehabilitation**,** teleneuropsychology
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4 Examining the Patterns of Compensatory Strategy Usage as Self-Reported Memory Complaints Increase

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Objective: People who have memory complaints often use compensatory strategies in daily life. Identifying patterns of compensatory strategy use based on age and type of memory complaints could inform clinical recommendations.
Participants and Methods: 819 participants with a mean age of 57.46 years (range: 22-99 years) completed two questionnaires regarding memory complaints and compensatory strategies online via Qualtrics. Prospective (PM) and retrospective memory (RM) complaints were measured separately and combined into a total memory complaint score. Five types of compensatory strategies were assessed: internal (e.g., imagery/rehearsal), external (e.g., writing things down), time (e.g., speaking slowly to help remember), reliance on other people, and effort (e.g., concentrating or trying harder to remember). Multiple linear regressions examined relations between memory complaints and strategy use and whether those relations were moderated by age. Significant interactions were post-hoc probed based on methods described in Holmbeck (2002). Analyses of only older participants (age 65+) were performed to inform clinical questions pertaining to cognitive aging.
Results: In the full sample, compensatory strategies increase as memory complaints increase (ß = 0.58, $p < 0.001$), and age moderates this relation (ß = -0.07, $p < 0.05$). Post-hoc probing showed that younger adults used more strategies as their complaints increased compared to older adults. Significant relations were observed between total memory complaints and internal, time, reliance, and effort strategies, and age modified the relation between memory complaints and reliance on others (ß = -0.097, $p < 0.01$). Post-hoc probing showed that the relation between memory complaints and reliance was stronger for

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younger adults than older adults. PM and RM complaints revealed different patterns of compensatory strategy usage. PM complaints were significantly related to external strategies, reliance on others (significantly moderated by age [ß = -0.09, $p < 0.05$]), and effort strategies. Post-hoc probing demonstrated that younger adults relied on other people to aid in their PM more than older adults. RM complaints were significantly related to internal strategies, reliance on others, and time strategies, with age moderating external strategy use (ß = 0.08, $p < 0.05$) and reliance on others (ß = -0.10, $p < 0.01$). Post-hoc probing revealed that younger adults used more compensatory strategies for RM than older adults. When isolating older adults, the patterns of compensatory strategy usage remained the same for PM failures but showed that older adults used time and reliance strategies (but not internal strategies) for RM failures.
Conclusions: At all ages, people with memory complaints engage in compensatory behavior. However, younger adults report using more compensatory strategies when they experience subjective memory complaints compared to older adults. Younger adults more frequently rely on other people to aid in their prospective and retrospective memory. People rely on different compensatory strategies for aiding in PM versus RM; external aids, relying on other people, and exerting more effort are used for PM, whereas internal strategies, relying on other people, and slowing down (time) are used to compensate for RM. Older adults should be instructed on a range of compensatory strategies to improve memory abilities.
Keywords: adaptive functioning**,** memory complaints

5 A Systematic Review of the Benefits of Olfactory Interventions on Cognitive and Neurological Outcomes Across Clinical Populations

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Objective: Olfactory dysfunction is a troubling symptom occurring in a variety of disorders, including Parkinson's disease, upper respiratory infection, SARS-Cov-2, and traumatic brain injury. Anosmia, the complete loss of olfactory function, and hyposmia, significantly reduced olfactory function, negatively impact quality of life in affected patients. Currently, there are limited treatment options, although olfactory training and other related treatments have shown promising results both clinically, as reflected by improved olfactory threshold, and anatomically, as reflected by increased network connections in olfactory processing regions. Smell training consists of smelling specified odors for a consistent number of minutes, commonly twice daily, over a period of weeks to months. Current research has focused on the impact of these olfactory interventions on specific clinical populations, but few studies have examined whether such interventions produce cognitive and neurological benefits. This literature review aimed to integrate results from the various experimental studies for a comprehensive understanding of the cognitive and neurological benefits of olfactory training across a multitude of clinical disorders and normal aging adults.
Participants and Methods: Using PRISMA principles, we searched PubMed and Google Scholar databases to identify experimental studies that assessed changes in olfaction and cognitive/brain function following olfactory intervention in adult humans. Articles that focused on animal studies, meta-analysis, or did not include a measure of both olfactory performance and cognition or brain function, were excluded from the analysis. Of the 12 studies identified, one was a case study, three involved within-group comparison before and after treatment, and eight utilized a control and treatment group(s). Smell training was used in 11 of the studies, and photobiomodulation was used in one.
Results: All studies revealed significantly improved olfaction in most participants. Five of the studies examined impact of cognition. Overall cognitive status significantly improved in four of the studies, with two studies also

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providing evidence for significantly improved working memory and verbal fluency. Seven studies found increased gray matter volume, particularly in the hippocampus and olfactory bulb using neuroimaging data. Functional neuroimaging studies revealed neural reorganization with stronger connection within the piriform cortex, and increased signal activity in several olfaction network areas (anterior cingulate, frontal gyrus, anterior entorhinal cortex, inferior prefrontal cortex and primary somatosensory cortex).
Conclusions: Olfactory interventions consisted primarily of smell training. Such interventions were shown to improve olfaction and, in addition, yield a bottom-up effect in improving cognition and neurophysiological outcomes. Future empirical studies should focus attention towards longer training periods, as there has been evidence for greater improvement in functional network connectivity and olfaction when the training period was increased from 12 to 18-weeks. Given mixed results regarding cognitive changes following training, a more comprehensive neuropsychological battery would likely increase our understanding of the impact of the olfactory processing network re-organization on various cognitive domains.
Keywords: olfaction**,** brain plasticity**,** cognitive rehabilitation

6 Cognitive Telerehabilitation Group Intervention for Cognitive Impairments in Traumatic Brain Injury and Brain Tumor Populations: A Feasibility Study

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Objective: To assess feasibility of group cognitive telerehabilitation in traumatic brain injury (TBI) and primary brain tumor (PBT) populations with self-reported cognitive impairments.
Participants and Methods: Two groups were administered standardized cognitive rehabilitation via telehealth; TBI (n=5) and PBT (n=3). TBI participants were recruited from an outpatient urban level one trauma center, had mild TBI (GCS 13-15) and were 2-18 months post-injury. PBT participants were recruited from an outpatient academic medical center, were not on active tumor treatment and had stable grade I-II tumor pathology. All patients self-reported executive dysfunction, were not aphasic, had no acute psychiatric concerns, were able to perform ADLs independently, and had no prior cognitive rehabilitation.
Due to the frequency of executive functioning changes in both populations, the cognitive rehabilitation program provided via telehealth was Goal Management Training™. Groups were facilitated by trained neuropsychologists over the course of 9 weekly sessions (90 minutes each) using standardized materials, duration, and treatment frequency. Assessment measures administered pre and post intervention for the TBI group included Goal Management Training Questionnaire (GMT), Neurobehavioral Symptom Inventory (NSI), Rivermead Post Concussion Symptoms Questionnaire (RPQ), Traumatic Brain Injury - Quality of Life: Cognition (TBI-QOL:C), Traumatic Brain Injury - Quality of Life: Resilience (TBI-QOL:R), and Quality of Life After Brain Injury: Overall Scale (QOLIBRI-OS). Assessment measures administered pre and post intervention for the PBT group included Goal Management Training Questionnaire (GMT), Brief Symptom Inventory 18 (BSI), and Frontal Systems Behavior Scale (FrSBe). Post intervention patient satisfaction data was collected for both groups.
Results: TBI participants attended 70% of the group sessions with 20% attrition (attrition n=1). PBT participants attended 96% of the group sessions (attrition n=0). Both TBI and PBT patients self-reported post treatment cognitive improvements (TBI GMT mean= -29.5; TBI NSI mean= -4.5; PBT GMT mean= -22). Qualitatively, both groups consistently reported post treatment improvements in daily cognitive slips such as "walking into a room and forgetting what it was that you had come

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for." TBI group self-reported improvement in overall satisfaction (QOLIBRI-OS mean= 11.25). Participants of both groups reported high acceptability for receiving cognitive rehabilitation via telehealth, would recommend it to others, and were interested in continued group cognitive rehabilitation treatment if it were offered.
Conclusions: Access to cognitive rehabilitation is a major barrier to manage and improve cognitive symptoms. Telehealth visits provide significant advantages regarding ease of access and follow-up. This study demonstrates promising evidence for the feasibility of providing cognitive rehabilitation in a group format via telehealth. Both PBT and TBI participants reported group cognitive rehabilitation via telehealth was highly acceptable and meaningful in learning ways to manage their cognitive symptoms. Small sample size and lack of objective data of improved cognitive functioning post treatment are study limitations. Though both groups were small pilot groups, the intervention was found to be feasible for both TBI and brain tumor populations and should be studied further as a viable treatment option given the current barriers to accessing cognitive rehabilitation treatments.
Keywords: cognitive rehabilitation**,** brain tumor**,** traumatic brain injury
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7 Personalized Smartphone Reminder Application Facilitates Relevant Everyday Activities in the Home for Individuals with Mild Cognitive Impairment and Dementia

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Objective: To evaluate a person-centered smartphone reminder application (SmartPrompt) based on a neuropsychological model of functional disability for people with mild cognitive impairment (MCI) and dementia. Feasibility, usability, and effectiveness in the home environment were examined.
Participants and Methods: Six participants (M age=75.2 ± 3.7; M education=14.8 ± 3.3) with MCI or mild dementia and their care-partners identified two personally-relevant everyday tasks they wished to complete more independently, and tracked task completion for two weeks with the SmartPrompt (SP) and two weeks without (Control; order counterbalanced). The SP was installed on participants' personal smartphones; alerted them to complete two tasks each day at times preferred by the participant/care-partner; incorporated personalized images, audio, and rewards; and included motivational and logging features targeting common errors in everyday tasks. Participants and care-partners completed baseline and post-study questionnaires, were trained to use the SP, and tracked task completion using daily diaries. The SP also recorded task completion during the SP weeks. Feasibility outcomes included training metrics, use of the training manual, engagement with the SP, maintenance of SP knowledge, and technical difficulties. Subjective usability was evaluated using participant- and care-partner-reported usability scales. Effectiveness outcomes included diary-reported task completion, checking behaviors, independence, and caregiver burden in the SP vs. Control weeks, as well as automated SP records of task completion.
Results: The most frequently targeted task was medications (58%); others included hydration, exercise, psychological wellness, and chores. All participants completed the SP training during a single 1-hour session; during the SP weeks, 0 participants and 50% of care-partners referred to the training manual. According to care-partners, participants remembered how to use the SP 88% of the time with technical difficulties reported on only 2/84 SP study days. Care-partners' (M=90/100) and participants' usability ratings were above average and increased before (M=78/100) vs. after the SP weeks (M=88/100; $t(5)=2.5$, $p=.055$) for participants. Participant and care-partner daily diaries did not differ during the SP vs. Control weeks (reports of task completion, frustration; *p's* >.05). During the SP weeks, participants (who reported completing an average of 23.5/28 tasks) and care-partners (who reported an average of

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25.5/28 tasks) differed in their diary reports. Automated SP records showed an average of 26/28 tasks logged and completed, indicating a discrepancy between automated records and participant daily diaries. Automated SP records also showed that 67% of participants engaged with the SP at least once a day, whereas only 50% of participants engaged with the daily diary at least once per day during the SP weeks. At the end of the study, 67% of care-partners and participants reported that participants spent less time checking, 83% of participants reported increased independence, and 100% of care-partners reported less caregiving time during the SP weeks. All six participants decided to keep the SP on their smartphone after study completion.
Conclusions: Participants quickly learned to independently use a novel smartphone application at home to facilitate increased independence, diminished checking behaviors, and less caregiving. Usability ratings among participants and care-partners were favorable, and maintenance of SP knowledge was reported.
Keywords: technology**,** everyday functioning**,** mild cognitive impairment
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8 New Directions in Rehabilitation of Functional Impairment: Leveraging Technology to Develop and Implement Theoretically Informed Interventions for Everyday Activities

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Objective: Everyday activities, such as meal preparation, are cognitively complex tasks that are negatively impacted by neurological disease/injury, including neurodegenerative disease and traumatic brain injury. Functional difficulties contribute to decreased quality of life, higher costs of care, increased caregiver burden, and a variety of other adverse outcomes. Although cognitive models have been proposed to explain the functional deficits seen in dementia and other forms of cognitive decline, there are essentially no interventions informed by these theories to improve everyday functioning. In contrast, the field of aphasiology has a long history of employing cognitive models of language to motivate development of aphasia treatments. Given key shared features between cognitive models of language and everyday action, theoretically informed aphasia interventions may be an instructive paradigm to guide development of interventions for everyday activities. Here we will review parallels between cognitive models of language and everyday action, discuss implications of theoretically informed aphasia interventions for development of everyday action interventions, and consider opportunities for leveraging novel technologies to develop and implement theoretically motivated interventions for everyday activities.
Participants and Methods: Cognitive models were reviewed from the cognitive psychology, aphasiology, and clinical neuropsychology literatures to identify shared characteristics of language and everyday action models. Theoretically informed interventions for aphasia were reviewed to identify language interventions with instructive principles for everyday functioning intervention. Opportunities for utilization of technology to implement everyday action interventions were identified.
Results: Cognitive models of language and everyday action share important features, including hierarchical organization of representations and their activation via top-down and bottom-up processes. Relevant to development of interventions, common sources of language/action errors include inappropriate activation of non-target representations and premature decay of task-relevant activations. To target error mechanisms, aphasia interventions have (1) introduced response delays to extend activation of representations, (2) promoted rapid responding to improve precision of representations and/or preclude premature decay of representations, and (3) trained semantic features of atypical category exemplars to improve activation of the wider semantic network. Promising emerging technologies, including immersive and non-immersive virtual reality, smartphone applications, and sensors, may expand the effectiveness of action interventions by enabling personalization to target culturally relevant and

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personally meaningful activities and reducing costs.
Conclusions: Cognitive models of language and aphasia share similarities to cognitive models of everyday action and functional disability. Consequently, theoretically motivated and effective interventions for aphasia have great potential to inform development of interventions to improve everyday functioning. Emerging technologies, such as virtual reality, will likely facilitate implementation and systematic investigation of newly developed action interventions.
Keywords: everyday functioning**,** aphasia**,** technology
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9 Does Mindfulness-Based Stress Reduction Improve Neurocognitive Performances in Veterans with Gulf War Illness?

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Objective: Veterans deployed to the Gulf War in 1990-1991 sometimes present with a constellation of health consequences referred to as “Gulf War illness” (GWI), which can include subjective cognitive concerns and objective neuropsychological impairments. A previous study using the current sample (Kearney et al., 2016) reported improved subjective cognitive functioning following a mindfulness-based stress reduction (MBSR) treatment; however, that study did not report on objective neuropsychological change following treatment. The current study evaluated whether Veterans with GWI randomized to MBSR treatment showed greater improvement in neuropsychological performances compared to Veterans receiving treatment as usual (TAU).
Participants and Methods: 53 Veterans with GWI were randomized to TAU plus MBSR (n=25) or TAU only (n=28). MBSR was delivered in 8 weekly 2.5-hour sessions plus a single 7-hour weekend session. A standardized neuropsychological battery and the Cognitive Failures Questionnaire were administered at baseline, post-treatment, and 6-months follow-up.
Results: Across most (8 out of 9) neuropsychological outcomes, there were significant improvements across groups from baseline to either post-treatment or at 6-month follow-up (all *p*s < .05, Cohen’s *f* range .22-.52). Largest effect sizes were observed for list learning (i.e., California Verbal Learning Test 2nd Edition immediate recall; *f* = .52), working memory/speed of processing (i.e., Paced Auditory Serial Addition Test; *f* = .35), and set-shifting (i.e., Trail Making Test, B; *f* = .33). However, for no neuropsychological outcome at any time point was there a significant group by time interaction, indicating no differences in the rate of change for the MBSR group compared to the TAU only group (*p*s >.10). In an exploratory follow-up analysis, there were significant interactions between treatment group and baseline neuropsychological performances with regard to change in self-reported cognitive functioning, indicating that better baseline delayed memory and set-shifting was associated with greater reductions in cognitive concerns in the MBSR group (*r* range .44-.57, all *p*s < .05), but not the TAU group (*r* range -.08-.24, *p*s >.10).
Conclusions: Although neuropsychological outcomes improved over the course of the study for most measures, these were not specific to MBSR and may be due to practice effects. These findings stand in contrast to those

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demonstrating greater improvement in self-reported cognitive functioning in Veterans enrolled in MBSR (Kearney et al., 2016) from the same dataset. Current data suggest that mindfulness-based approaches may target subjective but not objective cognitive symptoms in Veterans with presentations consistent with GWI. MBSR may be particularly useful for reducing subjective cognitive concerns among Veterans with higher baseline cognitive functioning. Similar to treatment goals of interventions in other clinical populations (e.g., chronic pain), future clinical trials are needed to determine whether mindfulness treatments can improve everyday functioning outcomes (e.g., social functioning, employment) through reducing subjective cognitive symptoms even in the absence of treatment-specific changes in objective neuropsychological functioning. Future investigations also may aim to replicate current findings in other Veteran populations demonstrating poor convergence between subjective ratings and objective performances of neurocognition (e.g., mild traumatic brain injury).
Keywords: treatment outcome**,** cognitive rehabilitation**,** chronic stress
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10 Pilot Study Investigating the Feasibility and Potential Benefits of a Parent-delivered Cognitive Intervention for Attention and Executive Function in a Mixed Pediatric Sample

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Objective: Attention and executive function (A/EF) deficits are prevalent across a variety of neurodevelopmental disorders. The current pilot study investigated the feasibility and potential benefits of a parent-delivery model of a novel intervention called Dino Island (DI), which aims to improve A/EF in children. DI is a 'serious game' designed by researchers at the University of Victoria, based on a hybrid model of cognitive rehabilitation which combines direct A/EF training using a process specific approach with metacognitive strategy instruction (i.e., compensatory approach). DI was designed to be accessible and feasible for community delivery in local and remote settings, to fill the gap in treatment options for children with neurodevelopmental disorders, and to meet stakeholders' requests for intervention that can be delivered by parents in a home setting.
Participants and Methods: Four children with neurodevelopmental disorders (Autism Spectrum Disorder, Attention-Deficit/Hyperactivity Disorder, Learning Disorder, and Down Syndrome), between the ages of 5 and 12 years, and their parents participated in the pilot study. Families were recruited through Kids Uncomplicated/The Uncomplicated Family (TUF), a service-company for children with NDDs based in Alberta, Canada. Parents completed an online training course before taking on the role of their child's interventionist to deliver the intervention to their child in the home environment. Children were tested before and after the intervention using cognitive and behavioural outcome measures assessing A/EF, academic fluency, metacognitive skills, and adaptive behaviour. Parents completed pre/post ratings of caregiver quality of life and parenting stress. Parents were instructed to deliver the intervention to their children over eight to ten weeks, approximately three times per week, for a total of 14-16 intervention hours. Following the intervention, parents completed exit interviews on their experience of delivering the intervention and rudimentary fidelity data was collected. Given the primarily qualitative, multiple-case study design, data was analyzed using a pattern-matching approach.
Results: Findings indicate that the DI intervention can be delivered in the home environment, and that the intervention is generally feasible and a positive experience for children and parents. However, barriers emerged with respect to intervention delivery,

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fidelity monitoring, and technology use. Potential gains were observed on several performance measures of A/EF, as well as on parent-reported behavioural rating scales and exit interviews. Parent stress and quality of life ratings varied across participants. Efficacy and implementation data will be expanded further in the poster.
Conclusions: The DI intervention shows promise for fostering the development of A/EF skills in children with NDDs and increasing the accessibility of neuropsychological services for children. Parent facilitated delivery of cognitive intervention is a novel approach that is supported by the current study. Further research using RCT's with larger samples is needed to establish an evidence-base for the DI intervention. Benefits and barriers to remote parent delivery of neurocognitive interventions and future directions will be discussed.
Keywords: attention**,** executive functions**,** child development disorders

11 Efficacy of an Adaptive 3-Month Cognitive Training Intervention on Proximal Transfer Across Domains in an Older Adult Population

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Objective: Recent research has proposed that cognitive training (CT) can be used as a potential intervention to remediate age-related cognitive changes, including across memory, executive function, attention, and processing speed domains. Past studies have consistently found improvements on proximal transfer (trained tasks) following CT interventions to analogous tasks. However, this is likely the result of practice effects and it remains unclear whether the efficacy of proximal transfer effects is equivalent across cognitive domains. Thus, the current study aimed to explore proximal transfer effects within 8 attention/processing speed and working memory tasks delivered through adaptive CT intervention.
Participants and Methods: 78 healthy older adults (mean age=71.13±4.694) were assigned to either an adaptive CT intervention (n=39) or educational training (ET) control group (n=39), over the course of 12-weeks. The CT condition consisted of 20 hours of working memory (To-Do List Training, Memory Grid, Card Shark and Auditory Ace tasks) and 20 hours of attention/processing speed training (Divided Attention, Target Tracker, Double Decision and Hawk Eye tasks) (POSIT BrainHQ). The ET condition required participants to watch 40 hours of educational videos. All participants underwent sham or active transcranial direct current stimulation (tDCS) as an adjunctive intervention, although not a variable of interest in the current study. Repeated-measures ANCOVA were conducted to assess for pre/post change in POSIT subtask scores between intervention groups, controlling for age, sex, education and tDCS group. Bonferroni-corrected p-value (p=0.00625) was set to correct for multiple comparisons.
Results: Repeated-measures ANCOVAs revealed a significant timepoint*intervention group interaction for all 8 POSIT subtasks. To assess the relative strengths of the findings, we then calculated Cohen's f for all significant interactions. Specifically, participants in the CT intervention had higher scores on the To-Do List Training ($F[1,72]=19.940, p<0.001$; Cohen's *f=0.22*), Target Tracker ($F[1,72]=8.869, p=0.004$, Cohen's *f=0.12*), Memory Grid ($F[1,72]=31.267, p<0.001$, Cohen's *f=0.32*), Card Shark ($F[1,72]=38.188, p<0.001$, Cohen's *f=0.31*), and Auditory Ace ($F[1,72]=16.916, p<0.001$, Cohen's *f=0.27*) tasks post-intervention, compared to the ET group, Participants in the CT intervention had significantly faster performance on the three tasks measured by reaction time, Divided Attention ($F[1,72]=22.704, p<0.001$, Cohen's *f=0.27*), Hawk Eye ($F[1,72]=10.994, p=0.001$, Cohen's *f=0.19*), and Double Decision ($F[1,72]=103.358, p<0.001$, Cohen's *f=0.54*) post-intervention compared to the ET group. Of note, no main effect of time point for the

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collapsed CT/ET groups were found for any of the 8 POSIT subtasks, even when Bonferroni corrections were not applied (all p-values>0.05). **Conclusions:** Our findings suggest that multimodal working memory and attention/processing speed intervention produces significant proximal transfer effects. We showed small-moderate effect sizes on performance of Target Tracker and Hawk Eye, and moderate-large effect sizes on the remaining 6 subtasks. Double Decision, modeled off the Useful Field of View (UFOV) task, had the largest Cohen's *f*=.54. Importantly, no main effect of timepoint was found, suggesting that practice effects were not significant for the ET group. Additionally, our data signifies that effect sizes were driven by improvements in the CT group. Future studies should examine near and far transfer effects of multimodal CT interventions.

Keywords: aging (normal), cognitive functioning, computerized neuropsychological testing

12 A Transdiagnostic Approach to the Teen Online Problem Solving Program: Website Adaptation and Therapist Training

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Objective: To illustrate the process for adapting an evidence-based online intervention focused on improving family coping and child self-regulation following traumatic brain injury (TBI) into a transdiagnostic program applicable to patients with epilepsy, encephalitis, stroke/neurovascular disease, anoxic injury, post-surgical resection, and other brain conditions in addition to TBI.
Participants and Methods: Current users of the Teen Online Problem Solving Program (TOPS) are adolescents and young adults (AYA) generally between the ages of 13-19 who have recently experienced a moderate to severe TBI. The transdiagnostic program was adapted to serve patients ages 13-22 with a wide range of brain conditions (see above) diagnosed at any point in their lifetime. The process of adaptation began with qualitative stakeholder interviews. AYA with a brain condition and their parents were asked about the impact of their diagnosis in areas such as daily functioning, school, and social interactions. REDCap surveys were also distributed to medical providers who commonly treat these diagnoses to assess which symptoms are most frequently endorsed by patients with these conditions. Lastly, additional training material was developed for new and existing therapists delivering the program across the United States and Canada.
Results: Stakeholders indicated a variety of issues, including medication adherence, coping with physical disability, and self-advocacy. Providers (N=42) endorsed many symptom domains, with significant variation across diagnoses, $F(3,345)=53.17$, $p<.001$, indicating difficulties common to AYA survivors regardless of their diagnosis. There were also significant differences by diagnosis; providers rated cognitive/communication symptoms, $F(4,119)=4.84$, $p=.001$, and behavioral/emotional symptoms, $F(4,119)=3.60$, $p=.008$ as highest for survivors of anoxic injuries. As a result, commonalities across diagnoses were prioritized in core sessions, while additional content was created in supplemental sessions for specific patient populations (e.g., "medication adherence", "coping with visible and invisible disability"). Language throughout the program was also revised to reflect transdiagnostic terminology (e.g., "brain condition" instead of "brain injury"). New therapists for the TOPS program represented a range of professions from psychologists and social workers to speech language pathologists, and participated in a five-week training followed by a booster session in order to help troubleshoot and answer questions. Existing therapists are receiving informational webinars on topics such as working with different populations.
Conclusions: Psychosocial interventions for AYA survivors of brain conditions are scarce, and existing interventions can be difficult to access. Drawing both qualitative and quantitative data from stakeholders and medical providers helped guide the adaptation of the transdiagnostic program to address the needs of

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patients and families. Our implementation of therapist training has yielded an international collaboration with a diverse group of professionals across disciplines, with the goal of providing accessible, tailored psychosocial care.
Keywords: adolescence**,** teleneuropsychology**,** cognitive rehabilitation
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13 Compensation Training and Lifestyle Modifications to promote healthy aging in persons at risk for Alzheimer's disease

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Objective: The protocol and initial cohort demographics for 'Brain Boosters', a novel combined compensatory training and lifestyle modification intervention aimed at Alzheimer's disease (AD) risk reduction is presented.
Participants and Methods: Training in memory compensation will focus on calendar and daily task tracking, organizational strategies, and goal setting, all aimed at supporting independent function. These same compensatory tools will be employed to facilitate adoption of lifestyle changes that support brain health (e.g., exercise, engagement in cognitively stimulating activities, and stress management) through behavioral monitoring and feedback. A comprehensive suite of digital tools encapsulated in the Electronic Memory and Management Aid (EMMA), an easy to use, interactive application, will be used to facilitate behavioral change and enhance participant motivation. EMMA also allows collection of real-time data to track intervention adherence and factors that influence adherence using in-the-moment assessment. To capitalize on a critical window of intervention opportunity, we will target cognitively normal older adults with subjective cognitive concerns (SCC), an established risk for AD and cognitive impairment. The trial will enroll 225 older adults with SCC who will be randomized to our digital application-supported compensation training and lifestyle modification intervention or to an education onlycontrol group that will not use the EMMA app or be taught how to implement the educational material into their daily lives. Both intervention arms will be delivered in a group setting over 6 months, followed by 12 months of unsupervised follow-up.
Results: Specific aims of the project include to: 1) evaluate intervention efficacy on primary outcomes (global cognition and everyday function); secondary outcomes focus on indicators of well-being, cognitive domains (memory and executive function), physical function, compensation, and health behaviors; 2) evaluate characteristics of treatment responders; 3) evaluate adherence and identify the effective components of the target intervention using a mixed-method approach; and 4) design machine learning algorithms that use patterns of change in real-time data metrics to identify incipient declines in treatment adherence and changes in health status.
Conclusions: The project is expected to expand understanding of factors that may impact adherence to and outcomes of a preventative intervention and optimize a scalable intervention to reduce dementia risk applicable to diverse populations.
Keywords: aging (normal)

14 Impact of In-Person versus Virtual Interventions on Persons with Acquired Brian Injury and their Caregivers.

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Objective: The COVID-19 pandemic highlighted an existing need for virtual psychotherapy interventions. Our objective is to investigate modality (in-person vs. virtual) specific treatment responses for a group-based coping skills

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intervention for brain injury survivors (BIS) and their caregivers.
Participants and Methods: Data from in-person groups for the 18 months prior to the COVID-19 pandemic (*n*=12 dyads, mean age 67.7, 66.7% male) and virtual groups conducted during the first 18 months of the COVID-19 pandemic (*n*=16 dyads, Mean age 54.25, 75% male) were analyzed. Diagnoses were 58% stroke, 17% traumatic brain injury (TBI), and 25% other (metabolic encephalopathy, CSF syndrome, HSV encephalitis) for the in-person groups and 62.5% TBI, 18.8% stroke, 6% anoxic Injury, 6% tumor, and 6% other (post-transplant encephalopathy) for the virtual groups. All primary caregivers were spouses in both groups. All groups were enrolled in a 12-week program aimed at improving the lives of BIS and their caregivers through education, peer support and coping skills training. Caregivers completed the Frontal Systems Behavior Scale (FrSBe) as well as the Caregiver Perceived Burden Scale (CARS-PBS) and Caregiver Relationship Satisfaction Scale (CARS-CRSS. BIS completed the Patient Health Questionnaire-9 (PHQ-9), Satisfaction with Life Scale (SWLS), and Brain Injury Coping Skills Questionnaire (BICS-Q). all measures were completed at admission and discharge. A two-way repeated measures ANOVA examined the main and interactive effects of BICS intervention modality (in-person vs. virtual) on pre-post measures for each identified outcome. Results with significant interaction effects were followed-up with a paired t-test to assess pre-post significance.
Results: There were significant main effects of time on the PHQ-9, $F(1, 17) = 5.62$, $p = .03$; SWLS, $F(1, 17) = 5.73$, $p = .03$; and BICS-Q, $F(1, 17) = 7.14$, $p = .02$, measures with scores improving in the expected direction pre-post BICS treatment. Significant interactions between time and setting were present for both the PHQ-9, $F(1, 17) = 4.44$, $p = .05$, and CARS-CRSS, $F(1, 18) = 4.72$, $p = .04$, measures. Results of the paired t-test on the PHQ-9 measure showed a significant difference in pre-post scores for the in-person setting, $t(7) = 2.36$, $p = .05$, but no significant difference for the virtual setting, $t(10) = .26$, $p = .8$. Likewise, results from the CARS-CRSS measure showed a significant difference in pre-post scores for the in-person setting, $t(9) = -2.84$, $p = .02$, but no significant difference in the virtual setting, $t(9) = .12$, $p = .9$. No main effects or interactions were observed for remaining measures (FrSBe, CARS-PBS, CARS-CRSS).
Conclusions: Our results show improvement in caregiver-rated depressive symptoms, life satisfaction, brain jury coping skills, and caregiver relationship satisfaction, despite stable frontal behavioral symptoms and caregiver burden. However, only the in-person setting proved effective for improving depressive symptoms and caregiver relationship satisfaction. Confounding variables may include small number of participants, baseline differences in brain injury severity and type, and the stress caused by the COVID-19 pandemic in the virtual group. These results suggest that virtual group interventions may be a viable alternative for this population, though clearly more research is needed assessing the efficacy of in-person versus virtual group-based in
Keywords: cognitive rehabilitation**,** brain injury**,** caregiver burden

15 Enhancing Verbal Memory Performance Using Errorless Learning and Self-Generation in a Depressed Population

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Objective: In addition to mood symptoms, Major Depressive Disorder includes cognitive symptoms that are observed on objective measures (East-Richard et al., 2019) and subjectively reported at high rates (94% of sample, Condradi et al., 2011). While many cognitive domains are impacted by depression, executive functioning difficulties are most pronounced, which is theorized to drive verbal memory impairments. Memory deficits are particularly insidious for people with depression, underlying difficulties in occupational functioning.
In contrast to trial-and-error learning (Effortful Learning), Errorless Learning (EL) eliminates errors during initial learning trials (Baddeley & Wilson, 1994). Theoretically, EL learning improves memory recall by reducing the burden

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on executive functions during encoding and retrieval. Since memory deficits in depression are largely driven by executive functioning failures, EL Learning could be an ideal intervention for this population. Our goal was to determine whether EL Learning benefits memory performance in a depressed population, as compared to Errorful Learning (EF). We hypothesized that EL learning would improve free recall performance for both depressed and non-depressed adults, but that depressed participants will benefit more from EL learning as compared to non-depressed participants
Participants and Methods: Ninty-nine participants from Mechanical Turk participated for compensation. Depression status was determined by the Patient Health Questionnaire-8 Item (PHQ-8). Our sample included 51 non-depressed (≤9 PHQ-8; *M*=2.5, *SD*=2.8) and 48 depressed (≥10 PHQ-8; *M*=13.6, *SD*=2.9) adult participants (age *M*=42.5, *SD*=10.3).

We utilized a within-group, experimental design. Participants learned 3 lists of words using a word-stem completion task. For EF learning participants were forced to make an error in the initial stages of learning ("This word begins with PR, can you guess that word?). EL Learning eliminated errors by giving the answer ("This word begins with PR and that word is Prince"). EL Learning plus Self-Generation (EL-SG) eliminated errors by giving a semantic clue to elicit the answer ("This word begins with PR and describes a position of royalty, the son of a king"). After learning each list twice, participants completed an immediate free recall task.
Results: Consistent with our hypothesis, a mixed-design ANOVA revealed main effects for learning strategy, *F(*1, 194)=53.1, *p*=<.0001. Paired samples t-tests revealed that EL Learning (*M*=9.65, *SD*=3.5) and EL-SG Learning (*M*=10.44, *SD*=3.1) resulted in better free recall than EF Learning (*M*=8.41, *SD*=3.09); *t(*98)=-4.04, *p*=<.0001; *t*(98)=-7.33, *p*<.0001. EL-SG Learning resulted in better free recall than EL Learning *t*(98)=-2.69, *p*=.009. Contrary to our hypothesis, there was no significant interaction effect using a mixed-design ANOVA, *F*(1, 194)=.105, *p*=.747.
Conclusions: Regardless of depression status, eliminating errors during the initial stages of learning enhanced recall performance. Interestingly, we observed that eliminating errors by eliciting information through semantically rich clues (EL-SG) was a superior learning strategy compared to giving the information right away (EL). This has important implications for rehabilitation settings, as it suggests that Errorless Learning strategies differ in their effectiveness. Surprisingly, the current study found no difference in immediate free recall performance between depressed and non-depressed adults. Future studies will examine whether harder memory tasks or a more severely depressed population can answer our question regarding the relative benefits of EL Learning in depressed populations.
Keywords: depression**,** memory training**,** cognitive rehabilitation
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16 Implementation Feasibility and Process for Remote Parent-Delivery of a Neurocognitive Intervention in Autism Spectrum Disorder (ASD)

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Objective: Neurorehabilitation programs have significant barriers to access (location, cost, clinician availability). This study focused on the feasibility of parent implementation of an accessible neurocognitive intervention (Dino Island, DI) in children with ASD. DI utilizes neuroscientific principles of process specific training in the form of a "serious game" to directly target attention and executive functions (A/EF), combined with metacognitive strategy instruction. It was designed for non-expert delivery to surmount barriers to accessing rehabilitative services but has not been evaluated from an implementation science perspective. Objectives were to identify factors that predict parent adherence to an evidence-

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based intervention protocol and implications for parent delivery of neurocognitive interventions.
Participants and Methods: Fifty-seven children with ASD between ages 4-14 years ($\bar{x}$ = 8.76 years) and their parents participated. Families were recruited through a British Columbia school district and Alberta/Ontario service agencies for children with NDDs. Parents completed a 3-5 hour online training course and a brief, remote Q&A session with the research team. The training program provided key information for delivering the A/EF intervention: importance of A/EF, neurocognitive rehabilitation principles, how to play the serious game, metacognitive strategy instruction, goal setting, positive behavior management, and fidelity procedures. Following training, parents were instructed to deliver 14-16 hours of intervention over 6-10 weeks, divided into 3-4 weekly sessions of 30-60 minutes each. Intervention delivery was flexible although certain core components were required. Parents were asked to provide data on session delivery (levels played, duration, etc.) and the child's use of learned metacognitive strategies, and to periodically connect with the research team for feedback. To evaluate feasibility and satisfaction, we collected fidelity data (videos and tracking sheets), quantitative data (parent pre-/post-rating scales on stress, quality of life, and caregiving attitudes), and qualitative data (exit interviews on implementation experience).
Results: Challenges in obtaining fidelity data prevented detailed analysis of fidelity metrics, though adherence to the protocol varied across the sample. We conducted analyses of variance to investigate group differences in demographic, child, or parent factors between families who continued and discontinued in the study. Results indicated that families who continued in the intervention showed significantly lower parent-perceived level of dysfunctional parent-child interactions, F (1,45) = 4.849, p = .033, lower parent-perceived level of child's "difficulty", F (1,45) = 4.021, p = .051, and lower overall parenting stress, F (1,45) = 3.453, p = .070. There were no significant differences in continuation between groups for age, ASD severity, caregiver quality of life, or socioeconomic status. Qualitative results indicated that technology, time required, and child resistance were barriers while benefits included positive interactions and enjoyment of the game.
Conclusions: Implementation of neurocognitive interventions by non-experts is critical for accessibility and meeting stakeholder needs. Delivery of DI by parents was feasible under certain contexts, taking into consideration time available, level of external support, nature of the parent-child relationship, and parents' perception of their child's difficulties. This poster will expand on specific benefits and barriers to home delivery of neurocognitive interventions as informed by critical implementation science data.
Keywords: cognitive rehabilitation**,** clinical trials**,** child development disorders

17 Default Mode Network Changes Following Goals-Oriented Attentional Self-Regulation Training in Veterans with Mild Traumatic Brain Injury: Preliminary Findings from a Randomized Controlled Trial

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Objective: Mild Traumatic Brain Injury (mTBI) can have lasting consequences on cognitive functioning and well-being. Goals-Oriented Attentional Self-Regulation (GOALS) training has been shown to improve attention and executive functioning, as well as emotional functioning in Veterans with chronic TBI. An ongoing clinical trial (NCT02920788) is further evaluating GOALS training, including underlying neural mechanisms of change. A core element of GOALS is attentional self-regulation, a psychological process that incorporates mindfulness and redirection of attention. Previous literature has documented changes in

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the default mode network (DMN) related to attention. Examining changes in DMN connectivity related to GOALS training may provide insight into the mechanisms underlying the intervention.
Participants and Methods: Veterans with a history of mTBI at least six months post-injury (*N*=26) were randomly allocated to GOALS (*n*=14) or an intensity matched active control group (Brain Health Education [BHE] training; *n*=12). GOALS consists of attention regulation and problem-solving applied to individually defined, relevant goals spread across ten 2-hour group sessions, three 1-hour individual sessions, and 20 hours of home practice across five weeks. Participants underwent multiband resting-state fMRI acquisition at baseline and post-intervention. Independent component analysis (ICA) identified the DMN. An exploratory 2x2 mixed ANOVA model was applied to the DMN to identify pre-to-post changes in DMN connectivity for GOALS vs. BHE. Post-hoc paired- and independent samples t-tests evaluated the direction of effects.
Results: Analyses revealed a significant DMN connectivity cluster in the right precuneus (xyz=12,-52,48; k=130; p<.05 FDR-corrected; post-hoc rmANOVA Time x Group interaction: $F_{1,24}$=30.20, p<.001). There was a significant pre-to-post intervention decrease in DMN connectivity among GOALS participants (t_{13}=3.81, p<.002). At post-intervention GOALS participants had significantly lower connectivity compared to BHE (t_{24}=2.62, p=.008).
Conclusions: Our preliminary findings are a first step toward understanding the neural mechanisms related to GOALS training and point to neural connectivity changes in the DMN. This training-related neuroplasticity may play a role in improved cognitive and emotional functioning following GOALS. The present findings are limited by a small sample size and significant baseline differences between groups. Recruitment to our clinical trial is ongoing and these results will be investigated in larger samples. The present findings will also be followed up with additional within- and between-network connectivity analyses, including an evaluation of frontoparietal and other attention-related neural networks.

Keywords: traumatic brain injury**,** neuroimaging: functional connectivity**,** treatment outcome
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18 Title: Computerized Cognitive Training Interventions as an Augment for Cognitive Rehabilitation Following Mild Traumatic Brain Injury: A Comparison of Two Programs

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Objective: Computer-based cognitive trainings are claimed to improve a broad range of cognitive abilities. Research has shown that it is effective in improving neuropsychological performance in patients with traumatic brain injury (TBI). In recent years, more programs have been developed and marketed as therapeutics. As more programs are developed, it is critical that research is done to directly compare efficacy as a rehabilitation tool.
Participants and Methods: A randomized controlled trial consisted of 26 active-duty male and female service members with a history of mild TBI (mTBI). Participants were randomized to Lumosity, which is a commercial available cognitive rehabilitation tool (LUM; n= 10) or an academically manufactured program (University of California Brain Games) with focus on visual attention and memory (UCR; N= 16). Treatment duration for both conditions was 4 weeks, 5 days a week for 60 minutes. Cognitive assessment was completed at baseline and following treatment. Neuropsychological tests included: Wechsler Test of Adult Reading; Neuropsychological Assessment Battery (Digit Forward, Digit Backward, Number-Letter, and Driving Scenes); Symbol Digit Modalities Test;

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Continuous Performance Test 3rd Edition; and Paced Auditory Serial Addition Test. All participants passed a validity measure at pre and post assessment. Paired sample t-tests were conducted to evaluate differences on the cognitive measures from baseline to post treatment. T-scores were used in the analyses. **Results:** The two groups were comparable in age (M= 30.80, SD=6.57), gender (24 males and 2 females), education (80% high school diploma only, 20% college degree), and premorbid IQ estimate (WTAR FSIQ M= 109, SD= 6.05). When looking at the overall sample, there was a significant difference in scores after treatment with small to moderate effect sizes for NAB Driving (p=0.035, d= 0.36), NAB Number-Letter B (p=0.018, d=0.37), and PASAT (p=0.0006, d= 0.61). 92% of the participants had a positive change; of those, 33% demonstrated a T-score change greater than one standard deviation (>10 for mean change score). There were no interaction between the conditions. However, for NAB Driving, participants who completed the UCR intervention improved from M= 42.75, SD= 11.38 to M= 47.27, SD= 14.11 (d=0.35) and LUM improved from M= 42.3, SD=14.89 to M= 46.89, SD=10.94 (d=.40). For NAB Number-Letter B, UCR improved from M= 43.81, SD=12.43 to 47.13, SD=10.41 (d= 0.29) while LUM improved from M=39.7, SD=11.30 to M=44.78, SD=8.45 (d=0.50). For PASAT, UCR improved from M=46.64, SD=5.87 to M=54.08, SD= 7.17 (d=1.14) while LUM improved from M=46.2, SD=11.90 to M=50.11, SD=7.96 (d=0.38). Change scores were also calculated and averaged to get an estimate of each participants overall change. (i.e., mean change in T-score from T1 to T2). The LUM condition improved M= 8.96, SD=5.54 while UCR improved M= 7.32, SD= 4.81). **Conclusions:** The results indicated that both programs proved effective at improving visual attention symptoms suggesting treatment equivalency. These findings provide support for the use of computerized cognitive rehabilitation programs as a form of intervention for mTBI without evidence to suggest a specific test has superior efficacy.

Keywords: traumatic brain injury, cognitive rehabilitation, assessment

19 Systematic Review of Combined tDCS and Cognitive Training Interventions

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Objective: Cognitive impairment is a major determinant of functional disability and is relevant to a range of neurological and psychiatric conditions. To meet the need for treatments in this area, non-pharmacological methods of cognitive enhancement have received growing scientific attention and gained some empirical support. As both cognitive training and neuromodulation are potentially effective treatments, investigations of their combined and possibly synergistic effects are needed. In accordance with the Preferred Reporting of Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2020), we conducted a systematic review of combined tDCS and cognitive training studies in clinical populations. For the purposes of this review, only tDCS was considered (rather than other methods of neurostimulation like TMS or tACS), and cognitive training was defined in agreement with previous literature (e.g., Clare & Wood, 2003) as guided, repeated practice on a set of standard tasks designed to target particular cognitive abilities such as attention, memory, problem-solving, or language. **Participants and Methods:** A search of five databases (Ovid Medline, PsycINFO, Scopus, CINAHL, and Cochrane CENTRAL) through July 2020 with comprehensive search terms yielded 2,120 results. Title and abstract screening produced 213 papers that represented: (1) primary published research, (2) human participants, (3) clinical population, (4) combined intervention with tDCS and cognitive training, and was (5) published in English. Of those, full-text review yielded 11 publications that included data for an intervention and a sham tDCS control group, reported a cognitive outcome, and were conducted in either primary neurodegenerative disorders or primary psychiatric disorders (versus clinical populations with focal lesions or primarily structural brain

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changes like stroke or TBI). An updated search through May 2021 produced another four publications, for a total of 15 included in the systematic review.
Results: Ten of the studies were in neurodegenerative disorders (Alzheimer's Disease, Primary Progressive Aphasia, Parkinson's Disease, Mild or Major Neurocognitive Disorder, and Mild Cognitive Impairment) and five were in psychiatric disorders (Schizophrenia, Major Depressive Disorder, Substance Use Disorder). Twelve studies used a design including cognitive training with randomization to active or sham stimulation (two were crossover studies with at least two months in between conditions); tDCS was most often delivered to left dorsolateral prefrontal cortex (F3 according to the international 10-20 EEG system) at 2mA (range 1-2) for 20 minutes (range 20-30). The number of tDCS sessions varied widely from 2 to 28. Most studies used computerized cognitive training administered concurrently with tDCS and utilized outcome variables distinct from training tasks, though there was a wide array of training programs and neuropsychological outcome measures.
Conclusions: There is more published literature on combined tDCS and cognitive training in neurodegenerative disorders than psychiatric disorders, though the numbers are fairly small. In general, the field shows greater consistency in tDCS parameters (electrode placement, current strength, duration) than method of cognitive training, and there is minimal uniformity in outcome measurement. Meta-analyses to evaluate the efficacy of these combined interventions are underway and will be helpful in determining the utility of multi-modal cognitive treatments.
Keywords: neuromodulation**,** memory training

20 Interactive-Care development: A promising new tool for remote family caregiving of older adults with cognitive impairment

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Objective: Family members often assume caregiving roles for individuals with cognitive impairment and dementia. However, globalization and desire to maintain separate households poses caregiving challenges given the remote and long-distance nature of care. To address these challenges, our team developed the Interactive-Care (I-Care) platform, a web-based tool that transforms and augments a cognitive rehabilitation tool, the dry erase whiteboard, to a digital format. The current project focuses on the development of I-Care through an iterative user-centered interface and functionality design process. Following two rounds of I-Care modifications based on two rounds of interviews, we anticipated high ratings of satisfaction and usefulness ($\geq$80%) during our third and final round of interviews.
Participants and Methods: Three rounds of semi-structured interviews took place involving an I-Care demonstration, solicitation of feedback, and ratings of satisfaction/usefulness (on a scale with 1-10, with 10 being the highest). Round 1 involved 4 individual video-based interviews with 4 experts in dementia caregiving, gerontechnology, and digital health. Round 2 interviews were conducted in-person with 3 cognitively impaired care receivers/cognitively normal spouse caregiver dyads. Round 3 interviews were a mix of in-person/video-based interviews with 3 remote-care family caregivers and 2 care receivers living independently with mild to moderate cognitive impairment. I-Care modifications were conducted based on rounds 1 & 2 feedback. Round 3 served to validate I-Care changes with end users.
Results: Round 1 "experts" rated I-Care as a useful tool both for individuals with cognitive impairment (M = 8.33, SD = 1.53) and remote caregivers (M = 9.33, SD = 1.15). Recommended improvements included minor modifications to the user interface and functionality (e.g., text contrast, medication tracking). Round 2 care receivers provided 10/10 ratings for both usefulness and satisfaction. Caregivers were also very satisfied with I-Care (M = 9.00, SD = 1.00) and rated it as a useful tool both for care receivers (M = 9.67,

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SD = 0.58) and caregivers (*M* = 8.67, *SD* = 0.47). Recommended improvements included the ability to create and collaborate on text documents, which was implemented prior to round 3. Round 3 care receivers again had high ratings for both usefulness and satisfaction (*M* = 9, *SD* = 1.41 for both). Caregivers provided 10/10 ratings for caregiver and care receiver usefulness and satisfaction.
Conclusions: As predicted, following 3 rounds of iterative development, I-Care was rated as a very useful and satisfactory remote caregiving tool by both individuals with cognitive impairment and family caregivers. Next steps include conducting a pilot intervention with remote care dyads followed by a randomized clinical trial.
Keywords: technology**,** mild cognitive impairment**,** caregiver burden

21 Chiari Malformation, Neuropsychological Testing and Neuropsychological Intervention: A Case Series

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Objective: Chiari malformation (CM) are structural abnormalities that occur from herniation of the cerebellar tonsils through the foramen magnum and/or complete agenesis of the cerebellum and produce added pressure and fluid (El-Barr, Strong & Groff, 2014). Neurosurgical intervention for this disorder entails “decompression” in an attempt to reduce pressure on the cerebellum. The neurocognitive sequela of CM is under researched; however, it is known that the condition itself and aftermath of the surgical intervention impact cognitive functioning. Based on previous research on cerebellar cognitive affective syndrome, damage to the cerebellum can include cognitive deficits and affect regulation. The cerebellum clearly has a role in cognitive and emotional functioning and therefore CM patients may have similar features. Neuropsychologists should be on the forefront of advancing the understanding of neurocognitive sequela of CM and providing neuropsychological intervention. The neuropsychology division within WC Neurological Surgery derived a neuropsychological battery to determine a neuropsychological profile of CM patients. Select CM patients participated in a working memory training study to examine the benefits of such an intervention. Three cases will be reviewed to demonstrate post-operative cognitive profiles of CM patients as well as determine efficacy of a computerized working memory training program (CWMT) on enhancement of cognitive functioning, mood and self-perception.
Participants and Methods: Three females with CM (ages 29-41; 13-17 years of education; and 2-3 years post-surgery) who had received surgical decompression were administered a comprehensive neuropsychological evaluation. Subsequently, these patients completed a computerized working memory training program (CWMT) consisting of 25 sessions across 8 weeks. Two out of three participants underwent follow-up neuropsychological testing after completion of CWMT.
Results: Results from neuropsychological testing and mood at baseline revealed diminished working memory, set shifting and processing speed across patients. All three participants reported clinically significant neurobehavioral dysfunction. Follow-up scores after CWMT intervention revealed improvement in anxiety level from the moderate and severe ranges to the mild range in two participants. Depressive symptoms improved in one participant from the moderate to mild range. Finally, self-reported neurobehavioral dysfunction generally remained high, although there was evidence of reduced apathy in one participant.
Conclusions: CM patients experience neurocognitive and neuropsychiatric dysfunction as evidenced by the three participants in the case studies. At baseline, neurocognitive performance was generally inconsistent between and within domains across participants. Similarly, self-report measures of emotional functioning revealed variable levels of mood disturbance. Self-perception of behavioral

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functioning was consistent with high levels of dysfunction in daily living across participants. At follow-up, subsequent to CWMT, neuropsychological scores revealed improvements in aspects of mood in both participants. Finally, self-perception of neurobehavioral functioning remained largely stable, though reduced apathy was noted by one participant. The neuropsychological sequalae of CM patients warrant further investigation and should be included in the neuropsychological knowledge base through collection of data to characterize the neuropsychological profile of this population and researching the efficacy of neuropsychological intervention to enhance cognitive functioning and quality of life.
Keywords: neuropsychological assessment**,** cognitive functioning**,** cerebellum
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22 Integrated Cognitive Remediation/CBT Group Treatment for Persistent Neurocognitive and Psychiatric Sequelae of COVID 19 (PNSC)

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Objective: Recent evidence of persistent neurocognitive and psychiatric sequalae (PNSC) suggests that infection with Sars-Cov-2 virus can result in neurological dysfunction. In fact, 36.4% of the patients develop neurological disturbance including headaches, paresthesia, and disordered consciousness. Sars-Cov-2 is thought to impact neurological function through different pathways: 1. Infectious Toxic Encephalopathy, 2. Viral Encephalitis, and 3. Acute cerebrovascular disease resulting in hypoxic encephalopathy (Das et al, 2020). Persistent neurocognitive and neuropsychiatric sequelae of COVID-19 can include cognitive deficits (e.g., slowed processing speed, executive dysfunction), somatic symptoms (e.g., fatigue, neuropathy) and psychological (e.g., anxiety, depression). This subgroup of COVID-19 survivors, deemed “long haulers,” experience neurocognitive and psychiatric sequelae beyond the acute and symptomatic phases of illness and, as a result, incur disability and consequent diminished quality of life for several months, or longer. Severity of illness and medical comorbidities may not predict the occurrence of PNSC, as otherwise healthy individuals with mild COVID symptomology have become “long haulers”. Therefore, it is imperative for interventional neuropsychologists and rehabilitation psychologists to develop neurorehabilitation protocols that include assessment and treatment of the tripartite needs of individuals with PNSC from COVID-19. Extrapolating from evidence-based interventions for disorders with similar biopsychosocial dimensions may facilitate development of a treatment protocol. Elements of cognitive remediation and CBT have been effective for improving function in concussion and oncology populations. The current study describes the use of integrated cognitive remediation/CBT in a group format to treat individuals with PNSC.
Participants and Methods: 8 participants with PNSC (> 4 weeks post infection) of varying levels of illness severity and vocational impairment. Cognitive remediation and CBT were integrated in hierarchically sequenced modules to help patients develop compensatory strategies, restorative practices, and adaptive coping skills.
Results: 7/8 participants completed the 12 cognitive remediation/CBT session protocol. All 8 participants reported utilizing the cognitive strategies in daily functioning and completed homework assignments involving practice of strategies. All 8 participants reported increase in self-perception of cognitive functioning. Additionally, all participants expressed high satisfaction with group and telehealth format, citing support and accessibility as key components.
Conclusions: Integrated CBT/cognitive remediation in a group modality has the potential to target and treat the tripartite presentation of PNSC through addressing ways in which

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cognitive fatigue/brain fog negatively impact attentional functions and processing of new information and teach strategies to enhance processing of information despite the presence of fatigue. Additionally, CBT skills including thought reframing and activity pacing to allow for gradual re-introduction to daily tasks with consistent breaks. Group treatment contains therapeutic factors that render this modality optimal for a rapidly growing patient population including increased accessibility and validation and support for the challenges experienced by persistent sequelae of a novel virus.
Keywords: infectious disease
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23 Does Comorbid Bipolar Disorder Influence Cognition in Parkinson's Disease Patients?

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Objective: Research has shown that people with bipolar disorder are at a higher risk for developing Parkinson's disease (PD) and that both bipolar disorder and PD are often accompanied by cognitive deficits. This study examines similarities and differences in the cognitive profiles of PD patients with comorbid bipolar disorder compared to PD patients without bipolar disorder.
Participants and Methods: A total of 141 patients (44 women, *M* age = 74.19, *M* education = 15.43) diagnosed with PD participated in comprehensive neuropsychological assessment as part of outpatient neurology evaluations. Cognitive measures included Trailmaking A & B, COWAT FAS and Animals, BNT, ROCF, HVLT-R, BVMT-R, and select subtests of the DKEFS, WMS-IV, and WAIS-IV.
Results: MANOVAs showed that patients with PD and comorbid bipolar disorder performed significantly worse on the set of nonverbal memory and visuospatial measures relative to their PD counterparts without bipolar disorder, Wilks λs = .85 & .90, respectively, *p*s < .02. Independent samples *t*-test analyses revealed that patients with PD and comorbid bipolar disorder performed worse on WAIS-IV Digit Span, $t(134) = 3.11$, $p < .01$, BVMT-R Trials 1-3, $t(105) = 2.39$, $p < .02$, BVMT-R Delayed Recall, $t(105) = 2.21$, $p < .03$, ROCF 3' Delay, $t(116) = 3.04$, $p < .01$, ROCF 30' Delay, $t(92) = 2.95$, $p < .01$, ROCF Copy, $t(116) = 2.19$, $p < .04$, WAIS-IV Block Design, $t(123) = 2.70$, $p < .01$, and WAIS-IV Picture Completion, $t(136) = 2.38$, $p < .02$, than those with PD and not suffering from comorbid bipolar disorder. There were no significant differences between PD patients with comorbid bipolar disorder compared to their counterparts on measures of processing speed, verbal memory, language functioning, and frontal-executive skills.
Conclusions: These findings suggest that bipolar disorder compounds and worsens basic attention and all aspects of visuospatial functioning (e.g., visual perception, visuospatial construction) and nonverbal learning and memory (e.g., both timed and untimed, as well as simple and complex visual information) among those with PD. This could be secondary to the right hemisphere dysfunction common among those with bipolar disorder. These findings have implications for screening and treating the cognitive deficits associated with PD. Further research can explore potential differences in motor functioning and hemispheric onset between PD patients with and without comorbid bipolar disorder.
Keywords: Parkinson's disease**,** bipolar disorder**,** cognitive functioning
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24 The Cognitive Profile of Impulse Control Disorders in Parkinson's Disease

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Objective: To investigate the cognitive profile of Parkinson's Disease (PD) patients meeting criteria for elevated symptoms of impulse control

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disorders (ICDs) (i.e., pathological gambling, hypersexuality, compulsive shopping, and binge eating) and related behaviors (i.e., hobbyism-punding).
Participants and Methods: In a database including pre-surgical deep brain stimulation (DBS) candidates with PD, 87 patients with elevated symptoms of ICDs and 87 matched controls who completed comprehensive neuropsychological evaluations covering core domains and the Questionnaire for Impulsive-Compulsive Disorders in PD-Rating Scale (QUIP-RS) were identified. A principal component analysis was conducted to extract empirically derived cognitive factors (i.e., executive functioning, processing speed, verbal/visual, memory, and general/overall). Additional cognitive composites were calculated based on neuropsychological theory. Independent t-tests were used for comparison between the two groups. Multivariate analysis of variance was conducted to assess group differences in cognition across ICD subtypes.
Results: PD patients with ICDs had significantly lower performance on the verbal/visual factor (p = 0.04). PD patients with elevated symptoms of hobbyism-punding had significantly lower performance on the executive functioning factor (p = 0.05). The hobbyism-punding group had significantly lower performance on individual aspects of executive functioning (i.e., WAIS-IV Matrix Reasoning (p = 0.04), Wisconsin Card Sorting Test-64 (WCST-64) Perseverative Errors (p = 0.05), WCST-64 Total Errors (p = 0.006)) and visual memory (p = 0.06). There were no significant group differences in cognitive domains across ICD subtypes.
Conclusions: PD patients with elevated symptoms of ICDs had significantly lower performance on the verbal/visual factor. PD patients with elevated symptoms of hobbyism-punding had significantly lower performance on measures of executive functioning. Hobbyism-punding is perhaps more related to obsessiveness and thus more related to executive dysfunction. ICD subtypes did not significantly differ on cognitive domains. The relationship between the presence of mild cognitive impairment (MCI) and ICD outcome post-DBS surgery needs to be further investigated.

Keywords: Parkinson's disease**,** executive functions

25 Validation of tele-neuropsychology in pre-surgical Deep Brain Stimulation for Parkinson's disease

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Objective: Tele-neuropsychology (teleNP) has been validated for use in various patient populations including those with amnestic mild cognitive impairment and Alzheimer's disease. Since the COVID-19 pandemic, the demand for video visits has surged among many other patient groups, including pre-surgical Deep Brain Stimulation (pre-DBS) patients with Parkinson's disease (PD) whose motor disability or distance from a surgical center can limit access to in-office visits. As no study has specifically explored teleNP use in DBS patients, we aim to provide validation of teleNP in the PD-DBS population.
Participants and Methods: We conducted a retrospective chart review of 100 consecutive patients referred for routine pre-DBS neuropsychological exam through the DBS Neurosurgical Program at Mount Sinai Hospital, NY. Of those patients, fifty percent completed in-office, in-person exams, and the remaining completed teleNP exams. Of this sample, 60% had PD; of this cohort, only dominant English speakers were included given the uniformity of cognitive measures and normative data across the assessments. The in-office group completed the evaluations in the traditional office setting that was face to face with the examiner. The teleNP group completed the assessment using a HIPAA compliant video-conferencing platform with screen-shared features from their own home; at the start of each visit, it was confirmed that the patient was in a private, quiet room with limited distractions, and was using a device with a screen measuring at least 8 ½ "x 11". Between group differences (tele-NP vs. in-office) in demographics, neuropsychological test

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performance, and diagnosis (non-amnestic vs. amnestic) were tested using *t*-tests, X^2, *ANCOVA*s, and logistic regressions among this sample of pre-DBS patients with PD. **Results:** Analyses revealed that the teleNP group was significantly less likely to arrive with a collateral, and, at the trend level, was younger with younger ages of PD onset. No other between group differences were observed in patient demographics. After adjusting for demographics, the telehealth group performed significantly worse than the in-office group on Animals (p = 0.03) and HVLT-R Total Immediate Recall (p = 0.01). No other between group differences were attributable to assessment modality, including risk for an amnestic profile **Conclusions:** TeleNP appears to be valid for use in pre-DBS assessments for Parkinson's disease, however, there do appear to be differences across select measures of attention and processing speed, consistent with prior studies.

Keywords: deep brain stimulation**,** Parkinson's disease**,** teleneuropsychology

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26 The Relationship Between Resilience and Quality of Life in Individuals with Parkinson's Disease

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Objective: Parkinson's disease (PD) is a neurodegenerative disease characterized by motor and non-motor symptoms that negatively impact quality of life (QoL). According to Connor and Davidson, resilience encompasses the personal qualities that enable people to persevere when faced with adversity. It has been shown that higher resilience predicts better overall QoL in individuals with PD. However, no studies to date have investigated the relationship between resilience and the specific aspects of QoL, such as psychological, physical, social, and environment QoL, nor controlled for depression, which is common in PD. Thus, it is unclear if resilience uniquely contributes to certain facets of QoL above and beyond one's mood state. Findings could inform interventions for specific areas of poor QoL in individuals with PD. Therefore, the aim of this study was to evaluate the relationship between resilience and QoL domains in individuals with PD.
Participants and Methods: Eighty-eight individuals with PD were administered the 10-item Connor-Davidson Resilience Scale (CD-RISC) and the abbreviated version of the World Health Organization Quality of Life questionnaire (WHOQOL-BREF). Hierarchical regressions were used to evaluate if the CD-RISC total score predicted the four QoL domains of the WHOQOL-BREF (i.e., Psychological, Physical Health, Social Relationships, and Environment) while controlling for demographics, disease duration, and mood (Geriatric Depression Scale).
Results: Greater levels of resilience were significantly related to less depressive symptoms (p < .001), but not to age, gender, education, or disease duration (all p's > .10). Higher resilience scores significantly predicted higher scores of the WHOQOL-BREF Psychological (p = .01) and the Environment (p < .05) domains above and beyond demographics, disease duration, and depression. Resilience was not significantly related to the Social Relationships or Physical Health WHOQOL-BREF domains (both p's > .10).
Conclusions: Higher resilience uniquely predicts better psychological and environment

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QoL in individuals with PD above and beyond the effects of mood, demographic, and PD characteristics, but not social or physical QoL. Thus, higher levels of resilience specifically relate to higher self-esteem, less negative thoughts, and more positive attitudes, as well as positive perceptions of cognitive abilities (i.e., psychological QoL) in PD. Greater resilience in those with PD is also associated with greater satisfaction related to finances, living environment, and available resources such as health services, transport, and knowledge (i.e., environment QoL). Resilience training (e.g., cognitive behavioral therapy, mindfulness, or emotional regulation therapy) may be an important treatment approach to help individuals with PD learn how to better face the adversities of worsening symptoms over time and improve their psychological and environment QoL. Future studies exploring how resilience is related to QoL longitudinally may further elucidate the role of resilience in individuals with PD.

Keywords: Parkinson's disease**,** quality of life**,** personality

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27 Coping Strategies Used by Persons with Parkinson's Disease during the COVID-19 Pandemic

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Objective: Using effective coping strategies has been shown to improve quality of life in persons with Parkinson's disease (PwPD). The COVID-19 pandemic added life stressors to PwPD, and it is important to know its effect. Using an online survey, we asked PwPD to describe what coping strategies they used since the beginning of the pandemic and examined whether the use of certain strategies related to demographics, disease severity, motor symptoms, non-motor symptoms, and mood.

Participants and Methods: The Boston University Online Survey Study of Parkinson's Disease enrolled 347 PwPD between 2017-2018. We re-contacted these participants in regard to the COVID-19 pandemic. 130 PwPD responded with 118 completing the listed questionnaires in their entirety (mean [SD]; age: 67.0 years [8.0]; education: 16.8 years [2.45]; disease duration: 8.1 years [4.7]; male=51, female=67). The questionnaires included 13 subscales (2 questions/subscale, mean score) from the abbreviated version of the Coping Orientation to Problems Experienced Inventory (Brief-COPE) to examine coping strategies used: self-distraction, denial, substance use, emotional support, instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. Questions were rated on a Likert scale from 1-4, with 1= "I haven't been doing this at all" and 4= "I've been doing this a lot". Participants were also given the Unified Parkinson's Disease Rating Scale (Part I: subjective non-motor experiences of daily living; Part II: subjective motor experiences of daily living), Beck Depression Inventory-II, Starkstein Apathy Scale, and Parkinson's Anxiety Scale (PAS) to examine additional non-motor and motor symptoms. Frequency analyses were performed to characterize coping strategies used and Spearman correlations were conducted to examine the relation between coping strategies and questionnaire responses, disease duration, and demographics (age, sex, education).

Results: All but one PwPD endorsed using at least one coping strategy from the Brief-COPE (99.2%). The most frequently endorsed strategies were acceptance (mean=3.2), planning (mean=2.3), and use of emotional support (mean=2.2) (all ranges=1-4). The least frequently endorsed were substance use (mean=1.1, range=1-2), behavioral disengagement (mean=1.1, range=1-3), and denial (mean=1.1, range=1-2.5). More anxiety per the PAS total anxiety score ($r=0.34$, $p<.001$) and persistent anxiety subscore ($r=0.34$, $p<.001$) was associated with engaging in more self-distraction. There were no other significant correlations at a $p<.001$ level (corrected for multiple comparisons).

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Conclusions: PwPD endorsed using at least one coping strategy in response to the COVID-19 pandemic. The most frequently endorsed coping strategies (acceptance, planning, use of emotional support) are generally categorized as active or positive, whereas the least frequently endorsed (substance use, behavioral disengagement, and denial) are generally categorized as passive or negative coping strategies. These results suggest, first, that PwPD were taking active steps to deal with the additional stressors of the COVID-19 pandemic. Without longitudinal coping data, we cannot know whether the pandemic influenced coping strategies previously used by these PwPD; general characteristics of our sample were probably also pertinent. Second, self-distraction was found to be related to anxiety in general, and to persistent anxiety specifically, in line with evidence from persons with anxiety without PD who use avoidance as a coping strategy.
Keywords: Parkinson's disease**,** everyday functioning**,** movement disorders

28 Predictors of Quality of Life in Care Partners of Persons with Parkinson's Disease: Results from an Online Survey

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Objective: Parkinson's disease (PD) is characterized by motor and non-motor symptoms that impact daily functioning. With disease progression, persons with PD (PwPD) often rely on informal care partners (e.g., family or friends) for assistance with medications, activities of daily living, transportation, and social support. Carers provide physical, emotional, or economic support to PwPD and often experience burden and stress, which affects their quality of life (QoL). Using an online survey, we examined potential predictors (PwPD demographics, disease characteristics, and mood variables; carer demographic variables) of carer QoL.
Participants and Methods: Sixty pairs of PwPD and their carers were drawn from the Boston University Online Survey Study of Parkinson's Disease, which included (among other questionnaires for PwPD) the Non-Motor Symptoms Questionnaire to assess non-motor PD symptoms, the Unified Parkinson's Disease Rating Scale Part II: subjective motor experiences of daily living ($UPDRS_{MEDL}$) to assess subjective motor symptoms, and the Beck Depression Inventory-II (BDI-II) and Beck Anxiety Inventory to assess mood. Their care partners completed the PDQ-Carer, which assesses quality of life across four domains: Social and Personal Activities, Anxiety and Depression, Self-Care, and Stress. Correlations were conducted between demographic variables, PwPD symptoms (non-motor, motor, and mood), and PDQ-Carer domain and total scores to identify potential predictors of carer QoL. Multiple regressions were conducted with significantly correlated variables entered as predictors to examine the relation between predictors and PDQ-Carer domain and total ratings.
Results: After correcting for multiple comparisons, significant correlates of worse PDQ-Carer total score included higher motor and depressive scores and hours per week spent with PwPD (p's≤.01). Correlates of worse PDQ-Carer Social and Personal Activities score included higher PwPD age, motor and depressive scores, and hours per week spent with PwPD (p's<.02). The only correlates of worse PDQ-Carer Anxiety and Depression were higher PwPD depressive scores (p=.01). Correlates of worse PDQ-Carer Self-Care included higher PwPD age and motor and depressive scores (p's<.02). There were no correlates of worse PDQ-Carer Stress after correcting for multiple comparisons. Regression results revealed that higher $UPDRS_{MEDL}$ scores (β=.294, p=.023) predicted worse PDQ-Carer Social and Personal Activities. Higher PwPD BDI-II scores (β=.331, p=.010) predicted worse PDQ-Carer Anxiety and Depression. Higher PwPD age (β=.319, p=.005) and $UPDRS_{MEDL}$ scores (β=.371, p=.003) predicted worse PDQ-Carer Self-Care. Higher $UPDRS_{MEDL}$ scores (β=.371, p=.043) and hours per week spent with PwPD (β=.250, p=.0038) predicted worse PDQ-Carer Total score.
Conclusions: Higher PwPD age, motor and depressive scores and number of hours per

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week spent with the PwPD were related to overall carer QoL as well as to the domains of social activities, mood, and self-care. These findings point to priority PD treatment targets to improve PwPD carer QoL. Clinicians should assess for these concerns in care partners, and provide resources geared toward improving carers' mood and their ability to engage in social and personal activities and in self-care. Reducing problems in these domains may be particularly important for maintaining QoL in carers of older PwPD with elevated motor and depressive symptoms.

Keywords: Parkinson's disease**,** movement disorders**,** quality of life

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29 Self and Informant Ratings of Executive Functioning in Parkinson's Disease

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Objective: Patients with Parkinson's disease (PD) often present with difficulties in executive functioning (EF) on performance-based tests. Little research has been conducted, however, on the nature and extent of these difficulties in these patients' everyday lives. The present study examined subjective ratings of EF in patients with PD and their association with performance-based measures of cognition and mood.

Participants and Methods: Participants were 39 patients with PD (82.1% female; mean age = 64.90 years, SD = 9.84, range 43-81) seen for a neuropsychological evaluation at a large Northeastern medical center. As part of a larger battery, patients completed the Behavior Rating Inventory of Executive Function – Adult version (BRIEF-A), which assesses nine aspects of EF in everyday life over the past month; higher scores reflecting worse EF. The BRIEF-A Informant report was also available for a subset of 32 patients. Patients were also administered the Symbol Digit Modalities Test (SDMT), Verbal Fluency from the Delis-Kaplan Executive Function System (DKEFS), Wisconsin Card Sorting Test (WCST), Boston Naming Test (BNT), and a depression inventory (Geriatric Depression Scale or Beck Depression Inventory).

Results: As a group, clinical elevation (T > 65) on the BRIEF-A self-report was only seen for the Working Memory scale (*M* = 67.33, *SD* = 13.70), though subtler elevations (T = 60-64) were seen for the Shift, Initiate, Plan/Organize, and Task Monitor scales. Within the PD group, clinically significant difficulty was endorsed most commonly for the Working Memory (64%) and Plan/Organize (41%) scales. No significant elevation was seen for the Informant report, though subtler concern was endorsed for Working Memory. Among the informant sample, the most commonly endorsed problems were for the Initiate and Working Memory scales (both 40.6%). Greater depression severity was associated with worse self-rated EF on several BRIEF-A scales. Furthermore, worse performance on the SDMT (oral version) was correlated with worse EF as reflected by the Shift, Initiate, Plan/Organize, and Organization of Materials scales. Better letter fluency was associated with worse Plan/Organize score, while worse category fluency was related to worse scores for Shift, Emotional Control, Self-Monitor, and Organization of Materials. No significant associations were observed between BRIEF-A and either BNT or WCST.

Conclusions: Patients with PD most commonly reported difficulty with working memory in their everyday lives, which was also noted for some by their informants. This is consistent with prior research indicating the presence of working memory dysfunction in PD. In contrast to expectation, worse self-rated EF was associated with better performance on tests of letter fluency. This discrepancy may be due to, at least partly, to the effects of depression on self-appraisal. Consistent with expectation, worse self-rated EF was associated with worse performance on tests of processing speed and category verbal fluency. Together, these findings highlight the importance of assessing both subjective and objective cognitive functioning in patients with PD, as well as addressing mood as a contributor to reported cognitive changes.

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Keywords: executive functions**,** Parkinson's disease**,** self-report

30 Motivation Disorders and Executive Dysfunction in Parkinson's Disease

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Objective: Recent research has countered the view that apathy (hypomotivation) and impulse control disorders (ICDs; hypermotivation) fall at opposite ends of the motivational spectrum (Scott et al., 2020). Instead, apathy and ICDs can co-occur in up to 17% of patients with Parkinson's disease (PD). The goal of this study was to learn whether distinct apathy-ICD subgroups were associated with different types of fronto-executive disturbances in PD. We predicted PD patients with self-reported symptoms of both apathy and ICDs would have worse scores on executive function measures than those with apathy or ICDs.
Participants and Methods: Patients with PD (N = 98; mean [M] age [years] = 65.5, standard deviation [SD] = 8.1; M education [years] = 15.1, SD = 2.8; M disease duration [years] = 9.4, SD = 5.3) completed measures of working memory (Backward Digit Span), inhibition (Stroop Color-Word Trial), set shifting (Trail Making Test Part B), and letter fluency (FAS) as part of a comprehensive pre-surgical clinical evaluation for deep brain stimulation. Previously published cutoff scores for the Apathy Scale and Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale were used to classify motivation disorder type (Apathy, ICDs, Both, or Neither). Separate analyses of covariance (ANCOVAs) were performed with raw scores serving as the dependent variables, and motivation disorder type as the independent variable. All analyses controlled for age, education, and sex. Owing to data non-normality, ANCOVAs were bootstrapped bias-corrected using 10,000 samples.
Results: Prevalence rates of motivation disorders included 20.4% of PD patients with Apathy (PD-A), 27.6% with ICDs (PD-ICD), and 13.3% with Both (PD-B); 38.7% had Neither (PD-N). Groups significantly differed on two measures: Stroop Color-Word Trial, (p = .04, *partial* η^2 = .09), and Trail Making Test Part B, (p = .04, *partial* η^2 = .10). On Stroop, the PD-B group performed worse than PD-ICD or PD-N groups, (ps < .002), while performance of the PD-A group fell in between (ps > .10). On Trail Making Test, the PD-ICD group performed better than PD-N, PD-A, and PD-B groups (ps ≤ .05). There were no significant group differences on remaining measures (Backward Digit Span or FAS).
Conclusions: In sum, the pattern of findings differed from our predictions. Rather, PD-ICD patients had better scores on a measure of speeded set shifting as compared to PD-Neither, PD-Apathy, and PD-Both patients. In addition, PD-Both patients had worse scores on a measure of speeded inhibition as compared to PD-Neither and PD-ICD patients, but not PD-Apathy patients. Findings emphasize apathy and ICDs co-occur and influence different aspects of executive function. It is possible that the presence of both apathy and ICDs reflects shared underlying pathology, or, alternatively, the involvement of multiple disrupted neural systems. Future work should consider including psychiatric diagnoses of motivation disorders and non-timed measures of executive function to better understand the relationship between apathy, ICDs, and executive dysfunction in PD.
Keywords: motivation**,** executive functions**,** Parkinson's disease
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31 Impact of online versus face-to-face administration for endorsement of impulse control disorders in Parkinson disease: Do methods matter?

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Objective: Impulse control disorders (ICDs) are common motivational disturbances that are typically underdiagnosed and undertreated in individuals with Parkinson disease (PD). Social desirability bias refers to the tendency to underreport socially undesirable attitudes or behaviors and has been suggested as one reason patients may underreport these potentially embarrassing symptoms. Since anonymous survey methods have been shown to promote greater disclosure of sensitive or stigmatizing information, the current study aimed to (1) determine if individuals with PD would be more likely to endorse ICD symptoms on the same questionnaire administered in person vs. online (i.e., where they may have more of a sense of anonymity), and (2) examine the relationship between self-reported ICD symptoms and a measure of social desirability bias.
Participants and Methods: 60 participants with mild to moderate idiopathic PD (ages 45-83) completed the Marlowe-Crowne Social Desirability Scale (MC-SDS) and the Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease–Rating Scale (QUIP-RS). Both measures were completed in person, in the presence of a research assistant, and the QUIP-RS was subsequently re-administered in an online format within 1-2 weeks, allowing participants to complete the questionnaire from the comfort of their own homes.
Results: Repeated measures ANOVA revealed significant two-way interactions between QUIP-RS subscale scores with gender and administration mode, indicating that (1) men reported greater symptoms on some subscales (e.g., gambling and sexuality) while women endorsed greater symptoms on others (e.g., compulsive buying and punding), and (2) higher scores were obtained via online administration for some subscale scores (e.g., hypersexuality and compulsive buying) but not others. Men and women also demonstrated a different pattern of in-person vs. online score discrepancies for hobbyism, compulsive eating and medication use, but the 3-way interaction between these variables did not reach significance. These differences in reporting resulted in a higher prevalence of clinically significant symptoms of gambling, hypersexuality, and compulsive buying and eating in men, while only the latter two were significantly higher in women. Greater ICD symptom endorsement was also associated with greater social desirability bias (MC-SDS) which accounted for 12-23% of the variance in QUIP-RS subscale scores.
Conclusions: This study demonstrated that individuals with PD were more likely to endorse greater ICD symptoms when questions were administered in an online format where they may feel a greater sense of anonymity. These findings are consistent with the notion that social desirability bias contributes to the underreporting of ICD symptoms in individuals with PD, which may, in turn, preclude accurate diagnosis and treatment. Observed gender effects are also consistent with prior work in other areas suggesting that gender norms likely create different expectations about socially acceptable behavior, resulting in a different pattern of ICD symptoms that men and women are willing to disclose. Overall, our results highlight the importance of social context/setting and the need for sensitivity and discretion when screening for ICD symptoms, which may be facilitated through the increased use of technology and the ongoing provision of psychoeducation as a means of de-stigmatizing these repetitive reward seeking behaviors.
Keywords: Parkinson's disease**,** neuropsychological assessment**,** motivation
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32 From pleasure to punding: Distinct patterns of anhedonia and impulsivity in

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individuals with Parkinson disease and motivational disturbances.

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Objective: Apathy and impulse control disorders (ICD) are motivational disturbances that commonly co-occur in individuals with Parkinson disease (PD). While apathy has been linked to the dopamine depletion characteristic of the disease, it has been argued that trait impulsivity and deficits in hedonic processing constitute both independent and synergistic risk factors for the development of ICDs. However, accumulating evidence suggests that anhedonia and impulsivity represent multi-dimensional constructs encompassing different behavioral phenotypes with distinct albeit overlapping neurobiological mechanisms. The present study aimed to determine if individuals with PD, with and without motivational disturbances, exhibit different patterns of impulsivity and anhedonia when these constructs are broken down into their constituent parts.
Participants and Methods: 64 non-demented participants with PD (ages 45-83) completed questionnaires assessing apathy (Apathy Scale: AS) and ICD (Questionnairre for Impulsive-Compulsive Disorders – Rating Scale: QUIP-RS) symptoms, along with multidimensional measures of anhedonia (Temporal Experience of Please Scale: TEPS) and impulsivity (UPPS-P Impulsive Behavior Scale: UPPS-P). Participants were assigned to motivational groups using a cutoff of 14 on the AS and established subscale cutoffs on the QUIP-RS. The TEPS assesses anticipatory and consummatory aspects of anhedonia and the UPPS-P assesses sensation seeking, positive urgency (acting rashly under positive emotions), negative urgency (acting rashly under negative emotions), lack of premeditation, and lack of perseverance.
Results: Motivational subgroups included 7 (10.9%) individuals with apathy only (PD-Apathy), 19 (29.7%) with ICD only (PD-ICD), 15 (23.4%) with both apathy and ICD (PD-Both), and 23 (35.9%) with neither (PD-Neither). Motivational groups did not differ significantly along demographic and disease variables, but significant group differences were found on the TEPS and UPPS-P. Specifically, the PD-Apathy group had significantly greater anticipatory anhedonia and the PD-Both group had significantly greater consummatory anhedonia than both the PD-ICD and PD-Neither groups. Regarding impulsivity, the PD-Both group reported significantly greater symptoms of positive and negative urgency than all other groups and obtained significantly higher scores on the lack of premeditation and lack of perseverance subscales than the PD-ICD and PD-Neither groups. There were no significant between-group differences on the sensation seeking subscale.
Conclusions: The current study showed that different patterns of impulsivity and anhedonia are found in individuals with PD, with and without motivational disturbances, and that these symptoms are most severe in those with co-occurring apathy and ICDs. These findings suggest that distinct albeit overlapping neurobiological mechanisms may underly different behavioral phenotypes of motivational disturbances in PD, which may aid future investigations into the pathophysiology and potential therapeutic approaches for these debilitating syndromes.
Keywords: Parkinson's disease**,** motivation**,** neuropsychological assessment
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33 Relating the Impact of the COVID-19 Pandemic to Non-Motor Symptoms in

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Parkinson's Disease: Results from an Online Survey

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Objective: The COVID-19 pandemic has had a profound impact on the lives of persons with Parkinson's disease (PwPD), with lockdown measures and social distancing leading to social, health, and economic consequences. Reduced physical activity owing to pandemic restrictions has been associated with worsening of motor symptoms. Our objective was to characterize the impact of the pandemic on non-motor symptoms (NMS), which strongly predict quality of life in PwPD.
Participants and Methods: Between 2017-2018, 347 PwPD responded to the Boston University Online Survey Study of Parkinson's Disease. These individuals were re-contacted for the PD-COVID-19 survey, with 130 responding. Of these, 123 completed the listed questionnaires (mean [SD]; age: 67.2 years [7.9]; education: 16.8 years [2.4]; disease duration: 8.1 years [4.8]; male=54, female=69). The Coronavirus Impact Scale assessed the extent of change (mild, moderate, severe) experienced in routines, family income/employment, access to food, healthcare and social supports, diagnosis and severity of COVID-19 symptoms (personal, family/close friends). Participants also received the Beck Depression Inventory-II (BDI-II), the Parkinson's Anxiety Scale (PAS), the Quality of Life in Neurological Disorders (Neuro-QOL) Fatigue subscale, and the Non-Motor Symptoms Questionnaire (NMSQuest), which assessed the total number of different NMS endorsed. Frequency analyses were used to characterize changes due to the pandemic and Pearson correlations were conducted to examine the association of COVID-19 impact with NMS and demographics.
Results: Most PwPD endorsed mild changes in medical healthcare access (58.5%), access to social support (49.6%), and experiences of stress (56.9%). Examples included appointments being moved to telehealth, keeping in touch with loved ones via phone/video calls, and stress-related symptoms such as mild sadness or anxiety. Most PwPD reported moderate (2 domains, 43.9%) to severe changes (3+ domains, 31.7%) in their routines, e.g., in work, social life, hobbies, or religious activities. Eight PwPD endorsed a personal diagnosis of mild COVID-19 with symptoms effectively managed at home, and two endorsed a diagnosis of moderate COVID-19, with symptoms requiring brief hospitalization; 16% reported a diagnosis of mild COVID-19 for their immediate family members and 26% for extended family/close friends. Most PwPD reported no changes in family income, access to food and mental health treatment, or stress/discord in the family. More severe impact of COVID-19 was associated with more NMS (on NMSQuest) and higher depression, anxiety, and fatigue scores (p's≤.001). More severe impact of COVID-19 was associated with younger age and longer disease duration (p's<.05).
Conclusions: Most PwPD reported experiencing no or mild impact of the COVID-19 pandemic on domains such as family income, access to food, healthcare and social support systems. A moderate impact on routines was reported. These results should be interpreted in light of the characteristics of the sample-volunteers for an online survey. Those who were more severely impacted by the pandemic were younger, had a longer disease duration, and higher depression, anxiety and fatigue scores. A limitation is that we cannot ascertain directionality: worse NMS may have made PwPD more vulnerable to the pandemic's impact, or experiencing COVID-19 and its attendant restrictions may have worsened NMS.
Keywords: Parkinson's disease**,** depression**,** anxiety

34 Improving Movement Awareness and Responsivity of the Sensorimotor Cortical Network via Feldenkrais Method: Psychometric and Electrophysiological Evidence

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Objective: Movement awareness is the phenomenological aspect of proprioception and interception processes associated with movement. Greater movement awareness can improve the efficiency of motor acts, and therefore increase the efficacy of sensorimotor functions with potentially-valuable implications for practice in clinical and sport-related contexts. Among the methods devised to train such form of consciousness of the self and of own behavior, the Feldenkrais method aims to promote self-awareness and to optimize the ability to regulate the body in action through a somatic-proprioceptive training protocol mediated by movement and self-observation. Yet, as in the case of many other similar approaches to self-empowerment, empirical evidence concerning the efficacy of the method is scarce and often inconsistent. The present study aims at investigating the effects of an empowerment protocol based on the Feldenkrais method on proprioception, self-awareness, and body image, as well as on responsivity and regulation of the sensorimotor cortical network during observation, imagination and execution of complex gestures.
Participants and Methods: 25 healthy volunteers took part in the study and were randomly divided into an experimental (EXP) and a control (CON) group. The EXP group underwent a 7-month training based on Awareness Through Movement lessons derived from the Feldenkrais method (28 sessions, 1 lesson per week). CONT participants were, instead, put in a waiting list. Pre- and post-training assessment phases included multilevel outcome measures: psychometric tools investigating subjective correlates of body and self awareness; self-report tools concerning the representation of the body image; and central electrophysiological correlates (power of the Mu EEG band) related to the degree of activation of the sensorimotor cortical network during perception, imagery, and execution of complex gestures.
Results: Data analysis highlighted, in the EXP group, a post-training improvement in the complexity of the body image representation, paired with greater activation of the sensorimotor network (as mirrored by the desynchronization of Mu oscillations) over central regions during execution and imagination of complex movements.
Conclusions: Present findings complement the limited scientific literature on the effect of self-empowerment protocols based on the Feldenkrais method. Namely, they suggest that the implemented movement awareness and proprioception practices might represent a valuable mean to upregulate the activity of cortical structures constituting the sensorimotor network and to improve the responsivity of such structures during execution as well as imagination of complex gestures.
Keywords: proprioception**,** awareness**,** movement

35 Predicting Risk of Cognitive Impairment in Parkinson's Disease Using Concomitant Health Conditions in a Pre-Surgical Deep Brain Stimulation Sample

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Objective: Parkinson's disease (PD) is a progressive movement disorder that affects over 1 million people in the US and 10 million people worldwide. Common non-motor symptoms include cognitive deficits, with an estimated 30% having PD related mild cognitive impairment (MCI-PD). Concomitant medical conditions that increase risk for cognitive decline, such as hypertension and other vascular risk factors, are also common. While there is no cure or disease modifying agents available for PD, deep brain stimulation (DBS) is an approved and effective surgical intervention that can provide symptom relief. Pre-surgical evaluations for DBS often include a neuropsychological assessment to determine current cognitive function and assess risk for cognitive decline following surgery. The current study aimed to investigate whether there

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was an increased risk for cognitive impairment presenting as amnestic memory or executive dysfunction when co-morbid medical conditions were present, as such factors could help predict post-surgical outcome and possibly progression of cognitive symptoms.
Participants and Methods: Participants were 136 individuals (mean age = 66; range = 40-85 years) with PD presenting for DBS pre-surgical neuropsychological evaluation (male = 60%; right-handed = 93%; mean years education = 14). Amnestic memory was defined as < 70% retention following a long delay in verbal (HVLT-R) and visual (BVMT-R) domains. Executive dysfunction was defined as 1.5 SD below the mean on trails switching (DKEFS or Trails B). Co-morbid medical conditions included hypertension, hyperlipidemia, diabetes, obstructive sleep apnea, and history of stroke. A 2x2 chi-square was conducted, test performance (impaired vs. unimpaired) by co-morbid condition (present vs. absent), with an accompanying odds ratio (OR) and 95% confidence interval (CI) calculated to quantify increased risk of impairment associated with each condition.
Results: The majority of individuals (n = 112; 82%) presented with at least one co-morbid medical condition with hypertension (n = 73; 54%), hyperlipidemia (n = 44; 32%), and diabetes (n = 26; 19%) being the most common. An amnestic cognitive profile was present in at least one domain for 55% (n = 73) of participants, while 13% (n = 17) presented with an amnestic profile in both verbal and visual domains. An executive dysfunction profile was present in 43% (n = 58) of participants. Overall, no co-morbid medical condition was associated with a significantly increased risk of presenting with an amnestic or dysexecutive neurocognitive profile.
Conclusions: In a population of PD patients presenting for pre-surgical DBS neuropsychological evaluation, presence of a co-morbid medical condition was not associated with significantly increased risk of having an amnestic or dysexecutive neurocognitive profile. Limiting factors include a PD sample with a high degree of cognitive change, thus possibly not affected incrementally by medical risk factors. Future analyses should examine proportion of white matter change as a predictor of cognitive change. While current analyses are supportive of broad medical inclusion criteria for DBS eligibility, additional assessment of the impact of vascular risk factors on cognitive symptom trajectory prior to and following DBS surgery will help with diagnostic accuracy and prognostic predictors.
Keywords: Parkinson's disease, neuropsychological assessment
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36 More Than Meets the Eye: Case Study of Rare Phenotype in Progressive Supranuclear Palsy

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Objective: Progressive Supranuclear Palsy (PSP) is an uncommon neurodegenerative disease, often classified as an atypical parkinsonian syndrome. Common clinical features include gait and motor disturbances, oculomotor dysfunction, cognitive deficits, behavioral and emotional difficulties, and poor sleep quality. To aid in early detection, multiple PSP phenotypes have been identified based on initial and predominant symptomology. Out of the eight formally recognized variants, PSP with predominant corticobasal syndrome (PSP-CBS) is considered exceptionally rare. The current case study aimed to provide diagnostic clarification for a patient who was referred by neurology for clinical features of both PSP and corticobasal degeneration.
Participants and Methods: The patient was a 68 year old, right-handed, white, male with 16 years education. He was seen in an outpatient neuropsychology clinic in an academic medical center in the Midwest. The evaluation included review of medical records, patient and collateral interviews, neurologic exam, and neuropsychological testing.
Results: Results implicated PSP-CBS. Subsequent recommendations aimed to improve symptom management, explicate the patient's functional abilities and communicate the

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patient's disease related concerns to the referring provider.
Conclusions: Neuropsychology can provide unique information that allows for diagnostic clarification and aids in early detection of rare neurodegenerative syndromes. We can also serve as advocates for our patients by answering their questions, addressing their concerns and communicating relevant information to the referring provider.
Keywords: movement disorders**,** Parkinson's disease**,** medical disorders/illness
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37 Executive Functioning in Primary Dystonia: A Meta-Analysis

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Objective: Primary (idiopathic) dystonia is a movement disorder characterized by prolonged muscle contractions or abnormal postures, typically without other motor or neurological symptoms. Growing research indicates cognitive dysfunction may be a common component of primary dystonia. This meta-analysis quantitatively synthesizes literature documenting performance on clinical measures of executive functioning (EF) in persons with primary dystonia (PWD).
Participants and Methods: Data from this study came from a larger study comparing overall neuropsychological functioning in PWD and healthy controls (HC). Standardized search terms were applied to PubMed, Embase, Cochrane Library, Scopus, and PsycINFO (1/1/2000-10/21/2020). Analyses were random-effects models. Hedge's *g* was used as a bias-corrected estimate of effect size. Between-study heterogeneity was assessed using Cochran's *Q* and I^2. Publication bias was assessed with Egger's regression test (i.e., the association between standard error and effect size). High heterogeneity in effects (i.e., $I^2 \geq 30\%$) was further explored for possible moderating variables (e.g., age, disease duration) using meta-regression and sub-group analyses.
Results: Eight-hundred-and-fifteen studies were screened; 17 studies (n=647 PWD and 790 HC) met inclusion criteria and included clinical measures of EF. PWD demonstrated moderately worse performance in EF overall when compared to HCs (g=-0.503, p<.001, I^2=23.2, -0.50 *SD* units). Assessment-specific findings were marginally dispersed around the mean, indicating relatively little between-study heterogeneity. Similar moderate effects were observed on measures of broad set-shifting (k=8, g=-0.696), abstract reasoning (k=4, g=-0.780), and verbal fluency (k=9, g=-0.561). Largest combined effect was observed for performance on measures of planning (k=2, g=-0.856), while smallest was observed for Stroop-interference (k=7, g=-0.293) and card sorting tasks (k=6, g=-0.362).
Egger's regression intercept revealed no association between effect size and standard error (t=1.37, p=.19), suggesting minimal publication bias. While between-study heterogeneity was low in the EF domain, a substantial degree of heterogeneity was observed in assessment-specific findings of broad trails switching (Q=17.787, p=0.013, I^2=60.646), abstract reasoning (Q=14.619, p=0.002, I^2=79.478), and verbal fluency (Q=24.945, p=0.002, I^2=67.929). Moderators were tested in the tasks with highest heterogeneity. Meta-regressions revealed longer disease duration (years) was significantly associated with greater dysfunction on trails switching tasks (β=-.114, p=.006, R^2

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analog=.860). Findings from subgroup analyses were either insufficiently powered or negative. **Conclusions:** PWD perform worse on neuropsychological measures of executive functioning when compared to HCs. The largest effects were seen on measures of planning, followed by moderate effects on set-shifting, abstract reasoning, and verbal fluency. The smallest effects were seen on Stroop-interference measures and card sorting. Disease duration was related to stronger effects on trails switching tasks; no other moderation effects (i.e., of demographic and clinical variables) were observed. Relatively few studies were found, which limited our ability to examine moderator variables. Despite this, the overall effect across EF tasks was generally stable (i.e., low between-study heterogeneity). Future studies with large, well-defined PWD samples, as well as longitudinal studies, are needed to further characterize cognitive dysfunction in these conditions.

Keywords: movement disorders**,** executive functions

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38 Assessing Validity of the Money's Road Map Test in a Parkinson's Disease Sample

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Objective: Visuospatial and executive deficits are common in individuals with Parkinson's Disease (PD). The Money's Road Map Test (M-RMT) is used in PD studies to measure right/left reasoning in extrapersonal space. However, the clinical utility of the M-RMT is restricted by limited normative and validity data. Our aim was to examine M-RMT scores and present descriptive data in a sample PD and normal controls (NC) adults. A second aim was to examine differences in M-RMT scores between PD and NC.
Participants and Methods: Our sample included 127 adults with PD (M_{age}=60.7, SD_{age}=10.3; 67% male) and 22 NC (M_{age}=59.8, SD_{age}=7.5; 55% male). Linear regressions were performed to examine the relationships between M-RMT scores and other visuospatial and executive measures including Judgment of Line Orientation Short Form (JLO-SF), Hooper Visual Organization Test (HVOT), D-KEFS Tower A (raw score, total rule violations [TRV], and move accuracy ratio [MAR]), Trail Making Test B (TMT-B; raw score, errors), and Wisconsin Card Sorting Task (WCST). In accordance with prior research, adults were categorized into younger (ages 26-64) and older (ages≥65) groups, and a clinical cut-off of 10 M-RMT errors was used to classify adults with high errors (n=19) from other adults (n=130). Chi-square analyses were run to assess differences in M-RMT scores between the PD and NC groups.
Results: Analyses revealed that Tower TRV, TMT-B errors, and JLO-SF predicted M-RMT errors after accounting for age and education in the PD sample (ps <.05). Older PD males (n=34) exhibited more M-RMT errors (M=4.6; SD=4.7) compared to younger PD males (n=61) (M=3.9; SD=4.1). Contrary to existing literature revealing a male visuospatial advantage, PD females in this sample exhibited better performance. Older PD females (n=18) exhibited more M-RMT errors (M=4.2; SD=4.2) compared to younger PD females (n=33) (M=2.9; SD=3.8). Additional analyses did not indicate M-RMT group differences between PD and NC (X_2=0.89, p>.05).
Conclusions: M-RMT demonstrated convergent validity, as it was significantly associated with another measure of visuospatial abilities. Further, the M-RMT was significantly associated with executive measures as well. While the M-RMT did not distinguish PD and NC groups, it is unclear whether this was due to methodological limitations (i.e., small sample). As visuospatial and executive deficits remain highly prevalent in PD, it continues to be important to assess these areas using adequate measures.

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Keywords: visuospatial functions**,** executive functions**,** validity (performance or symptom)
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39 Depressive Symptoms Influence Patients' and Caregivers' Perceptions of Neurobehavioral Changes in Parkinson Disease

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Objective: Depression often co-exists with other neurobehavioral symptoms in patients with Parkinson disease (PD). Though disruptions to frontal-striatal circuits contributes to such comorbidities, depression can contribute to a negative perceptual bias and the perception of globally worsening symptoms. In this study, we examined the influence of depression on patients' perceptions of neurobehavioral symptoms and if depression influenced patients' and caregivers' perceptions of neurobehavioral symptoms and change in a similar or discordant manner.
Participants and Methods: We conducted a retrospective analysis of 209 dyads of patients with PD (mean age = 64.3, SD = 9.1) and their caregivers, who completed the patient and caregiver versions of the Frontal Systems Behavior Scale (FrSBe). A subset of 116 patients also completed the Beck Depression Inventory-2nd Edition (BDI-II). We used Pearson correlations and Welch paired t-tests to analyze FrSBe apathy, disinhibition, and executive dysfunction subscale T-scores. Relationships between BDI-II and FrSBe scores were analyzed using linear mixed model regressions and linear mixed model ANOVAs.
Results: Retrospective patient and caregiver FrSBe scores were correlated (all p values <.001). However, patients had significantly higher retrospective scores than caregivers (mean differences: apathy = 4.7, p <0.001; disinhibition = 5.8, p <0.001; executive dysfunction = 7.0, p <0.001). Patients also had higher current disinhibition (mean difference = 3.6, p = 0.002) and executive dysfunction scores (mean difference = 3.8, p = 0.002), but not current apathy scores, than caregivers. Patients perceived less severe behavioral changes than caregivers (mean difference in Δ: apathy = 5.9, p <0.001; disinhibition = 2.2, p = 0.009; executive dysfunction = 3.2, p <0.001).
BDI-II scores predicted patients' and caregivers' current scores on all FrSBe subscales (all p values <0.01). BDI-II scores also predicted patients', but not caregivers', retrospective apathy ($\beta_{regression\ slope}$ = 0.56, p <0.001), disinhibition ($\beta_{regression\ slope}$ = 0.52, p = 0.003), and executive dysfunction scores ($\beta_{regression\ slope}$ = 0.40, p = 0.013).
Within time point analyses showed that as BDI-II scores increased, the difference between patients' and caregivers' current apathy ($\beta_{regression\ slope}$ = 0.52, p <0.001) and disinhibition scores ($\beta_{regression\ slope}$ = 0.72, p <0.001) decreased, indicating a greater alignment of perceptions. Analysis of retrospective scores yielded similar results.
Within rater analyses showed that for both patients and caregivers, as BDI-II scores increased, the difference between their current and retrospective scores on all subscales also increased (all p values <0.01). However, the current versus retrospective score differences were not significantly discrepant between caregivers and patients for any subscale.
Conclusions: Patients with PD perceive themselves as having more severe neurobehavioral symptoms than their caregivers, while caregivers perceive greater neurobehavioral change than patients. The severity of depressive symptoms influences patients' and caregivers' perceptions of neurobehavioral symptoms and change. Whereas the severity of patients' depressive symptoms predicts their self-perceived behavior at present and retrospectively, for caregivers, it influences only their current perceptions of patients' behaviors. Patients and caregivers are more aligned in their current and retrospective perceptions when patients' depressive symptoms are more severe. Both patients and caregivers are apt to perceive neurobehavioral changes over time, and in a similar manner, as a function of increasing depressive symptoms.

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Keywords: Parkinson's disease**,** depression**,** apathy

40 Subjective Memory Impairment and Emotional Health in Parkinson's Disease

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Objective: To assess the correlation between subjective memory impairment (SMI) and emotional health across age and disease duration cohorts and to elucidate to what extent engagement in adaptive coping behaviors impacts subjective experience of memory and emotional health.
Participants and Methods: Cross sectional, survey-based research design. Participants: 444 individuals with PD. Age and disease duration cohorts: Younger (< 70 years of age); Older (70+ years of age); Early Disease Duration (<6 years); Early Advanced Stage PD (6-10 years); Late Advanced Stage PD (11+ years). Instruments: Metamemory in Adulthood (MIA) Questionnaire; PROMIS Cognitive Concerns Scale; PROMIS - Anxiety Scale and Depression Scale; Parkinson Alliance Questionnaire.
Results: Average age of the participants was 71.7 (SD: 8.74) , with 50.2% male participants, 94.8% Caucasian, 71.5% married, and 61.4% having a college degree or higher. SMI was highly prevalent (68%), ranging between mild (40.1%) and severe (2.5%). For those endorsing memory difficulties, SMI adversely impacted day-to-day functions and relationships for 75.3% and 71.4%, respectively. SMI and cognitive concerns were highly correlated with anxiety and depression. The Advanced Stage PD cohort reported greater SMI, cognitive concerns, and impact on day-to-day functioning and relationships when compared to the Early Stage PD cohort (<.01). Reportedly, 46.0% of the sample report having undergone memory assessment by a provider (e.g., neurologist, internist, speech language pathologist, etc.), with 16.4% having been evaluated by a neuropsychologist. Of those reporting SMI, 81% have attempted to apply compensatory aids, with 6.5% having formally participated in cognitive rehabilitation.
Conclusions: SMI and emotional disturbance are highly prevalent and strongly correlated in PWP. SMI, but not emotional disturbance, had strong association with increased age and disease duration. Efficacy of adaptive coping behaviors for memory difficulties and emotional disturbance are discussed. Implications for neuropsychologists are reviewed.
Keywords: Parkinson's disease**,** memory complaints**,** emotional processes
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41 Utility of the ALSFRS-R for Predicting ALS and Comorbid Disease Neuropathology: The Veterans Affairs Biorepository Brain Bank

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Objective: The amyotrophic lateral sclerosis (ALS) functional rating scale-revised (ALSFRS-R) is a commonly used measure to track ALS disease progression; however, little is known about whether the ALSFRS-R is related to underlying central nervous system pathology.
Participants and Methods: The current study examined the association between ALSFRS-R total and subdomain (bulbar, fine, gross, and respiratory function) scores and ALS-specific and comorbid neuropathology among veterans ages 60-85 with pathologically-confirmed ALS.
Results: Initial correlational analyses showed that ALSFRS-R scores correlated with some but not all neuropathological variables. We then

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examined whether subgroups with different patterns of motor dysfunction—determined via hierarchical cluster analysis (HCA) of ALSFRS-R subdomain scores—were associated with neuropathology. The HCA revealed three latent groups: Cluster 1 - predominantly diffuse functional impairment; Cluster 2 - spared respiratory/bulbar and impaired motor function; and Cluster 3 - spared bulbar and impaired respiratory, fine, gross motor function. Separate analyses of variance and covariance with post-hoc comparisons revealed that individuals in Cluster 1 (and to a lesser degree Cluster 3) exhibited greater accumulation of ALS-specific neuropathology (ALS-NP) and less comorbid neuropathology than did individuals in Cluster 2. Thus, ALSFRS-R total and subdomain scores correlated with underlying ALS-NP, and further, discrete patterns of ALS dysfunction determined via statistical analyses exhibited differences in ALS and comorbid pathology.
Conclusions: These findings suggest that ALSFRS-R scores are related to underlying neuropathology, and support the growing consensus that ALSFRS-R subdomain scores may provide a better characterization of the heterogeneous disease progression in ALS and may assist researchers in identifying and defining endophenotypes for assessment in clinical trials.
Keywords: amyotrophic lateral sclerosis**,** motor function

42 Dynamic Functional Connectivity Between the Dorsolateral Prefrontal Cortex and Cerebellum is Associated with Short-Term Memory Ability in Relapsing-Remitting Multiple Sclerosis

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Objective: To investigate the relationship between dorsolateral prefrontal cortex (dlPFC) to cerebellar (Cb) dynamic functional connectivity and memory impairment in multiple sclerosis (MS). Network connectivity is disrupted in MS and is related to cognitive function. Memory impairment is common in MS yet the underlying neuropathology is still unknown. Research suggests both dlPFC and Cb involvement in mnemonic function, and the cerebellum is known to be adversely affected by MS. Dynamic resting-state functional connectivity, or the time-varying connectivity, is strongly related to cognition in network neuroscience. Thus, investigating the role that Cb dysfunction plays in MS-related abnormal dynamic connectivity and memory impairment may aid in understanding MS-related memory impairment.
Participants and Methods: 32 MS and 20 healthy controls (HC) participants completed the Digit Span Test – Forward as a measure of short-term memory and underwent magnetic resonance imaging. Dynamic resting-state functional connectivity analysis was used to assess connectivity.
Results: The MS group (M=7.12, SD=1.29) performed comparably to the HC group (M=7.65, SD=1.23) on the DST-F (t=1.47, p=.147). Analysis of dlPFC-Cb connectivity revealed differences in the relationship between dynamic connectivity and digit-span ability across groups. In the MS group, connectivity between the left dlPFC and Cb explained 15% of the variance in digit-span variability after controlling for age and education (F(1,28)=6.63, p=.016, ΔR^2=.15), and connectivity between the right dlPFC and Cb explained 13% of the variance in digit-span variability after controlling for age and education (F(1,28)=5.17, p=.031, ΔR^2=.13). In the HC, connectivity between the left (F(1,14)=2.43, p=.142, ΔR^2=.12) and right (F(1,14)=0.00, p=.949, ΔR^2=.00) dlPFC and Cb did not significantly explain any variance in the digit-span.
Conclusions: Dynamic resting-state connectivity between the cerebellum and dlPFC is critical for the maintenance of memory function observed in MS.
Keywords: neuroimaging: functional connectivity**,** cerebellum**,** multiple sclerosis

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43 Processing Speed and not Executive Function Mediates Prospective Memory among People with Multiple Sclerosis

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Objective: Cognitive impairment is prevalent among people with multiple sclerosis (PWMS), affecting as many as 70% of PWMS. Common deficits include information processing speed, executive function, and memory. Memory deficits can be particularly problematic and diminish functional outcomes. In particular, memory for intentions (e.g., remembering to take medications), otherwise known as prospective memory (PM), can reduce well-being. PM deficits occur commonly among PWMS, and are presumed to rely heavily on executive function in healthy individuals and other clinical populations. Previous research shows that PWMS with greater executive function deficits performed worse on PM tasks. However, the potential role of information processing speed has not been consistently evaluated. The current study sought to evaluate the relative influence of information processing speed and executive function on PM function among PWMS.
Participants and Methods: Participants were 139 adults (43 healthy individuals, 96 PWMS) who were primarily women (75%) and Caucasian (90%). Average age was 44.4 years (standard deviation = 10.7). PWMS diagnoses were confirmed by board-certified neurologists, and a majority were diagnosed with a relapse-remitting course (67%). PM was measured using the Memory for Intentions Test (MIST) total score. Executive function was measured with a composite of tests relating to complex working memory, verbal fluency, abstract verbal reasoning, and set-shifting (a = .78). Information processing speed was measured using the oral trial of the Symbol Digit Modalities Test (SDMT). Mediation analyses were conducted using the PROCESS macro for SPSS.
Results: MIST, Executive function composite, and SDMT scores were significantly lower in the PWMS group (*p*s < .002). While controlling for age and education, the indirect effect of the executive function composite on the relationship between group and MIST scores was significant (-.20, 95%CI = -.35, -.07). The pattern of relationships indicated that lower executive function among PWMS resulted in lower PM. In a parallel mediation model with the executive function composite and SDMT entered as mediators, the indirect effect of the executive function composite was no longer significant (-.13, 95%CI = -.29, .04). In contrast, the indirect effect of SDMT on the relationship between group and MIST scores was significant (-.16, 95%CI = -.42, -.01). The pattern of relationships indicated that lower SDMT among PWMS resulted in lower PM.
Conclusions: The current study sought to further elucidate cognitive mechanisms leading to PM deficits among PWMS. In a simple mediation model, executive function appeared to explain poorer PM among PWMS. However, when accounting for information processing speed using the SDMT, only the indirect effect of SDMT was significant. This suggests that PM deficits may be attributable to information processing speed deficits, rather than executive function. These findings may inform cognitive rehabilitation strategies aimed at improving PM among PWMS.
Keywords: multiple sclerosis**,** memory: prospective**,** executive functions

44 Quality of Life and Subjective and Objective Cognitive Impairment: What's Sleep got to do with it?

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Objective: Sleep disturbances are common in multiple sclerosis (MS) and impaired cognitive functioning is associated with both MS and sleep disturbance. Impairments in cognitive functioning can be mean differences or fluctuations in performance (e.g., variability) over time. The first aim of the current study was to understand the impact of poor sleep quality on subjective cognitive difficulties and objective cognitive performance. The second aim was to examine group differences between persons with MS (PwMS) with poor sleep quality and normal sleep quality across specific domains of quality of life (QoL).
Participants and Methods: This cross-sectional study included 97 PwMS (females=80). A neuropsychological battery and psychosocial questionnaires were administered. A sleep quality composite was created from the sleep and rest scale of the Sickness Impact Profile (SIP), sleep-related items on the Multiple Sclerosis-Symptom Severity Scale (MS-SSS) (i.e., sleeping too much or sleep disturbance, fatigue or tiredness, and not sleeping enough), and an item from the Sleep Habits Questionnaire (SHQ) ("How many nights on average are you troubled by disturbed sleep?"). Lower scores were indicative of worse sleep quality. Two sleep quality groups were created using a cutoff score of one standard deviation below the mean: normal sleep quality PwMS (n=72) and poor sleep quality PwMS (n=22). QoL was measured using seven domains from the Functional Assessment of Multiple Sclerosis (FAMS): mobility, symptoms, emotional well-being, general contentment, thinking, fatigue, and family/social well-being. Subjective cognitive difficulty was measured using an item on the SHQ ("have sleep patterns affected your cognitive ability?"). An overall composite of mean neuropsychological performance and two intraindividual variability (IIV) indices were created from ten indices spanning domains of executive functioning, attention, and verbal and visual memory. Two multivariate analyses of covariance (MANCOVAs) were conducted to examine group differences on cognitive outcomes and the subscales of the FAMS after controlling for disability status, as measured by the Expanded Disability Status Scale (EDSS). A chi-square test of independence compared the proportion of poor sleep versus normal sleep quality PwMS who reported subjective cognitive difficulties.
Results: MANCOVA results revealed that, overall, the poor sleep quality group reported worse QoL than the normal sleep quality group, $F(8,83)=2.04, p=.05, h^2=.16$. Three specific domains of QoL were significantly different between the groups, with poor sleep quality being associated with lower QoL in: symptoms, $F(1,90)=5.08, p=.03, h^2=.05$; thinking, $F(1,90)=6.05, p=.02, h^2=.06$; and fatigue, $F(1,90)=5.17, p=.03, h^2=.05$. There were no objective cognitive differences between the two groups on mean cognitive performance or IIV, $F(3,71)=.82, p=.49, h^2=.03$. A significantly greater proportion of poor sleep quality PwMS (86.36%) reported that sleep was impacting their cognitive abilities (i.e., subjective cognitive difficulties) compared to normal sleep quality PwMS (40.28%), $\chi^2(1,N=94) =14.32$, $p<.001, \varphi=.39$.
Conclusions: Poor self-reported sleep quality is associated with worse QoL overall and in specific domains of symptoms, thinking, and fatigue in PwMS. Poor sleep quality was not associated with objective cognitive impairments, but it was associated with greater perception of subjective cognitive difficulties. Thus, in PwMS, the impact of poor sleep quality may be the greatest on perception of cognitive functioning rather than objective cognitive impairment, which has implications more broadly for QoL.
Keywords: quality of life**,** sleep**,** multiple sclerosis

45 Cognitive Reserve Moderates the Effect of Perceived Cognitive, Physical, Psychosocial and Overall Fatigue on Depression in Multiple Sclerosis

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Objective: To investigate cognitive reserve as a possible moderator in the relationship between fatigue and depression in persons with multiple sclerosis (PwMS).
Participants and Methods: Fifty-four PwMS (38 female) completed a comprehensive neuropsychological test battery and psychosocial questionnaires that assessed physical, cognitive, and emotional functioning. Cognitive reserve (CR) was operationalized in two ways: Fixed CR and Malleable CR, as coined by Cadden and colleagues (2019). Fixed CR was defined as the standardized mean of years of education and the Shipley Institute of Living Scale (SILS) Vocabulary subtest. Malleable CR was conceptualized as the standardized mean of the cognitive exertion, physical exercise, and socializing items from the Cognitive Health Questionnaire (CHQ). The three subscales from the Modified-Fatigue Impact Scale (mFIS), physical, cognitive, and social, as well as the total mFIS score, were used to measure fatigue. The Beck Depression Inventory-Fast Screen (BDI-FS) was used to assess depression. A series of hierarchical linear regressions were conducted with depression as the outcome variable. Both conceptualizations of cognitive reserve, each type of fatigue, and their interactions were included as predictors. Disability status, measured with the Expanded Disability Status Scale (EDSS), and previous treatment for depression were included as covariates in the final analyses.
Results: Regression analyses revealed that the interactions between overall fatigue and both conceptualizations of cognitive reserve were significant (p=.01 [Fixed CR]; p=.03 [Malleable CR]). Regardless of the type of cognitive reserve examined, simple effects tests revealed that overall fatigue predicted depression only in PwMS with low cognitive reserve (p<.001). For the subcomponents of the mFIS, several interactions were also significant. For cognitive fatigue, the interactions with both conceptualizations of cognitive reserve were significant (p=.02 [Fixed CR]; p=.048 [Malleable CR]); cognitive fatigue predicted depression only in PwMS with low cognitive reserve (p≤.001). For physical fatigue, the interactions with both conceptualizations of cognitive reserve were significant (p=.01 [Fixed CR]; p=.008 [Malleable CR]); physical fatigue predicted depression in PwMS with low cognitive reserve (p<.001). Finally, for psychosocial fatigue, only the interaction with Fixed CR was significant (p=.04); psychosocial fatigue predicted depression only in PwMS with low Fixed CR (p=.001).
Conclusions: Cognitive reserve moderated the relationship between fatigue and depression in PwMS. More specifically, cognitive, physical, psychosocial, and overall fatigue did not appear to influence depression in PwMS with high Fixed CR. Additionally, cognitive, physical, and overall fatigue did not appear to influence depression in PwMS with high Malleable CR. Overall, cognitive reserve may serve as a potential buffer against the negative emotional effects of fatigue in MS. Although education level and vocabulary are typically established by adulthood, and, thus, relatively less modifiable, these findings suggest that increasing PwMS's engagement in physically and cognitively stimulating leisure activities may help protect against the deleterious effects of fatigue on depression.
Keywords: multiple sclerosis**,** cognitive reserve**,** fatigue
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46 Comparison of Factor Structure of Self- and Informant-Reported Fatigue on the Fatigue Impact Scale in a Multiple Sclerosis Sample

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Objective: Studies have observed a mixed factor structure for the Fatigue Impact Scale (FIS) in persons with multiple sclerosis (pwMS). In addition, there are no widely used informant-report measures of fatigue, despite

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the importance of informant perspectives on salient MS symptoms such as fatigue. The purpose of this study was to (1) examine the factor structure of the FIS in a sample of pwMS, (2) determine factor structure on an informant-adapted version of the FIS, (3) compare items that load onto each factor between raters, and (4) evaluate inter-factor correlations.
Participants and Methods: The 40 items of the original FIS cognitive subscale were administered to 150 pwMS (*M* age=45.39, *SD* age=10.38; 79.3% female; 98.0% White; *M* education=15.10, *SD* education=2.28). Their informants (71.9% significant other; 15.1% family member; 11.5% friend; and 1.4% co-worker) responded to the same items that were adapted for other-report. We conducted separate exploratory factor analyses (EFA) for each rater category. Number of factors to retain was determined a priori using parallel analysis. Factors were extracted using principal axis factoring, and rotated using direct oblimin rotation. Items with loadings of <.50 were eliminated from EFA models in an iterative process. We saved regression-based factor scores for inter-rater analyses. Bivariate correlations were used to compare latent factors within and between raters.
Results: Both FIS forms had an acceptable Bartlett's Test of Sphericity (both $p<.001$) and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (both=.941). For the self-FIS, four items were removed over one iteration, and a three-factor solution emerged [64.3% of variance accounted for] consisting of Physical (13 items; loadings ranging from .563 to .927), Psychosocial (13 items; loadings ranging from .504 to 741), and Cognitive (10 items; loadings ranging from .517 to .862)
dimensions. Fourteen items were removed for poor loading in the informant-FIS after three iterations, and a similar three-factor solution emerged [63.1% of variance accounted for] with Physical (12 items; loadings ranging from .514 to .887), Psychosocial (6 items; loadings ranging from .542 to .854), and Cognitive (10 items; loadings ranging from .570 to .886)
dimensions. Intra-rater factor correlations were moderate-to-strong for both self-FIS (*r*s=.441 to .616) and informant-FIS (*r*s=.543 to .626). Lastly, inter-rater correlations were strong for Physical ($r=.709$), Psychosocial ($r=.533$), and Cognitive ($r=.595$) latent factors.
Conclusions: Our findings support a three-factor structure (i.e., Physical, Cognitive, Psychosocial) for fatigue ratings of pwMS and their informants on the FIS. In addition, similar items loaded onto each factor for each rater, with the same 10 items loading onto each Cognitive factor. The content of the Physical facets was likewise similar, but far fewer items loaded on the Psychosocial factor in informants. This may reflect differential observability of fatigue dimensions. That is, cognitive and physical items are possibly more easily observed by informants. Conversely, psychosocial aspects of fatigue may vary more from person to person, lending to weaker and instable item loadings. Finally, factors were associated between and within raters, though correlations suggest uniqueness of fatigue factors between and within raters. These data provide preliminary psychometric support for an informant-adapted FIS for capturing 'other-rated' fatigue in pwMS.
Keywords: multiple sclerosis**,** fatigue**,** psychometrics

47 Subjective Executive Functioning in Multiple Sclerosis

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Objective: Patients with multiple sclerosis (MS) may demonstrate deficits on performance-based tests of executive functions such as cognitive flexibility and working memory even early in the course of illness. To date, little research has examined the subjective experience of executive functioning (EF) in the everyday life of these individuals. The present study aimed to characterize subjective ratings of EF in patients with MS and examine their association with performance-based measures of cognition and mood.
Participants and Methods: Participants were 21 patients with MS seen for neuropsychological evaluation at a large regional medical center.

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The sample was predominantly female (71%) and had an average age of 51.52 years (SD = 7.46). Participants completed the Behavior Rating Inventory of Executive Function – Adult version (BRIEF-A), which assesses nine aspects of EF in everyday life over the past month; higher scores reflecting worse EF. The BRIEF-A Informant report was also available for a subset of 10 patients. Patients were also administered the Beck Depression Inventory-II (BDI-II), Wisconsin Card Sorting Test (WCST), Symbol Digit Modalities Test (SDMT), California Verbal Learning Test (CVLT), Brief Visuospatial Memory Test-Revised (BVMT-R), Boston Naming Test (BNT), and Verbal Fluency from the Delis-Kaplan Executive Function Systems (DKEFS).
Results: As a group, clinical elevations (T > 65) on the BRIEF-A were seen for the Shift (M = 67.24, SD = 9.62) and Working Memory (M = 74.52, SD = 12.49) scales. Within the sample, clinically significant difficulty was endorsed most commonly for the Working Memory (81%), Shift (66%), and Task Monitor (57.1%) scales. Informants endorsed observing significant difficulty on the Working Memory scale (M = 66.00, SD = 16.27). Better performance on SDMT was associated with worse self-rated EF on the Inhibit, Shift, Initiate, Working Memory, and Plan/Organize scales. More perseverative errors on the WCST was correlated with less difficulty on Task Monitor and Organization of Materials scales, while better CVLT Trials 1-5 was related to worse Working Memory score. Greater depression severity was associated with worse self-rated executive functioning on several BRIEF-A scales (though not Working Memory).
Conclusions: Patients with MS were most likely to endorse having significant difficulties with working memory and cognitive flexibility, consistent with prior research showing deficits in these executive functions on performance-based tests. Contrary to expectations, however, poorer self-rated EF in everyday life was related to better processing speed, verbal learning, and cognitive flexibility during problem solving. The reason for the inconsistency between subjective and performance-based measures is unclear; but could potentially reflect factors such as effects of depression on self-appraisal of cognitive functioning and limitations in self-awareness.
Keywords: executive functions**,** self-report**,** cognitive functioning
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48 Testing a Cognitive Model for Cognitive Fatigue in Individuals with Multiple Sclerosis

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Objective: Fatigue is one of the most pervasive yet least understood symptoms in individuals with multiple sclerosis (MS). Cognitive neuroscience research has previously examined the influence of effort and reward separately on cognitive fatigue. However, the effect of the interaction between effort and reward on cognitive fatigue has not been directly tested. This behavioral study aimed to evaluate whether an effort-reward imbalance, a model based in cognitive neuroscience, could explain cognitive fatigue.
Participants and Methods: Forty persons with MS and forty age- and educated-matched controls (HC) participated in a computerized switching task with independent high and low demand (effort) and reward manipulations. Objective fatigue (OF) was measured as performance on task while subjective fatigue (SF) was assessed using the Visual Analog Scale of Fatigue (VAS-F) before the start of the task and after each condition. Mixed-effects models were used to estimate the association between effort and reward and OF and SF.
Results: We found that subjects with MS report higher VAS-F scores than their HC counterparts (p=.02). Subjects with MS were slower (p<.001) and additionally slower in the high-demand condition than the HC group (p<.001). The high demand condition was associated with increases in VAS-F scores (p<.001) as well as response times (RT) (p<.001) and lower

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accuracy (p<.001). The high reward condition was associated with faster RT (p=.006) and slightly higher accuracy (p=.03). We did not observe evidence that the relationship between effort and VAS-F scores or RT and accuracy changes based on reward condition.
Conclusions: This initial behavioral study did not find evidence for the effort-reward imbalance. However, our results are theoretically consistent with models that suggest cognitive fatigue is central to effort and reward processes. Our findings support the role of effort in subjective cognitive fatigue and *both* effort and reward in objective cognitive fatigue. More specific and salient reward manipulations could be needed to identify the effect of effort-reward interactions on subjective cognitive fatigue. In addition, future neural measures of fronto-striatal circuit activity and integrity could elucidate the brain basis of cognitive fatigue.
Keywords: fatigue**,** cognitive neuroscience
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49 Cognitive Predictors of Understanding Medical Treatment Decisions in Multiple Sclerosis

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Objective: Cognitive impairment is associated with declines in medical decision-making capacity (MDC) in many disorders including multiple sclerosis (MS). In a medical context, “Understanding” reflects comprehension of information that allows for flexible generalizations about diagnosis, prognosis, and treatment options. Since cognitive decline is common in MS, investigating the cognitive abilities underlying Understanding is essential for screening compromised capacity. Thus, we examined the association between cognition and Understanding in a representative sample of persons with MS.

Participants and Methods: Participants included 32 consecutive persons diagnosed with MS (29 with relapsing-remitting and 3 with progressive) who presented for treatment at the University of Alabama at Birmingham (UAB) and agreed to be administered a comprehensive neuropsychological battery and the Understanding standard from the Capacity to Consent to Treatment Instrument (CCTI). Cognitive measures were chosen to assess each of the major cognitive domains. Normally distributed z-scores for each cognitive domain were calculated using available normative mean and standard deviation (stratified by age and education when possible). For each domain, an average z-score for the combined measures was used to represent an aggregated domain score. The cognitive composite score was the average of all domain z-scores. Participants were divided into intact and impaired groups for cognitive and CCTI variables. Impairment was designated for those falling $\geq$1.5 standard deviations below normative means on $\geq$1 cognitive domains or CCTI Understanding. Statistical analyses included independent t-tests, Pearson's chi-square tests, and binary logistic regression.
Results: Eighteen participants were found to have intact cognition (mean age=55, mean education=16 yrs, 13/5 White/Black, 16 female). Fourteen participants displayed impaired cognition (mean age=52, mean education=15 yrs, 9/5 White/Black, 11 female). For CCTI Understanding, 24 participants were intact (mean age=53, mean education=16 yrs, 18/6 White/Black, 20 female) and 8 were impaired (mean age=56, mean education=15 yrs, 4/4 White/Black, 7 female). Significant differences were not noted between the intact and impaired groups for demographic variables. For cognition, significant differences (p<.01) were observed for Verbal Memory, Visual Memory, Processing Speed, Executive Function, Language, and Cognitive Composite Score. A significant difference was also observed for CCTI Understanding (p<.001). To maintain a ratio of one predictor to ten participants, we used the three cognitive domains with the largest *t*-values (Verbal Memory, Processing Speed, Language) to construct a binary logistic regression, with intact/impaired on CCTI Understanding functioning as dependent variable. Pseudo *R*-

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square for the resulting model was .537 (p<.001).
Conclusions: "Understanding" is a complex decisional capacity that is highly related to cognitive ability. In our sample of persons with MS, more than 1/3 of participants had impairment in this component of decisional capacity, with Verbal Memory, Processing Speed, and Language being the strongest predictors. These findings in a representative sample of persons with MS highlight the need for routine assessment of cognition and medical "Understanding" in the patient population. These results also indicate a need for the development and investigation of interventions to improve MDC in MS.
Keywords: multiple sclerosis**,** cognitive functioning**,** neuropsychological assessment
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50 Standalone Performance Validity Test Scores and Neuroradiological Disease Burden in Patients with Multiple Sclerosis

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Objective: Standard accepted practice in clinical neuropsychological assessment includes the utilization of performance validity tests (PVTs; Sweet et al., 2021). Importantly, known neurological disease/insult may deleteriously affect performance on PVTs and subsequent clinical interpretation (Martin, Schroeder, & Olsen, 2020). Despite the increase in attention to PVTs in patients with multiple sclerosis (pwMS) – a chronic, inflammatory and degenerative condition of the central nervous system with characteristic neuroradiological findings – little is known about the relationship between bona fide disease burden and PVT performance in this population. As such, the present study sought to examine the relationship between quantified neuroradiological disease burden in pwMS and scores on three standalone PVTs.
Participants and Methods: Thirty-three pwMS (M age = 45.76 ± 12.52; 72.7% women; 78.8% White) were referred for neuropsychological evaluation at a large, academic medical center. Participants had standardized structural magnetic resonance imaging (MRI) data (M days from neuropsychological testing = 203) with data available for the following imaging variables: normalized T2 hyperintensity lesion volume (T2LV); and whole brain (WBF), gray matter (GMF), white matter (WMF), thalamic (TF), and hippocampal fractions (HF). All participants were administered three standalone PVTs as part of their evaluation: Victoria Symptom Validity Test (VSVT) Total Score (Resch et al., 2020); Word Choice Test (WCT; Bernstein et al., 2021); and Dot Counting Test (DCT; Boone et al., 2002). Due to non-normal distributions of PVT scores, non-parametric Kendal tau-b correlations (τ) were performed between all pairs of variables.
Results: Statistically significant (ps < .05) correlations emerged between VSVT-WCT (τ = .33) and VSVT-DCT (τ = -.42), but not between WCT-DCT (τ = -.18, p > .05). Of the 18 bivariate correlations between PVTs and imaging variables, only three were statistically significant (DCT-GMF τ = .26; DCT-TF τ = .31; VSVT-TF τ = -.32; ps < .05), with the rest emerging as nonsignificant with magnitudes below |.25| (ps > .05).
Conclusions: Results revealed significant correlations between only three pairs of PVT-imaging variables (DCT-GMF, DCT-TF, and VSVT-TF) and relatively little statistical overlap between PVTs and other explored measures of objective neuroradiological insult in this sample of pwMS. While most PVTs did not appear to significantly relate to imaging variables, it may be that some PVTs may be inadvertently sensitive to thalamic involvement, possibly related to its role in cognitive performance (Bisseco et al., 2021). Additionally, the DCT's use of a processing speed-like paradigm may make it more susceptible to overlap with known neuropathology in MS, given processing speed as a core deficit in this disease (Benedict et al., 2008). Importantly, future work should seek to replicate, extend, and/or challenge these findings, given the novelty of this research, relatively small sample size, and lack of control for type I error herein. Overall, continued

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attention to the relationship between neuroradiological disease burden and neuropsychological performance (especially PVTs) is duly needed in pwMS.
Keywords: validity (performance or symptom), multiple sclerosis, neuroimaging: structural
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51 Young-Onset Autoimmune Mediated Encephalomyelitis: ADEM, NMO, MS, or Post Infectious

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Objective: Acute Disseminated Encephalomyelitis (ADEM) is a rare but growing primarily monophasic inflammation that affects the myelin within the brain and spinal cord, most commonly in children often following an infection or vaccine. ADEM is estimated to occur in 1 in 250,000 individuals and can often abruptly present with fever, diminished sensation, weakness, back pain, fatigue, and cognition impairment. Due to its variable presentation, diagnoses such as Neuromyelitis Optica Spectrum Disorder (NMOSD), Multiple Sclerosis (MS) and post-infectious encephalitis are often part of the differential diagnosis. Furthering the diagnostic challenge, individuals with ADEM have been found to have the presence of myelin oligodendrocyte glycoprotein antibodies (MOG-abs) and anti-myelin oligodendrocyte glycoprotein antibodies (anti-MOG), and rarely oligoclonal bands (OCB) or antibodies such as anti-NMDA, anti-Hu or anti-GAD. Neuropsychological outcome studies in ADEM have primarily involved children with findings of primarily residual processing speed deficits. This case provides unique insight into a challenging neurological presentation growing among young adults with immune-mediated encephalomyelitis.
Participants and Methods: A 20-year-old African American male college student who reported progressive onset of cognitive and physical deficits was referred for a neuropsychological assessment by his neurologist to aid in differential diagnosis (MS, ADEM, NMO, & PI) and treatment planning. An interview with the patient and his mother, along with administration of a neurocognitive battery and review of his medical records, including neurodiagnostic tests, was completed and will be presented in detail.
Results: The patient reported slowly progressive weakness, numbness, fatigue, and back pain initially attributed to pinched nerve over a 6-month period. Upon admission, he displayed nystagmus, bilateral Hoffman, perseveration, and confusion. Today 3 month's post admission and steroid treatment, he reported improving cognition yet ongoing emotionality. His family also noted slowness, affective lability and apathy. Neuropsychological assessment revealed memory, processing speed, spatial judgment and reasoning deficits with strengths across measures of language, basic construction, mental flexibility and problem-solving. Brain MRI upon admission revealed "extensive probable demyelinating disease in the brain and spinal cord", but none in the orbits. Cerebral spinal fluid testing was positive for oligoclonal bands, with follow-up testing revealing elevated anti-NMDA and anti-MOG antibodies. We review course, immunology, and neuroimaging between these conditions in determining a final diagnosis.
Conclusions: ADEM, NMO, MS, and post-infectious encephalitis, while different diseases, often overlap in symptomatology and immunologically, especially in young adults. This case provides important neuropsychological data contributing to our understanding of the cognitive and functional sequelae for individuals with autoimmune mediated encephalitis. Neuropsychologist should be aware of these complicated illnesses and distinguishing features including course, immunology and neuroimaging.
Keywords: demyelinating disorders, encephalitis, autoimmune disorders

52 An Examination of Dementia Risk in Parkinson Disease: The Dual-Syndrome Hypothesis

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Objective: According to the Dual-Syndrome Hypothesis, individuals with Parkinson disease (PD) are differentiated by early evidence of predominant fronto-striatal impairment or posterior cortical impairment (Kehagia et al., 2013). This study examined whether early posterior cortical impairment is associated with more risk of developing dementia as predicted by the Dual-Syndrome Hypothesis.
Participants and Methods: Data used in the preparation of this study were obtained from the Parkinson's Progression Markers Initiative (PPMI) database (www.ppmi-info.org/data). This study was a retrospective design that examined an inception cohort of 312 individuals with de novo PD. Inclusion criteria were evidence of dopaminergic denervation via a dopamine transporter SPECT scan and available data for neuropsychological and motor tests from the baseline (< 2 years of PD diagnosis) and 12th visit (5 years post baseline visit). Participants completed a series of neuropsychological tests, including the Letter Number Sequencing (LNS) Test, Benton Judgment of Line Orientation (JoLO), Semantic Fluency Task, and Montreal Cognitive Assessment (MoCA).
An *a priori* classification system for cognitive profiles was developed using guidance from extant literature and the available neuropsychological measures. All participants were assigned a cognitive profile of fronto-striatal, posterior cortical, or indeterminate at baseline. The fronto-striatal profile was defined as impaired performance on the LNS Test and attention and executive tasks of the MoCA, with relative preservation of semantic fluency and visuospatial functioning. The posterior-cortical profile was based on impaired performance on the JoLO, Semantic Fluency Task, and visuospatial tasks of the MoCA. Participants who fit neither criteria were classified as indeterminate. These cognitive profiles were utilized in a logistic regression, with age as a covariate, examining the risk of developing dementia at visit 12 based on early (baseline) cognitive profile.
Results: At baseline, 4.49% (n=14) of participants met the strict inclusion criteria for the fronto-striatal profile, 32.30% (n=107) the posterior cortical profile, and 61.22% (n=191) the indeterminant profile. By visit 12, 7.14% (n=1) of the 14 individuals with the fronto-striatal profile at baseline developed mild cognitive impairment and 7.14% (n=1) dementia. Of the 107 participants with the posterior cortical profile at baseline, 9.35% (n=10) developed mild cognitive impairment and 9.35% (n=10) dementia by visit 12. There was no significant difference in dementia risk between the fronto-striatal and posterior cortical groups (p=0.62). However, individuals in the posterior cortical group had significantly higher odds of developing dementia compared to those in the indeterminate group (OR=0.16, p=0.006).
Conclusions: Per the Dual-Syndrome Hypothesis, individuals with posterior cortical impairments are more at risk for dementia with disease progression. Our results support this tenet of the hypothesis, as individuals with posterior cortical deficits at baseline were at greater risk for dementia than individuals with an indeterminate profile. As a limited number of participants met the strict criteria for the fronto-striatal profile at baseline, the current study did not have enough power to elucidate group differences in dementia risk between the fronto-striatal and posterior cortical profiles. Future research would benefit from increased sample size, expanded longitudinal assessments, and consideration of the interaction with motor phenotype.
Keywords: Parkinson's disease**,** cognitive functioning

53 Longitudinal Change in Hippocampal Subfields, CSF Biomarkers, and Cognition in Patients with Parkinson Disease Without Dementia

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Objective: Understanding the mechanisms of cognitive decline associated with Parkinson's disease (PD) can facilitate early disease detection and intervention. Recent evidence suggests that co-occurring Alzheimer's disease-related pathologies (amyloid plaques and tau tangles) are common and may contribute to PD disease progression. Hippocampal atrophy is associated with cognitive decline in PD; however, it is unclear to what extent it is due to the progression of PD-related pathology (alpha-synuclein) or co-occurring Alzheimer's disease-related change. This study aims to evaluate whether cerebral spinal fluid (CSF) biomarkers [alpha-synuclein, beta amyloid 1-42, or total-tau (t-tau)] predict hippocampal subfield atrophy in a *de novo* cohort of PD patients collected as part of the Parkinson's Progression Markers Initiative (PPMI). We hypothesize that CSF beta amyloid 1-42 and t-tau at baseline are associated with hippocampal subfield atrophy and memory decline in PD.
Participants and Methods: We identified a subset of PPMI participants with longitudinal T1-weighted imaging (baseline plus at least two additional visits across 12, 24, and 48 months) and CSF biomarkers available at baseline. All participants underwent neuropsychological assessment that included: The Montreal Cognitive Assessment (MoCA), Hopkins Verbal Learning Test-Revised (HVLT-R), Benton Judgment-of-Line-Orientation total score (JLO), Semantic Fluency (SF), Letter-Number Sequencing (LNS), and Symbol Digit Modalities Test (SDMT). Hippocampal subfield segmentation of T1-weighted images was completed using Freesurfer image analysis suite 7.1.0, resulting in twelve subfields for analyses. CSF samples were collected following standardized lumbar puncture procedures and analyzed following a standard protocol. We imputed data for participants with one missing visit using linear interpolation for 12 and 24 months and last observation carried forward for 48 months to reflect gradual and consistent volume changes. We performed linear mixed model analyses to evaluate the longitudinal change in hippocampal subfields and cognition accounting for age, sex, education, and intracranial volume. We evaluated the interaction of time and each of the CSF biomarkers. A false discovery rate (FDR) was used to correct for multiple comparisons.
Results: Examination of hippocampal subfields indicated a significant interaction between time and both t-tau and alpha-synuclein in their relationship with the right hemisphere subiculum (t-tau p <0.0001; alpha-synuclein p <0.0001) and presubiculum (t-tau p <0.0001; alpha-synuclein p <0.0001), respectively. Follow-up analyses indicated an increasingly negative relationship between t-tau and these hippocampal volumes over time (slopes over time: subiculum = -9.9, -15.8, -23.0, and -27.3; presubiculum = -24.5, -21.1, -34.9, and -39.5). In contrast, a positive relationship between alpha-synuclein was observed that increased over time (slopes over time: subiculum = 0.0026, 0.0065, 0.0107, and 0.0277; presubiculum = -0.0004, -0.0034, 0.0048, and 0.0200). With the exception of the JLO, there were no significant relationships between individual cognitive test performances and CSF values. JLO and t-tau showed a decreasingly negative relationship over time (slopes over time: -1.17, -1.83, -1.45, and -1.25).
Conclusions: In a *de novo* PD cohort, t-tau and alpha-synuclein were associated with hippocampal subfield volumes (the right subiculum and presubiculum). These relationships highlight that higher CSF t-tau was associated with smaller hippocampal subfields and this relationship strengthened over time.
Keywords: aging disorders**,** Parkinson's disease

54 Regional White Matter Fiber Tracts and Cognition in Parkinson's Disease

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Objective: Cognitive impairment in Parkinson's disease (PD) is heterogeneous and impacted by multiple neuropathological processes. Previous research has primarily examined diffusion weighted imaging metrics in relation to motor symptoms. It is increasingly appreciated that PD patients experience deterioration of white matter tracts secondary to cerebral small vessel disease, which may contribute to or exacerbate cognitive decline. However, it is unclear to what extent individual tract profiles are associated with cognition in PD. In this study, we examine the relationship between tract-specific white matter integrity and cognition in a de novo PD cohort collected as part of the Parkinson's Progression Marker's Initiative (PPMI).
Participants and Methods: 79 PD participants were identified based on the availability of diffusion weighted imaging at baseline. Automated Fiber Quantification was used to identify and evaluate a measure of white matter integrity, fractional anisotropy (FA), along 10 major fiber tracts in the brain. Manual quality assessment was performed on all tracts. A neuropsychological test battery was preformed and generalized linear regressions were used to examine the relationship between the dependent measures (FA along individual fiber tracts) and cognitive outcomes (HVLT delayed recall and retention, JLO, SF, LNS, and SDMT) accounting for age, sex, education and disease duration.
Results: In a *de novo* cohort of PD patients, PD patients with increased cardiovascular risk exhibited a significant reduction in FA relative to the PD patients with relatively lower risk along aspects of the right arcuate and left inferior fronto-occipital fasciculus.
Conclusions: FA measures across numerous tracts were significantly associated with cognitive outcomes. The cingulum cingulate, cingulum hippocampus, inferior fronto-occipital fasciculus, and inferior longitudinal fasciculus exhibited associations across multiple cognitive measures examined. Future analyses will evaluate how variation in these regions impacts cognitive functioning and longitudinal change over time.
Keywords: Parkinson's disease**,** aging disorders

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55 Cognitive Effects of Thalamotomy for Tremor: A Meta-Analysis

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Objective: Tremor is a debilitating symptom observed across multiple neurological disorders, including essential tremor (ET), Parkinson's disease (PD), and multiple sclerosis (MS). The first-line treatment for tremor is pharmacological, however, up to 50% of patients are resistant to medications or cannot tolerate side effects. For these patients, surgical interventions targeting the ventral intermediate nucleus of the thalamus (Vim) may be considered.
Vim thalamotomy can be performed with radiofrequency, and more recently less invasive procedures, such as gamma knife or magnetic resonance-guided focused ultrasound (MRgFUS). Although Vim thalamotomy effectively mitigates tremor, there is some concern of post-operative cognitive disturbances. While some studies have reported worsening cognition following thalamotomy, others have found stable or even improved post-

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operative cognitive performance. The aim of the present study was to quantitatively summarize the impact of Vim thalamotomy for tremor across multiple cognitive domains.
Participants and Methods: We systematically searched MEDLINE, Embase Classic + Embase and Evidence-Based Medical Reviews for studies that examined cognition before and after Vim thalamotomy for tremor. Eligibility criteria consisted of: (1) neuropsychological testing at baseline and follow-up (at least one week post-operatively), (2) at least one objective neuropsychological test, (3) participants with ET, PD, or MS, and (4) randomized controlled trials, open-label trials, or case series with at least 3 participants.
We calculated standardized mean differences (SMD) and 95% confidence intervals (CI) between pre- and post-operative cognitive scores using random effects models. Separate analyses were performed for domains of global cognition, verbal memory, non-verbal memory, executive functioning, phonemic fluency, semantic fluency, and visuospatial processing.
Results: The literature search returned 1154 records and seven studies met inclusion criteria. Across studies, the maximumcombined sample size was 189 (mean study sample size = 27.00, SD = 12.11). There were 85 patients with ET, 99 with PD, and 5 with MS. The mean age across studies was 65.28 years (SD = 4.55) with a mean tremor duration of 15.94 years (SD = 6.45). Thalamotomy was performed with MRgFUS (n = 3 studies), radiofrequency (n = 3 studies), or gamma knife (n = 1 study). 139 of these participants underwent left thalamotomy and 50 underwent right thalamotomy. On average, follow-up occurred 6.51 months (SD = 4.17) post-operatively.
There was a small, but statistically significant, negative effect of thalamotomy on semantic fluency (7 studies, SMD = -0.21, 95% CI = [-0.41, -0.00], p = 0.046) and a trend in the same direction for phonemic fluency (5 studies, SMD = -0.26, 95% CI = [-0.55, 0.03], p = 0.079). No post-operative changes were observed in global cognition, verbal and non-verbal memory, executive functioning, and visuospatial processing (p > 0.18).
Conclusions: Based on a small set of studies, Vim thalamotomy for tremor appears to be relatively safe from a cognitive standpoint. However, there may be a small, circumscribed negative impact on verbal fluency. Given the growing popularity of MRgFUS, there is a need for additional well-designed, adequately powered studies investigating the neurocognitive sequelae of Vim thalamotomy for tremor.
Keywords: movement disorders, neuropsychological assessment, neuromodulation
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56 Assessment of Cognitive Safety with the Utilization of MRgFUS Thermoablation of the Ventral Intermediate Nucleus of the Thalamus in Essential Tremor Patients

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Objective: Magnetic resonance imaging-guided high intensity focused ultrasound (MRgFUS) of the ventral intermediate nucleus (VIM) of the thalamus is a transformative neurosurgical approach that was approved by the FDA in 2016 for treatment of essential tremor. The relative novelty of this intervention requires ongoing studies to further assess cognitive safety and longitudinal outcomes. Studies which utilize a variety of repeated neuropsychological measures and appropriate longitudinal statistical techniques (i.e., reliable change indices) are especially lacking in the literature.
Participants and Methods: A total of 10 participants (4 female, 6 male) with essential tremor were treated with MRgFUS ablation of the VIM and also completed both pre-operative and post-operative neuropsychological testing. Repeated measures on neuropsychological testing included at least one common task in the domains of language (i.e., Controlled Oral Word Association, Boston Naming Test), attention/working memory (WAIS-IV Digit Span,

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Trailmaking Test Part A), executive functioning (Trailmaking Test Part B, Wisconsin Card Sorting Test), and memory (i.e., California Verbal Learning Test). Follow-up evaluations occurred approximately 6 months after the surgery. For all participants, reliable change indices were calculated for each repeated test score available using a 95% confidence interval (i.e., *z*-score cutoff of 1.96).
Results: Out of the 10 participants with both pre and postoperative neuropsychological evaluations, 9 did not demonstrate significant reliable change across the domains of language, attention/working memory, executive functioning, or memory using at least one repeated measure. One participant demonstrated multi-domain decline in cognitive functioning, but also was diagnosed with a comorbid degenerative health condition.
Conclusions: Overall, findings are generally supportive of the cognitive safety of MRgFUS ablation of the VIM for treatment of essential tremor in our relatively small patient cohort. Considerations based on clinical presentation/history and other participant characteristics, as well as directions for future research will be discussed.
Keywords: neuromodulation**,** cognitive functioning**,** movement disorders
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57 Preliminary Evidence of Non-Invasive Vagal Nerve Stimulation Effects on Parasympathetic Activity During Sleep in Veterans with Post-Traumatic Stress Disorder

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Objective: A core feature of post-traumatic stress disorder (PTSD) is autonomic dysregulation, characterized by diminished activity of the parasympathetic nervous system and elevated activity of the sympathetic nervous system. This dysregulation manifests as decreased high-frequency heart rate variability (HF-HRV) during both wake and sleep, which is in turn associated with increased risk for adverse cardiovascular events, including mortality. Transcutaneous vagal nerve stimulation (tVNS) is a non-invasive technique that has potential to impact sleep quality via afferent input into the nucleus tractus solitarius and to increase parasympathetic nervous system activity via both peripheral and brain effects. The current pilot study explored the effect of one hour of tVNS administered at “lights out” on HF-HRV during sleep in veterans with PTSD.
Participants and Methods: 6 veterans ages 28-52 (M = 40.2, SD = 7.8) completed two counterbalanced nights of laboratory-based polysomnography with concurrent HRV assessment: one with active tVNS (administered at the tragus), and one with sham stimulation (administered at the earlobe). Power spectral analysis of HRV was estimated from the electrocardiogram signal, with the high frequency band defined as 0.12-0.40 Hz. Sleep staging and stability metrics (e.g., cyclic alternating pattern [CAP], spectral EEG analysis) were derived from the polysomnography data.
Results: A two-way repeated measures ANOVA was performed to evaluate the effect of stimulation condition (active tVNS versus sham) on HF-HRV across successive NREM sleep cycles. There was a large main effect of stimulation condition ($F[1, 5] = 3.99$, $p = 0.10$, $\eta_p^2 = 0.44$), such that HF-HRV was greater on nights of active tVNS versus sham stimulation. There was also a large main of effect of cycle ($F[4, 20] = 2.59$, $p = 0.07$, $\eta_p^2 = 0.34$); however, the interaction term was non-significant. Greater HF-HRV during sleep was associated with a reduction in CAP rate ($r = -0.57$, $p = 0.08$) and alpha power ($r = -0.69$, $p < 0.02$) during NREM sleep.
Conclusions: In this pilot study, we found preliminary evidence that one hour of tVNS administered at “lights out” is associated with a sustained increase in HF-HRV across successive NREM sleep cycles in veterans with

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PTSD. This increase in parasympathetic modulation may have important clinical implications, particularly for cardiovascular health. Moreover, increased HF-HRV during NREM sleep was associated with reduced CAP rate and alpha power during NREM sleep, indicative of improved sleep stability. It will be important to replicate these findings in a larger sample in the future and to investigate whether these changes in autonomic activity during sleep may translate to meaningful improvements in subjective sleep quality and cardiovascular health.

Keywords: neurostimulation**,** sleep**,** post-traumatic stress disorder

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58 Heart-Rate Variability Predicting Executive Functions in Accelerated Intermittent Theta-burst Stimulation for Treatment-Resistant Depression

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Objective: Heart-rate variability (HRV) is a reliable biomarker of psychopathology and cognitive functions (Thayer & Lane, 2000). The Stanford Accelerated Intelligent Neuromodulation Therapy (SAINT) is an accelerated, high-dose resting-state functional connectivity MRI (fcMRI)-guided intermittent theta-burst stimulation (aiTBS) protocol on the left dorsolateral prefrontal cortex (dlPFC) for treatment resistant depression, and it has shown promising results achieving high remission rates in depression and demonstrated no cognitive side effects based on an open-label clinical trial (Cole et al., 2020). Using the neurovisceral integration model, Thayer (2009) proposed that the manipulation of resting HRV was associated with changes in executive functions. This study aims to explore the changes in HRV and executive functions in the treatment-resistant population following SAINT in a double-blinded, randomized-controlled trial.

Participants and Methods: A total sample of 18 participants with treatment-resistant depression recruited into the original study "Accelerated Theta Burst in Treatment-Resistant Depression: A Biomarker Study" at Stanford University Brain Stimulation Lab were randomized into active treatment group (n=8) and sham treatment group (n=10) for one week of SAINT. Working memory, switching and inhibition functions were measured by the Delis-Kaplan Executive Function Systems (DKEFS) Trail Making and Color-Word interference subtests, computerized *n*-back task, and NIH Toolbox Cognition Module. HRV levels (time-domain and frequency-domain) were measured by Polar H10 device synced to the Elite iPhone application and processed on Kubios software.
Results: At baseline, the two groups did not differ on demographics, depression severity, cognitive test performance and HRV levels. Age, hours of sleep, and IQ were controlled as confounding variables in data analyses. Mixed-effects Models (MEM) indicated that there were no significant group differences on changes in HRV parameters after active SAINT intervention (ps > .05). In terms of cognitive functioning, the MEM showed a significant treatment group*time interaction for a verbal working memory computerized task (2-back accuracy rate) (F=10.69, p=.01), with active SAINT group showing improvement whereas the sham group showed significant decline in performance (p=.01). Regression analyses indicated that changes in HRV parameters did not predict changes of depression severity across total sample. Although changes in HRV did not significantly predict changes in neurocognitive test performance in the entire sample, additional regression analyses revealed that within the active SAINT group, HRV levels changes significantly predicted changes in 2-back reaction time (F(1,5)=26.47, p=.007, R^2=.869), NIH Toolbox Flanker Inhibitory Control (F(1,5)=7.150, p=.056; R^2=.641) and DKEFS Trail Making Test Condition 3 (F(1,5)=14.605, p=.019; R^2=785).
Conclusions: This study is the first to report on the neurocognitive outcomes and its relations to HRV in the context of SAINT in treatment-resistant depression. Verbal working memory as measured by the *n*-back task improved after receiving active SAINT. Within the active

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treatment group, participants' HRV changes predicted changes in working memory, switching and inhibitory performance. The current findings lend support to the neurovisceral integration model, and highlight the role of HRV and cognition as potential biomarkers of neuromodulation in treatment-resistant depression.
Keywords: neuromodulation**,** depression**,** neurocognition
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Coffee Break

12:30 - 1:00pm
Thursday, February 3, 2022

LIVE Invited Symposium 2: Building a Research Career in Neuropsychology

Chair: Ruchika S. Prakash Presenters: Desiree Byrd, Cerise Elliott, Stephen M. Rao

1:00 - 2:25pm Thursday, February 3, 2022

Abstract & Learning Objectives:
This symposium is geared towards early career neuropsychologists, mentors, and institutions committed to furthering research in the field of neuropsychological sciences. The symposium speakers will discuss best practices for building a programmatic line of research, securing funding, balancing clinical work with research, networking, and promoting your research activities in academia. This symposium will also identify barriers and challenges that interfere with neuropsychological science career progression for underrepresented scholars. The presentations will identify evidence-based strategies and solutions for trainees, mentors, and institutions that will effectively support science career success in neuropsychological trainees.

Upon conclusion of this course, learners will be able to:
- Identify strategies to build and strengthen a program of research
- Describe training components necessary for securing tenure-track and academic medical center research positions
- Discuss effective structural, institutional, and individual level responses that facilitate entry to and persistence in neuropsychological science careers

Symposium 08: PediaTrac: A Longitudinal Tool to Measure and Track Infant and Toddler Development

1:00 - 2:25pm
Thursday, 3rd February, 2022

27 PediaTrac: A Longitudinal Tool to Measure and Track Infant and Toddler Development

Chair

Renée Lajiness-O'Neill
Eastern Michigan University, Ypsilanti, USA

Discussant

H. Gerry Taylor
Nationwide Children's Hospital, and The Ohio State University, Columbus, USA

It has been 10 years since the NICHD 2012 Scientific Vision stated that *"within the next 10 years, scientists should be able to…fully understand the neurobiological bases, delineate the full developmental spectrum and trajectories, and identify the key biologic markers for five behavioral or cognitive disorders."* The delineation of the developmental spectrum and trajectories has not yet been fully achieved in infancy due to the lack of a: 1) universal and systematic measure of infant developmental behaviors, and 2) multidimensional method of

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tracking early developmental trajectories. This type of assessment tool would substantially improve pediatric care by helping clinicians more fully evaluate developmental status, improve early identification of risk, and monitor treatment outcomes. In addition, when measured systematically, researchers will be able to correlate infant developmental status with molecular, cellular, and brain-system level data. Thus, there is a crucial need to develop an efficient, low-cost, yet comprehensive assessment tool to measure and track infant/toddler development and to examine the behavioral correlates of brain structure and function.This symposium will describe the development and testing of a novel measure, PediaTrac™, that collects longitudinal, real-time, multi-domain data from caregivers to characterize infant/toddler developmental trajectories. Dr. Lajiness-O'Neill will summarize current methods of infant/toddler assessment, the unique niche of PediaTrac, and the development, methodology, and validation of this new tool. Dr. Warschausky will will describe the need for a systematic way to assess and track infant/toddler motor functioning and the development of the Sensorimotor (SEM) domain using item response theory (IRT) methods. Dr. Staples will discuss how early parent-infant relational health impacts development, including emerging attachment security, as well as on the psychometrics and validity of the Early Relational Health (ERH) domain and its associations with sociodemographic factors. Ms. Cano, MPH, will review the foundational role of sociodemographic factors in infant development and examine the impact of objective indicators, such as neighborhood deprivation and maternal education, as key predictors of PediaTrac measures of infant development. The symposium will conclude with a discussion led by Dr. Taylor of the implications of emerging evidence of the validity of PediaTrac, which has the potential to become a standard for monitoring development beginning at birth for early detection in the primary care setting.

Keywords: assessment**,** test development**,** child development (normal)

748 PediaTrac: The Development and Validation of a Web-Based Tool to Measure and Track Infant and Toddler Development from Birth Through 18 Months

Renée Lajiness-O'Neill[1,2], Alissa Huth-Bocks[3], H. Gerry Taylor[4], Seth Warschausky[2]
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Objective: Development is multidimensional and multiply determined. During early development, sensorimotor, socioemotional, communication, and cognitive abilities develop concurrently and mutually influence each other. Critically, the attainment of these skills and quality of development in infancy provide the foundation for children's health and well-being throughout their lives. Adverse early biological events such as prematurity and adverse environmental exposures such as poverty can have deleterious and cascading effects on development. As such, it is crucial to identify risk and developmental deviations in the first year of life when prevention could alter a child's trajectory, enhance quality of life, and substantially decrease lifetime costs of care. This talk describes the development and validation of PediaTrac™ v3.0, a measure to track infant/toddler development, through an ongoing multisite, longitudinal study (2018-2023) of 571 primary caregivers of a cohort of full-term and preterm infants to characterize early developmental trajectories.
Participants and Methods: Primary caregivers completed PediaTrac v3.0, a survey tool of 511-558 items (depending on age) that query core domains of early development including feeding/eating/elimination, sleep, sensorimotor (SEM), social/sensory information processing, social/communication/cognition (SCG), and early relational health (ERH). Information was also obtained about demographic, medical, and environmental factors, as well as response bias. Employing a prospective approach that systematically measures infant/toddler development during a schedule that

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corresponds to well-child visits (newborn (NB), 2-, 4-, 6-, 9-, 12-, 15-, 18-months), 331 caregiver/term infant dyads and 240 caregiver/preterm infant dyads (gestational age < 37 weeks) (pooled infant sample 48% female) were enrolled from three academic medical centers. Data analyses are ongoing. Item Response Theory (IRT) methods are used to evaluate PediaTrac's psychometric properties. Convergent and predictive validity are evaluated by examining relationships between the PediaTrac domains and legacy measures of developmental/behavioral status and caregiver/mental health. A comprehensive test of infant development will be administered to a subsample of 100 participants at 24 months of age.

Results: Mean age for the total sample of caregivers is 30.1 (SD=6.04) years of whom 48.3% are White, 34.1% African American, and 10.3% Multiracial, with 32.8% below the poverty threshold. Caregivers of term infants completed PediaTrac soon after birth, and those of preterm infants once the infant had reached a postmenstrual age of 39 weeks. The methodology has been well accepted by caregivers, with an attrition to date of only 11.38%. Preliminary results reveal that the latent traits for SEM and SCG were reliably estimated by theta at the NB period (.94 and .98, respectively). Factor analysis reveals four factors for SEM (NB) and three factors for ERH at 9 and 12 months. SCG, SEM, and ERH show good convergent validity with legacy measures of infant development and caregiver mental health.

Conclusions: PediaTrac is an efficient, low-cost method to collect and track multi-domain data on infant/toddler development. It fills an important gap in assessment that will assist in early identification of developmental disorders and provide behavioral correlates for studies of infant brain development. By involving caregivers in the digital reporting and child-centered monitoring of development, PediaTrac may improve access to care by reducing the direct assessment burden on the clinician within pediatric health care settings.

Keywords: test development**,** child development (normal)**,** psychometrics

763 Development and Validation of the Newborn Sensorimotor Domain of PediaTrac v3.0, a Web-Based Tool to Measure and Track Infant and Toddler Development using Item Response Theory

Seth Warschausky[1], Trivellore Raghunathan[2], Patricia Berglund[2], Alissa Huth-Bocks[3], H. Gerry Taylor[4], Renée Lajiness-O'Neill[5,1]
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Objective: Approximately 5-10% of children exhibit developmental deviations in motor skills and/or other domains; however, it is estimated that physicians detect less than one third of these abnormalities. Infants born preterm are at a particularly high risk for delays in motor development and cerebral palsy. Systematic tracking and early identification of developmental deviations particularly in early sensorimotor skills are fundamental steps in ensuring that affected children receive targeted interventions. The primary aim of this study was to evaluate the psychometric properties and dimensionality of the newborn (NB) Sensorimotor (SEM) domain of PediaTrac™ v3.0, a novel caregiver-based assessment to track infant development. Item Response Theory (IRT) methods identified a latent trait of newborn sensorimotor ability. Factor structure of the items was estimated with exploratory factor analyses (EFA). Hypotheses: 1) parameter estimates of the items will be reliably modeled, 3) the latent trait, SEM, will be reliably estimated by theta, 3) estimates of reliability of SEM will be in the acceptable to good range (> 0.70), and 4) a second order latent factor structure of SEM can be fit to the variables.

Participants and Methods: A prospective, longitudinal sample of 571 caregiver/infant dyads (48% female) were recruited from

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three academic medical centers, including 331 term and 240 preterm infants. Participant caregivers were mean age 30.1(6.04) years, and identified as 48.3% White, 34.1% African American, and 10.3% Multiracial, with 32.8% below the poverty threshold. Caregivers of term infants (39 weeks) completed PediaTrac soon after birth (GA_{Mean}=39.0 weeks), or if preterm when the infants reached a postmenstrual age of 39 weeks (uncorrected GA_{Mean}=33.0 weeks). Responses were ordinal (1=never to 5=always), and higher scores represented more developed abilities. IRT graded response modeling of the 15-item NB SEM domain was used to model item parameters. Theta values were generated for each participant. EFA with oblique rotation was conducted to further examine dimensionality and estimate the factor structure.
Results: Total Information for the NB SEM domain was 15, and the reliability was 0.94. Mean theta value for the group was 0.03 (*SD*=0.90) (interpreted similar to Z-score distribution) and ranged from -3.03 to 3.18. Discrimination estimates for the items ranged from 0.43 to 1.93, with four items providing the most information and best targeting SEM. FA revealed that four factors accounted for 43.20% of the variance, termed Bilateral Motor Function, Head and Trunk Control, Rolling, and Reflexive Fine Motor Control.
Conclusions: The investigation demonstrated that the latent trait, SEM, could be reliably estimated by theta at the NB period in a large sample of term and preterm infants. Item discrimination and item difficulty of each of the 15 items could be reliably modeled across the range of ability. The reliability of the SEM domain was high. A possible second order factor structure emerged revealing that distinct motor functions could be validly reported by caregivers at the NB period. This is the first known caregiver instrument that can assess sensorimotor ability in the NB period with high reliability in typically developing and at-risk infants.
Keywords: motor function**,** child development (normal)**,** psychometrics

772 Preliminary Psychometrics of a Novel Measure of Early Relational Health: Relationships with Sociodemographic Characteristics

Amanda Hicks[1], Natasha Lang[1], Renée Lajiness-O'Neill[1,2], Alissa Huth-Bocks[3], Angela D Staples[1]
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Objective: Past research has shown that parental psychopathology is related to parenting stress (Shea & Coyne, 2010; Raphael et al., 2010). Furthermore, mothers with severe symptoms of anxiety and depression who are parenting infants have significantly higher levels of parenting stress compared to mothers with less severe symptoms (Fernandes et al., 2021). As the parent-infant relationship develops during the first year, parental stress and psychopathology may have long lasting effects on infant development (Sliwerski et al., 2020). As part of a transactional system, early parent-infant relational health may encompass aspects of parental psychopathology, parenting stress, and emerging attachment security. The present study examined the factor structure of a new measure of early relational health, its validity with existing measures of psychopathology, and sociodemographic covariates.
Participants and Methods: Longitudinal data (N=484; boys=259) collected at 9 and 12 months of age were from a larger, ongoing longitudinal study of a pooled sample of term and preterm infants from newborn to 24-months recruited from three metropolitan academic hospitals using PediaTrac™ an online tool for tracking development. Mothers at Sites 1|2 were more likely to be Black/African American (53%, White=45%, multiracial=8%, other=3%), have lower household income (47% below federal poverty level), less likely to be married (45%), and live in neighborhoods with greater deprivation (census-based area deprivation ADI M=76.05, SD=23.59) compared to Site 3 (Black/AA=6%, White=83%, multiracial=5%, other=3%; income 10% below federal poverty

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level, married=83%, ADI M=45.09, SD=25.57) (all ps < .05).
Results: Mothers at Sites 1|2 reported similar levels of anxiety ($M_{9|12}$ =0.29|0.24, SD=0.51|0.41) and depression ($M_{9|12}$=0.31|0.29, SD=0.53|0.50) (Brief Symptom Inventory, BSI) as mothers at Site 3 (anxiety $M_{9|12}$=0.34|0.39, SD=0.51|0.54; depression $M_{9|12}$=0.34|0.39, SD=0.51|0.54) at both sampling periods (ps > .05). Exploratory factor analysis with oblique rotation of 28 early relational health (ERH) items [5-point response scale never (1) to always (5)] identified three factors with sufficient alpha coefficients: ERH Caregiving Stress (CS; 6 items), ERH Anxious-Depression (AD; 6 items), and ERH Attachment Security (6 items). For space, statistically significant (ps < .05) relations evident at both sampling periods are reported. Greater ERH caregiving stress was associated with greater ERH anxious-depression. Both greater ERH CS and AD were associated with greater BSI Anxiety and greater BSI Depression. ERH CS, but not ERH AD, was associated with less ADI, more household income, being married, and being older.
Conclusions: Overall, this new measure of ERH shows good convergent validity with established measures of anxiety and depression. In support of current literature, caregiving stress was related to caregiver psychopathology as measured by ERH. More sociodemographic resources were related to more caregiving stress suggesting that sociodemographic characteristics are important for understanding how parental stress may relate to early relational health in the first year.
Keywords: assessment**,** emotional processes**,** psychometrics

778 Longitudinal Sociodemographic Predictors of Infant Development: A PediaTrac Study

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Objective: Development during infancy establishes a foundation for a child's prospective health, growth, and learning. Sensorimotor, social, communication, and cognitive abilities in early development are substantially influenced by sociocultural factors, such as maternal education. Although sparse, increasing evidence suggests that neighborhood deprivation is also a salient influence on early development. This study examines maternal education and objective indicators of neighborhood deprivation as predictors of infant sensorimotor (SEM) and social/communication/cognition (SCG) development. Neighborhood deprivation was hypothesized to be a stronger predictor of development than maternal education.
Participants and Methods: 571 caregiver/infant dyads (331 term; 240 preterm) participated in the longitudinal multi-site PediaTrac study. Outcome variables, SEM and SCG, were collected via caregiver-reported PediaTrac™ questionnaires at newborn, 2-, 4-, and 6-months. Percent of maximum possible scores were calculated for SEM and SCG domains; higher scores indicate more advanced development. Maternal education was collected at the newborn period. Neighborhood deprivation was measured by the Area Deprivation Index (ADI), a neighborhood-level composite of sociodemographic variables from US Census data. Mixed-effects models assessed relationships of longitudinal changes in SEM and SCG scores with maternal education and ADI, separately and stratified by term status, with caregiver age and time (weeks since birth at survey completion) as predictors.
Results: Mean caregiver age was 29.4 ± 5.78 (term) and 31.1 ± 6.26 (preterm) years. There was an interaction between term status and time only for SEM, such that SEM scores increased to a greater degree in the term compared to the preterm group over time (p <0.0001), whereas SCG scores were higher in the term compared to the preterm group, irrespective of time (p = 0.005). Higher maternal education was associated with lower SEM scores in the term

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group (p = 0.0004), but there was no association in the preterm group (p = 0.19, model R^2 = 0.22, 0.14, respectively). Higher ADI was associated with higher SEM scores in the term group (p < 0.0001), but no association was present in the preterm group (p = 0.16, model R^2 = 0.23, 0.14, respectively). Higher maternal education in both term (p = 0.0002) and preterm groups (p = 0.03, model R^2 = 0.44, 0.44, respectively) was related to lower SCG scores. Higher ADI in both term (p < 0.0001) and preterm groups (p = 0.03, model R^2 = 0.44, 0.44, respectively) was associated with higher SCG scores. Younger caregivers reported better infant development, while controlling for other covariates, in all but one model (p ≤ 0.03).
Conclusions: Despite the multidimensionality of the ADI, maternal education independently performed equally well in predicting development. However, the directionality of effects is paradoxical even when accounting for sociocultural factors, consistent with prior caregiver-report research. It is plausible older and more educated mothers are reporting less advanced development because of greater expectations and knowledge of development. The unexpected relationship between ADI and development may also be driven by issues with response bias in reporting development. Clarification of contextual effects on developmental reporting may lead to improved identification of deviations.
Keywords: assessment**,** child development (normal)**,** pediatric neuropsychology

986 Discussion: PediaTrac as a contribution to the field of "infant neuropsychology"

H. Gerry Taylor
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Objective: The aims of the discussion are to highlight the unique features of the PediaTrac project as one that focuses on infant neuropsychology, emphasize the need for new measures of early infant development and the ways in which PediaTrac addresses this need, review the strengths and limitations of this approach, summarize the primary take-home messages of the panel's presentations and ways to utilize these new measures, and underscore this area investigation as new territory and one that provides opportunities for new discoveries.
Introduction: The PediaTrac project is a good example of research in the emerging field of infant neuropsychology. Infants display a wide range of behaviors and skills even at birth,with a good deal of individual variability. The also make impressive progress over the course of the first 18 month in development of physical, social, and cognitive skills. Although this is a fascinating period of development, and one quite distinct from other periods, this is not an age range that most neuropsychologists focus on in their research and clinical practices. Appreciating individual differences among infant at a given ager and in terms of development over the course of the first year and a half is critical in identifying those with or at risk for special needs – and would also contribute new knowledge on normal development.
Critique of methods: There are many existing measures of infant development including the Ages & Stages Questionnaire, Adaptive Behavior Assessment System, 2nd Ed., Vineland Adaptive Behavior Scales, 3rd Ed., and ratings scales that assess temperament and other characteristics of infant behavior. The PediaTrac project is using some of these as "legacy" measures to help validate the PediaTrac. However, there are major limitations to existing measures. Many fail to provide more comprehensive assessment of development during early infancy, while others require extensive resources. We are unaware of any existing measures that are take advantage of item response theory (IRT) approaches to assessment or that allow measurement of developmental trajectories.
The benefits of PediaTrac measures described in this symposium are their capacity to assess multiple aspects of development across the first 18 months and examine longitudinal changes as well as response tendencies or biases among raters. A further advantage is that these measures are also based on IRT, which allows for efficient assessment and increases the potential for wide-spread applications.

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Limitations include the fact that ratings are subjective and that raters of infant behavior and that additional work is needed to further validate the measures. The PediaTrac does not replace direct assessments but does offer an accessible means for early developmental monitoring.
Summary of panel presentations: One of the take-home messages from this symposium is that our project has been successful in recruiting and large and diverse population of infant-mother dyads that includes both term-born and preterm infants. The data presented here also provide evidence to indicate that three PediaTrac measures of three developmental domains, including sensorimotor, social-communication-cognition, and relational health, have good psychometric characteristics. The scales are reliable, with evidence for construct, discriminant, and convergent validity. The findings also confirm the need to account for unanticipated response tendencies or biases.
Conclusions: More research is needed to further validate PediaTrac measures of development at later follow-ups as well as growth trajectories in relation to existing or "legacy" measures and to preterm vs. term status. We are also interested in examining these measures as markers of normal or abnormal brain development, means for assessing the effects of other congenital abnormalities on development and the precursors of later-emerging disabilities, and ways to evaluate the effects of early interventions. We are excited by the participation we've enjoyed from young families and the opportunities for new discoveries in this relatively new area of infant neuropsychology.
Keywords: assessment
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Paper Session 10: Epilepsy

1:00 - 2:25pm
Thursday, February 3, 2022

1 Impact of Social Determinants of Health on Access to Epilepsy Care at a Large Veterans Hospital

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[1]Michael E. DeBakey VA Medical Center, Houston, TX, USA. [2]University of Louisville, Louisville, KY, USA. [3]Baylor College of Medicine, Houston, TX, USA

Objective: Social determinants of health refer to individual factors and community conditions that interact to impact a wide range of health risks and outcomes. It is increasingly understood that sociodemographic and neighborhood determinants may limit access to specialized epilepsy care. The standard of care in epilepsy includes access to clinics and qualified providers, diagnostic testing, and repeat visits to tailor medication treatment. Veterans may be at a particular disadvantage because of both high rates of epilepsy due to military trauma and traumatic brain injury as well as unique socioeconomic hardships. We investigated the extent to which social determinants impacted access to epilepsy care within a large Veterans Health Administration (VHA) hospital.
Participants and Methods: Participants included 180 veterans diagnosed with epilepsy following epilepsy monitoring at a large VHA hospital in the Southeastern United States between 2013 and 2020. Record review gathered clinical and demographic data. Time to referral (TTR), or the gap between diagnosis of seizures and referral for epilepsy monitoring, was the primary outcome measure. Social determinants that were included in data collection were age, sex, race, education, and geographic distance from the nearest VHA clinic. In addition, rurality and overall neighborhood disadvantage were assessed using Rural-Urban Committing Area (RUCA) and Area Deprivation Index (ADI) codes. Pearson's correlations were computed to assess correlations among variables, and significantly related variables were entered into a regression model to predict TTR.
Results: Longer TTR was significantly associated with older age ($r=.027$, $p<0.001$). Trend level findings were detected with RUCA ($r=0.14$, $p=0.08$) and sex ($r=-0.14$, $p=0.06$), such

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that (at trend) longer TTR was associated with more rural neighborhood status and male sex. Linear regression with TTR as the outcome and predictors of age, sex, and RUCA was significant (R=0.30, R^2=0.09, F=5.33, p<0.01). Age was the only significant predictor retained in the model (*B*=.25, t=3.40, p<0.01).
Conclusions: Mean time to referral among veterans with epilepsy in our sample was 12 years, which is longer than desired but an improvement relative to delays of 18-23 years shown in civilian samples. Longer TTR to an epilepsy monitoring unit was predicted by older age, consistent with previous studies showing that health inequalities are more pronounced among older adults. Reduced access to quality care among older veterans may be related to increase in disability, comorbidities, and physical, cognitive, and sensory limitations. Rates of epilepsy monitoring referrals among older adults may also be lower due to evidence that providers are more reluctant to recommend surgical intervention to older adults. Male sex was shown to be a potential risk factor for increased TTR; females averaged 8.5 years before referral, while the gap for males was closer to 13 years. This may reflect better health literacy and advocacy among females in addition to potential efforts within the VHA system to target women's health. Taken together, we found that access to epilepsy care was largely unimpacted by social determinants in a large VHA hospital. Future studies may assess the structure of the VHA model to identify components that might improve access to quality of healthcare in the general population.
Keywords: epilepsy / seizure disorders**,** minority issues**,** inclusion

2 The Effects of Focal Cortical Dysplasia on General Intelligence and Cognitive Function in Children with Refractory Epilepsy

Lauren M Goedde[1,2], Kelly J Peterson[1,2], Nahal D Heydari[2], Marla J Hamberger[2]
[1]Barnard College, New York, New York, USA. [2]Columbia University Irving Medical Center, New York, New York, USA

Objective: Focal cortical dysplasia (FCD), a type of abnormal cortical development, is one of the most common causes of refractory epilepsy in pediatric patients. Despite its prevalence, research regarding FCD has been relatively sparse due to the level of technology required to detect and study these small cortical abnormalities. However, with recent advancements in both the resolution of magnetic resonance imaging (MRI) and pathological analysis, FCD has become more definitively recognized and diagnosed. Nevertheless, only a few case studies and small case series examining the effects of FCD have been reported, and these tend to focus on "catastrophic" epilepsies. To address this knowledge gap, we conducted a retrospective analysis among children with refractory epilepsy, comparing those with and without FCD. In light of the abnormal cortical development, which essentially defines FCD, we hypothesized that children with FCD would perform more poorly in comparison to non-FCD patients.
Participants and Methods: Neuropsychological test data were part of an NIH-funded prospective study of language function in children with pharmacologically refractory epilepsy. Participants included 112 children, 24 with FCD and 88 non-FCD, determined by either brain MRI (n = 9) or postoperative pathological analysis (n = 15). To meet inclusion criteria, patients had FSIQ ≥ 69 and were native English speakers. Cognitive function was assessed with the following standardized measures: WISC IV, V or WASI I, II, Children's Auditory and Visual Naming Tests (AVNT), and Digit Span. All Naming Test scores were converted to age-referenced z-scores and standardized or scaled scores were used to compare groups on other measures. Multivariate ANOVA and chi-square analyses were used to compare groups on cognitive measures and clinical and demographic variables.
Results: There were no significant group differences in age, age of epilepsy onset, the ratio of females to males, or the number of anti-epilepsy medications (all $p > .05$) Additionally, there were no significant differences in test scores between children with and without FCD (all $p > .05$). In fact, with the exception of borderline Auditory Naming summary scores in both groups, all test scores were within the

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normal range in both FCD and non-FCD patients.
Conclusions: At odds with our hypothesis, children with FCD performed comparably to those without FCD on measures of intelligence, language, and working memory, and in fact, most test scores were well within the normal range. Accordingly, it appears that at least some forms of FCD are not necessarily associated with cognitive dysfunction. This information is important for healthcare providers treating patients with FCD and is reassuring for parents with children diagnosed with FCD. Future work should include larger samples of patients to assess the effects of localization of FCD and examine a wider range of cognitive and psychological functions, such as memory, spatial skills, and mood.
Keywords: epilepsy / seizure disorders**,** language**,** pediatric neuropsychology

3 Elevated Clinical Conditions, Psychiatric Comorbidities, and Suicidality Present in Women Veterans with PNES versus Epilepsy

Erin Sullivan-Baca[1], Yosefa A Modiano[1], Brian I Miller[1], Zulfi Haneef[1,2]
[1]Michael E. DeBakey VA Medical Center, Houston, Texas, USA. [2]Baylor College of Medicine, Houston, Texas, USA

Objective: Despite emerging evidence of sex differences in patients with seizure disorders, there is a dearth of literature on characteristics of women Veterans presenting to the Veterans Affairs (VA) healthcare system for seizure care. The present study explored clinical factors, including co-occurring medical conditions and gynecological history; psychiatric comorbidities and treatment; and history of suicidality to characterize women Veterans presenting to an Epilepsy Center of Excellence (ECoE) within the VA system and determine which characteristics may differentiate women Veterans with psychogenic non-epileptic seizures (PNES) from those with epileptic seizures (ES).
Participants and Methods: All women Veterans diagnosed with PNES (n = 90) or ES (n = 28) following an epilepsy monitoring unit admission at a large VA medical center between 2010 and 2020 were included in the present study, which utilized a retrospective chart review for data collection. T-tests were used to assess group differences for continuous variables and chi-square analyses were used to examine group differences for nominal variables. A logistic regression analysis was conducted including significant variables as predictors to calculate odds ratios of diagnostic group membership.
Results: Results: The ES group was older than the PNES group (47.8 vs. 41.0 years, p = 0.015), but otherwise the two groups did not differ on demographic variables. Migraine (p = 0.044) and history of hysterectomy (p = 0.032) emerged as clinical characteristics differing between PNES and ES, with higher rates in the PNES group (76.7% vs. 57.1% with migraine; 40% vs. 17.9% with hysterectomy). Women with PNES had a greater number of psychiatric diagnoses (2.5 vs. 1.7; p = 0.011) and were prescribed more psychotropic medications (1.8 vs. 1.0; p = 0.001) than those with ES. They were also more likely to have a history of suicide attempts (42.2% vs. 14.3%, p = 0.005) and psychiatric hospitalizations (42.2% vs. 21.4%, p = 0.047). Logistic regression built on these results and revealed women with PNES were 4.5 times more likely to have had a hysterectomy (OR = 4.531, CI = 1.254–16.369, p = 0.021) and 2.2 times more likely to be prescribed more psychotropic medications than those with a diagnosis of ES (OR = 2.195, CI = 1.116–4.318, p = 0.023). Suicidality history also increased the odds of PNES diagnosis by 2.8 times (OR = 2.867, CI = 0.962–8.549, p = 0.059).
Conclusions: Conclusions: Women Veterans with PNES are likely to have complex psychiatric and clinical presentations and differ from those with ES across several factors, including psychiatric diagnosis and treatment burden, as well as risk of suicidality. The reason for the high rate and significant difference in hysterectomy status among women with seizures is unclear, and this result warrants further investigation. Overall, the present work adds to the paucity of literature of women Veterans with seizures and may have implications for decreasing time to

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diagnosis and maximizing treatment interventions.
Keywords: epilepsy / seizure disorders, nonepileptic seizures

4 Neuropsychological Phenotypes in Pediatric Frontal Lobe Epilepsy

William A Schraegle[1,2], Jenna A Chiang[1,2], Julia M Guerin[1,2], Rosario C DeLeon[1,2], Jeffrey B Titus[1,2]
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Objective: To characterize the presence and nature of discrete cognitive phenotypes and their correlates in a cohort of youth with frontal lobe epilepsy (FLE).
Participants and Methods: The study included 51 children and adolescents with FLE (60% male) age 8 to 17 (M=13.43; SD=3.06) who underwent comprehensive neuropsychological evaluation. Patient results were grouped into cognitive domains (language, perceptual, verbal memory, attention, speed, and executive function) based upon their test performance. These factor scores were subjected to Ward's hierarchical clustering method with squared Euclidean distance.
Results: Hierarchical clustering identified three distinct cognitive profiles: (1) normal functioning (31% of sample); (2) language and executive function weaknesses (36% of sample); and (3) attention, response speed, and executive function weaknesses (33% of sample). When considering epilepsy-specific factors, Cluster 3 had a higher rate of patients undergoing presurgical evaluation compared to Cluster 1 (p<.05), and Clusters 2 and 3 had a higher incidence of focal findings on MRI compared to Cluster 1 (p<.05). Patients in Cluster 3 were prescribed more anti-seizure medications than those in Cluster 1 and 2 (p<.05). Interestingly, a prior history of developmental delay was significantly more prevalent in Cluster 3 (40%) in comparison to Cluster 1 (7%) and Cluster 2 (6%) (p<.05). There were no significant differences among the three cluster groups on demographic characteristics or remaining clinical characteristics.
Conclusions: Children and adolescents with FLE present with distinct cognitive phenotypes ranging from broadly average performance to more discrete challenges with either language and executive function or speed, attention, and executive function. Results partially support previous hypotheses highlighting the cumulative neurobiological burden on the developing brain in the context of chronic epilepsy and provide a framework for the cognitive domains most vulnerable to the FLE disease process.
Keywords: epilepsy / seizure disorders, frontal lobes

5 Can Bilingualism Increase Neuroplasticity of Language Networks in Epilepsy?

Alena Stasenko, Adam Schadler, Erik Kaestner, Anny Reyes, Carrie R McDonald
UCSD, San Diego, CA, USA

Objective: Language is represented predominately in the left hemisphere in most neurologically healthy right-handed individuals. Atypical (i.e., bilateral or rightward) language lateralization is more frequently observed in patients with epilepsy, in particular in those with a left hemisphere seizure focus. This is commonly attributed to language re-organization and neuroplasticity that occurs as the result of a left hemisphere lesion. In addition, healthy bilingual individuals tend to show more bilaterally distributed language lateralization than monolinguals, which may also suggest greater plasticity of language networks. To that end, we investigated the combined influence of bilingual language experience and epilepsy on language lateralization. We predicted that bilinguals with temporal lobe epilepsy (TLE) would have greater atypical (i.e., rightward) language lateralization than monolinguals. We also predicted that bilateral language representation in bilingual TLEs would be associated with higher language scores.

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Participants and Methods: A fMRI semantic judgement task was used to determine language lateralization in 25 bilingual and 72 monolingual individuals with left TLE (LTLE; *n* = 27), right TLE (RTLE; *n* = 31), and 40 neurologically healthy controls. Using a fMRI language composite asymmetry score derived from activations in peri-sylvian cortex as the outcome, ANOVAs examined the effect of group (LTLE, RTLE, controls), language status (bilingual, monolingual) and their interaction. Pearson correlations examined associations between language lateralization and performance on standard neuropsychological measures of naming and fluency.
Results: As expected, healthy controls showed greater leftward lateralization relative to LTLE, and bilinguals tended to have weaker leftward lateralization relative to monolinguals. This was qualified by a significant group and language status interaction (η_p^2 = .07) such that bilinguals with LTLE showed more rightward lateralization relative to monolingual LTLE (η_p^2 = .08). This interaction remained significant after controlling for age, sex, and education and was observed across three peri-sylvian regions with medium effect sizes. Finally, for RTLE and controls, typical (i.e., leftward) lateralization was associated with better language ability. In contrast, for LTLE, atypical (i.e., rightward) lateralization was associated with better language ability, and this was a stronger trend in the bilingual group.
Conclusions: Bilingual individuals with LTLE appear to have more atypical (i.e., rightward) language dominance on fMRI. This suggests a synergistic effect of an early life experience and a neurologic insult, which may collectively drive neuroplasticity and re-organization of language in the brain. Our findings are also consistent with studies proposing that bilingualism recruits right hemisphere brain networks due to a greater need for linguistic control or reduced frequency of language use. As rightward lateralization was associated with better language ability, this suggests that bilingualism in TLE may be protective, with could help to mitigate post-operative cognitive decline. Our data underscore the need to consider bilingualism as a cognitive reserve factor in epilepsy and other neurological disorders, and to incorporate bilingualism as an additional predictor of language laterality in a presurgical evaluation.
Keywords: epilepsy / seizure disorders**,** bilingualism/multilingualism**,** laterality

Paper Session 11: Dementia 2

1:00 - 2:25pm
Thursday, February 3, 2022

1 Partial Least Squares Regression Analysis of Alzheimer's Disease Biomarkers, Modifiable Health Variables, and Longitudinal Cognition in Older Adults with Mild Cognitive Impairment

Jessica H. Stark, Kelly J. Hiersche, Alexander N. Hasselbach, Jasmeet P. Hayes, Scott M. Hayes
The Ohio State University, Columbus, OH, USA

Objective: To identify novel relationships between modifiable physical and health variables, Alzheimer's disease (AD) biomarkers, and cognitive change over two years in a cohort of older adults with mild cognitive impairment (MCI).
Participants and Methods: Metrics of cardiometabolic risk (e.g., blood pressure), stress (e.g., cortisol), inflammation (e.g., c-reactive protein), neurotrophic/growth factors (e.g., brain-derived neurotrophic factor), and AD pathology (e.g., plasma tau) were assessed in 126 older adults with MCI from the Alzheimer's Disease Neuroimaging Initiative (ADNI) at baseline (mean age = 74.0; sd =7.6; mean education = 16.0; sd = 2.9). Episodic memory and executive function were assessed at baseline and 2-year follow-up. Partial least squares regression (PLSR), a multivariate technique that defines optimal combinations of variables that best predict an outcome, was used to identify which, if any, of these physiological variables were important in predicting change in a composite score of episodic memory or executive function over 2 years.
Results: The two PLSR models predicted 26% and 34% of the variance in change in episodic memory or executive function respectively at 2-

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year follow-up. Baseline inflammation and AD biomarkers were important in predicting change in both episodic memory and executive function performance over 2 years. Baseline education and brain-derived neurotrophic factor were important in predicting change in episodic memory but not executive function performance at 2-year follow-up. Modifiable cardiometabolic metrics such as blood pressure, triglycerides, and cholesterol were important in predicting change in executive function but not memory at 2-year follow-up. Age was not a significant predictor in either PLSR analysis.
Conclusions: These data-driven analyses suggest that variables associated with cognitive reserve and neuroplasticity may be more predictive of change in episodic memory, whereas variables associated with cardiometabolic function may be more predictive of change in executive function. Thus, interventions targeting cardiometabolic health variables may be more effective in slowing decline in executive function in older adults with MCI. Future research should assess the relative importance of these physiological and demographic variables in preserving breath health throughout older adulthood.
Keywords: aging disorders**,** memory disorders**,** executive functions

2 Monthly At-home Computerized Testing to Detect Cognitive Change in Preclinical Alzheimer's Disease

Roos J Jutten[1], Dorene M Rentz[1,2], Rebecca E Amariglio[1,2], Rachel F Buckley[1,3], Michael J Properzi[1], Paul Maruff[4,5], Michael Yassa[6], Craig E Stark[6], Keith A Johnson[1], Reisa A Sperling[1,2], Kathryn V Papp[1,2]
[1]Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA. [2]Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA. [3]University of Melbourne, Melbourne, VIC, Australia. [4]Cogstate Ltd., Melbourne, VIC, Australia. [5]The Florey Institute of Neuroscience and Mental Health, Melbourne, VIC, Australia. [6]University of California, Irvine, CA, USA

Objective: Alongside the increased focus on characterizing Alzheimer's disease (AD) in the preclinical stage, there is a need to improve the detection of cognitive changes that may emerge during this stage. Computerized cognitive testing has the potential to facilitate this, by enabling standardized administration and data analyses allowing for remote, unsupervised, and more frequent assessments. Higher frequency assessments enable the study of practice effects (PE) that can occur with repeated cognitive testing, and which previously has been shown to provide a meaningful cognitive marker in preclinical AD. Here, we aimed to investigate whether monthly assessments of the Computerized Cognitive Composite (C3) could aid in the characterization of PE in cognitively unimpaired (CU) older adults.
Participants and Methods: N=114 CU individuals (age 77.6±5.0, 61% female, MMSE 29±1.2) from the Harvard Aging Brain Study completed the self-administered C3 monthly at-home on an iPad for over one year. The C3 comprises the Face Name Associative Memory Exam, the Behavioral Pattern Separation Task-Object version, and the Cogstate Brief Battery-One Card Learning Task. At the start of the at-home study, participants also underwent in-clinic Preclinical Alzheimer's Cognitive Composite (PACC) testing, and a subsample (n=72, age=77.8±4.9, 59% female, MMSE 29±1.3) had one year follow-up in-clinic PACC testing available as well. Participants also underwent PIB-PET (0.99±1.6 years within at-home baseline) and Flortaucipir PET imaging (n=105, 0.62±1.1 years within at-home baseline). Linear mixed models were used to investigate C3 performance over time (months) adjusting for age, sex, and education, and to extract individual covariate-adjusted slopes over the first 3 months. Correlations were used to investigate the association between 3-month C3 slopes (covariate-adjusted) and global amyloid burden and tau deposition in the medial-temporal lobe. Receiver Operating Characteristic analysis was conducted to examine how accurately 3-month C3 slopes could identify individuals that would show more than 0.10 SD annual decline on the PACC.
Results: Overall, individuals improved on the C3 over 12 months (β=0.23, 95% CI [0.21-0.25], p<.001), but improvement over the first 3 months

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was greater (β=0.66, 95% CI [0.57-0.76], p<.001) suggesting stronger PE over initial repeated exposures. However, less improvement over 3 months was associated with higher global amyloid burden (r = -.20, 95% CI [-0.38 – -0.01], p=.04), more tau deposition in the entorhinal (r = -.38, 95% CI [-0.54 – -0.19], p<.001) and inferior-temporal cortex (r = -.23, 95% CI [-0.41 – -0.02], p=.03) and annual decline on the PACC (r = .69, 95% CI [.55 – 0.80], p<.001). 3-month C3 slopes showed good discriminative ability to identify >0.10 SD annual PACC decline (optimal cut-off: 0.7, AUC: 90.8% (95%CI [83.9% - 97.7%])), performing better than baseline C3 (AUC: 68.6%, 95%CI [55.3% - 81.8%], p<.001) and baseline PACC performance (AUC: 74.5%, 95% CI [63.1% - 85.9%], p=.02).

Conclusions: While PE commonly occur in CU adults, we showed that diminished PE over monthly repeated computerized testing are associated with AD biomarker burden and predictive of cognitive decline. Our findings imply that unsupervised computerized testing using monthly retest paradigms may provide an examination of lack of practice as a more nuanced way of exploring cognitive change in preclinical AD.

Keywords: computerized neuropsychological testing**,** learning**,** cognitive functioning

3 Normed Versus Raw Hippocampal and Entorhinal Volumes as Predictors of Memory Performance

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Objective: Alzheimer's disease (AD) is associated with reduced hippocampal and entorhinal volume and function, leading to decreased memory performance. However, it is unclear whether to reference hippocampal and entorhinal atrophy by raw volume measurements or age- and sex-adjusted normative values. We aimed to examine associations of raw and normed volume of medial temporal structures (i.e., hippocampus and entorhinal cortex) in relation to memory performance in each AD diagnostic group.

Participants and Methods: We analyzed the ADNI2 (Alzheimer's Disease Neuroimaging Initiative) baseline data of 790 participants (52.0% female) from all diagnostic categories [cognitively normal (CN: n=188, 52.1% female), subjective memory complainers (SMC: n=106, 58.5% female), mild cognitive impairment (MCI: n=345, 44.8% female), AD (n=151, 41.7% female)]. Means and standard deviations were calculated from CN participants' hippocampus and entorhinal volumes using two age groups (below 75 or 75 and above) and sex (male or female). The results were applied to create normed z-scores of hippocampal and entorhinal cortex volumes for the other three diagnostic groups. We conducted linear regressions to examine associations between regional volumes and objective memory [Rey Auditory Verbal Learning Test (RAVLT)] separately for normed and raw volumes. Models with norm volumes accounted for intracranial volume (ICV) as covariates, whereas models with raw volume included additional demographic (age, sex) covariates. All p-values were Bonferroni corrected (q).

Results: Greater normed hippocampal volume was associated with greater RAVLT scores in the AD (t=2.56, q=0.03) and MCI (t=5.49, q<0.001) groups but not in the SMC group (t=-1.13, q=0.78). Raw hippocampal volume was associated with RAVLT score only in the MCI group (t=5.06, q<0.001). In the analyses with entorhinal volume, greater normed and raw volume were associated with greater RAVLT score only in the MCI group (norm: t=5.10, q<0.001: raw: t=4.95, q<0.001). In addition, in the analysis of raw hippocampal and entorhinal volumes, we observed sex was a significant predictor of RAVLT scores in the MCI group (t=-2.88, q=0.01, t=-2.91, q=0.012 respectively).

Conclusions:
While raw hippocampal volumes predicted mem ory performance only in the MCI group, normed hippocampal volumes predicted memory performance across a broader spectrum of AD stages (AD and MCI). Both normed and raw entorhinal volumes predicted objective memory performance only in MCI. Using raw volume of

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both regions allowed for examination of other potentially important factors such as sex differences. Normed volumes of medial temporal structures may be useful for capturing clinically relevant information for diagnostic purposes, whereas raw volumes may be more useful for research investigations of cognitive function in AD.
Keywords: dementia - Alzheimer's disease**,** neuroimaging: structural**,** normative data

4 Predicting Time to Loss of Independence in Alzheimer's Disease

Jessica H Helphrey, Hudaisa Fatima, Allison Parker, Anthony Longoria, Michael Conley, Jeffrey Schaffert, John Hart, Hsueh-Sheng Chiang, C. Munro Cullum, Christian LoBue
UT Southwestern Medical Center, Dallas, TX, USA

Objective: Alzheimer's disease (AD) cannot be prevented or substantially modified and leads to an eventual loss of independent living (LIL). The question often arises as to when patients will likely require full time care following an AD diagnosis, but very little research exists on what factors may be associated with LIL. This study aimed to examine factors that may predict LIL in AD, first with factors that can be gathered during a comprehensive clinical interview at the time of AD diagnosis, and second with the addition of neuropsychological test scores.
Participants and Methods: Using the National Alzheimer's Coordinating Center database, participants age 50 and older with no history of stroke having a clinical diagnosis and autopsy confirmation of AD were selected. LIL was defined as progressing from having no/minimal assistance with complex activities to needing assistance with some/all basic activities. Survival analyses were used to examine which clinical factors and neuropsychological test scores at the time of clinical AD diagnosis predicted time to LIL. For the first model, 13 variables involving demographics (e.g., sex, education, race), clinical features (e.g., age at AD diagnosis), social determinants of health (e.g., marital status), medical history (e.g., composite vascular score), disease characteristics (e.g., incontinence), and neuropsychiatric symptoms (e.g., hallucinations, delusions, disinhibition) were examined as predictors. A second model included all of the significant variables from the first plus neuropsychological test scores in the domains of memory, language, attention, and executive function. Time to LIL was calculated by taking the number of days from the visit of AD diagnosis to the follow-up visit where LIL was documented. For those who did not lose independence prior to death, time from AD diagnosis to the last follow-up visit was used instead.
Results: Among 1,485 participants with AD, 72% (*M* age=77.78, *SD*=10.55) had a LIL on average 3.22 years after clinical diagnosis. Four clinical factors were significant predictors of timing to LIL, with hallucinations (HR=1.72; *p*<.01), delusions (HR=1.35; p<.01), and disinhibition (HR=1.41; p<.01) being associated with more rapid LIL, while older age of AD diagnosis (HR=.97 p<.01) was associated with a slower rate of LIL. When neuropsychological scores were added to the model, lower z-scores on Boston Naming Test (HR=.87; *p*<.01), Category Fluency (HR=.97; *p*<.01), Trail Making Test Part A (HR=.92; *p*<.05) and Part B (HR=.91; *p*=.01), and delayed verbal recall (HR=.86; *p*<.05) were associated with a faster rate of LIL.
Conclusions: Factors easily identified with a clinical interview, such as neuropsychiatric symptoms, were associated with faster time to LIL after AD diagnosis. In contrast, older age at AD diagnosis appeared to be associated with a slower rate of LIL. When considering clinical staging, greater disease severity at time of AD as measured by lower scores on tests of memory, language, attention, and executive function significantly added value in predicting time to LIL. This study identified key clinical and neuropsychological factors that could be useful to examine in future research aimed at developing models to predict duration to LIL after AD diagnosis.
Keywords: dementia - Alzheimer's disease**,** neuropsychiatry

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5 Serum Brain Derived Neurotrophic Factor Interacts with Diabetes Status to Influence Memory and Hippocampal Volume in Older Adults

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Objective: Brain derived neurotrophic factor (BDNF) plays an important role in regulating synaptic activity and plasticity and has been shown to be reduced in patients with type 2 diabetes (T2D) and those with Alzheimer's disease (AD). One area where BDNF is expressed is the hippocampus, and research suggests that serum BDNF levels are positively associated with delayed memory in individuals with T2D. Since T2D increases the risk of cognitive decline and development of dementia, including AD, and several studies have suggested that lower BDNF levels may be a risk factor of diabetic neurovascular complications, we sought to investigate BDNF as a moderator of the effect of diabetes on cognition, hippocampal volume, and temporal lobe white matter hyperintensities (WMH).
Participants and Methods: Older adults without dementia from the Alzheimer's Disease Neuroimaging Initiative (ADNI; N=454 including 49 with T2D and 405 without diabetes) underwent neuropsychological evaluation, magnetic resonance imaging (MRI) exams to quantify hippocampal and WMH volumes, and blood draw to assess serum BDNF. Categorical levels of BDNF were calculated using quartiles, with low BDNF being the bottom 50%. Analysis of variance was used to examine group differences in BDNF level based on T2D status. Multiple linear regression assessed the interaction between T2D status and BDNF on memory recall (on the Rey Auditory Verbal Learning Test), hippocampal volume, and temporal WMH. All models adjusted for age, gender, and cognitive status (i.e., cognitively unimpaired versus mild cognitive impairment). Models also adjusted for education when memory was the dependent variable.
Results: Older adults with T2D showed significantly reduced serum BDNF relative to those without T2D (M=0.17; SD=0.40 versus M=0.28; SD=0.39; p=0.047). There was a significant interaction between T2D status and BDNF on memory recall (p=0.021) whereby, among participants with T2D, there was a significant positive association between BDNF level and memory recall (p=0.044); however, there was no significant association between BDNF and memory among those without T2D (p=0.619). Results also showed significant interactions between BDNF and T2D status on hippocampal volume (p=0.0498 for right; p=0.035 for left). For individuals with T2D, there was a significant main effect of BDNF level on right hippocampal volume (p=0.018); for those without T2D, there was a significant main effect of BDNF level on left hippocampal volume (p=0.017). Lastly, there was no significant interaction between T2D status and BDNF on temporal WMH (p=0.748).
Conclusions: These results suggest that the relationship between T2D and memory may depend on level of BDNF. Specifically, results showed a significant positive association between BDNF and memory in the T2D group, but not the non-diabetes group. This suggests that older adults with T2D may experience decreased BDNF that affects cognition prior to the onset of dementia. Results also showed that the relationship between T2D and hippocampal volume depends on BDNF level. Specifically, in those with T2D, BDNF was significantly positively associated with right hippocampal volume, suggesting that higher BDNF levels may be protective against right hippocampal volume loss. Further research is needed to clarify the role BDNF plays as a potential risk factor for neurovascular complications and dementia risk in T2D.
Keywords: diabetes**,** hippocampus**,** brain plasticity

6 Aspects of Social Relationships as Moderators of the Relationship Between Subjective Cognitive Decline and Cognition

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Objective: Subjective cognitive decline (SCD), shown to increase the likelihood of later dementia diagnosis and cognitive decline in older adults, is increasingly being considered one of the earliest clinical signs of Alzheimer's Disease (AD). Certain lifestyle factors may be protective against cognitive decline in the context of SCD. Social networks and the quality of social relationships have been correlated with higher global cognition in older adults, raising the possibility that these aspects of social relationships may confer reserve or resilience to age-related neurodegenerative disease. Further, it is possible that strong social relationships may moderate the connection between SCD and later cognitive decline. The current study aimed to examine the interactive effects of social network size and social relationship quality, independently, on the relationship between SCD and cognitive decline in a racially and ethnically diverse cohort of cognitively healthy older adults.
Participants and Methods: A total of 506 cognitively healthy older adults (32% Non-Hispanic White, 31% Non-Hispanic Black, 37% Hispanic; mean age=76.08 (SD=5.66)) from the Washington Heights-Inwood Columbia Aging Project were selected for this study. All participants underwent neuropsychological testing assessing memory, language, and visuospatial functioning, and completed a questionnaire assessing SCD at ~18-month intervals. Social relationship quality was measured using one item in which participants were asked to rate the quality of their relationship with the person to whom they felt closest on a 4-point scale from "poor" to "very good". Social network size was measured as the number of individuals (i.e., sum of spouse, children, relatives, and friends) on whom the participant felt they could rely on. Generalized estimating equation (GEE) models were used to examine main and interactive effects of SCD, social network and relationship quality on subsequent rate of cognitive decline. Models were adjusted for demographics (age, education, sex/gender and ethnic racial group).
Results: 313 (70%) participants endorsed SCD. Mean social network size was 9 (range 0-64) whilst the mean relationship quality was 2.82 (range 0-3). GEE models revealed main effects of SCD on overall memory and language abilities (β=-.22 p<.001 SE=.04; β= -.09 p=.006 SE=.03). SCD also associated with faster rates of decline on memory and language abilities (β=-.20 p=.023, SE=.09; β=-.05 p=.004, SE=.02). Social network size had a main effect on language abilities (β=.01 p=.029, SE=.002) but did not associate with the rate of language decline over time. Relationship quality did not associate or predict rate of change in any cognitive domain. Neither social network size nor relationship quality moderated the effect of SCD on cognitive decline.
Conclusions: Findings underscored the predictive utility of SCD for decline in memory and language abilities. Whilst greater social network size associated with better language performance it did not predict slower language decline. These results raise the interesting possibility that social interaction may partially aid language abilities. However, neither social network size nor relationship associated with slower rates of decline nor did they moderated the effect of SCD on future decline. Future studies should include finer grain measures of social relationships and quality to more accurately assess its potential protective effects.
Keywords: social processes**,** memory complaints**,** cognitive functioning

Mid-Career Award Presentation
Presenter: Carrie McDonald

Imaging Brain Networks in Epilepsy: Determining the Neural Basis of Cognitive and Clinical Co-morbidities

1:00 - 2:25pm
Thursday, February 3, 2022

Imaging Brain Networks in Epilepsy: Determining the Neural Basis of Cognitive and Clinical Co-morbidities

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Over the past decade, the conceptualization of epilepsy as a network disorder has revolutionized our approach to the study of seizures, as well as psychiatric and cognitive co-morbidities in epilepsy. Brain imaging has been at the forefront of this movement, shifting the focus from one of identifying epileptic lesions to one defining epileptogenic networks. In parallel, the study of cognitive impairments in epilepsy has shifted from the study of isolated cognitive impairments within epilepsy syndromes (e.g., memory impairments in temporal lobe epilepsy; TLE) to one that emphasizes cognitive and psychiatric profiles within and across epilepsy syndromes—or cognitive phenotyping. In this talk, Dr. McDonald will describe a 15- year NIH-funded program of research using advanced, quantitative structural, functional, and diffusion imaging to characterize the neural substrates underlying cognitive co-morbidities in patients with epilepsy. Her talk will highlight network abnormalities associated with cognitive phenotypes in TLE and describe how these patterns may be useful for identifying patients at risk for progressive cognitive decline. She will also describe network features that predict individualized risk for cognitive decline following epilepsy surgery, as well as possible mechanisms of cognitive reserve. Finally, Dr. McDonald will review the need to consider how patient-specific risk and resilience factors, including bilingualism, can influence brain and neuropsychological profiles and could modify risk for post-operative cognitive decline. Future efforts discussed will include the need to harmonize neuropsychological approaches to cognitive phenotyping for deployment in large-scale, international studies. Such global efforts are essential to determine the reproducibility and generalizability of the current findings, accelerate scientific discoveries, and advance personalized medicine in epilepsy.

Poster Session 08: Cultural | Imaging

1:00 - 2:00pm
Thursday, February 3, 2022

01 TAM Battery: Development and Validation of a Comprehensive Computer- Assisted Test Battery for Testing Cognition of Tamil Speaking Older Adults in India.

Porrselvi A P
Unified Brain Health Care, Chennai, Tamil Nadu, India

Objective: To develop the first comprehensive computer-assisted cognitive test battery- TAM Battery- for testing cognition of Tamil speaking older adults in India.
To standardize the administration and scoring procedures of the test battery.
To evaluate the psychometric properties of the battery.
Participants and Methods: There were two phases to this research, Phase 1 included identifying tests, developing new tests, developing the test battery application and the test administration, and scoring manual. Phase 2 included testing the battery and its psychometric properties in the target population. The development of the TAM battery was in accordance with the prescribed guidelines of the ITC for translating and adapting tests.
Phase 2-

The test battery was administered to 100 cognitively normal subjects (Age:55+ Males:43 Females:57 Education:0-20+) from different regions of Tamil Nadu, India. The battery was again administered to a sub-group of 33 people at t2- 6 months after the first administration. 24 patients with Mild Cognitive Impairment (Age: 55+ Males:11 Females:13 Education:9+) were recruited, to test the clinical and concurrent validity. Concurrent validity was tested against the Clinical Dementia Rating Scale. A neurotypical sample of 19 subjects (Age:18-40 Education:12+) were coached to feign cognitive impairments to test the efficiency of the embedded symptom validity measures.
TAM Battery:
It is a comprehensive computer-assisted battery of neuropsychological tests that is available in multiple Indian languages for testing cognitive function in adults, above 18 years of age. The total time for administration of the battery is 2 hours and 30 minutes for a well-motivated cognitively normal individual. It can provide for tele-evaluation as well as in person testing. The TAM Battery has 15 tests out of which 8 tests are novel or have been uniquely adapted for

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use. All the tests can be used as stand-alone measures with their own population derived norms.
Results: The TAM Battery has shown robust psychometric properties and uses a dynamic data pool which collects normative data and clinical data from every test that is administered using the battery. The Quick Screen Module has proven to be useful for cognitive screening as well as enabling the subjects to familiarize with the testing protocol. The Assessment of Premorbid Cognitive Abilities (APCA) score proved to be a better objective measure of premorbid cognitive function, than traditionally used demographic details. The Figural Memory Test and the Word List Learning Test were the best tests at detecting MCI. The symptom validity measures, especially the Visual Association Test, showed good sensitivity to sub-optimal performance. Test performance showed gradual decline with increasing age, was better with increase in years of formal education and increase in APCA Score. It was worse in monolingual subjects of rural background. The limitation of this ongoing study currently is its small sample size.
Conclusions: TAM battery has proven that such technological advances can be used for assessing individuals irrespective of their proficiency in the use of technology, level of education and sociodemographic background. The possibility of testing cognition with robust psychometric properties on any gadget from any location allows optimal usage of limited quality healthcare resources in India.
Keywords: test development**,** computerized neuropsychological testing**,** cross-cultural issues

02 The Effect of Acculturation on The Cordoba Naming Test in Guatemalans

Isabel C Munoz[1], Abril J Baez[2], Daniel W Lopez-Hernandez[1], Bethany A Nordberg[1], Selina Mangassarian[1], Sarah Saravia[2], Raymundo Cervantes[1], Winter Olmos[1], Mariam Gomez[3], Santiago Espinoza[3], Sarah Fatoorechi[1], Enrique Lopez[1], Pavel Y Litvin[1], Matthew J Wright[1], David J Hardy[4], Alberto L Fernandez[5]
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Objective: The Cordoba Naming Test (CNT) is a confrontational naming test used to evaluate lexical retrieval. Research shows acculturation can influence cognition. Studies have found acculturation influences CNT performance in Mexicans residing in the United States (U.S.). To our knowledge, this is the first study to examine CNT performance in Guatemalans. We predicted Guatemalans residing in Guatemala (GRG) would outperform Guatemalans residing in the United States (GRUS) on the CNT, report higher Spanish acculturation scores on the Abbreviated Multidimensional Acculturation Scale (AMAS), and report lower English acculturation scores on the AMAS.
Participants and Methods: The sample consisted of 32 GRG and 25 GRUS participants. All participants completed the CNT and the AMAS in Spanish. The AMAS consists of six subscales (i.e., English language, U.S. identity, U.S. competency, Spanish language, Latino competency, & Latino identity). An ANOVA using a demographically-adjusted T-score was used to evaluate CNT performance; meanwhile, ANCOVAs, controlling for education and age, were used to evaluate acculturation on the AMAS subscales. Next, Pearson's correlations were used to evaluate the influence of acculturation on Guatemalans' CNT performance. Finally, Stepwise hierarchical regressions were used to identify predictor variables on CNT performance in each Guatemalan group.
Results: We found the GRG group outperformed GRUS on the CNT, p=.038, ηp^2=.08. Next, on the AMAS, results revealed thatthe GRUS group reported higher English acculturation traits compared to the GRG, $p's$<.05, ηps^2=.43-.65. We also found on the AMAS, the GRG group reported higher levels of Spanish language compared to the GRUS group, p=.000, ηp^2=.30.Pearson's correlations revealed significant correlations between all the AMAS predictors, except U.S. identity and CNT performance in the GRG group, $r's$=.35.68, $p's$<.05. Additionally, Pearson's correlations

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revealed that GRUS group Spanish AMAS subscales significantly correlated with their CNT performance, *r*'s=.40-.76, *p's*<.05. Regression results indicate an overall model of four predictors (English language, Latino identity, U.S. competency, and Latino competency) that significantly predict GRG CNT performance, R^2=.670, R^2_{adj}=.635, *p*<.001. This model accounted for 67% of the variance in GRG CNT performance. Finally, the second regression results indicate an overall model of one predictor (Spanish language) that significantly predicted GRUS CNT performance, R^2=.583, R^2_{adj}=.564, *p*<.001. This model accounted for 58% of the variance in GRG CNT performance.
Conclusions: As expected, GRG outperformed GRUS on the CNT. Also, as expected the GRUS group reported higher English acculturation traits on the AMAS compared to the GRG; meanwhile, they only reported lower Spanish language abilities. We also found that language impacted and was the variable that predicted CNT performance between groups, respectfully. Bilingualism may be a possible explanation for why the Guatemalans groups performed differently on the CNT. Research has shown that speaking multiple languages can influence cognition. Guatemalans that immigrated to the U.S. may have integrated and adopted the dominant language (i.e., English) influencing their lexical retrieval performance. Future studies with larger samples sizes is needed to evaluate if lexical retrieval differences exist between Guatemalans that immigrated to the U.S., Guatemalan-Americans, and GRG, and if speaking multiple languages is driving the relationship between Guatemalans.
Keywords: language**,** acculturation
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03 Generating and Testing Neuropsychological Test Norms That are Fair, Reliable and Accurate in a Low- and Middle-income Country.

Hetta Gouse[1,2], Kevin G.F. Thomas[1], Jane C. Masson[1], Michelle Henry[1], John A. Joska[1,2], Lucette Cysique[3], Simin Ling[4], Elaine Ye[4,5], Jun Liu[6,7,4], Reuben N. Robbins[6,7,4]

[1]University of Cape Town, Cape Town, South Africa. [2]Neurosciences Institute, Cape Town, South Africa. [3]University of New South Wales, Sydney, Australia. [4]Columbia University, New York, USA. [5]Smith College, Massachusetts, USA. [6]HIV Center for Clinical and Behavioral Science, New York, USA. [7]New York State psychiatric Institute, New York, USA

Objective: Effective neuropsychological assessment in low- and middle-income countries (LMICs) is hampered by the unavailability of adequate test norms. We evaluated the utility of three types of normative data (US-published norms; uncorrected South African norms; and demographically corrected South African norms [regression-based norms]) in appraising neuropsychological test performance and rates of neurocognitive impairment among people with HIV living in South Africa.
Participants and Methods: 114 HC (aged *M* = 35.44±11.95, range = 18–64 years) and 102 demographically-comparable people with HIV (aged *M* = 33.31±7.46, range = 19–56 years) completed a comprehensive neuropsychological test battery that assessed performance across seven cognitive domains. Scaled scores from US-published norms were transformed into *z*-scores; uncorrected South African norms and demographically corrected South African norms were expressed as *z*-scores using data from the healthy control group. Independent-sample *t*-tests and a chi-square tests assessed between-group sociodemographic differences, as well as differences with regard to neuropsychological test performance outcomes using the different norms. Our main analysis evaluated the utility of these three different methods for generating locally appropriate normative data by examining relative test performance and rates of neurocognitive impairment among people with HIV using *t*-tests and Fisher's exact tests.
Results: On average, HC (*M* = 10.54±1.43, range = 7–13 years) had fewer years of education than people with HIV (*M* = 11.25±1.99, range = 8–14 years, *p* = .003), but there was a good overlap between the two samples. Analyses also detected a statistically significant between-group difference in sex distribution (HC: women = 58 of 114; PWH: women = 83 of 102, *p* < .001), but the gender effect was well represented in the normative HC

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sample (51% female). People with HIV performed significantly more poorly than HC on 14 tests when evaluated against demographically corrected South African norms (versus 9 for US-published norms and 8 for uncorrected South African norms); and significantly more poorly than HC within 5 cognitive domains (versus 4 for US-published norms and none for uncorrected South African norms). Using a Global Impairment Rating, US-published norms estimated more than 95% of all study participants to have cognitive impairment.
Conclusions: In this setting, demographically corrected South African norms derived from locally based healthy control samples were the most robust method to generate locally appropriate normative data. Expansion of this method in other LMICs to create population-appropriate norms will benefit both research and clinical practice.
Keywords: cross-cultural issues**,** normative data**,** HIV/AIDS

04 Demographic Characteristics of the Saint Louis University Mental Status Examination (SLUMS) in a Large Veteran Clinical Sample

Christopher Anzalone[1], Jessica Nicholson[2], Patricia Peruggia[3], Trevor Buckley[3], Brandon Roberg[3]
[1]University of South Carolina, Columbia, SC, USA. [2]Memphis VAMC, Memphis, TN, USA. [3]Columbia VA Healthcare System, Columbia, SC, USA

Objective: Cognitive screener measures are commonly used in clinical settings to make important determinations about cognitive change. There is an increasing scientific literature on how traditional cut-off scores for cognitive screeners may not be appropriate for clinical use in patients who differ in race/ethnicity from the screeners' reference group. This current study examined the characteristics of SLUMS data in a large (N=536) sample of Black (n=153) and White (n=383) veterans in a VA hospital located in the Southern United States.
Participants and Methods: SLUMS data was gathered from retrospective chart review between January 2016 and February 2020. Item level SLUMS data was obtained from review of an electronic note template used by hospital providers in scoring the SLUMS. Clinical indication for SLUMS administration was determined by the individual hospital provider. Race/ethnicity data was also gathered by chart review.
Results: A Mann-Whitney U Test revealed Black veterans (Mdn=18) scored lower than White veterans (Mdn=22) in total SLUMS score (U=21338.5, p<0.00001). These differences persisted when accounting for education by comparing those veterans with a high school education or higher (Black Mdn=18, n=129; White Mdn=23, n=322; U=14734.5, p<0.00001). However, this result was not found in a smaller sub-sample of those with less than a high school education (Black Mdn=16.5, n=24; White Mdn=20, n=61; U=617, p=0.262).
Conclusions: This was the first study to examine factors of race/ethnicity on the SLUMS in a large veteran clinical sample. The results provide evidence that recommended cutoff scores for the SLUMS may not be appropriate for clinical use in veterans that differ demographically from the original reference sample used to derive cutoff recommendations. In the case of the SLUMS, use of recommended cutoffs places VA hospital providers at risk of over pathologizing Black veterans as having a neurocognitive disorder.
Keywords: demographic effects on test performance**,** cognitive screening**,** assessment

05 Education Level and Performance on the Saint Louis University Mental Status Examination (SLUMS) in a Large Veteran Clinical Sample

Christopher Anzalone[1], Jessica Nicholson[2], Patricia Peruggia[3], Trevor Buckley[3], Brandon Roberg[3]
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Objective: Cognitive screening measures are commonly used in clinical settings to make important determinations about cognitive change. It is well established that a person's level of education is associated with performance on cognitive measures. Therefore, many cognitive screeners provide the ability to adjust interpretative results based on the individual's level of education. For example, the SLUMS provides a two-point adjustment to account for differences in SLUMS total score that are likely attributable to differences in education level. The current study examined the impact of education on both item level SLUMS data and total SLUMS score to better characterize the effect of education on this widely used cognitive screener.
Participants and Methods: SLUMS data was gathered from retrospective chart review between January 2016 and February 2020 in a VA hospital located in the Southern United States. A large (N=536) total sample of veterans SLUMS scores was examined. All veterans were age 60 or older, most (n=450) had a high school or greater level of education, and some (n=86) had less than high school level of education. Item-level SLUMS data were obtained from review of an electronic note template used by hospital providers in the scoring of the SLUMS. Clinical indication for SLUMS administration was determined by the individual hospital provider.
Results: A Mann-Whitney U Test revealed veterans with less than high school education scored lower (Mdn=19) than veterans with a high school or greater education (Mdn=22) in total SLUMS score (U=13683.00, p<0.0001). Exploratory item level Chi Square analyses were used to identify test items that are resistant to the effects of veteran education level, in addition to test items with significant relationships between education level and performance.
Conclusions: This was the first study to examine the effects of education on item-level and total SLUMS performance. The results provide evidence suggesting the two-point adjustment permitted for lower education may not be sufficient and that a three-point adjustment may be more appropriate for veterans in the Southern United States. Additionally, the results note the individual item-level questions most sensitive to the effects of education. This study underscores the importance of understanding the impact of education on cognitive screeners in order to avoid over pathologizing people with lower education levels and improve health outcomes.
Keywords: cognitive screening**,** demographic effects on test performance

06 Inhibition and Autobiographical Memory Among a Sample of Bilingual and Monolingual Hispanics

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Objective: The specificity of episodic autobiographical memory (EAM), meaning the episodic richness of memories for unique, personal life events, may be particularly sensitive to age-related cognitive decline and risk for Alzheimer's disease. Most autobiographical memory research on episodic specificity comes from studies with samples that are predominately non-Hispanic white. Virtually nothing is known about EAM specificity in Hispanic individuals. Bilingualism is a cognitive factor that may influence EAM specificity among Hispanics. One potential reason why is that bilingualism may affect executive functions, particularly inhibition, which in turn may influence the types of details generated while recalling EAMs. The present study aimed to 1) reveal whether bilingualism influences EAM specificity in young adult Hispanics and 2) explore the influence of inhibition on EAM specificity in this population.
Participants and Methods: Bilingual (English and Spanish) and monolingual (English only) young adult Hispanics narrated EAMs using the established Autobiographical Interview (Levine et al., 2002), which instructs participants to focus on recalling episodic details of a series of unique events varying in temporal remoteness. Bilingual Hispanics narrated memories in Spanish and English, describing events that happened while speaking one language or the other. Monolingual Hispanics narrated EAMs in English. Using the scoring protocol of the Autobiographical Interview, we evaluated the narratives for episodic and non-episodic

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(semantic and other) detail. We also had both groups complete a computerized version of the color-world inhibition “Stroop” test.
Results: Young adult bilingual and monolingual Hispanics did not significantly differ in episodic or non-episodic detail generation for memories retrieved in English ($p = .18$). Additionally, bilingual Hispanics did not generate significantly more or less episodic and non-episodic details for memories retrieved in Spanish versus English, nor did the detail make-up of their memories retrieved in Spanish significantly differ from the memories retrieved in English by the monolingual Hispanics (p’s $> .65$). However, both bilingual and monolingual Hispanics retrieve more episodic than non-episodic detail while describing EAMs ($p < .001$). Finally, while inhibition did not significantly differ between monolingual and bilingual Hispanics, nor was inhibition correlated with episodic detail generation in either Hispanic group (p’s $> .13$), bilingual Hispanics who generated more non-episodic detail for English memories also tended to have worse inhibition ($r = -.73$, $p = <.001$).
Conclusions: Our findings suggest that young bilingual Hispanics are not more or less likely to describe their EAMs in rich episodic detail, regardless of the language used to recall the memories. However, poorer inhibition may have a specific effect on non-episodic detail generation in bilingual Hispanics, when speaking English. Future directions include examining which language characteristics are driving this inhibition effect among young bilingual Hispanics and examining the relationship between bilingualism and EAM specificity in older Hispanics.
Keywords: memory: normal**,** language**,** cognitive control

07 Physical Activity and Vitamin B12 in Relation to Plasma Markers of Neurodegeneration in Cognitively Normal Older Adult Mexican Americans: A HABS-HD Study

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Objective: Neurofilament light chain (NfL) is a biomarker of neurodegeneration that accumulates in plasma and cerebral spinal fluid as axonal damage occurs. Physical activity and vitamin B12 have beneficial effects on neurocognitive health. However, neither physical activity nor vitamin B12 have been studied thoroughly in populations disproportionately impacted by poorer neurocognitive health in late adulthood such as Hispanics/ Latinos. The present study sought to determine whether physical activity and vitamin B12 relate to NfL among cognitively normal Mexican Americans, and whether cognitively normal Mexican Americans and non-Hispanic Whites differ in NfL concentrations.
Participants and Methods: We used data from the Health and Aging Brain Study - Health Disparities (HABS-HD). Individuals were excluded from our analyses if they had 1) MMSE scores below 25, 2) CDR scores greater than 0, 3) history of stroke, 4) a traumatic brain injury in the past 3 years, 5) current alcohol use disorder, 6) or failed/missing performance validity testing data. Following exclusion of these individuals, 448 cognitively normal Mexican Americans (age 64.17±7.35 years) and 542 non-Hispanic Whites (age 69.73± 8.24 years) remained for analysis. Self-reported physical activity was measured with the Rapid Assessment of Physical Activity (RAPA), which assesses engagement in aerobic physical activity (RAPA 1 score) and stretching and toning activities (RAPA 2 score). NfL and Vitamin B12 concentrations were assessed in plasma samples following standard protocols. NfL was log transformed and categorized into quartiles due to non-normal distribution of residuals.
Separate linear regression models tested the relationship between NfL and physical activity with the RAPA 1 and RAPA 2 scores while controlling for age, body mass index (BMI), and glucose concentrations. A similar approach was used to test the association between vitamin B12 and NfL. To test for ethnic/racial

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differences in NfL, we used a one-way ANCOVA that controlled for age, BMI, and glucose concentrations.
Results: RAPA 1 score, RAPA 2 score, and vitamin B12 were not associated with NfL concentrations among cognitively normal Mexican Americans (*p*s>.05). Between-group analyses with ANCOVA revealed significant differences in NfL between cognitively normal Mexican Americans and non-Hispanic Whites ($F(1, 214) = 16.55$; $p < .001$) such that non-Hispanic Whites had greater concentrations of NfL.
Conclusions: Our results suggest that self-reported physical activity and serum levels of vitamin B12 may not be associated with NfL in Mexican Americans. However, our findings suggest that there are ethnoracial differences in plasma NfL concentrations, a biomarker of neurodegeneration, even among cognitively normal older adults. Future research may benefit by 1) determining whether objective measures of physical activity associate with NfL concentrations; 2) exploring how other dietary related factors beyond vitamin B12 relate to NfL concentrations; and (3) identifying factors that contribute to ethnoracial differences in NfL.
Keywords: aging (normal), diversity

08 Racial Bias in AD prevention: Disparities in Cognitive Scores among Racial Groups

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Objective: The Computerized Cognitive Composite (C3) may provide an efficient assessment of early cognitive impairment to inform early interventions and screening criteria for Alzheimer's disease clinical trials. The C3 battery, which includes the CogState Brief Battery, has components assessing memory, reaction time and aspects of executive function. The battery has little demand for spoken language and may reduce the sociocultural biases of traditional paper-and-pencil tests. It is not well understood how non-White individuals perform across the C3 battery. The goal of this project was to assess cognitive performance on the C3 battery across different racial groups.
Participants and Methods: We examined 4,026 cognitively normal participants at baseline visit (165 non-Hispanic Asian (NHA); 146 non-Hispanic Black (NHB); 3,715 non-Hispanic White (NHW)) with examined Amyloid status from the Anti-Amyloid Treatment in Asymptomatic Alzheimer's Disease (A4) clinical trial. The C3 battery includes the Behavioral Pattern Separation-Object Task (BPXT) which is a memory test with an outcome measure of frequency of correct responses. Additionally, the C3 battery includes the CogState Brief Battery which has the following tests: One Card Learning Task (OCL) is a visual learning test with an outcome measure of accuracy; Identification Task (IDN) is a visual attention test with an outcome measure of reaction time; Detection Task (DET) is a psychomotor test with an outcome measure of reaction time; and the One-Back Task (ONB) is a working memory test with an outcome measure of reaction time. Participants were matched on years of education using a ratio of 2:1 for NHW to NHB and NHA using propensity score matching to the nearest neighbor. Linear models were performed to examine the association of the racial groups and C3 tests, adjusting for years of age, years of education, gender/sex, and Apolipoprotein E (APOE) genotype (e3e3 vs. e2+ vs. e4+).
Results: The NHB group performed significantly worse compared to the NHW group across all C3 tests (BPXT: B=-0.021, SE=0.006, p=0.002; DET: B=0.061, SE=0.009, p<0.001; IDN: B=0.031, SE=0.007, p<0.001; ONB: B=0.044, SE=0.008, p<0.001; OCL: B=-0.041, SE=0.010, p<0.001). The NHB group also performed significantly worse compared to the NHA group across all C3 tests except for BPXT: (DET: B=0.049, SE=0.012, p<0.001; IDN: B=0.037, SE=0.009, p<0.001; ONB: B=0.057, SE=0.011, p<0.001; OCL: B=-0.035, SE=0.013, p=0.008). Finally, the NHA group had a lower correct response rate on BPXT compared to the NHW group (B=-0.021, SE=0.009, p=0.023). Similar results were found in a matched cohort analysis.
Conclusions: The NHB participants performed worse across all of the C3 battery tests compared to the NHW and NHA participants. The NHA participants had a lower response rate

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on the memory task, BPXT, compared to the NHW group, suggesting the C3 battery may not accurately reflect early memory impairment in this population. We conclude that biases within current cognitive evaluations extend to computerized assessments. Culturally sensitive neuropsychological tests, or culturally sensitive norms, are needed to better assess for cognitive impairment in the Black and Asian communities and to ensure more representative samples recruited to early intervention Alzheimer clinical trials.

Keywords: computerized neuropsychological testing**,** ethnicity**,** aging (normal)

09 Spanish Translation and Validation of the Medication Management Ability Assessment: A Teleassessment Study

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Objective: Performance-based functional assessments (PBFAs) objectively assess an individual's capacity in certain activities of daily living and have several advantages over the self- and informant-report measures. However, there is a lack of culturally appropriate PBFAs to measure daily function, particularly those that might be appropriate for telehealth administration. To address this limitation, we translated and validated the Medication Management Abilities Assessment (MMAA) from English to Spanish for use in assessing daily functioning capacity via teleassessment in Hispanic/Latin Americans.
Participants and Methods: Following International Test Commission Guidelines for Translating and Adapting Tests, the study included (1) translation/back-translation, (2) a focus group to refine the translated measure, and (3) a pilot sample for validation of the translated measure. Face validity was demonstrated through a focus group (n=6, age=34.33±12.74, education=17.67±3.27, 83.3% female) of native Spanish-speakers to revise the translation to acceptable contextual and cultural conditions. Construct validity was demonstrated with a multitrait-multimethod approach through a pilot sample (n=90, age=28.33±10.48, education=15.10 ± 4.35, 47.8% education in Latin America, 64.4% female, 92.2% native Spanish-speakers, 62.2% primary Spanish-speakers) that completed a remotely administered psychological and cognitive assessment. Participants in the validation sample completed a battery of self-reported and objective measures of cognitive and functional abilities in Spanish and via teleassessment. Participants were administered several well-validated measures of self-report and performance-based daily functioning, cognition, and health literacy in addition to the MMAA. The MMAA is a standardized PBFA in which examinees demonstrate their ability to plan and carry out a medication regimen of four pseudo-medications, each with different dosage and instructions (e.g., take once daily with food, take twice a day on an empty stomach). For test-retest reliability, participants completed a second assessment within two weeks of their first. All measures utilized in this study, except for the MMAA, were previously validated for use in Spanish speakers.
Results: The test-retest reliability of the MMAA was medium in effect size (r_s = 0.33, p = 0.002) and demonstrated a small practice effect (difference = 1.41, Cohen's d = 0.39, p = <0.001). PBFAs and objective measures of cognition were significantly and positively associated with the MMAA at small to medium effect sizes. The self-report measures of daily function and cognition, as well as measures of health literacy and of premorbid intellectual functioning were not significantly associated with MMAA performance at less than small to small effect sizes.
Conclusions: The hypotheses for establishing convergent and discriminant validity were overall supported by the pilot sample analysis. The present study provides preliminary evidence for the construct validity of a newly translated Spanish version of the MMAA as a performance-based functional assessment measure that can be administered via telehealth. Moreover, our results further expand the potential clinical utility of PBFAs in culturally diverse, Spanish-speaking populations. Future studies should investigate the relationship between the MMAA and medication adherence, neuroimaging,

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biomarkers, and other measures of self-report and performance-based measures of cognition and daily functioning.
Keywords: activities of daily living**,** teleneuropsychology**,** test development
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10 Examination of the Cordoba Naming Test Across Different Latinx Spanish Speaking Adult Population

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Objective: The Boston Naming Test is a common widely used neuropsychological instrument to examine language abilities (e.g., naming or word retrieval). Researchers have used the Boston Naming Test to identify individuals with different clinical pathologies (e.g., brain lesions, Alzheimer's disease). Recently, a new lexical retrieval task was developed in Argentina called the Cordoba Naming Test (CNT). To our knowledge, no study has evaluated CNT performance differences between different Latinx countries. We examined CNT performance between Argentinians, Mexicans, and Guatemalans. It was predicted the Argentinian group would outperform both the Mexican and Guatemalan groups on the CNT.

Participants and Methods: The sample consisted of 20 Argentinians, 50 Mexicans, and 32 Guatemalans. All participants reported no neurological or psychiatric disorders and completed the CNT in Spanish. An ANCOVA, controlling for age, was used to evaluate CNT performance.
Results: Groups were not well not demographically matched (i.e., the Mexican group was older than the Guatemalan group). ANCOVA revealed the Guatemalan group underperformed on the CNT compared to the Argentine and Mexican groups, $p = .000$, $\eta p^2 = .22$.
Conclusions: As expected, the Argentine group outperformed the Guatemalan group on the CNT. Yet, surprisingly, results revealed the Guatemalan group underperformed compared to the Mexican group. A possible explanation for why the Guatemalan group performed worse on the CNT compared to their counterparts is acculturation traits. Further evaluation is needed with bigger sample sizes and Latinx individuals from other Spanish speaking countries (e.g., Costa Rica) to examine what variables, if any, are influencing CNT performance.
Keywords: multiculturalism**,** language
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11 Cognitive Interviewing for Cognitive Tests: Developing a Novel Approach to Adapt Neuropsychological Tests Across Cultures

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Objective: Adapting neuropsychological (NP) tests for culturally diverse and socioeconomically disadvantaged populations in low-and-middle-income countries (LMICs) that lack NP expertise and testing resources is an urgent global need. Some NP tests adapted for LMICs undergo a forward and backward language translation, and, in some instances, content review for language equivalency. Few, if any, tests have been evaluated for examinee acceptability, understandability, and cultural relevance - important considerations when following governing body guidelines established for psychological testing. Furthermore, modern NP assessment increasingly relies on the use of computerized tests delivered on touchscreen devices. Yet, many LMICs have limited access to and experience using computers and touchscreens, further complicating acceptability and usability of tests. Cognitive interviewing (CI) is a well established methodology to analyze how respondents understand, process, and respond to quantitative survey questions to assess item understandability, relevance, and acceptability. It has not been used to assess performance-based NP tests or tablet-based NP tests. Here we describe the development of a novel CI protocol to assist in the adaptation of NeuroScreen, a battery of tablet-based NP tests, for use with adolescents and older adults in Uganda and South Africa.
Participants and Methods: CI methodology was adapted for tablet-based NP tests over a series of meetings between research teams based in the United States, Uganda, and South Africa (N=14 team members). The process of adaptation involved six steps: (1) consult with a CI expert to review CI methods and discuss how to use them with performance-based NP tests; (2) identify appropriate CI questions and probes; (3) draft a CI protocol for NP tests; (4) review the CI protocol with US team and all teams; (5) revise protocol; (6) pilot protocol.
Results: The CI approach chosen for tablet-based NP tests was to assess: comprehension of test instructions; cultural acceptability and sensitivity of test stimuli; acceptability of test time limits; usability of the touchscreen format. Protocols also included retrospective probes for test difficulty level and familiarity, comfort, and ease with the touchscreen format. Two final CI protocols were developed - one for adolescents and one for older adults. The final CI procedure first administers each NP test, then asks retrospective probes about the instructions, stimuli, and usability of the tablet. Laminated screenshots are made available to assist participants in describing their process in completing each test.
Conclusions: CI may be a useful, acceptable, and novel method for adapting NP tests (e.g., NeuroScreen) cross-culturally. Currently, there are no published guidelines on how to adapt and evaluate NP tests for acceptability, understandability, and cultural relevance. This protocol of test evaluation may be utilized both internationally, including in LMICs, and domestically to adapt NP tests, identify and address sociocultural factors that impact examinee understanding of NP tests, and improve cultural relevance of current NP tests delivered through a variety of mediums.
Keywords: computerized neuropsychological testing**,** cross-cultural issues**,** cognitive screening
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12 Assessing Acceptability of Tablet-Based Neuropsychological Tests Cross-Culturally in South Africa and the United States

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Objective: Neuropsychological (NP) tests are increasingly deployed via computer-based technologies, such as touchscreen tablets. Access to these technologies varies across communities and contexts, particularly in resource-limited settings (e.g., low- and middle-income countries [LMICs]). Yet, there is a dearth of research on the acceptability and usability of NP tests deployed on tablets across different contexts. To optimize NP testing for diverse populations, experience with computer-based technologies and taking NP tests on them must be understood. The current study examined experience with computer-based technologies and acceptability of *NeuroScreen*, a short battery of tablet-based NP tests, among people living with HIV in New York City (NY) and Cape Town (CT), South Africa.
Participants and Methods: *NeuroScreen* was administered to 189 NY participants (M_{age}=49.6 years; 56.6% male; 57.7% Black/African American, 29.6% White; $M_{education}$=13 years) and 102 CT participants (M_{age}=33 years; 81.4% male; 100% Black African; $M_{education}$=11 years). After completing *NeuroScreen*, participants completed a questionnaire about experiences with and comfort using computer technologies (i.e., desktops/laptops, smartphones, tablets) and comfort taking the *NeuroScreen* tests. Participants rated their ease of using the *NeuroScreen* tablet (1=very easy to 5=very difficult). They also identified the easiest and most difficult *NeuroScreen* subtests to complete. Chi-square tests of independence tested for group differences.
Results: NY participants were more likely than CT participants to have ever used a computer (96.8% vs. 31.4%, p<.001), smartphone (91% vs. 57.8%; p<.001), and tablet (89.9% vs. 22.5%, p<.001). Of those who had ever used a computer, smartphone, or tablet, NY participants were more likely than CT participants to own a computer (72.7% vs. 21.9%, p<.001), smartphone (91.3% vs. 72.9%, p<.001), and tablet (65.3% vs. 30.4%, p=.001). Most NY (84.1%) and CT (67.6%) participants reported completing the tablet tests was “easy” to “very easy”. When asked which tests, if any, were easiest to complete on the tablet, 93.7% of NY and 100% of CT participants identified at least one test being easiest – a finger tapping-type test among NY (43.4%) and CT (39.2%) participants. When asked which tests, if any, were most difficult to complete on the tablet, 57.1% of NY and 82.4% of CT participants identified at least one task being most difficult – the finger tapping-type test among NY participants (39.4%), and a trail making-type test among CT participants (28.4%).
Conclusions: There were significant group differences on prior experience with computer-based technologies. Participants in NY had more experience with and ownership of technology than participants in CT. Despite these differences, reports on experience with and ease of completing *NeuroScreen* tests were similar. Tablet-based assessments may be acceptable and appropriate in a variety of resource-limited settings, including LMICs, where uptake and use of technology might be low. Attention must be paid to why some tests are more difficult to complete than others on a touchscreen where individual factors (e.g., long fingernails or experience drawing lines on a touchscreen) could affect test performance. Future research should examine if NP test performance is affected by experience with computer-technologies and comfort using them.
Keywords: HIV/AIDS**,** computerized neuropsychological testing**,** technology
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13 Research Engagement Recommendations for Neuropsychological Dementia Disparities Studies in South Asian Immigrant Elders

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Objective: The United States is the world’s top migrant-receiving country, with 40 million

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immigrant residents including nearly 5.4 million of South Asian origin. Among Americans aged 65 years and older, 14% are immigrants; a proportion expected to swell to 25% by 2060. Although foreign-born residents have always been a part of the American fabric, they have received inadequate attention in neuropsychological study, producing significant knowledge gaps in dementia science for foreign-born elderly, especially South Asians. South Asians are at a higher risk for Alzheimer's and related dementia due to the disproportionate burden of diabetes, mid-life hypertension, obesity, smoking, depression, low educational attainment, and physical inactivity that they face. One of the most commonly cited obstacles to neuropsychological research advances in immigrant communities is the lack of engagement models to guide equitable recruitment and retention. The current study interrogates extant dementia science study designs to identify methods and theories that address immigrant dementia disparities to guide recruitment of the initial phase of prospective research program aimed at eliminating dementia disparities in immigrant communities.
Participants and Methods: The immigrant dementia science literature was qualitatively reviewed for empirical examples of successful engagement models and procedures which might be transferable to neuropsychological research. Studies were collected from scientific database searches using keywords to indicate immigration status, South Asian identity and dementia. Studies were coded for focus on neuropsychological assessment, US-based settings, sample size (greater/less than 50) and the presence of distinct methods for targeted recruitment and/or retention of South Asian older adults who immigrated to the US.
Results: The literature search revealed a paucity of US-based studies dedicated to dementia science in South Asian immigrants and even fewer dedicated to neuropsychological assessment. The majority of the dementia studies specific to South Asian immigrant populations were based in other migrant-receiving countries, such as England, Canada and Australia. Further demonstrating how delayed American neuropsychological science is in be to address dementia disparities this population. Nearly all of the dementia studies with large numbers of immigrants from any ethnic group were recruited through large healthcare systems such as Medicare and Kaiser Permanente. Successful engagement strategies in studies using direct recruiting reflected culturally responsive design details such as: congruent staffing (bilingual, ethnicity and/or immigration-status matched), convenient assessment locations (home/local community), family involvement, community partnerships, and explicit efforts to earn participant trust (enhanced transparency, explicit discussion of data usage). These strategies are feasible for neuropsychological studies and are recommended for future studies addressing immigrant dementia disparities.
Conclusions: Neuropsychological study of dementia disparities among South Asian immigrant elders deserves greater attention. The absence of culturally and linguistically competent research engagement methods reflects a major shortcoming in the field, which contributes to the persistence of dementia disparities. Though the body of immigrant dementia disparities literature is small and based primarily in non-US settings, there are effective examples of novel engagement efforts that are transferable to neuropsychology study designs. These culturally & linguistically responsive engagement methods are detailed and recommended to neuropsychological scientists who are committed to addressing and eliminating dementia disparities for South Asian and other immigrants.
Keywords: cross-cultural issues**,** dementia - Alzheimer's disease**,** ethnicity
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14 The Role of Chronic Stress, Interleukin-6, and C-Reactive Protein on Cognition: A HABS-HD Study

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Objective: Identifying lifestyle factors and biomarkers that may be monitored is critical to

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help mitigate poor cognitive outcomes. Recent research has shown that elevated perceived chronic stress helps partially explain the relationship between inflammatory biomarkers and cognition, but this relationship has been underexplored, particularly in individuals of Mexican American backgrounds. We aimed to examine the relationship of stress, as measured by C-Reactive Protein (CRP), Interleukin-6 (IL-6), and the endorsement of chronic stress on cognitive performance.
Participants and Methods: A sample of 765 participants (age = 67.66±8.44; education = 13.01±4.73; 58% female; 52% non-Hispanic White, 48% Mexican American; 31% Spanish-speaking) from the Health and Aging Brain Study (HABS-HD) in Dallas-Fort Worth, Texas was used for analysis. Exclusion criteria included failed performance validity testing, evidence of alcohol use disorder, severe anxiety/depression, and a history of stroke, seizure, or traumatic brain injury with loss of consciousness. A composite of global cognition was derived using principal component analysis of scores from Trails A & B, Logical Memory 1 & 2, Word Fluency, Animal Naming, Spanish English Verbal Learning Test, and Digit Symbol Substitution. Missing data on cognitive tests (0-0.8%) were imputed with the iterative PCA method. Linear regression was used to assess associations of global cognition by CRP, IL-6, and endorsement of chronic stress while adjusting for relevant sociodemographic factors (e.g., age, gender, years of education, ethnicity, interview language, diabetes, hypertension, and dyslipidemia). Augmented backward elimination (ABE) was utilized for model specification in the regression analyses.
Results: ABE resulted in the removal of diabetes, hypertension, and dyslipidemia from the final model due to lack of significance (p-values > .2) and minimal consequence on the estimates of other variables. The final regression model explained a statistically significant proportion of variance ($F_{8,756} = 100.46$, $p = < 0.001$, adjusted $R^2 = 0.51$). The effects of IL-6 (β = -0.037 [-0.090, 0.017]), CRP (β = 0.018 [-0.035, 0.071]) and reported chronic stress (β = 0.029 [-0.022, 0.080]) were not significant. Cognition was positively associated with female gender (β = 0.432 [0.328, 0.535]) and years of education (β = 0.448 [0.375, 0.521]) and negatively associated with age (β = -0.356 [-0.411, -0.301]), Mexican American ethnicity (β = -0.450 [-0.600, -0.300]), and Spanish language (β = -0.214 [-0.389, -0.040]). In bivariate analysis, IL-6 and CRP were positively associated (r = 0.317 [0.252, 0.379]), but endorsement of chronic stress was not associated with CRP (r = 0.005 [-0.066, 0.076]) or IL-6 (r = 0.039 [-0.032, 0.109]).
Conclusions: Results provide evidence in support of the relationship between CRP and IL-6, but not for their impact on cognitive ability. Endorsement of chronic stress was not associated with cognition, CRP, or IL-6, suggesting that the measure might have potential limitations. Other measures of stress such as endorsement of experienced racism/discrimination, neighborhood safety, and early life stress may be more informative. Future investigations should model the longitudinal relationship of IL-6, CRP, and endorsement of various types of stress in culturally and linguistically diverse samples to further elucidate the robustness of the reported associations.
Keywords: cross-cultural issues**,** chronic stress
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15 Where Education is Attained in Ethnically Diverse Immigrants Affects Neuropsychological Test Performance

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Objective: Neuropsychological test norms are developed as a reference point for assessing normal and abnormal test performance (Manly & Echemendia, 2007; Mitrushina et al., 2005). However, these norms are often created without taking into consideration the cultural experiences that influence neuropsychological test performance in ethnically diverse individuals. Currently, there is a lack of guidelines for use in ethnic minorities, despite the United States Bureau of Census estimating that about 50% of the US population will be from a non-Anglo background by the year 2050

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(Census of Population, 1990). The objective of this study was to examine whether where an individual received their education (e.g., within or outside of the U.S.) can significantly influence their neuropsychological test performance.
Participants and Methods: A total of 214 participants were recruited from the greater Los Angeles area. For the purposes of this study, the performance of fluent English speakers from Hispanic, Middle Eastern and Asian ethnic backgrounds were examined. Participants were administered a demographic questionnaire, an acculturation measure and the following neuropsychology (NP) tests: Full Scale IQ (FSIQ), Verbal IQ (VIQ), Performance IQ (PIQ), Vocabulary, Block Design, Similarities, Matrix Reasoning, Trail Making Test A and B (TMT-A; TMT-B), Stroop Test C, Digit Symbol, Digit Span, Phonemic Word Fluency (FAS), Semantic Word Fluency, and Wisconsin Card Sorting Test (WCST) in English.
Results: Multivariate covariate analysis was performed using the neuropsychological outcome scores as the dependent variables, where an individual received their education (inside, outside, or a combination of inside and outside of the U.S.) was used as the independent variable, and age and level of education were used as the covariates. The overall MANCOVA was significant, Wilks Lambda $F(28, 250) = 2.42$, $p < .001$. Follow up ANCOVA analyses revealed significant differences in where an individual was educated in FSIQ, VIQ, Vocabulary, Phonemic Word Fluency, Semantic Word Fluency, and Wisconsin Card Sorting Test. Furthermore, the post-hoc analysis also revealed a similar pattern in that those educated in the U.S. performed better than those who had some education inside and some outside of the U.S. In addition, those who had some education inside and some outside of the U.S. performed better than those who were solely educated outside of the United States on all neuropsychology variables, with the exception of the WCST Total Errors.
Conclusions: The results of this study suggest that beyond the age and actual years of education attained, *where* one received their education plays a significant role in neuropsychological test performance in ethnically diverse individuals. The findings indicate that it is important to consider the effects of education attained within the U.S. on neuropsychological test performance above and beyond the number of years of total education attained.
Keywords: cross-cultural issues**,** neuropsychological assessment
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16 Multicultural and Multidisciplinary Considerations in the Identification of Psychogenic Nonepileptic Seizures: A Case Report

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Objective: Language is one of the most important neuropsychiatric tools in accurately diagnosing patients (Farooq et al., 2015). Further, emotional speech acts may be more common in a person's dominant language (Dawaele, 2010). Multicultural/multilingual neuropsychologists can aide in clarifying diagnoses in patients presenting with psychogenic neurological disorders, such as psychogenic nonepileptic seizures (PNES). This case report illustrates the importance of bilingual/bicultural neuropsychological services in the identification and treatment of PNES in a bilingual (Spanish/English) Latina patient.
Participants and Methods: The patient was a 34- ear-old, married, right-handed, Spanish- and English-speaking female of Central American origin with 12 years of education and a history of epilepsy, borderline personality disorder, major depressive disorder, anxiety disorder, and past substance use. She presented to a specialized cultural neuropsychology program to aid in the assessment of her cognitive and emotional functioning to assist with targeted treatment planning. Regarding epilepsy, she presented reporting 30-minute seizures where she would cry, run in a circle, experience changes in body temperature, and be unable to talk to others. Seizures reportedly occurred two to three times

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per week. At the time of evaluation, she was treated with various antiepileptic medications. She had recently completed MRI, PET, and vEEG (and had had similar procedures in various countries), all within normal limits. Nonetheless, she presented to our team reporting a past diagnosis of a seizure disorder. **Results:** The case report illustrates how to rule out a seizure disorder. The patient was identified to be a balanced proficient bilingual, with testing conducted in her preferred language (English) though she had the liberty to code-switch to her native language (Spanish). Neurocognitively, the patient performed broadly within expectations aside from isolated weakness in one of two visuoconstructional tasks. She also expressed significant psychological turmoil in face-valid questionnaires and objective personality measures. Behaviorally, she was observed to have multiple crying spells during testing without specific triggers, particularly during less cognitively demanding test such as forced-choice memory tests. In various instances, increased emotionality was observed in her native language. She was diagnosed with Conversion Disorder with seizures, Major Depressive Disorder, and Borderline Personality Disorder. Recommendations were presented to a neuropsychologist in a specialized PNES clinic and to the referring neurologist. The patient was recommended to engage in psychotherapy with a bilingual/bicultural clinical neuropsychologist who sought consultation from the evaluators. **Conclusions:** Many patients with PNES receive antiepileptic medication treatment prior to accurate diagnosis. Bicultural and bilingual neuropsychologists play an important role in assisting with diagnostic clarification, particularly when patients bring international records documented in a language other than that of the multidisciplinary team. In the present case, the neuropsychological profile did not display seizure localization, converging with other neurodiagnostics. Instead, the patient reported significant psychological distress (not previously discussed in the medical record), which was addressed in both Spanish and in English during the neurobehavioral interviews conducted. Therefore, her main complaints were attributed to a behavioral and psychogenic etiology.
Keywords: multiculturalism**,** epilepsy / seizure disorders

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17 Adolescents and Youth Mental Health During the COVID-19 Pandemic: The Intersectionality of Race and Gender

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Objective: Adolescence is a developmental period marked by intense maturational (pubertal and cerebral), emotional, cognitive and social changes. This is a lifespan stage when individuals are especially vulnerable to adversity and toxic stress. Social determinants of health, such as adversity associated with social isolation, exposure to racism and violence, poverty and lack of peer and/or family support, are associated with social, emotional, and cognitive difficulties. The COVID-19 pandemic has changed the dynamics of the adolescents and young people lives, resulting in adversities that are added to the increase in social, racial and gender inequalities in Brazil. The aim of the study was to understand the impact of the COVID-19 pandemic on the mental health of Brazilian youth analyzing the intersection of race and gender.
Participants and Methods: This is a descriptive cross-sectional study that uses prospective data collected through standardized and validated scales for the Brazilian context (eg.: Revised Child Anxiety and Depression Scale - RCADS), in addition to semi-structured questionnaires developed for this research. The instruments

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were answered digitally. Participated in the study 311 adolescents (40.2%) and young people (59.8%) between 12 and 25 years (M=18.1, SD=2.5), 81.6% living in poverty contexts. The percentage of people who declared themselves black and brown corresponded to 71.7% of the sample, 22,2% declared themselves white. Regarding gender, about 65% self-declared cisgender women, 31.8% cisgender men, 1% transgender people and 2.3% as binary gender. Of the total, 67.8% lived in the state of São Paulo, 16.6% in the state of Rio de Janeiro and 8.9% in other regions of Brazil.
Results: Among adolescents, 73.6% exceeded the clinical threshold for Generalized Anxiety Disorder (GAD), 58.4% for Major Depressive Disorder, 72.8% for Social Anxiety and 40.0% for Panic Disorder. Obsessive-Compulsive Disorder (OCD) was the most prevalent clinical condition (82.4%). For all disorders analyzed, the study revealed higher prevalence in women. As an example, 85.2% of the women and 52.4% of the men had GAD ($F(3,121)=6.09$, $p<0.01$). Afican brazilian adolescents (61,3%) had higher scores in MDD ($U=885.50$, $p=0.033$). About the young people, severe or moderate symptoms of depression were reported by 66.1% of the participants, with a higher prevalence in women (76.2%) than in men (46.8%, $F(3,179)=5.97$, $p<0.01$). The same epidemiological profile was maintained for severe or moderated symptoms of anxiety, with a prevalence of 47.4% among all the participants, 55.7% among women, and 31.1% among men ($F(3,180)=8.77$, $p<0.01$).
Conclusions: Compared with previous epidemiological studies in the target population, the results of this research point to an increase in the incidence of mental disorders contextualized in the intensification of risk factors associated with the COVID-19 pandemic in Brazil. Risk factors affected the studied population unequally, resulting in higher vulnerability of women and african brazilians youth.
Keywords: adolescence**,** depression**,** cross-cultural issues
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18 Sociocultural Variables and Neuropsychological Test Performance among Chinese and Chinese Americans

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Objective: Review of the extant literature indicated that the roles of cultural and related contextual factors have impactful contribution to neuropsychological test performance of individuals from diverse racial/ethnic and/or cultural backgrounds. Despite growing interest in exploring the relationship between acculturation and neuropsychological test performance in the recent years, there continues to be a paucity of research in this area. Furthermore, existing studies are most prolific with Latinx and African American samples, other ethnic groups have received less attention. While studies on Latinx and African American populations indicated that racial/ethnic disparities in neuropsychological performance can be partially explained by acculturation, little is known regarding the relationship between sociocultural factors and neuropsychological performance among Asian and Asian Americans, specifically Chinese and Chinese American population. To our knowledge, there has been only two published studies to date investigated the relationship between sociocultural factors and cognitive functioning among Chinese and Chinese American, using the same sample. While the result suggested acculturation positively correlated with global cognitive functioning, working memory and verbal memory among this group of Chinese American elders, the significant effect was tapered off after controlling for covariates. Given the rapid changes in U.S. demographics, the dearth of competent cross-cultural neuropsychological assessment tools and limited understanding of the impact of sociocultural variables have pressing implications for upholding the standard of patient care, as well as navigating the relevance and future of neuropsychologist as a profession in the healthcare market. Therefore, current study seeks to examine the relationship between sociocultural factors and neuropsychological test performance among Chinese and Chinese American population.

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Participants and Methods: Eighty-two Chinese international students and Chinese American immigrants were administered a battery of tests utilizing a combination of virtual testing and computerized neuropsychological tests, as well as measures of acculturation, motivation, and mood. The tests were completed in their preferred language, either English or Mandarin Chinese. The participants were further divided into three groups based on their acculturation characteristics. Within-group comparisons were examined, and between-group comparison were conducted with an existing database of white American peers.
Results: Compared to their white American peers, Chinese and Chinese American young adults evidenced better performance on aspects of executive functioning while no group difference was observed on tests of processing speed. On test of nonverbal reasoning, no significant difference emerged in group comparison with one exception: white Americans scored significantly higher than Chinese immigrants who moved to the U.S. at an older age, despite their comparable educational attainments. Furthermore, language-mediated difference was observed on task of simple attention while the difference is attuned on working memory.
Conclusions: Current findings highlighted the important roles of acculturation, immigration context, educational background, and language when interpreting neuropsychological test performance. It further indicated that the relationship between acculturation and neuropsychological test performance among Chinese Americans are distinctive and are not consistent with previous cross-cultural comparisons involving Latinx and African American populations.
Keywords: ethnicity**,** neuropsychological assessment**,** executive functions
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19 Adapting The Montreal Cognitive Assessment (MoCA) For Use With Deaf Older Adults Who Sign In A Clinical Setting: A Multicase Study

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Objective: The limited research regarding the use of cognitive screening measures with deaf adults has primarily focused on translating or adapting existing measures, such as the Montreal Cognitive Assessment, (MoCA; Nasreddine et al., 2005) by eliminating or replacing some or all spoken instructions and items with written cues (Dawes et al., 2019; Parada et al., 2020). A few studies have examined administration of the Mini-Mental State Examination (MMSE; Folstein et al., 1975) with adults in the United States and Europe who use sign language. None of these studies have adapted the MoCA for use with Deaf adults who use American Sign Language (ASL) and administered it in clinical settings to screen for neurodegenerative disorders. This multicase study describes the process of adapting and administering the MoCA to Deaf older adults who use ASL as their primary language. This was a first step in adapting an ASL version of the MoCA for the purposes of determining the feasibility and utility of a linguistically and culturally appropriate and accessible cognitive screening measure that can be used in combination with more extensive neuropsychological evaluation.
Participants and Methods: Four prelingual Deaf older adults (age range = 65- 84 years; 3 females) were administered an ASL version of the MoCA as part of neuropsychological evaluation of neurodegenerative disorders in a clinical setting. Each individual identified ASL as their native language and written English as their second language. MoCA instructions and items were adapted with recognition of the unique aspects of Deaf culture. The adaptation also attempted to account for concerns and standards surrounding the development and administration of cognitive screeners to a population using sign language (Dean et al., 2009: MMSE; Atkinson, et al., 2015; The British Sign Language Cognitive Screening Test).
Results: MoCA total scores for each individual were consistent with performances on other neuropsychological tests, final diagnoses, and severity of symptoms as classified for hearing

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individuals who speak English. The Deaf adult sample appeared to have little to no difficulty comprehending the signed instructions and stimuli. Visuospatial, attention, executive functioning, and abstract reasoning domains were generally intact. Diminished performances on the language, memory, and orientation domains appeared to result, in part, from neurodegenerative processes, rather than the changes to the specific MoCA items.
Conclusions: Performances on an ASL adapted MoCA administered to a clinical sample of Deaf adults suggest that this cognitive screener can be included as part of a comprehensive neuropsychological evaluation of neurodegenerative disorders. However, it is recommended that a formal adaptation be further developed that includes community-based participatory research. It also will be important to include psychometric and normative data from healthy and clinical samples. For neuropsychologists who are not trained or experienced in working with this population and/or are not proficient in ASL, this version of the MoCA can potentially be used with support from certified and qualified interpreters and/or when presented via teleneuropsychology. Additional studies are required to investigate these latter approaches.
Keywords: cognitive screening**,** bilingualism/multilingualism**,** diversity
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20 The Association Between Vigilance and Memory

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Objective: Vigilance is a coping mechanism that some Black Americans develop in response to disproportionate experiences of daily discrimination, and includes proactive thoughts and behaviors to try to prevent being targeted for racial discrimination. Vigilance is a part of the discrimination-stress model that is believed to be linked to poor health outcomes. The link between stress and brain health is well-understood, but we do not know whether vigilance coping style relates to cognitive function. The aim of the current study was to determine the relationship between vigilance and memory.
Participants and Methods: We partnered with 307 middle-age, Black men (n= 114) and women (n=193) who participated in the Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease. Vigilance was measured with a 5-item survey and then categorized as none, low, and high vigilant coping. Memory was assessed with an immediate and delayed word list recall. Covariates included years of education and age. Linear regression models were used to assess the relationship between vigilance and memory across sex/gender.
Results: The majority of Black men (64%) and women (51%) reported high vigilance. Black women demonstrated higher scores on both memory indicators compared with Black men. Age and education were not associated with vigilance measures. Controlling for covariates, there was no relationship between vigilance and performance on measures of immediate (none vs. low vigilance B= -.181 (95% CI: -.8, .46), none vs. high B= .075 (95% CI: -.45, .6)) and delayed recall (none vs. low B= -.31 (95% CI: -.96, .32), none vs. high B= -.13 (95% CI: -.64, .38)) among Black women. There was also no relationship between levels of vigilance and performance among men on immediate (none vs. low vigilance B= .47 (95% CI: -.99, 1.3), none vs. high B= .202 (95% CI: -.44, .84)) and delayed recall (none vs. low B= -0.58 (95% CI: -.92, .8), none vs. high B= .63 (95% CI: -.61, .737)).
Conclusions: This research builds on a study linking vigilance and BMI, which used data from the Chicago Community Health study. Black women and men in the Offspring cohort reported higher vigilance (Women: 51%, Men: 64%), than those in the Chicago study (Women: 30%, Men

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33%). Although there was no relationship between memory and vigilance for Black men and women, the intersectional approach of this study should be replicated in future health disparity studies. Future research should explore the relationship between vigilance and other cognitive health outcomes

Keywords: minority issues**,** memory disorders**,** diversity

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21 A culturally-informed neuropsychological assessment: An illustrative case study of a Vietnamese patient with Dementia with Lewy Bodies

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Objective: To illustrate a culturally-informed neuropsychological assessment with a Vietnamese-speaking patient. A cultural context for understanding the patient will be described based upon pertinent cultural facets identified in Fujii's (2017) ECLECTIC framework (Education/literacy, Culture/acculturation, Language, Economics, Communication style, (perception of the) Testing situation, Intelligence conceptualization, and Context of immigration). Next, accommodations for the neuropsychological assessment will be identified with consideration to the four pillars of the American Education Research Association's (2014) standards for fairness in testing (i.e., testing situation, testing bias, accessibility, and test validity).

Participants and Methods: The patient was a 69-year-old, right-handed, Vietnamese man with 12 years of education referred for a neuropsychological evaluation for a one-year history of memory decline and emotional dysregulation. He was born and raised in Vietnam, was a product of a normal pregnancy, and achieved all developmental milestones within normal limits. He completed the equivalent of high school education in Vietnam, then traveled to Thailand and entered a monastery, where he became a Buddhist monk. He immigrated to the United States in 1992 at the age of 44. Accommodations for facilitating fairness in the testing situation included a clinical interview and assessment completed in Vietnamese. Additionally, select neuropsychological tests with less reliance on English language demands were utilized. The patient's level of acculturation and language proficiency were assessed by examining languages spoken in various settings, participation in social groups, preferred activities and entertainment, and reading materials.

Results: Overall performance revealed significant deficits in visual spatial and constructional abilities and learning and memory. Variability was observed on tests of executive function that ranged from impaired to average. Performance on tests of attention, concentration, and language functioning were relatively intact. The patient also reported visual hallucinations characterized by "shadowy figures," REM sleep behaviors (dream enactment), and parkinsonian features (i.e., slow writing and imbalance). Altogether, the reported disease course, difficulties with managing instrumental activities of daily living (IADLs), emotional dysregulation, and presenting symptoms were most suggestive of a major neurocognitive disorder due to dementia with Lewy bodies.

Conclusions: The final neuropsychological report emphasized the non-standardized test administration, limitations of test interpretation, and conceptualization of diagnostic implications (i.e., medical conditions and cultural beliefs about illness). Limitations of the evaluation, such as lack of standardized measures and appropriate norms were discussed. Lessons learned from the case study and implications for future clinical services will be presented. For example, clinicians should be aware that there are considerable intraethnic variations on the perception of dementia. This variability may

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range from the understanding of dementia via the biomedical model (i.e., dementia syndromes as neurodegenerative processes) versus folk model (i.e., dementia syndromes as byproduct of mental illness such as spiritual possession), with the latter often resulting in underutilization of services and increasing the likelihood of caregiver burden. Therefore, it is critical to explore patients and caregivers' positions on the continuum of acculturation to ensure the delivery of culturally congruent clinical services.
Keywords: dementia with Lewy bodies**,** cross-cultural issues**,** diversity

22 The Wechsler Adult Intelligence Scale, Fourth-Edition, Greek Adaptation (WAIS-IV GR): Normative Data for Elderly Greek Australians

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Objective: In the absence of reliable and valid neuropsychological measures, accurate assessment of culturally and linguistically diverse groups (CALD) is a major challenge facing the Australian neuropsychological community. The aim of this study was to investigate the construct validity and to develop specific reference group norms using the WAIS-IV Greek adaption (WAIS-IV GR) for elderly Greek Australians.
Participants and Methods: A convenience sample of 90 healthy elderly Greek Australians (M = 77.14 ± 4.46; Range = 70-85; 39 Males & 51 Females), with a primary school level of education (M = 5.60 ± 0.68; Range = 4-6) were recruited throughout the Melbourne metropolitan area.
Results: Confirmatory factor analysis indicated that a four-factor solution consisting of the WAIS-IV Index Scores displayed superior fit with significant parameters of acceptable magnitude ($\chi2(29) = 40.07$, $p > 0.05$, $\chi2 /df = 1.38$; RMSEA = 0.065 (90% CI = 0.00–0.11); CFI = 0.94; TLI = 0.91; AIC = 4345.40). Regression modelling showed that age, education and gender linearly predicted between 8% and 27% of the variance of the subtest raw scores. Normative data for all WAIS-IV GR subtests and indices were obtained, in addition to values for the 90% and 95% confidence interval bands.
A comparison of WAIS-IV subtest raw scores between Greek Australians, Greek Nationals, and US samples showed that the application of US data to either Greek group underestimated performance by 1-2 SD's across all subtests. Furthermore, the use of Greek National data in low educated Greek Australian samples showed comparable performances across most subtests, with the exception of verbal subtests, which underestimated performance by 1-2 SD's.
Conclusions: Current findings support the application of the traditional WAIS-IV factor structure to a Greek-Australian sample. The use of US or Greek National WAIS-IV data is not recommended for assessment of long-term Greek immigrants. Differences observed between these samples are likely due to level/quality of education, cultural/linguistic difference, acculturation, and test-taking attitudes. Utilising specific reference group norms for Greek-Australians with limited education will facilitate accuracy of assessment findings and avoid potential underestimation and/or misinterpretation of cognitive impairment.
Keywords: psychometrics**,** cross-cultural issues**,** acculturation

23 Major Experiences of Discrimination and Acculturation Predict Neuropsychological Test Performance in Hispanic/Latinx Young Adults

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Objective: Prior research suggests various sociocultural factors and life course exposures affect neuropsychological test performance (NP). More specifically, psychosocial factors such as perceived discrimination, both racial and other forms, have

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been associated with several adverse psychological and physical health outcomes that have been known to contribute to deficits in cognition. While studies have reported the impact of such factors on NP in minoritized racial/ethnic groups, research on the impact of factors that capture life experiences on NP in the Hispanic/Latinx community has been limited. The purpose of this study was to examine how acculturation, childhood socioeconomic status, and life experience of discrimination, associate with and predict neuropsychological performance in healthy Hispanic/Latinx young adults.
Participants and Methods: A total of 112 Hispanic/Latinx freshman and sophomore university students participated in this study for class research credit. A demographic questionnaire, an adapted version of the 20-item Acculturation Rating Scale for Mexican Americans (ARSMA) questionnaire, and the Major Experiences of Discrimination (MED) questionnaire were administered via Qualtrics. Neuropsychological tests were administered remotely via video conferencing and included animal fluency, letter fluency (FAS), Stroop A, B, and C, the Wisconsin Card Sorting Test (WCST; percent of conceptual understanding), and the adapted MacArthur Scale of Childhood Socioeconomic Status Ladder test (SES Ladder).
Results: Correlational analyses indicated a significant positive relationship between acculturation and both letter fluency (FAS) and category fluency (Animals). There was a positive association between major experiences of discrimination and executive functioning (WSCT). A series of stepwise regression analyses revealed that acculturation was the best predictor of letter fluency (FAS), R^2 = .13, $F(1, 110) = 16.92$, $p < .001$, followed by major experiences of discrimination, R^2 = .18 $F(2, 109) = 12.09$, $p < .001$. For category fluency (Animals), acculturation was the best predictor, R^2 = .04, $F(1, 110) = 4.91$, $p = .03$. Lastly, for the executive functioning (WCST), major experiences of discrimination was the single most significant predictor, R^2 = .24, $F(1, 20) = 6.17$, $p = .02$.
Conclusions: Taken together, these results are consistent with previous literature which indicate that levels of acculturation account for NP. However, they expand our understanding regarding the significant role major experiences of discrimination plays in predicting specific NP in Hispanic/Latinx individuals. Accurately assessing and understanding factors that impact cognitive abilities within diverse populations across the life span can assist in identifying barriers, help inform interventions and aid in reducing health disparities existing within these groups. Altogether, these sociocultural factors may need to be considered in clinical assessment.
Keywords: multiculturalism**,** neuropsychological assessment**,** acculturation
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24 MMSE, MOCA, and Depression in an Elderly Chinese Speaking Population

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Objective: The Mini Mental State Examination (MMSE; Folstein et al., 1975) and the Montreal Cognitive Assessment (Nasreddine et al., 2005) are common neurocognitive screeners in clinical settings with translations made in numerous languages including Mandarin. Existing research has identified a negative correlation between the level of depression and performance on these neurocognitive screeners (Wu et al., 2021). Specifically, studies have identified that level of depressive symptoms impact performance in specific domains such as orientation, memory, abstraction, attention, and language fluency (Del Brutto et al., 2015; Tzang et al., 2015). In contrast, Hao et al. (2017) reported no significant impairment in performance on naming, abstraction, and executive functioning in a sample of older Chinese immigrants with depression. Existing research has also demonstrated different patterns of symptom expression in Asian populations as it relates to depressive symptoms – with greater somatic symptoms reported (Dere et al., 2013; Kalibatseva et al., 2014; Kalibatseva & Leong,

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2011). This pattern is evident in an older Asian sample as well (Dere et al., 2013).
The current study examines domain-based cognitive performance as related to overall depressive symptoms using Mandarin language measures in a sample of an elderly population of immigrants from China living in the Chicagoland area.
Participants and Methods: 23 mainland-born Chinese immigrants, age 65 and above, were recruited from local community centers and Chinese churches through the snowball sampling methods. The MMSE Chinese-Mandarin version, the MoCA v. 7.1, and the Chinese Version Geriatric Depression Scale (GDS-15), translated by Stanford University, were neurocognitive instruments used for this study.
Results: A bivariate Pearson's product-moment correlation coefficient (r) was calculated. The bivariate correlation between GDS and MOCA was not significant, r (23) = .38, P < .001. Likewise, the bivariate correlation between GDS and MMSE was not significant, r (23) = .43, p < .001. Furthermore, analysis on each domain in MOCA showed that there is no significant result between GDS and orientation (r = .42, p = .04), short-term memory (r = .24, p = .28), delayed memory (r = .38, p = .87), attention (r = .13, p = .57), language (r = .37, p = .83), visuospatial (r = .14, p = .54), and abstraction (r = .11, p = .61). Similarly, analysis on each domain in MMSE showed that there is no significant result between GDS and MMSE orientation (r = .28, p = .20), Short-term memory (r = .11, p = .62), delayed recall (r = .20, p = .37), attention (r = .28, p = .20), and language (r = .27, p = .22)
Conclusions: The results in this study are consistent with existing literature that did not find depressive symptoms impacting neurocognitive performance.
Keywords: aging (normal), cognitive screening, depression

25 Cultural and Lingusitic Considerations for Presurgical Assessments in Candidates for Epilepsy Surgery Immigrating from China

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Objective: The extant literature suggests that patients belonging to under-represented ethnic and racial groups are at increased risk of receiving sub-standard care, as compared to their White counterparts. Namely, patients in minority populations have their care managed outside of Level 4 Epilepsy Centers, but rather, by generalists and through ED interventions, resulting in longer lifetime duration of epilepsy, increased reliance on medication management and reduced rates of surgical intervention. Although recent investigations have focused on improving the quality of care delivered to other non-U.S.-born, non-native English-speaking populations with epilepsy (CITE 2-3 papers looking at Spanish speakers), there continues to be a paucity of available literature aimed at optimizing Chinese-speaking immigrant populations. Well-established prognostic indicators (i.e., Wada test findings, fMRI) cannot simply be generalized to speakers of Mandarin and Cantonese, owing to fundamental differences and Western languages, such as its logographic characters and emphasis on tonality. Not surprisingly, there are increased rates of atypical hemispheric language dominance for language (i.e., right hemisphere or bilateral representation) in epilepsy surgery candidates speaking a Chinese language or dialect.
The present case study highlights the potential limitations for reliable and valid data interpretation in a Mandarin-speaking patient undergoing comprehensive pre-surgical evaluation prior to epilepsy surgery.
Participants and Methods: We evaluated a 24-year-old, monolingual Mandarin-speaking male who was born and raised in mainland China, with a seizure onset occurring at age seven secondary to possible meningitis. Cognitive complaints included difficulty with attention, short-term episodic memory, receptive and expressive language. Reported psychiatric symptoms consistent with severe depression due to social isolation and safety concerns.

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Patient completed two sessions of neuropsychological assessment administered in both Mandarin Chinese and English (with assistance of interpreter), followed by Wada. **Results:** Given patient's inconsistent level of educational attainment and the elevated possibility for atypical language dominance in speakers of tonal languages, determination of language laterality using neuropsychological assessment data was inconclusive. Nevertheless, results revealed notable weaknesses in aspects of attention and executive functioning, which likely had a downstream adverse effect in his verbal and visual learning and memory, as well as visuospatial skills. Without the consideration of mentioned confounds, his relative weaknesses resemble to those seen in right-handed individuals with non-dominant hemisphere neuropathology and/or patients with frontal and posterior cortices involvement. Wada finding indicated left hemispheric dominance for language and bilateral involvement for memory functioning; However, there were confounds to this procedure and no fMRI could be conducted given that there was no Mandarin-language protocol available.
Conclusions: Given the dearth in the existing cross-cultural literature, this case study highlighted the need for developing culturally and linguistically salient approach for lateralization and localization of language and memory processing. Without valid and reliable methods, patients from historically under-represented backgrounds are at greater risk for significant post-operative morbidities and decreased chances for seizure freedom. Considering its non-invasive nature, future studies should focus on developing and validating fMRI paradigms, especially in the area of memory representation, among tonal-language speaking populations.
Keywords: epilepsy / seizure disorders**,** cross-cultural issues

26 Neuropsychological Assessment with a Linguistically Diverse Population in United States: A Qualitative Study

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Objective: This qualitative study aimed to gain a better understanding of the complex challenges and nuances of practical experiences with neuropsychological assessment of linguistically diverse populations across lifespan, as well as to inform clinical practice. Despite the emphasis on diversity and multicultural competency training in clinical practice of neuropsychology, little is known about actual assessment practice.
Participants and Methods: Present study utilized qualitative multiple case study design from the social constructivist framework to analyze multiple perspectives and experiences to answer the research question. Present study conducted in-depth, semi-structured interviews with four clinical neuropsychologists. One of the participants also provided a de-identified report on an adult client recommended for diagnostic clarification of neurocognitive functions. The assessment was conducted in English however it utilized neuropsychological tests developed for Spanish-speaking populations and appropriate normative data when possible. All narrative data collected through the interview process were transcribed verbatim, coded, and analyzed using NVivo 12 (Mac) qualitative data analysis software. Initially, the codes were structural in nature, in which a content-based or conceptual phrase represents a topic of inquiry (Saldaña, 2016). Additional coding methods were used to better capture the rich nature of narrative data. Specific assessment practices were coded using descriptive coding, in which each specific instrument information was assigned a code to keep an inventory. In Vivo coding was done when the codes were based on the participants actual words and phrases to reflect personal experience and perspective. Codes with similar meanings or describing similar experiences were grouped across data sources creating categories of emergent themes. Coding memos were used to help reflect on similar codes that emerged from the data and to guide the development of coding families and the final accumulation of codes into the categories. Analytic memos were written following interviews to summarize key ideas and potential questions for follow-up, as well as emerging topics that required further consideration.

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Results: The results reinforced the variability in assessment practice and clinical training. The results of present study propose that the individual's scope of practice including their clinical setting and demographics of their regions significantly impact their ability to access resources. This includes access to translator services and referral source. The majority of research and translation have been conducted in Spanish, as there is a higher need and greater availability of Spanish-speaking providers in the US. Present study highlighted the scarcity of instruments for languages other than English and Spanish and a lack of representation of diverse providers due to several barriers to diversity in the field.
Conclusions: Future research can examine making neuropsychological assessment services available in multiple languages. Future research should also further evaluate the process of helping training programs overcoming various barriers to diversity in the field of clinical neuropsychology.
Keywords: assessment**,** language: second/foreign**,** diversity

27 Examining the Impact of Perceived Discrimination and Social Support on Executive Functioning

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Objective: Perceived discrimination, defined as the experience of unfair treatment on the basis of race, sex, or other characteristics, is associated with negative psychological and physical health outcomes. However, less is known how perceived discrimination influences cognitive performance. In the current study, we examined relationships between perceived discrimination, race, and executive functioning in a sample of healthy adults. Moreover, we explored whether social support moderates the relationship between perceived discrimination and executive functioning.

Participants and Methods: 2925 adults (Mean age = 55 years, SD = 12.18) who self-identified as either Black or White completed a Midlife in the United Sates (MIDUS) visit. The mediating effect of perceived discrimination (in the context of everyday life or during major life events) on the association between race and an executive functioning composite score was tested using PROCESS (Hayes, 2013). Hierarchical linear regressions were conducted to examine the interactive effects of perceived discrimination and social support on executive functioning, with age, education, race, and sex as covariates.
Results: Mediation analyses revealed significant indirect effects of race on executive functioning through everyday discrimination (*ab* = -0.017, 95% CI [-0.031, -0.006]) and major events discrimination (*ab* = -0.042, 95% CI [-0.081, -0.006]). In both analyses, individuals who identified as Black reported greater levels of discrimination (everyday: a = 1.438, $p < 0.001$; major events: a = 1.886, $p < 0.001$), and greater discrimination was associated with lower executive functioning (everyday: b = -0.012, $p < 0.001$; major events: b = -0.022, $p = 0.022$). Additionally, there was evidence that race influenced cognition independent of everyday (c' = -0.795, $p < 0.001$) and major events discrimination (c' = -0.770, $p < 0.001$). Results of hierarchical regressions revealed that greater levels of everyday discrimination [ΔF (1, 2712) = 12.425, $p < 0.001$, $R^2 = 0.377$] were associated with worse executive functioning after adjusting for covariates. Family social support moderated the relationship between major events discrimination and executive functioning [ΔF (1, 2710) = 4.919, $p = 0.027$, $\Delta R^2 = 0.377$]. Partial correlations demonstrated that the relationship between major events discrimination and executive functioning was present for those with low ($p = 0.004$) but not high social support ($p = 0.799$).
Conclusions: Our findings provide evidence that experiences of discrimination can help explain differences in cognitive functioning between different racial groups. In addition, findings suggest that social support may preserve cognitive functioning among those who experience discrimination.
Keywords: cognitive functioning**,** executive functions**,** minority issues

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28 Alzheimer's Disease Plasma Biomarkers Are Not Associated with Subjective Cognitive Decline in a Mexican American Sample: A HABS-HD Study

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Objective: Subjective cognitive decline (SCD), the subjective perception of cognitive difficulty in the absence of objective cognitive impairment, could be indicative of the last stages of preclinical Alzheimer's disease related dementia (AD/ADRD). Increasing evidence has shown that SCD precedes mild cognitive impairment (MCI) by about six years. However, little is known about SCD in AD/ADRD health disparities populations, like Hispanics and Latinos (H/Ls). Use of SCD criteria combined with blood-based biomarkers could be a low-cost, accessible, sensitive means to identify risk for AD/ADRD, especially for H/Ls. We sought to examine how ethnicity is associated with amyloid, tau, and neurodegeneration (ATN) levels and SCD criteria in addition to how well each of these predicts objective cognitive performance.
Participants and Methods: Data from 781 participants were drawn from the community-based Health & Aging Brain Study: Health Disparities (HABS-HD) cohort. We excluded individuals with MMSE scores <25, CDR scores > 0, alcohol use disorder, history of stroke, traumatic brain injury or seizure within three years, and failed/missing performance validity testing. In the remaining sample, 316 identified as Mexican American and 465 identified as non-Hispanic White (NHW).
A cognitive composite score was created using principal components analysis and reflected attention, processing speed, memory, executive functioning, and language abilities. Serum values of amyloid beta 40/42, phosphorylated tau 181, and neurofilament light chain (NfL) were collected as part of the HABS-HD protocol following established guidelines. Subjective cognition was assessed using a questionnaire developed for this purpose (the Subjective Memory Concerns questionnaire). We used linear regression analyses to examine the relationships between these variables after controlling for relevant covariates (age, education, acculturation, socioeconomic status, mood).
Results: Covariates alone accounted for 32.7% of the variance of Subjective Memory Concerns (SMC) total score; $F(7, 732)=52.4$, $p<0.001$. Adding ethnicity slightly improved the model ($\Delta F=9.3$, $p=0.002$). However, ATN variables did not significantly contribute to the model (all ps>0.05). In relation to objective cognition, covariates alone explained 45.4% of variance; $F(7, 732)=88.7$, $p<0.001$. SMC ($\Delta F=7.5$, $p=0.006$) and ethnicity ($\Delta F=28.5$, $p<0.001$) contributed to additional variance. The ATN variables made a small, additional contribution to the model ($\Delta F=3.8$, $p=0.010$). Controlling for covariates, post hoc groupwise analyses by ethnicity showed that SMC was associated with objective cognitive performance in the NHW group ($\Delta F=8.1$, $p=0.005$), but not in the Mexican American group ($\Delta F<0.1$, p=NS).
Conclusions: Our results suggest plasma markers of ATN may not be a predictor of SCD and only a weak predictor of objective cognition in cognitively normal H/Ls. These findings may suggest limitations in the application of SCD criteria to diverse communities, application of the ATN framework in cognitively normal individuals, or a combination thereof. The results also highlight the importance of ethnicity and life factors in the study of AD/ADRD. These effects may make comparisons difficult and may contribute to problems with accurate assessment and diagnosis in diverse communities.
Keywords: cross-cultural issues**,** memory complaints**,** aging disorders

29 The Association Between Aggregate Vascular Risk, Healthcare Access and Utilization, and Cognition Among a

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Nationally Representative Sample of Older Adults

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Objective: Vascular risk factors are common in advancing age and associated with increased risk for cognitive impairment and dementia, including Alzheimer's disease. Many studies focus on individual vascular risk factors (e.g., hypertension, diabetes) in isolation, although multiple vascular risk factors often co-occur and incrementally increase the risk of dementia. Given longstanding systemic and structural inequities, vascular risk factors are more prevalent among Hispanic/Latinx and non-Hispanic Black older adults relative to non-Hispanic White older adults. The current study aims to (1) clarify the association between aggregate vascular risk and cognition across a nationally representative cohort of older adults in the United States and stratified by race/ethnicity and (2) examine whether healthcare access/utilization relates to cognitive functioning among those at elevated vascular risk.
Participants and Methods: Participants were 620 older adults without dementia (84 Hispanic/Latinx, 439 non-Hispanic White, and 97 non-Hispanic Black older adults) from the Health and Retirement Study (HRS) Harmonized Cognitive Aging Protocol. Aggregate vascular risk scores were calculated based on self-reported presence or absence of diabetes, hypertension, high cholesterol, history of stroke, heart disease, and current smoking. If participants had 3 or more of these conditions, they were categorized as having elevated vascular risk. Multiple analysis of covariance models compared low vs. elevated vascular risk groups on cognitive domain scores adjusting for age, sex, education, and depressive symptoms. We also ran these analyses stratified by racial/ethnic group. Additionally, healthcare access and utilization factors were examined to determine if they contributed to cognitive functioning among the subset of participants with elevated vascular risk (n=325).
Results: Elevated vascular risk was associated with poorer global cognition (p = .013) and executive function (p < .001) but not memory, language, or visuospatial abilities (p > .05). These findings remained after excluding participants with a history of stroke. When analyses were stratified by race/ethnicity, elevated vascular risk was associated with poorer executive function among Hispanic/Latinx participants (p=.026; partial h^2 =.062) and non-Hispanic Whites (p=.004; partial h^2=.019). Within non-Hispanic Black participants, elevated vascular risk was not associated with performance in any cognitive domains, though there was a trend toward lower global cognition (p=0.128; partial h^2=.025). When examining healthcare variables, among those who had elevated vascular risk, not having visited a doctor in the last two years (p=.011) was associated with poorer executive function. However, not being able to afford healthcare and having government insurance were not related to cognition (p > .05).
Conclusions: Consistent with previous findings, elevated aggregate vascular risk was associated with poorer global cognition and executive function. When stratified by race/ethnicity, elevated aggregate vascular risk was associated with poorer executive function among Hispanic/Latinx and non-Hispanic White participants, and there was a trend toward poorer global cognition among non-Hispanic Black participants. Given that vascular risk factors are potentially modifiable, they may be useful targets to reduce dementia risk. Future studies should replicate findings with a larger

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group of diverse older adults to further clarify which healthcare variables and other factors contribute to disparities in vascular health and dementia risk.
Keywords: vascular cognitive impairment**,** cognitive functioning**,** ethnicity

30 Lifetime dietary habits contribute to cognitive status in community-dwelling Latin American older adults

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Objective: There is increasing evidence that dietary patterns are an important predictor of cerebrovascular risk factors and related cognitive reserve. While this relationship is typically found in developed nations of Europe and North America, there remain considerable gaps about the dietary patterns and cognition of older adults in Latin America. Healthy diet habits are considered a modifiable lifestyle factor associated with higher life satisfaction, mood status, and brain health, but the interplay of these factors and their association with cognition in late life are not well characterized in community-dwelling Latin American older adults. This study examined the relationship between the consumption of vegetables across the lifespan to cognition in older Costa Rican individuals.
Participants and Methods: Data was collected from a sample of healthy, community-dwelling older adults (n =311, age range 60 – 85 years), enrolled in the Epidemiology and the Development of Alzheimer's Disease in Costa Rica (EDAD). EDAD is an exploratory/developmental research project with the primary aim of assessing healthy aging in rural and urban regions of Costa Rica investigating cognitive functioning, personality and psychosocial domains, physical health, diet, functional ability and physical fitness. Participants completed a self-report questionnaire measuring consumption fre quency of different food groups during various stages of life: childhood, adolescence, young adulthood, adult, middle age, late adulthood, elderly, and old age. For each period, diet-related questions were ranked as never, rarely, once per week, several times a week, almost daily, and daily. We used latent growth curve modeling to look at life course dietary consumption of vegetables in these subjects. Cognitive functioning was assessed with a composite measure of processing speed.
Results: Baseline and growth curve models fit the data well ($\chi 2$ goodness-of-fit > 1.49, $p < 0.01$; RMSEA ≤ 0.08; CFI ≥ 0.94). Higher vegetable consumption throughout the lifespan of healthy Costa Rican older adults was significantly correlated with better speed of processing scores in late life.
Conclusions: Consumption of vegetables has a potential neuroprotective effect and improves antioxidant status due to its high source of vitamins. Improved nutrition is a key factor that underlies longevity of life. In conclusion, consuming vegetables across the lifespan may be a particularly important component within an overall healthy lifestyle for promoting healthy cognitive aging amongst Latin American older adults.
Keywords: aging (normal)**,** diversity**,** information processing speed

31 Neuropsychological Functioning in Older American Indians of the Southwestern U.S.

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Objective: There is a dearth of research on neuropsychological functioning and the validity of assessment measures in American Indian (AI) older adults. The present study sought to

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comprehensively examine neuropsychological functioning in healthy AI older adults, compare performance with a matched White group, identify the impact of cardiovascular risk on cognition, and develop normative data.
Participants and Methods: Ninety participants (45 AIs and 45 non-Hispanic Whites) aged 44 and older (mean age of mid-60s) were matched on age decade, gender, and assessment battery. Participants were enrolled in the Arizona Alzheimer's Disease Center (AADC) database, which also includes data collected from the National Alzheimer's Coordinating Center's (NACC) Uniform Data Set (UDS). Data obtained included demographics, medical history, psychiatric variables, and raw neuropsychological scores. Analyses included ANCOVAs, chi-square, and stepwise multiple regression.
Results: AIs generally had lower performance across all neuropsychological measures compared with matched Whites, even after controlling for education. Performance between groups was most discrepant on several measures of global cognition (MMSE and MoCA), attention (WAIS-III Digit Span Forward and Stoop Color Condition), executive functioning (TMT-B, Stroop Color-Word Condition, WAIS-III Similarities), and language (BNT, AMNART, and WAIS-III Vocabulary), while performance was statistically comparable on measures of memory (WMS-R Logical Memory, Craft Story, RAVLT, and BVMT-R) and visuospatial abilities (WAIS-III Block Design and Judgement of Line Orientation). Regarding language tasks, significant group differences were not found on the MINT, Token Task, or Semantic fluency. The AI group had significantly higher proportions of diabetes and obesity, and overall cardiovascular risk significantly predicted worse performance on the CDR Sum of Boxes for the AI group only. Groups were comparable on the Geriatric Depression Score. Normative data was developed for the AI group, stratified by age decade.
Conclusions: Findings suggest that older AIs perform worse on many neuropsychological measures compared with Whites, even after controlling for demographic variables. This suggests that other factors, including language, culture, educational quality, overall health, socioeconomic status, and level of acculturation may be impacting test scores. Therefore, creation of normative data can be useful when assessing AI older adults in a clinical setting.
Keywords: multiculturalism**,** diversity**,** aging (normal)
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32 Are experiences of discrimination related to linguistic metrics of naturalistic speech in middle-aged adults without dementia?

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Objective: Life-course exposures and sociocultural factors, including experiences of discrimination, shape neuropsychological outcomes and are known to moderate risk of Alzheimer's disease. Linguistic metrics of naturalistic speech have potential as a novel cognitive marker of Alzheimer's disease in its early stages. However, the relationship between measurable characteristics of speech and how they relate to socio-cultural factors must be further explored to make metrics of naturalistic speech a more meaningful cognitive marker with cross-cultural applicability. In this study, we investigated the relationship between perceived discrimination in middle-aged individuals and 14 different linguistic markers of naturalistic speech.
Participants and Methods: Using linear regression models, we analyzed the relationship between the Everyday Discrimination Scale (EDS) log-transformed sum score and 14 linguistic metrics extracted from naturalistic speech samples of 115 middle-aged individuals without dementia from the ongoing prospective US-based Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease. The linguistic metrics were: total number of words, filler words,

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empty words, lexical frequency, type-token ratio, Honoré's statistic, Brunet's index, definite articles, indefinite articles, pronouns, nouns, verbs, determiners, and content words. Models were adjusted for age (mean = 55.8±11.6) and education (<high school (HS)=5, HS=19, >HS=91). We did not adjust for sex (male=50, female=65) or self-reported race/ethnicity (non-Latinx White=50, non-Latinx Black=17, Latinx=48) as these factors may be determinants of experiences of discrimination. Multiple comparisons were corrected for using the Benjamini–Hochberg procedure with false discovery rate (FDR) = 10%.
Results: A higher value on the EDS indicating more perceived discrimination throughout life was related to participants' production of more empty words in their speech (e.g., 'thing,' 'stuff'; β = .041 [.000, .083], p = .050). However, this result did not survive multiple comparison correction across all fourteen metrics, where the results are not strong enough to survive the comparison. EDS was not associated with any of the other linguistic metrics.
Conclusions: If linguistic metrics have the potential to identify early, Alzheimer's disease-associated cognitive impairment, the relationship of these measures to psychosocial function, life stressors, and social determinants of health must be clarified. We did not find strong relationships between a measure of discrimination and linguistic metrics of naturalistic speech. The data may suggest that there is a relationship between experiences of discrimination and production of empty words; however, more research is needed to replicate this finding and to investigate the underlying cognitive mechanisms. Being able to reflect on one's own discriminatory experiences depends on multiple aspects of social identities related to education, sex, gender, and race/ethnicity. Although our analyses are currently limited by sample size, with low power for group comparisons, subgroup analyses across these social identities should be further investigated as the cohort grows. Further examination of long-term effects of social exposures on linguistic metrics of spontaneous speech could help develop cognitive markers of Alzheimer's disease-risk that can be applied in individuals from different cultural backgrounds.

Keywords: cross-cultural issues**,** semantic processing**,** social processes
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33 The Influence of Socioeconomic Status on Parent-Reported Working Memory in Pediatric Cancer Survivors

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Objective: Working memory deficits are a commonly reported late effect of pediatric cancer and are typically assessed using a combination of objective measures and questionnaires. Prior research has demonstrated inconsistent concordance between these two assessment methods, with psychological factors (e.g., stress and mood) identified as moderating variables. However, investigation into the influence of socioeconomic status (SES) on parent-reported child functioning is surprisingly lacking, even though disparities in long-term neuropsychological outcomes continue to disproportionately impact pediatric cancer survivors of lower SES. Therefore, the goal of this study was to determine if parent report of functional working memory in pediatric cancer survivors differs significantly between socioeconomic groups.
Participants and Methods: Thirty-four patients ages 6-17 years with a history of cancer (brain tumor/non-CNS solid tumor) underwent neuropsychological evaluation. Working memory was assessed using Digit Span (DS; WISC-IV/V; WAIS-IV) and the Working Memory subscale from the BRIEF/2 (BRIEFWM). An additional variable was calculated to quantify the difference

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between Total DS (converted to inverted T-scores) and BRIEFWM as an indicator of concordance between measures. SES was estimated for each patient using the median household income for their zip code. Patients were then divided into two SES groups (i.e., "low" versus "medium/high") based on definitions by the U.S. Department of Housing and Urban Development. Group differences were determined by a series of independent-samples T tests.
Results: The low SES (n = 21) group scored lower than the medium/high SES group (n = 13) on all subscales of DS, though these differences did not reach statistical significance. Despite this finding and contrary to expectations, parents of children in the medium/high SES group reported significantly greater working memory concerns in daily life than the low SES group (Low SES $\bar{x}$ = 51.71; Medium/High SES $\bar{x}$ = 64.85; $p < .001$). Additionally, the discrepancy between Total DS and BRIEFWM scores was significantly greater for the medium/high SES group than the low SES group ($p<.01$).
Conclusions: Despite their child's lower performance on DS, low SES parents were significantly less likely to report concerns regarding functional working memory on the BRIEF than higher SES counterparts. Therefore, SES may influence parental perception and reporting of a child's working memory in daily life. This has significant implications for test selection and interpretation when providing neuropsychological services to families from diverse socioeconomic backgrounds. In particular, relying solely on parent-report questionnaires may lead to under-identification of low SES children who have more subtle deficits. This finding will be important to confirm in future studies given that lower SES is associated with barriers to accessing appropriate services to mitigate cognitive deficits. Additional studies with larger sample sizes and more precise measures of SES are indicated, as is determining whether this finding can be replicated when examining other neuropsychological domains.
Keywords: pediatric neuropsychology, cancer, working memory
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34 Generation Y and Z Perceived Workloads on the Cordoba Naming Test

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Objective: A generation is a cohort of people that are born within a certain period of time who share age and experiences. It is important for researchers to examine how age during a certain time period changes the way a group of individuals perceive the world. The Boston Naming Test is a common widely used neuropsychological instrument to examine language abilities (e.g., naming or word retrieval). Researchers have used the Boston Naming Test to identify individuals with different clinical pathologies (e.g., Alzheimer's disease). Recently, a new lexical retrieval task was developed in Argentina called the Cordoba Naming Test (CNT). Furthermore, research shows that self-reported workload correlates with neuropsychological test performance and that estimates of workload provide additional information regarding cognitive outcomes. We examined CNT performance and perceived workloads between Generation Z (born between 1997-2012) and Generation Y (born between 1981-1995) individuals. It was predicted that the Generation

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Y group would outperform the Generation Z group on the CNT. We also predicted the Generation Z group would have higher CNT perceived workloads compared than the Generation Y group.
Participants and Methods: The sample consisted of 49 Generation Z and 25 Generation Y participants. All participants reported no neurological or psychiatric disorders and completed the CNT and the NASA Task Load Index (NASA-TLX) in English. Perceived workload was assessed by the NASA-TLX. Independent samples t-tests were used to evaluate CNT performance and perceived workloads.
Results: We found the Generation Z group underperformed on the CNT compared to the Generation Y group, p=.039, ηp^2=.06. On the NASA-TLX, we found the generation Z group reported higher CNT perceived workloads (i.e., mental demand, temporal demand, effort, frustration, overall perceived workload) compared to the generation Y group, $p's$<.05, ηps^2=.07-.13.
Conclusions: As expected, the Generation Y group outperformed the Generation Z group on the CNT; meanwhile, the Generation Z group reported higher perceived workloads compared to their counterparts. A possible reason for the differences between the groups is their demographic experiences (i.e., Generation Y is older and more educated). To our knowledge, this is the first study that examines different generations' cognitive performance in English. Future studies should examine if other generational factors (i.e., first generation U.S. residents) impact CNT performance.
Keywords: language**,** multiculturalism
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35 Adolescents' Brain Response to Emotionally Salient Information is Associated with Distress Tolerance at Two-Year Follow-Up

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Objective: Distress tolerance (DT), the ability to persist while experiencing perceived affective distress, acts as an emotional regulatory method. Often, disruptions in distress tolerance and emotion regulation play a significant role in elevating one's risk of developing and maintaining psychopathology. Studying emotion regulatory skills during adolescence, a developmental period during which emotion regulation is still largely undergoing prominent developmental changes, may help to identify those at-risk for experiencing impairment when dealing with affective distress later in life. Investigating the neurobiology of emotional processing as it relates to future distress tolerance may provide preceding knowledge for early prevention strategies.
Participants and Methods: This study included 44 healthy 14-19-year-old (mean age = 17.6 years) adolescents. It aimed to investigate how the neurobiology of emotional processing, measured using an Emotional Go-NoGo task, during functional magnetic resonance imaging (fMRI), relates to future ratings of DT at a two ($\pm$ 0.5) year follow-up. The fMRI task consisted of three conditions: two conditions where the target stimuli were either happy or scared faces (emotional Go), with non-target facial stimuli (calm NoGo), and one condition with calm-only faces where Go/NoGo criteria was simply a facial distinction. Youths' capacity to tolerate emotional distress was measured using the self-reported Distress Tolerance Scale. Voxel-wise regression was used to examine the association between brain response (emotional Go vs calm NoGo) and future distress tolerance, controlling for sex, age, and time between visits.
Results: Accuracy and reaction time on the Emotional Go-NoGo task did not significantly relate to DT. Whole-brain analysis results showed a negative association between brain activation and DT, such that greater brain response to emotional stimuli in the left superior parietal lobule and left middle/inferior occipital gyri compared to the calm stimuli was associated with less distress tolerance at follow-up. When separated by emotional context (happy and scared), post-hoc results in these regions confirmed that greater brain response to both happy and scared stimuli were

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independently associated with lower distress tolerance at follow-up.
Conclusions: Difficulties with regulating emotions and lowered distress tolerance are risk factors for a variety of psychopathologies. The current study revealed that during processing of emotionally salient information, altered brain response in regions associated with attentional allocation and visual systems was related to lower distress tolerance in youth at a two-year follow-up. Findings suggest that individuals who allocate more visual and attentional resources to emotionally salient information tend to also display larger challenges with tolerating affective distress at a later time point. These results identify the necessity to improve our understanding of emotional processing during adolescence and how it relates to later distress tolerance, as preventive measures could be implemented prior to the onset of maladaptive emotion regulation strategies.
Keywords: adolescence**,** emotional processes**,** neuroimaging: functional

36 Default Mode Network Synchrony Across Satiation and Cessation in Opioid Use: a Functional Neuroimaging Study

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Objective: Resting state functional connectivity analyses have been used to examine synchrony in neural networks in substance use disorders (SUD), with the default mode network (DMN) one of the most studied. Prior research on DMN synchronicity in SUDs using resting state functional connectivity analysis have generally found less synchrony during use and greater synchrony during cessation, although there has been little research utilizing this method in studies of opioid use. This study examined resting brain activity in treatment-seeking persons who use opioids at two points—when using opioids and when opioid-free—to determine whether the DMN exhibits different levels of connectivity during opioid use and cessation, and whether differences in connectivity predict subsequent relapse.
Participants and Methods: The sample included 11 participants (*M* age = 30.9, *SD*= 4.32) who met DSM-5 criteria for opioid use disorder and initiated buprenorphine treatment following fMRI scans. Seed region functional connectivity analysis of resting-state fMRI data was employed to examine eight nodes of the default mode network in 11 participants who were each scanned twice—once while actively using opioids and once in an early stage of abstinence.
Results: Results showed greater functional connectivity in the DMN when participants were abstaining than when actively using opioids ($t(11)=-1.87$, $p=.045$), with effects appearing to be driven by changes in the right angular gyrus (rAG: $t(10)=-2.77$, $p=.010$) and right medial temporal gyrus (rMTG: $t(10)=-3.79$, $p=.002$). Withdrawal symptom severity was associated with a large proportion of the changes in DMN connectivity ($r= -.421$, $n= 11$, $p= .087$). Pretreatment DMN synchrony was not a significant predictor of treatment outcome.
Conclusions: Findings emphasize the importance of DMN connectivity patterns in early stages of opioid cessation and warrant further longitudinal exploration of the role of DMN associated cognitive processing in relation to abstinence and withdrawal. The finding of greater coherence of default network processing during acute abstinence compared to baseline opioid use as usual might reflect increased self-referential cognitive processing during the experience of withdrawal side effects and drug craving. Thus, greater DMN synchrony may reflect an increased withdrawal-associated endogenous, rather than exogenous, attentional bias. The study suggests that DMN connectivity may be an important objective neuromarker of addiction severity and potentially treatment outcome.
Keywords: neuroimaging: functional connectivity**,** substance abuse**,** neurocognition

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37 The Impact of Mindfulness-Based Interventions On Brain Functional and Structural Connectivity: A Systematic Review

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Objective: Despite the growing popularity of mindfulness-based interventions (MBIs), little is known about the neural connectivity changes that underly the effects of MBI. The aim of our systematic review was to gain a deeper understanding of the working mechanisms of MBI by elucidating the effect of MBI on the complex interactions and anatomical pathways between brain regions.
Participants and Methods: A systematic search was conducted based on the PRISMA guidelines, screening for journal articles on Web of Science, PubMed, and Scopus. The following inclusion criteria were used: 1) peer-reviewed empirical studies published in English; 2) adult population of 18 to 65 years old without meditation experience; 3) standardized and manualized 6- to 8-week MBIs with daily home practice; 4) longitudinal changes in functional and/or structural connectivity from pre- to post-intervention as measured with fMRI and DWI respectively; 5) active or waitlist control condition; and 6) randomized or non-randomized controlled designs.
Results: Eighteen hundred and ten records were identified, of which 57 full-text articles were screened. Ultimately, 11 studies were included in our review. Ten of the included articles described functional connectivity and two studies reported on structural connectivity. Nine of the included studies found functional connectivity changes and one found structural connectivity changes from pre- to post-intervention within the mindfulness group. Four of these studies showed significant group-by-time interaction effects, providing the most powerful evidence for the existence of an effect of MBI on brain connectivity from pre- to post-intervention compared to control groups. More specifically, these studies found increased connectivity between 1) amygdala and regions in the prefrontal cortex, 2) regions in the default mode and frontoparietal network and 3) regions in the salience and dorsal attention network. No significant group-by-time interaction effects for structural connectivity changes have been reported.
Conclusions: Our summary of results indicates that MBI may enhance functional connectivity between various brain networks. On the one hand, enhanced connectivity between attention- and salience-related brain areas might express the capacity to be aware of unfolding experiences. On the other hand, increased connectivity between the default mode and frontoparietal network might be interpreted as an enhanced ability to stay focused. These findings align closely with the definition of mindfulness as the process of paying attention on purpose with a curious, open and accepting attitude and the awareness that arises of unfolding experiences. However, considerable methodological heterogeneity warrants cautious interpretation of the results. More homogenous study designs are needed to elucidate the impact of MBI on the function and structure of the brain.
Keywords: brain function, brain structure
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38 Within-Individual Neural Variability in the N-back Task and its Associations

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with Neuropsychological Measures of Vigilance and Working Memory

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Objective: The current study sought to clarify our understanding of within-individual neural variability (WINV), or moment-to-moment fluctuation in brain signals, which has become a meaningful metric in recent years. Using functional magnetic resonance imaging (fMRI) during a letter n-back task, we first compared WINV patterns within and across regions of interest (ROIs) involved in vigilance and working memory (WM). Because this task involves reading and language processes to decode letter stimuli, ROIs characteristically associated with reading and language were included in analyses. Second, we assessed how WINV patterns in pre-identified ROIs during the in-scanner task translated to behavioral performance on out-of-scanner measures of vigilance and WM.
Participants and Methods: Forty-eight young adults (M_{age} = 22.41, *SD* = 4.47, 25 females) from the Atlanta area completed a letter n-back task in an MRI scanner, and neuropsychological measures of vigilance (Digit Span Forward (DSF)) and WM (Digit Span Backward (DSB), Auditory Consonant Trigrams (ACT)) outside the scanner. To compute WINV, operationalized as the standard deviation (SD) of the BOLD signal across task runs, we first regressed out white matter, cerebrospinal fluid, and motion parameters from voxel time series, concatenated time series across runs for each stimulus type (each n-back type and crosshair), and then calculated the SD of the concatenated time series for each stimulus type. Masks were then created to quantify levels of WINV in each ROI. Separate PLS regressions were run for vigilance (0- and 1-back combined WINV map and DSF) and for WM (2- and 3-back combined WINV map and DSB and ACT) to examine the relationship between WINV in the ROIs and performance on neurocognitive measures of vigilance and WM.
Results: In several of the WM ROIs, WINV was significantly greater for 2-back *versus* 0-back trials with medium effect sizes (Cohen's *d* range: .57-.77), and significantly greater for 3-back *versus* 0-back trials with small to medium effect sizes (Cohen's *d* range: .40-.76). For vigilance, WINV was significantly lesser for 0-back trials *versus* crosshair in one ROI (Cohen's *d* = .52). There were no significant differences in WINV for the 1-back *versus* crosshair contrast. PLS analyses demonstrated that WINV in frontoparietal regions and reading/language regions (left inferior frontal gyrus, left occipito-temporal cortex) during the vigilance and WM trials helped explain behavioral performance on DSB, ACT, and DSF.
Conclusions: During the n-back task, we observed greater WINV during WM trials and lesser WINV during vigilance trials. Greater WINV during the n-back task in WM trials was associated with better performance on DSB and ACT, supporting the notion that greater WINV is advantageous for cognitive flexibility, a component of WM. Greater WINV during vigilance n-back trials was correlated with better performance on DSF, though prior literature postulates that greater WINV results in worse in-scanner vigilance performance. Current findings suggest this relationship may not extend to out-of-scanner performance. Involvement of reading/language regions highlights that classic measures of vigilance and WM are reliant on processes supporting reading and language, an important consideration when evaluating vigilance and WM abilities in healthy and clinical populations.
Keywords: neuroimaging: functional**,** working memory**,** attention
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39 Investigating Tau Pathology in Gray Matter Regions via Diffusion MRI

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Objective: Alzheimer's disease (AD) is a neurodegenerative disease characterized by accumulation of amyloid-β and hyperphosphorylated tau proteins. Despite neuroimaging advancements, early microstructural changes in AD pathology remain controversial. Diffusion MRI, a more sensitive indicator of microstructural alterations than standard volumetric techniques, has increased the number of imaging studies in AD. However, research involving diffusion MRI is limited to white matter (WM). In recent pathological studies, researchers suggest that the microscopic changes in cerebral gray matter (GM) predate the macroscopic changes observed in WM during AD progression. This experiment utilizes a diffusion MRI metric, mean diffusivity (MD), to test whether the microstructural integrity of GM regions directly connected to the entorhinal cortex, one of the regions with early tau deposition, is associated with tau burden in the entorhinal cortex. We hypothesized that the tau-MD correlation would be stronger in connected GM regions closer than further from the entorhinal cortex. The overarching goal of this project is to determine the potential of MD as a plausible quantification of GM microstructure and as a possible candidate for early detection of AD pathology.
Participants and Methods: 27 participants recruited from the Reference Ability Neural Network and the Cognitive reserve studies were invited to the current study. 26 (mean age: 62.04 ± 6.96 years, 16 female) of the 27 were included in the analysis with one subject excluded due to extremely distorted diffusion MRI data. We preprocessed and analyzed the obtained diffusion MRI after diffusion tensor imaging (DTI) processing and fiber tractography to establish white matter tracts directly connected to the entorhinal cortex. Spherical ROIs created at the endpoints of entorhinal tracts overlapping with GM maps provided quantification of GM MD at GM regions directly connected to the entorhinal cortex. GM MD were measured at 2 distances from the entorhinal cortices, 20 and 60 mm, in order to test whether the tau-to-MD association gets weaker with further distance from the entorhinal cortices. Linear regression was used to determine whether there was a significant correlation between GM MD and tau pathology.
Results: A partial correlation was run to determine the relationship between the GM MD in ROIs measured at 20mm and 60mm from the entorhinal cortex and tau burden within the cortex whilst controlling for age and sex. Partial correlation shown a moderately negative partial correlation ($r = -0.411$, $df=22$, $p = 0.051$) between tau burden in the left entorhinal cortex and the GM MD at 20mm. However, the tau-to-MD association for all other ROIs produced no significant relationship (L| 60 mm $r = 0.016$, R| 20 mm $r = 0.097$, 60 mm $r = 0.157$, all $df=22$, $p > 0.05$). The associations in the let hemisphere was supportive of our hypothesis that tau-MD associations were stronger for 20 than for 60mm GM regions, but not supported by the associations in the right hemisphere.
Conclusions: This study demonstrated that the tau-to-MD association is potentially weaker with further distance from a tau burden region, suggesting that the MD metric is a plausible quantification of tau pathology.
Keywords: dementia - Alzheimer's disease

40 The Relationship Between Within-Individual Neural Variability During the N-Back Task and Neuropsychological Measures of Processing Speed

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Objective: Functional magnetic resonance imaging (fMRI) literature has focused on the importance of average brain activation patterns – that is, averaging blood oxygen level-dependent (BOLD) signal across a time course to extract "signal" from "noise." However, the brain's natural state is inherently variable, so variability in BOLD signal may be meaningful. Recent work exploring within-individual neural variability (WINV) during a letter n-back task – a task that assesses vigilance and working memory (WM) – supports the importance of WINV in cognitive processes. Although processing speed contributes to vigilance and WM, the relationship between processing speed and WINV during the n-back task remains

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unexplored. This study (1) investigates how WINV during the n-back task, within regions of interest (ROIs) pertaining to vigilance, WM, reading, and language, relates to out-of-scanner processing speed abilities and (2) identifies the ROIs in which WINV helps explain processing speed performance.
Participants and Methods: fMRI data was collected while 48 healthy, young adults (M_{age} = 22.41, *SD* = 4.47, 25 females) from the Atlanta area completed the n-back task (0-back, 1-back, 2-back, and 3-back trials) in an MRI scanner. Participants were also administered two measures of processing speed: the Oral Symbol Digit Modalities Test (OSDMT) and the Written Symbol Digit Modalities Test (WSDMT). fMRI data was processed in AFNI, and WINV was calculated as the standard deviation (SD) of the BOLD signal. ROI maps, consisting of 10 pre-identified ROIs, were concatenated across vigilance (0-back and 1-back) and WM (2-back and 3-back) trials. Partial least squares (PLS) regressions (for vigilance and WM trials separately) were used to analyze relationships between WINV and processing speed performance.
Results: Increased variability in both the vigilance and WM trials of the n-back task was associated with decreased oral *and* written processing speed scores, measured separately by the OSDMT and WSDMT. The correlation (r = .47, p < .001) between vigilance WINV and processing speed was best explained by WINV in the medial posterior parietal cortex (PPC), lateral PPC, left inferior frontal junction (IFJ), left inferior frontal gyrus (IFG), and left occipito-temporal cortex (OTC). The correlation (r = .63, p < .001) between WINV in WM trials and processing speed was explained by WINV in the left dorsolateral prefrontal cortex (PFC), left ventrolateral PFC, anterior cingulate cortex (ACC), dorsal inferior parietal cortex, right cerebellum, left IFJ, left IFG, and left OTC.
Conclusions: Results reveal that increased WINV is associated with decreased oral and written processing speed. This inverse relationship suggests that increased WINV may thwart efficient processing, leading to decreased processing speed in healthy young adults. Results also suggest that various reading and verbal fluency ROIs (e.g., IFG, OTC) contribute to performance on processing speed measures, highlighting that language and reading level might affect performance on these processing speed tasks. Next steps will explore specific processing speed ROIs to understand the role of WINV in processing speed more precisely. Future studies can extend these analyses to clinical populations to begin exploring whether WINV is adaptive or maladaptive for processing speed in different conditions.
Keywords: information processing speed , neuroimaging: functional
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41 Physical Activity Moderates the Association Between Executive Function and Anti-Correlated Networks in the Aging Brain

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Objective: Physical activity and fitness have been shown to be neuroprotective in the aging process, but the exact mechanisms underlying this neuroprotection need to be further evaluated. While several studies have examined the associations between physical activity and functional connectivity, the impact of physical activity and fitness on the functional connectivity of key brain networks that are anti-correlated in the aging brain is unknown. The strength of anti-correlations is related to cognitive performance across the lifespan. The purpose of the current study was to evaluate the influence of physical activity and fitness on the association between executive function and the anti-correlations between the Default Mode Network (DMN) and Dorsal Attention Network (DAN).
Participants and Methods: Participants were 51 older adults (M = 73 years; SD = 6.12) enrolled in a study where they participated in neuropsychological testing, physical activity and fitness measurements, and magnetic resonance imaging (MRI). Physical activity was calculated as average number of steps in one week and intensity of exercise (Moderate/Vigorous Physical Activity; MVPA) using an accelerometer. Physical fitness

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was measured using the 6-minute walk test (6MWT). Executive function was measured using a composite of scaled scores from the Delis-Kaplan Executive Function System (DKEFS). ROI-to-ROI analyses were conducted in the CONN toolbox and the anti-correlation between the medial prefrontal cortex (DMN ROI) and left intraparietal sulcus (DAN ROI) for each participant was extracted. To test the moderating effect of physical activity and fitness on the association between DMN/DAN anti-correlations and executive function, a moderated regression analysis was used. **Results:** Results of the regression analyses using physical activity and fitness variables indicated no significant effect of DMN/DAN anti-correlations on executive function. Steps ($F(2, 44) = 8.027$, $\Delta R^2 = .255$, $p < .001$), MVPA ($F(2, 44) = 3.318$, $\Delta R^2 = .118$, $p = .046$), and the 6MWT ($F(2, 48) = 4.241$, $\Delta R^2 = .140$, $p = .007$) were significantly positively associated with executive function. The interaction between DMN/DAN anticorrelations x steps ($F(3, 43) = 7.230$, $\Delta R2 = .068$, $p = .042$) and DMN/DAN anti-correlations x 6MWT ($F(3, 47) = 8.113$, $\Delta R2 = .191$, $p = .001$) were significant, and further probing suggested that for individuals with the lowest levels of DMN/DAN anti-correlation, higher physical activity and fitness was associated with greater executive function. **Conclusions:** All measures of physical activity and fitness were significantly positively associated with executive function, indicating that increased physical activity and fitness were related to better executive functioning performance. Moderation results indicated that both steps and the 6MWT moderated the association between DMN/DAN anti-correlations and executive function such that for those whose brains were less optimally anti-correlated, greater steps and fitness was associated with greater executive function performance. Taken together, these results indicate that that physical activity might impact both the functioning of the brain and cognitive outcomes, further supporting the use of physical activity as an intervention in aging.

Keywords: aging (normal), executive functions, connectomics

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42 Association of Cortical Microstructure with Cognitive Performance Among Cognitively Unimpaired Adults

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Objective: Due to the irreversible nature of neurodegeneration, effective treatment or prevention of age- and disease-related atrophy will need to be initiated prior to substantial tissue loss. Commonly used brain measures such as cortical thickness assess macrostructural properties that may not be sensitive to subtle neurodegeneration in these early stages. We and others have previously shown that conventional diffusion-based measures of tissue microstructure (e.g., cortical mean diffusivity) may predict conversion to mild cognitive impairment earlier and more accurately than macrostructural measures. Advanced diffusion techniques can better characterize the source of the diffusion signal by decomposing it into restricted, hindered, and free water compartments. In cortical gray matter, these components may reflect signal from neurites and small cell bodies, large cell bodies and extracellular spaces, and cerebrospinal fluid (CSF), respectively. Here we examine whether these microstructural measures are associated with cognitive performance across multiple domains during a period when age- and disease-related processes may have increasing impact on brain and cognitive health. **Participants and Methods:** We analyzed data from 389 men (mean age 67.6, range 61.4–71.7) who participated in wave 3 of the Vietnam Era Twin Study of Aging (VETSA). All participants completed an extensive neuropsychological battery and an MRI scan. Cognitive factor scores were calculated across the domains of episodic memory, executive function, working memory, verbal fluency,

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visuospatial ability, and processing speed. Analyses were restricted to cognitively unimpaired individuals. Restriction spectrum imaging (RSI), an advanced multi-shell diffusion technique, was used to characterize cortical microstructure, modeling diffusion in restricted, hindered, and free water compartments. Associations between cognitive performance and total diffusion within each compartment were examined for bilateral averages of 34 cortical ROIs defined by the Desikan-Killiany parcellation. As a sensitivity analysis, we also examined whether cognitive performance was associated with cortical thickness in the same regions.
Results: A number of regions spanning frontal, parietal, and temporal cortices demonstrated associations with RSI measures that survived FDR correction. In particular, higher cognitive performance in all domains except verbal fluency was associated with a higher hindered diffusion signal fraction and a lower free water signal fraction. Higher executive function, working memory, visuospatial and processing speed performance were also associated with a higher restricted diffusion signal fraction in lateral temporal and posteromedial cortices. Examining unthresholded maps revealed similar spatial patterns of effects across domains, suggesting that differences in cortical microstructure were associated with domain-general cognitive performance. Higher cortical thickness was only associated with better performance in the visuospatial and episodic memory domains.
Conclusions: Patterns of decreased restricted and hindered signal fraction, as well as increased free water signal fraction, may reflect a reduced volume of neurites and cell bodies, and a corresponding increase of CSF signal as cellular barriers along the cortical mantle breakdown. This pattern of brain microstructure is associated with lower cognitive performance across domains and may therefore demonstrate the potential of advanced diffusion techniques for detecting subtle brain differences due to age or disease-related processes that negatively impact cognitive health.
Keywords: neuroimaging: structural**,** cognitive functioning**,** brain structure

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43 Attention and Anterior Cingulate Volume in Veterans with Suicidal Behavior

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Objective: The Department of Veterans Affairs estimates that more than 17 Veterans die by suicide per day (Office of Mental Health and Suicide Prevention 2021). Prior research has shown relationships between cognitive performance and suicidal behavior, including alterations in memory, attention, and executive function. Still, few studies have incorporated magnetic resonance neuroimaging into studies of suicide and cognition with Veterans. Therefore, the current study sought to examine differences in anterior cingulate cortex (ACC) volume related to attention in Veterans with suicidal ideation and no suicide attempt compared to those with a history of suicide attempt(s).
Participants and Methods: Fifty-two veterans ages 18-55 completed a structured interview assessing history and current suicide ideation and attempts (Columbia Suicide Severity Rating Scales (CSSRS)) in addition to the Hamilton Depression Scale (HAM-D) and Hamilton Anxiety Inventory (HAM-A) to quantify mood symptoms. Participants also completed the Ruff 2&7 Selective Attention Test (Ruff 2&7) and magnetic resonance imaging on a 3.0 Tesla Siemens Magnetom Verio scanner using a standard 12-channel head coil. Using a T1-weighted 3D MPRAGE GRAPPA sequence, the axial plane T1-weighted images were acquired with the following parameters: Echo Time (TE)=3.42 ms, Repetition Time (TR)=2000 ms, Inversion Time (TI)=1100 ms, Flip Angle=8°, 256×256 acquisition matrix, 160 slices, and 1.0 mm slice thickness. Image data were transferred

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from the scanner in DICOM format and coded. Neurocognitive, MRI, and clinical analyses were completed using ANCOVA and correlations.
Results: Thirty veterans reported a history of suicidal ideation without a history of suicide attempts(s) (SI group) and 22 reported a history of suicide attempt(s) (SA group). Veterans with SA performed more slowly on the Ruff 2&7 Automatic Detection speed (p=0.03), Ruff 2&7 Controlled Search Speed (p=0.003), and Ruff 2&7 Total Speed compared to participants in the SI only group (p=0.02). Veterans in the SA group also reported significantly higher symptoms of depression and anxiety compared to veterans with SI only (HAM-D and HAM-A p<.001). Interestingly, differences in attention scores remained after controlling for both anxiety and depression (all *p*'s<.05). There were no significant between group differences in age or education.
After controlling for depression and anxiety scores, Veterans with SA showed negative correlations between right hemisphere rostral ACC volume and Automatic Detection Speed (*r*=-.52, *p*=.02), Controlled Search Speed (*r*=-.51, *p*=.02), and Total Speed (*r*=-.50, *p*=.02); however, Veterans with SI only showed no correlations between Ruff 2&7 measures and ACC volume.
Conclusions: Results from the current study show an association between rostral ACC volume and measures of attention in Veterans with a history of SA. These findings suggest that Veterans with a history of SA have decreased attention speed compared to Veterans with SI, and that these deficits are related to the ACC. Given the critical role of the cingulate in attentional processing and self-regulation, these findings suggest additional investigations into cingulate morphometry and suicide behavior are needed. In addition, there are significant clinical implications, as Veterans with a history of suicide attempt may process information more slowly. This slowed processing could impact therapeutic engagement and ability to complete work/school tasks in a timely manner.
Keywords: attention

44 Associations Between Abnormalities of Intracortical Myelin Content and Neuropsychological Functions in Middle to Older Aged Adults with Autism Spectrum Disorder (ASD)

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Objective: Intracortical myelin development and remodeling are protracted across the lifespan, with evidence of abnormal myelination in some neuropsychiatric disorders, mild cognitive impairment, and dementia. It is thought to play an important role in cortical connectivity and has been shown to correlate with neuropsychological performance. White matter myelin content (MC) has been found to be reduced in young adults with ASD, but patterns of myelination in cortex have not been examined in ASD at any age. With the added risk of demyelination associated with aging, older adults with ASD may be doubly susceptible to abnormalities of intracortical myelination. Given that heterogeneity in ASD impacts multiple aspects of phenotype (e.g., cognition, symptom severity, neuroanatomy, etc.), we aimed to use a subject-specific outlier analysis approach to determine if MC differs between individuals with ASD and typical control (TC) participants aged 40-70 years, and whether abnormalities of MC are associated with neuropsychological function.
Participants and Methods: T1-weighted and T2-weighted anatomical MRI scans from 66 participants (30 ASD; 36 TC) were processed using the Human Connectome Project pipelines to generate cortical surface myelin maps calculated using a T1/T2 ratio method. ASD diagnoses and symptoms were evaluated using the ADOS-2. IQ was assessed using the WASI-II and executive function was assessed using the BRIEF-A and DKEFS Trail Making (TM), Verbal Fluency, and Color Word Interference (CWI) tests. Groups were matched on age, sex, perceptual reasoning index, total brain volume,

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and contrast-to-noise ratio. We employed an outlier analysis method: for each individual, vertex-wise z-scores for MC were calculated based on the mean and standard deviation of MC within the TC group. Individual maps were thresholded at |z|≥2 to identify outlier clusters. The total surface area of outlier clusters was summed, resulting in load scores for positive, negative, and combined absolute value outliers across the cortex. Groups were compared using Mann-Whitney U-tests to account for a non-normal distribution of scores. Spearman correlations probed relationships between outlier scores and behavioral measures.
Results: Load scores did not differ significantly between groups. Positive MC load scores showed significant negative correlations with verbal, non-verbal, and full-scale IQ scores in the ASD group (ρs<-0.47, ps<0.01). Similarly, positive MC load scores showed significant negative correlations with TM number sequencing and number-letter sequencing, letter fluency, category fluency, and category switching, and CWI word reading, inhibition, and inhibition/switching scores from the DKEFS in the ASD group (ρs<-0.38, ps<0.05). Absolute value MC load scores showed significant positive correlations with BRIEF-A behavioral regulation index, metacognitive index, and global executive composite scores in the ASD group (ρs<-0.56, ps<0.01).
Conclusions: Middle to older aged adults with ASD may be at risk of abnormalities in intracortical MC from both a developmental and degenerative perspective. Although there was no difference between groups in outlier scores overall, the ASD group showed a number of significant associations between outlier scores and cognitive functions that were notably absent in the TC group. Given the role of myelin in synaptic plasticity and maintenance of intracortical circuits, abnormalities of intracortical MC could have deleterious effects on cognitive functions in ASD.
Keywords: autism spectrum disorder**,** neuroimaging: structural**,** cognitive functioning
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45 Fractional Anisotropy of the Fornix Mediates the Relation Between APOE4 and Memory Performance in a Sample of Majority White Older Adults with Subjective or Objective Cognitive Impairment

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Objective: The Apolipoprotein (APOE) e4 allele has been related to poorer cognitive outcomes, particularly poorer memory performance, in individuals with impaired cognitive function. However, the potential mechanisms by which APOE4 impacts memory need to be further examined. This study sought to better understand the potential mediating role white matter microstructure may play within the relation between APOE4 and memory in subjectively and objectively cognitively impaired older adults.
Participants and Methods: Participants included 161 older adults with a diagnosis of significant memory concern (SMC), mild cognitive impairment (MCI), and Alzheimer's disease (AD) within the ADNI dataset. Participants were on average 74 years of age, 40.4% female, college educated, majority White (92%), with an average MMSE score of 26/30. Participants were distinguished by APOE4 status (74 non-carriers, 87 carriers). From the battery of neuropsychological tests administered in ADNI, a composite memory score was created by the ADNI project. Mean fractional anisotropy (FA) and radial diffusivity (RD) values of white matter tracts within regions of interest (i.e., fornix, hippocampal cingulum) were individually used as the measures of white matter microstructure. Hayes' Process Macro Model 4 was utilized to run a simple mediation analysis. Indirect effects were tested using bootstrapping procedures.
Results: APOE4 was significantly related to FA of the fornix (p=0.014) but was not significantly related to FA or RD of the hippocampal cingulum or RD of the fornix. APOE4 and FA of the fornix were significantly related to memory (p=.001, p=.0293, respectively). FA of the fornix was a significant mediator between APOE4 and memory function (95% CI: -.1477, -.0039), with

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the hippocampal cingulum in the model as a potential mediator and controlling for age. FA and RD of the hippocampal cingulum and RD of the fornix were not significant mediators.
Conclusions: Our findings provide evidence that a potential mechanism by which APOE4 impacts memory performance in individuals with subjective and objective cognitive impairment is through white matter microstructural changes within the fornix, leading to poorer memory function.
Keywords: apolipoprotein E**,** memory disorders**,** neuroimaging: structural
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46 The Association Between Aerobic Fitness Level, Sex, and Network Connectivity in the Default Mode Network in Healthy Emerging Adults

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Objective: Accumulating evidence suggests that sedentary behavior and poor physical health negatively impact neurocognition. The transition from adolescence to young adulthood is associated with a reduction in physical activity and an increase in sedentary behavior. Aerobic fitness has exhibited positive effects on physical health, psychiatric and cognitive function in older adults. It has also been suggested that exercise during childhood may promote changes in brain structure and function, though less remains known about the effects during adolescence and young adulthood. Further, few have examined potential sex differences. Therefore, it is crucial to better understand the link between aerobic fitness and neurocognitive health, especially during adolescence and young adulthood when interventions may be pivotal. The current study examined aerobic fitness level, sex, and their interaction in relation to resting-state functional connectivity in the default mode network (DMN).
Participants and Methods: 61 physically healthy adolescents and young adults (36 low-fit [55% female], 25 high-fit [40% female]) underwent VO_2 max testing and an 8-minute resting-state fMRI scan. Participants were between the ages of 16-25 (*M* = 21.16, *SD* = 2.49) and were sex balanced (30 females, 31 males). Differences in DMN connectivity were examined between groups (low- vs. high-fit) and in a sex by group interaction, using a left posterior cingulate cortex (PCC) seed-based analysis.
Results: There was no significant main effect of aerobic fitness level or sex on network connectivity between the left PCC and the rest of the brain. The aerobic fitness level*sex interaction was significantly associated with connectivity between the left PCC and left paracentral lobule (X = 5.4, Y = 32.6, Z = 46.1; $F = 12.038$, $p < 0.001$); low-fit males displayed stronger connectivity than high-fit males while high-fit females displayed stronger connectivity than low-fit females.
Conclusions: Overall, results of the present study suggest that sex may moderate the relationship between aerobic fitness level and functional connectivity within the default mode network. In the present sample, high-fit females demonstrated increased functional connectivity between the left PCC and left paracentral lobule compared to low-fit females, while males demonstrated the opposite pattern (although it was less robust). This suggests aerobic fitness may have a more robust impact on DMN connectivity in females as they undergo neurodevelopment, although the opposite was found when examining functional connectivity in a verbal memory network (Jennette et al., under review). Future studies should examine these relationships longitudinally and inquire whether sex moderates the impact of aerobic fitness interventions on brain connectivity in adolescents and emerging adulthood.
Keywords: adolescence**,** neuroimaging: functional connectivity**,** brain development
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47 Incidental Finding? A Case Study of 53-Year-Old Man with Obstructive Hydrocephalus Secondary to Congenital Toxoplasmosis

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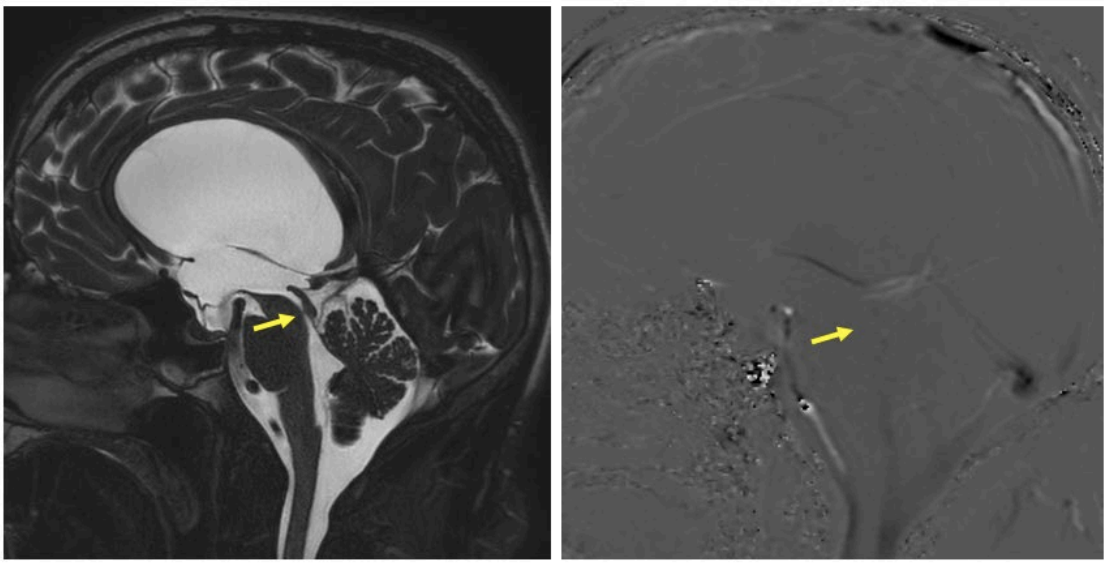
Thin-section, heavily T2 weighted images show posterior narrowing of the cerebral aqueduct. On phase-contrast CSF flow imaging, there is absence of flow-related signal through the aqueduct.



Rebecca Kraut, M.A.[1], Erica F. Weiss, Ph.D.[2], Judah Burns, M.D.[3], Ronda Facchini, Ph.D.[2]
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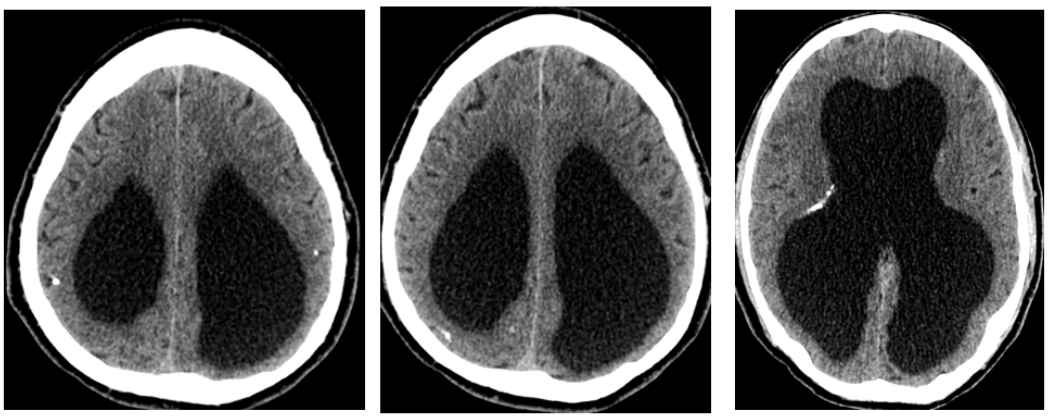
Objective: Congenital toxoplasmosis occurs from transplacental transmission of tachyzoites to the fetus following maternal infection. While most newborns with congenital toxoplasmosis are asymptomatic, 30-68% of symptomatic cases develop hydrocephalus. Here we report the neuropsychological findings of a patient with chronic, severe obstructive hydrocephalus, suggestive of chronic sequelae of toxoplasmosis, who presented without cognitive complaints to obtain a cognitive baseline after two right subcortical cerebrovascular accidents (CVA) thought by neurology to be secondary to small vessel disease. Clinical characterization of this high functioning patient, including his academic (master's degree) and employment (IT department) accomplishments, given notable and incidentally discovered hydrocephalus,

Non contrast head CT shows bilateral ventriculomegaly with relative thinning of the cortex in the parietal and occipital lobes. There are scattered cortical calcifications. Temporal lobes (not shown) demonstrate marked parenchymal volume loss.



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helps extend our clinical and scientific knowledge base.
Participants and Methods: Neuropsychological evaluation of a 53-year-old Caucasian man referred for cognitive evaluation in the context of CVA workup whose brain imaging revealed notable tri-ventricular ventriculomegaly with decreased volume of subcortical white matter in the parietal lobes and particular thinning in the temporal region. Evan's index of 0.45, but this is an underestimate of ventricle enlargement as the frontal horns are smaller than the body/occipital horns of the lateral ventricles, which are most enlarged. Images attached.
Results: Estimated premorbid functioning within the average/high average range which is commensurate with education and work history.
Current performances revealed grossly high average verbal and average visual perceptual performances across tasks. Basic attention was strong, but there was evidence of reduced vigilance over time on a sustained attention measure. Memory performances were variable with some loss of information on delayed recall. Speed of processing on tasks with visuomotor components was reduced and an area of relative weakness, although still within expectation. Fine motor task performances were weak and consistent with mild left-sided hemiparesis, partially in remission. Symptoms of anxiety were endorsed. Qualitatively, he had an odd interpersonal presentation and poor social awareness, which is likely longstanding. Speech was deliberate, with frequent pauses, which, per spouse, is a change.
Conclusions: Patient with brain MR and CT evidencing remarkable tri-ventricular ventriculomegaly with no history of clinical or cognitive complaints prior to recent CVAs, despite chronic, compensated aqueductal stenosis on imaging. Neuropsychological findings demonstrated relative weaknesses (but not significant impairment) in attention, memory, and processing speed which could be secondary to recent CVA or related to his history of hydrocephalus, but which are not at the level expected given severity of ventriculomegaly on neuroimaging. This case extends the body of knowledge with regard to cognitive functioning in congenital toxoplasmosis and further reinforces the need for neuropsychological evaluation as an independent measure of cognitive ability even in cases of profound imaging findings.
Keywords: hydrocephalus**,** neuropsychological assessment**,** neuroimaging: structural

48 Auditory and Verbal Fluency Tasks for FMRI Language Mapping in Pediatric Neurosurgical Patients

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Objective: Neurosurgical intervention has the potential to save lives, reduce disease burden, and improve quality of life. When making surgical decisions, physicians and families weigh the likely benefits of neurosurgery (e.g., seizure freedom, rupture prevention) against the potential for cognitive decline (e.g., language, memory). Currently, the best available methods for estimating the impact of surgery on cognition are neuropsychological assessment and cognitive mapping, including Wada testing, functional magnetic resonance imaging (fMRI), and stereotactic electroencephalography (sEEG). Due to its less invasive nature, fMRI language mapping has grown in popularity; however, research support in pediatric patients has lagged behind the adult literature. The purpose of this study is to report on the efficacy of two different fMRI language paradigms for localizing and lateralizing language in pediatric patients and investigate the impact of different thresholding and analysis methods on interpretation.
Participants and Methods: We retrospectively examined fMRI data from patients undergoing language mapping at a children's hospital between July 2019 and July 2021. Twelve patients performed both auditory decision making (ADT) and phonemic verbal fluency (PVF) tasks in a 3T Siemens Prisma scanner. Two patients had nondiagnostic scans due to excessive motion. The remaining 10 patients

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were included in the analyses. Patients were between the ages of 9 and 19 years old and were being evaluated for drug-resistant focal epilepsy (6), primary brain tumor (2), and vascular malformations (2). Functional maps were thresholded for interpretation according to the American College of Radiology Clinical Standards. Language localization and lateralization decisions were made independently for each task by a trained neuroradiologist. In addition, a research processing pipeline with a uniform statistical threshold set to a false positive rate of p<.05 was applied to all patients and tasks. Lastly, a threshold-independent laterality index (LI) was calculated for each patient and task. Laterality decisions using the three methods were compared across tasks and patients.
Results: As expected, group level statistical analysis of the ADT revealed robust activation in the left inferior and medial frontal gyri and left posterior temporal cortex (p<.001, k=30). A small cluster of activation was also seen in the right inferior frontal gyrus. Group level analysis of the PVF tasks revealed exclusively left frontal activation (p<.001, k=30). The ADT produced lateralizing decisions in 70% of patients using clinical guidelines, 60% with the research protocol, and 50% using a LI. The VPF produced lateralizing decisions in 80% of patients using clinical guidelines, 50% with research protocols, and 50% using a LI. Research and LI protocols were more likely than clinical guidelines to indicate a degree of bilateral language support.
Conclusions: Our findings suggest ADT and PVF are valid tasks for fMRI language mapping in children. ADT may be more useful for identifying both frontal and temporal language areas. Lateralization decisions may be improved by using multiple methods for interpretation. Longitudinal follow-up is needed to determine predictors of post-surgical language functioning.
Keywords: pediatric neuropsychology**,** neuroimaging: functional**,** language

49 Cerebral Metabolite Concentrations are Associated with Brain Functional Connectivity in Patients with Mild Cognitive Impairment

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Objective: As Alzheimer's disease (AD) continues to be the most common cause of dementia in older people, more information is needed on indices of brain health and how these measures may relate to brain function. Mounting evidence suggests that cerebral metabolite concentrations, such N-acetylaspartate (NAA) and myo-inositol (MI), are associated with different physiological processes in brain aging. We examined the relationship between cerebral metabolite concentrations and resting state functional connectivity in brain networks relevant to AD in patients with mild cognitive impairment (MCI).
Participants and Methods: Thirty-four older adults (15 women, 60-89 years of age) diagnosed with MCI were assessed. MCI was confirmed via diagnostic consensus conference with a neurologist and neuropsychologist (sources of info: Montreal Cognitive Assessment Test [MoCA], Clinical Dementia Rating scale [CDR], Functional Activities Questionnaire (FAQ), Hopkins Verbal Learning Test – Revised [HVLT-R] and medical record review). Magnetic resonance spectroscopy (MRS) and functional magnetic resonance imaging (fMRI) were collected on a 3T Siemens Prisma scanner and used to determine metabolite concentrations (referenced to water) and resting-state functional brain activity. MRS data were corrected for tissue volume using SPM segmentations and processed in LCModel. fMRI data were processed using CONN toolbox v18b.
Results: Linear regressions were performed using CONN toolbox v18b and revealed that N-acetylaspartate (NAA), myo-inositol (MI), choline-containing compounds (Cho), glutamate and glutamine (Glx), and creatine and phosphocreatine (Cr) were all associated with differences in functional connectivity between brain regions that are important in semantic and salience functions. ROIs include the left and right medial temporal gyrus (MTG), temporal

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pole (TP), superior temporal gyrus (STG), angular gyrus (AG), amygdala, hippocampus, and parahippocampal gyrus (PaHC).
Conclusions: Our findings suggest that in adults with MCI, cerebral metabolites indicative of different aspects of brain health are associated with differences in functional connectivity in brain regions associated with cognitive decline in MCI. Higher concentrations of metabolites associated with neuronal integrity (e.g., NAA) are associated with higher functional connectivity in semantic brain networks. The temporal and parietal structures that showed greater connectivity are associated with lexical-semantic processes that are directly related to cognitive decline in patients with AD-trajectory MCI. A greater understanding of the relationship between cerebral metabolites and brain activity may be useful to determining current brain health in patients with cognitive performance consistent with MCI (e.g., lower NAA levels may suggest greater likelihood over conversion to AD within a shorter time frame).
Keywords: magnetic resonance spectroscopy**,** mild cognitive impairment**,** neuroimaging: functional connectivity
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50 Comparisons of Tau PET Binding in a Young Middle-Aged Population with and without Neurodegeneration

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Objective: Tau PET imaging has been well studied in older adults with Alzheimer's disease along with healthy controls; however, there has been little research published on younger individuals. We sought to examine tau localization in a younger subset of middle-aged patients and to compare these results to what is known about tau staging in older onset patients using data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) study.
Participants and Methods: We searched the ADNI database in July 2021 to identify all participants between the ages of 55 and 60 with AV1451-PET (Tauvid) and MPRAGE MRI. We included 24 individuals in this analysis (11 cognitively normal, 10 mild cognitive impairment (MCI), and 3 dementia). We downloaded these individual's T1 MRI scans and AV1451 PET scans from ADNI (http://adni.loni.usc.edu) The T1 weighted MRI scans were processed using FreeSurfer V7.2. This subdivided the brain into distinct regions of interest based on the Desikan/Killiany atlas. The Tau PET scans (AV1451) from each individual were then processed using PETSurfer where they were combined with the processed MRI scan so that regional Tau ligand binding could be generated. Standardized uptake value ratios (SUVR) for the regions of interest were created using the cerebellum gray matter as a reference region. We explored tau ligand binding to two anatomical regions the "Braak 1&2" region and in the prefrontal cortex, a region where tau ligand binding has not been well explored. We used one way-ANOVAs to compare tau PET SUVRS in specific regions of interest across the groups and independent samples t-test to compare the cognitively normal group to the participants with mild cognitive impairment.
Results: The results of this study revealed greater tau binding in the Braak 1&2 region in the MCI group then in the cognitively intact group ($p=0.00894$). This finding is consistent with other reports in the literature. The findings for the prefrontal cortex region were surprising. There was less tau ligand binding in the MCI group than in the cognitively intact group ($p<0.01$). More work needs to be done for us to understand this finding. Little work has been done on this brain region in either aging or dementia, especially in subjects of this rather young age (55-60).
Conclusions: As expected, individuals with more disease had more tau in Braak stages 1&2 while healthy controls had less tau. More research to compare this group to the older group is needed to help us understand the spread of tau in younger middle-aged individuals and to assess whether imaging at earlier stages of neurocognitive impairment may be helpful.

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Keywords: dementia - Alzheimer's disease, positron emission tomography, memory disorders

51 Trends and Challenges in Diagnostic Prediction Modeling and Network Neuroscience

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Objective: The proliferation of machine learning (ML) for use in functional neuroimaging holds great promise to advance our understanding of neuropathology. However, improper implementation can limit the reproducibility and replicability of these invaluable advancements. By examining the current body of neuroimaging research utilizing ML, we can identify trends with profound implications to generalizability, including the use of external validation (i.e. lockbox), mean sample size, algorithm interpretation techniques, and overall transparency of methods and results. These trends underscore the importance of identifying common methodological pitfalls and identify good practices to properly utilize prediction modeling to enhance our understanding of both machine learning in neuroimaging and neurological disorders.
Participants and Methods: We reviewed primary research articles that used ML and resting-state fMRI connectomics for clinical diagnostics. Of the 1097 unique peer-reviewed publications identified in our search, 250 papers were retained for analysis. Key factors for the reproducibility, interpretability, and generalizability of the algorithm's design and implementation were collected. These factors included the use of external validation, network metrics input into the classifier, participant demographics, sample size, cross-validation (CV) technique, prediction accuracy, and specific techniques including consensus feature analysis. We further analyzed the 32 papers containing both CV and lockbox accuracy scores to directly examine the potential for overfitting.
Results: In the last decade, mean accuracy decreased from 92.0% to 82.6%. Even still, a significant (13.27%) discrepancy between CV and lockbox performance was observed, underscoring the ongoing nature of overfitting. Sample size, a variable crucial for overfitting (Varoquaux, 2018), varied widely, ranging from 17 to over 1300 participants. Subgroup sample size varied to a similar extent, ranging from 8 to 653 participants. Over half (n=136) of all studied had subgroup sample sizes of less than 30 individuals. There was significant annual increase in the total number of participants (r2=0.75, p=.001) (37 mean in 2010 to 169 in 2020), subgroup sample size (r2=.76, p=.001) (15 to 58), and in lockbox usage (r2=.57, p=.003) (0% of collected papers in 2010 to 27% in 2020). Similarly, more papers began to integrate algorithm or feature interpretability measures including feature importance, consensus features, permutation analysis, and ablation analysis (r2=0.26, p=.01). Reporting of key demographic factors remained relatively stable across time (r2=0.03, p=.47), and was marked by consistent reporting of participant age (88.8% of studies) and sex (86.8%), but underreporting of potentially confounding factors including handedness (27.2%), race (5.6%), and socioeconomic status (0.8%).
Conclusions: While challenges to reproducible ML and neuroimaging research remain, the current methodological trends are optimistic. Declining mean accuracy is potentially reflective of the growing literature on the importance of the prevention of overfitting (Hosseini et al., 2020), as evidenced by the increased utilization of lockboxes. Further, more steps, on average, are being taken to provide insight into the algorithm development and implementation There remains a large discrepancy between CV and lockbox performance, marking the continued prevalence of overfitting. Even so, the increases in methodological transparency are a positive sign for reproducible research. The application of ML promises to advance our understanding of brain disorders, and continued work to open the "black box" may prove to be a potent driving force for future discovery.
Keywords: neuroimaging: functional, transdisciplinary research, brain disorder

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52 Neural Correlates of Memory Formation in Term and Preterm Born Young Children

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Objective: Episodic memory formation is supported by the medial temporal lobe (MTL) and prefrontal cortex (PFC). Episodic memory is necessary for goal directed behaviors and classroom success, making the period of 5-6 years when children show substantial cognitive growth and begin formal schooling especially important to study. Preterm birth can be a risk factor for cognitive development and is linked to alterations specific in the MTL (e.g., hippocampus). Here we used functional MRI (fMRI) to examine memory formation in term and preterm born 5- to 6- year-old children. We specifically focused on MTL and PFC activations during encoding and tested the hypothesis that episodic memory performance in term compared to preterm born children is differentially dependent on contributions of activations in the MTL.
Participants and Methods: We examined a sample of 44 5- to 6-year-old children:17 preterm and 27 term born. Encoding activation in the MTL and PFC was assessed using a subsequent scene memory paradigm described in detail elsewhere (Ofen et al., 2007; Tang et al., 2020, 2018). Participants encoded 120 pictures of indoor and outdoor scenes in a scanner. Participants were instructed to answer per picture if depicted an indoor or outdoor scene via button press, and to memorize the scenes for a subsequent recognition test. Participants completed a self-paced recognition test of all 120 studied scenes intermixed with 80 new scenes outside the scanner. Episodic memory performance was calculated as the proportion of correctly recognized target images (Hit Rate) adjusted for the proportion of falsely endorsed new images (False Alarm Rate): Hit Rate – False Alarm Rate. SPM12 and custom software were used in fMRI analyses. Activation values for all encoding trials per individual were extracted from anatomically defined region of interests in the MTL and PFC. Analyses were conducted using separate general linear models (GLM) with encoding related activation (MTL or PFC) and birth status (preterm or term) predicting episodic memory performance. To address our question of differing neural correlates supporting memory formation between preterm and term born children, we examined the interaction between encoding activation (MTL or PFC) and birth status (preterm, full term). Socioeconomic status was included as a covariate of no interest.
Results: Consistent with our hypothesis, the relation between encoding activation in the MTL and episodic memory performance differed in the group of term compared to preterm born children, $F(1, 38) = 4.167$, $p = .048$. Specifically, higher MTL encoding related activation was associated with better episodic memory performance in preterm children, while lower MTL activation was associated with better memory performance in the term born children. Encoding related activation in the PFC was not associated with episodic memory performance overall $F(1, 38) = .033$, $p = .863$, nor differentially related to memory performance between groups $F(1, 38) = .022$, $p = .883$.
Conclusions: In this sample of 5- to 6-year-old term and preterm born children, MTL activation during encoding was differentially associated with episodic memory performance, highlighting the importance of MTL in accounting for effects of preterm birth at childhood on cognition.
Keywords: memory: normal
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53 Differential Executive Functioning in Young Adulthood as a Function of Experienced Child Abuse

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Objective: Previous research has shown cognitive dysfunction in adults with a history of child abuse. The purpose of the present study was to measure differences that exist in executive functioning skills between individuals who have been abused as children versus those without the history of childhood abuse.
Participants and Methods: The present study recruited 43 students from the University of North Dakota (33 women) between ages 18 and 23 years of age. The participants were administered several prescreening measures, including a measure of physical child abuse, emotional child abuse, and sexual child abuse. Based on responses to these measures, participants were grouped into a no- child-abuse group, a mild-child- abuse group, or a moderate-to-severe child abuse group. All participants were administered measures of executive functioning that included the Wisconsin Card Sorting Task, the Operation Span Task, and the Connors Continuous Performance Task with a simultaneous recording of electroencephalographic activity using a wireless 9 channel EEG system.
Results: There was a statistically significant main effect of child abuse group (no child abuse vs. moderate-to-high child abuse) for the EEG-derived probability of cognitive workload during the OSPAN. Beta bandwidths for individuals in the drug abuse group, which served as a covariate, was also found to be significantly attenuated during the Connors CPT.
Conclusions: Individuals that have been abused as children must use significantly more mental effort to complete executive functioning tasks as compared to their non-abused counterparts. Increased neurological effort could be used to explain poor decision-making skills that are common within the population.
Keywords: electroencephalography**,** executive functions**,** childhood maltreatment
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54 The Relationship Between Experimentally-Induced Stress and Performance Monitoring: A Go/No-go Event-Related Potential (ERP) Study

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Objective: Stress negatively impacts health-related behaviors and aspects of neuropsychological functioning, including performance monitoring. Performance monitoring is the ability to detect errors or conflict and adjust performance. Despite the known association between stress and poorer health outcomes, the relationship between stress and food-related performance monitoring (i.e., how stress affects one's awareness of errors and responses to high-calorie foods) during inhibitory tasks is less known. We tested the relationship between experimentally-induced stress (Trier Social Stress Task [TSST]) and neurophysiological indices of performance monitoring, as measured by the error-related negativity (ERN) and the error-related positivity (Pe) components of the scalp-recorded brain event-related potential (ERP), during a food and neutral go/no-go task. The ERN is larger when performance is worse than expected and the Pe is thought to reflect the conscious awareness of errors. We hypothesized that the TSST group would show larger ERN and Pe amplitude than the control group and that amplitude differences would be more pronounced on errors to high-calorie stimuli compared to neutral.
Participants and Methods: Participants included sixty individuals (70% female, M_{age}=20.1, *SD*= 2.1) randomly assigned to complete the Trier Social Stress Task (TSST; N=27) or watch relaxing videos (N=33). Systolic blood pressure and heart rate were used as manipulation checks. Following the TSST or video conditions, participants completed two go/no-tasks—one inhibiting to high-calorie foods and the other inhibiting to neutral stimuli (e.g., flowers), while electroencephalogram (EEG) data were recorded. Accuracy and response

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times were used as behavioral measures. Data were analyzed using repeated-measures analysis of variance.
Results: The stress manipulation was successful as individuals in the TSST condition showed significantly higher heart rate, $F(6, 342)=23.9$, $p<.001$, and systolic blood pressure, $F(6, 342)=34.2$, $p<.001$, following the TSST compared to control. For ERN component amplitude, there was a main effect of group, $F(1, 40)=5.9$, $p=.02$, with the TSST participants demonstrating larger overall ERN amplitude, and a main effect of response type with incorrect go trials eliciting larger ERN amplitude than correct go trials, $F(1, 40)=70.6$, $p<.001$. For the Pe component, there was a main effect of task with the neutral task eliciting larger Pe amplitude than the food task, $F(1, 58)=10.6$, $p=.002$, and a main effect of response with incorrect trails eliciting larger Pe amplitude compared to correct trials, $F(1, 58)=146.6$, $p<.001$. There were no main effects or interactions between stress condition and behavioral accuracy ($p>.60$), or response times ($p>.92$).
Conclusions: Stress levels were successfully manipulated with heightened measures of the stress response following the TSST condition compared to the control. Overall, TSST participants showed larger ERN amplitude that may be related to feelings of increased pressure or perception that their performance was worse than controls, despite no difference in accuracy between the two groups. Although both groups showed larger Pe component amplitude during the neutral task compared to high-calorie, perhaps indicating greater awareness of errors during the neutral task, there was not a difference between groups on Pe amplitude. Results suggest stress influences one's perception of performance (i.e. ERN) rather than the awareness of their performance (i.e., Pe).
Keywords: event-related potentials**,** cognitive processing

55 Investigating the Relationship Between Physiological and Self-Report Measures of Mental Effort During Cognitive Demand

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Objective: Sufficient mental effort while performing cognitive tasks is necessary for accurate interpretation of assessment results. However, subjective self-report measures are limited by perception of one's own cognitive processes, as well as trait and state factors. Thus, there is a need to develop more objective markers of mental effort, which could be useful in various assessment contexts. The goal of this study is to assess the relations between two physiological correlates of mental effort, which may be more objective tools for quantifying effort, and self-reported effort during a cognitively demanding task. It is hypothesized that physiological variables will be positively correlated with one another, but neither will be correlated with self-report measures of effort.
Participants and Methods: Seventy healthy older adults were recruited from the community to complete computerized resting and Flanker tasks during electroencephalography (EEG) and electrocardiogram (ECG) recording as part of a larger battery. Following exclusion for incomplete data, a final sample size of 59 (mean age = 69.97, *SD* = 5.77, 67.1% female) was used in the present analyses. The NASA Task Load Index (NASA-TLX) and Student Opinion Scale (SOS) were administered following the Flanker task to assess task-related effort. EEG data was epoched relative to flanker onset, screened for artifacts, and converted to frequency spectra using a fast Fourier transform. Power was extracted from the spectra at electrode FCz from a range of 4-8 Hz to obtain midline frontal theta (MFT) power. The root mean square of successive differences (RMSSD) from the ongoing ECG was used to operationalize heart rate variability. Zero-order correlations were calculated to quantify the relationships between a subtraction-based RMSSD difference score, regression-based RMSSD residual scores, MFT power, and effort subscales from the NASA-TLX and SOS. Each of the RMSSD variables and MFT power were log-transformed to correct for non-normality.
Results: Correlation analysis found that the subtraction-based RMSSD difference score was positively related to a residual score derived

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from a regression equation in which resting RMSSD was used to predict task-related RMSSD (r = .58, p < .0001). MFT power was not significantly related to any of the RMSSD scores (p > .05). Likewise, none of the physiological variables were correlated with self-report measures of mental effort (p > .05).
Conclusions: Results showed that HRV variables operationalized as an RMSSD subtraction-based difference score and regression-based residual scores do not relate to MFT power in the current dataset. Further, results indicated no correlation between physiological correlates and self-report measures of effort, suggesting no association between objective physiological measures and subjective assessments of mental effort in the present iteration of the Flanker task. The present non-significant findings may be explained by small sample size or insufficient task difficulty to capture task-related changes in HRV. In addition, operationalization of physiological variables and methods of analysis influence their relationships with psychological variables. Further research is needed to clarify the nature of physiological activity during cognitive demand and its relationship to subjective measures.
Keywords: assessment, self-report, electroencephalography
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56 Sensitivity of the EEG Aperiodic Slope and Offset to Age and Task Demand During Neuropsychological Task Performance

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Objective: Certain electroencephalogram (EEG) signals during experimental task performance have been well established as correlates to cognitive processes and status; however, little is known about EEG correlates of concurrent cognitive assessment. Developing EEG markers of real-time cognitive processes could be beneficial for neuropsychology, particularly for applications such as monitoring the neural resources individuals expend while performing tasks. Recent studies suggest that the EEG aperiodic slope and offset—measures derived from the power spectrum of the ongoing EEG signal— may provide such markers. This study conducted a preliminary investigation of the effects of age and task demand on the EEG aperiodic slope and offset during memory encoding and retrieval, as putative markers of real-time neural resource expenditure.
Participants and Methods: Twenty-one younger adults (mean age = 23.29, SD = 3.47, range = 19-33; 48% female) and twenty-four older adults (mean age = 70.58, SD = 5.77, range = 59-83; 83% female) completed the Repeatable Battery for the Assessment of Neuropsychological Status-Update (RBANS) as part of a larger study. EEG was recorded during an eyes closed resting period (Rest) and during administration of the RBANS. The current study focused on Figure Copy and Recall subtests. The continuous EEG data was converted to power spectra, and the aperiodic offset and slope were calculated from 2-25 Hz at electrode Fz. Separate mixed analyses of variance were used to assess the main effect of Task (Rest, Figure Copy, Figure Recall) and Age (Younger, Older), and their potential interactions, on the EEG aperiodic slope and aperiodic offset.
Results: A previous analysis with this dataset found no differences between age groups for raw scores on Figure Copy while younger adults had higher scores on Figure Recall. Current analyses regarding EEG variables found a main effect of Age on offset (F(1, 43) = 11.968, p = 0.001) and slope (F(1,43) = 12.209, p = 0.001) such that younger adults had higher offsets and steeper slopes than older adults. Likewise, there was a main effect of Task on both offset (F(2,86) = 14.175, p < .001) and slope (F(2,86) = 4.321, p = 0.016), such that offsets were higher and slopes were steeper during task performance than rest. The interaction between Age and Task was not significant for offset or slope. Pairwise comparisons further indicated higher offsets during Figure Copy relative to Rest and Figure Recall, and steeper slopes during Figure Copy relative to Rest.

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Conclusions: These results are consistent with prior studies showing lower offsets and flatter slopes among older adults during resting intervals, as well as with studies showing increases in the slope and offset between resting and experimental task performance. The current findings extend that literature, being the first to demonstrate the feasibility of measuring aperiodic signals during actual cognitive assessment, and suggest they possess some sensitivity to task demands. Further research with larger samples should determine how on-task measurements of aperiodic variables relate to performance on specific cognitive domains. In summary, aperiodic EEG spectral signals show promise for providing insight into real-time neuropsychological task performance.
Keywords: neuropsychological assessment**,** electroencephalography
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57 Alexithymia-Related Overactivation in Healthy Elders Suggests Attentional Bias to Expected Feedback During Non-Emotive Reinforcement Learning

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Objective: Alexithymia is a personality trait characterized by difficulty identifying (DIF) and describing one's feelings (DDF) and an externally oriented thinking style (EOT). Recent alexithymia studies highlight executive functioning and memory deficits even in non-emotive contexts. As alexithymia also tends to increase with age, the cognitive implications of alexithymia increase with age as well. Alexithymia has been associated with impaired frontal lobe attentional processes, especially related to the dorsal anterior cingulate cortex (dACC). The dACC is fundamental to effective cognitive control, including during reinforcement learning (RL). Thus, the current project investigated the role of alexithymia in dACC-generated activity via the feedback-related negativity (FRN), which reflects reward prediction error (i.e., the difference between expected and actual outcomes), during RL in healthy, cognitively intact older adults. We hypothesized that older adults with higher alexithymia would have excessive prediction error (i.e., larger FRN) to expected outcomes due to poorer cognitive control over attentional processes.
Participants and Methods: EEG data were collected from 38 healthy, cognitively intact older adults (M_{age}=79.45, *SD*=4.95, 76% female) during reinforcement learning. Subjects chose one of two stimuli on each trial (60 trials per block, maximum of 6 blocks, mean=3.5); pairs were reinforced on 80/20 (high probability of expected feedback) to 60/40 (low probability of expected feedback) schedules. Peak FRN amplitude was calculated for the difference between high and low feedback probability at electrode FCz, corresponding with dACC. Trials from early learning and late learning were assessed, separately. Hierarchical linear regression (Step 1: age; Step 2: all three Toronto Alexithymia Scale (TAS-20) factors) was used to predict FRN difference wave amplitudes.
Results: All participants successfully learned the task. Alexithymia (DIF; DDF trend) correlated with a greater number of learning blocks, but not with other task metrics. In this elderly sample, age did not significantly predict FRN amplitudes (*p*s > .50). During early learning, when reward prediction error should be largest (prediction value = 0), greater alexithymia predicted larger FRN amplitudes to expected vs. unexpected trials; each TAS-20 factor contributed comparably (R^2 = .28, p < .05; factor *p*s = .016-.018). During late learning, when prediction value should be aided by prior experience, EOT alone predicted larger FRN amplitudes to expected vs. unexpected trials (R^2 = .24, p = .05; EOT p = .004).
Conclusions: We found larger FRN activation to expected vs. unexpected outcome trials in older adults with elevated alexithymia scores. This suggests that elders with greater alexithymia over-attended to feedback on the more predictable trials, beginning in early learning; this pattern continued through late learning in those with higher EOT. Previous studies have found salience-related attentional allocation biases during emotion-related tasks in alexithymia. dACC-generated FRN amplitude is

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thought to index deviation from an expected outcome (i.e., surprise), but not valence (i.e., positive vs. negative), supporting its role in cognitive control and the salience network specifically, rather than more general reward processing. Thus, our findings suggest salience-related attentional biases in alexithymia even in non-emotive, complex cognitive processes, suggesting that alexithymia may contribute to risk for general age-related cognitive decline.
Keywords: attention, emotional processes, event-related potentials

58 Imaginative Elaboration in Agenesis of the Corpus Callosum:Topic Modeling and Perplexity

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Objective: Agenesis of the Corpus Callosum (AgCC) is the congenital absence of all or part of the corpus callosum. There is evidence that AgCC causes a constellation of core cognitive deficits, with a variety of secondary social and emotional behavioral challenges (Brown & Paul, 2019). For example in comparison with matched controls, Thematic Apperception Test (TAT) narratives produced by individuals with AgCC contained fewer words denoting emotions, social interactions, and the mental states of characters (Turk et al., 2009) and responses on the Animations Test (Abell, Happe, & Frith, 2000) revealed less social imagination (Renteria-Vasquez, et al., 2021). The latter study, utilized topic modeling (Latent Dirichlet Allocation) to factor texts from Animations Test responses into topics -- groups of associated words (Atkins et al., 2012) and compared the model of each individual's response with the model based on a typical (core) response. Responses of persons with AgCC were more conventional (had significantly lower perplexity scores), indicating less elaborative imagination in their responses than in responses of neurotypical controls. The current study used topic modeling to analyze social inference as evident in thematic content of the TAT responses studied by Turk et al. (2009). It was predicted that despite the reduced number of emotion, social and mental state terms, TAT narratives produced by individuals with AgCC would be more consistent and conventional (i.e., lower perplexity scores) indicating lower capacity for elaborative imagination.
Participants and Methods: Six socially provocative pictures from the TAT were administered to 27 individuals with AgCC and 30 neurotypical individuals. For each picture, participants were asked to tell a story with a beginning, middle, and end, including what the characters are thinking, feeling, and doing. Perplexity values for each response were determined by comparing the topic model from the participant's narrative to the topic model of the core text for that card (combined narratives of all control participants except the comparison control participant). Higher perplexity values indicate greater divergence from the core text.
Results: Perplexity values in the AgCC and neurotypical control groups were compared using MANOVA, with the six cards as dependent variables. As hypothesized, the AgCC group had significantly lower perplexity values overall ($p < .001$, $\eta_p^2 = .588$), and for each of the six cards ($p < .001$; $\eta_p^2 = .282$ to 458).
Conclusions: As on the Animations Test (Renteria-Vasquez et al., 2021), TAT narratives from persons with AgCC were more conventional (i.e., more similar to the core text) than narratives from neurotypical controls. These findings indicate that individuals with AgCC can make conventional social inferences about socially ambiguous stimuli, but restricted imaginative elaboration results in less topical variability (lower perplexity values) compared to neurotypical controls. The results of this study support the broader hypothesis that a fundamental consequence of congenital absence of the corpus callosum is a limited imagination for possibilities that extend beyond the immediate context.
Keywords: corpus callosum, creativity, congenital disorders

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59 Social Cognition and Emotional Assessment: Development of Culturally Adapted Norms for Latin America

Maria Florencia Clarens[1], Lucía Crivelli[1], María Eugenia Martín[1], Carlos Martínez Canyazo[1], Micaela Arruabarena[1], María Eugenia Tabernero[1], Cecilia Cervino[1], Yanina Varela[1], Romina Prestupa[2], Lucrecia Pereyra[2], Francina Rossi[2], Diego Ruben Sarasola[2], Ricardo Francisco Allegri[1]
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Objective: The Mini-SEA (Social cognition and Emotional Assessment) is a quick and brief cognitive assessment test developed to study social cognition (SC). It consists of a modified version of the Faux Pas Test and an emotional recognition test based on Ekman's faces. The administration takes approximately 20 minutes and yields scores for Theory of Mind, Emotional Recognition, and a composite total score. The objective of this work was to obtain the first Latin American Spanish Speaking norms for the Mini SEA test.
Participants and Methods: 64 healthy volunteers, between 35 and 80 years old, were recruited and evaluated with the Mini-SEA by specialized neuropsychologists from the Cities of Buenos Aires and La Plata, both in the Province of Buenos Aires, Argentina.
Results: The total mean (M) of the Mini SEA was 25 +/- 4. The M of the Faux Pas Score was 12.5 +/- 2.4 and the M of the Emotional Recognition Score was 12.8 +/- 1.5. The sample was divided into 4 age groups: Group 1 (<50 years), Group 2 (50-59 years), Group 3 (60-69 years) and Group 4 (more than 70 years). Differences were found in the Composite Emotional Recognition score between group 1 and 4 ($p < 0.05$) and between group 3 and 4 ($p < 0.01$). In the modified Faux Pas test, significant differences ($p < 0.05$) were found between Group 1 and Group 2 for the total score of the control questions, without finding differences in the age continuum. In the analysis of basic emotions, greater difficulties were found in the entire sample to identify fear, followed by sadness and a relative ease in recognizing happiness.
Conclusions: The development of norms that are culturally comparable to patient's population is extremely important for tests of SC. This study presents the first normative values of the Mini- SEA test for a Latin American Spanish-speaking population. This is an important accomplishment for the assessment of SC in the Latin American region and for the inclusion of diverse population and minorities.
Keywords: social cognition**,** test development**,** normative data
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LIVE Introduction to Special Interest Groups (SIGS)

2:30 - 2:55pm
Thursday, 3rd February, 2022

Presented by SIG Chair, Ruchika Prakash
Cultural
Brain Injury
Epilepsy
Social Cognition, Emotion and Communication (SEC)
TeleNeuropsychology
International Neuropsychology Data Network (INDN)
Dementia
Oncology
NeuroCovid
Rehabilitation
Babies, Infants, Toddlers and Young Children (BITSY)

Plenary C: Relationship Between the Gut Microbiome and Cognitive Decline
Presenter: Naoki Saji

3:00 - 3:55pm
Thursday, February 3, 2022

Abstract & Learning Objectives:
The number of patients with dementia in Japan is increasing. Therefore, a comprehensive strategy for dementia research has been introduced in Japan to improve the healthcare

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system. Recently, associations between the gut microbiome and cognitive decline have received increasing attention, because the analysis of such associations may reveal the mechanisms underlying the onset of dementia. We enrolled outpatients visiting our memory clinic. We collected patient demographics, risk factors, activities of daily living, cognitive function, and brain imaging data. The gut microbiome was assessed using terminal restriction fragment length polymorphism analysis. The concentrations of metabolites were significantly different between patients with and those without dementia. Their diet patterns were also associated with dementia. These findings support the presence of the gut-microbiome-brain axis. Further studies are warranted to clarify the mechanism underlying this relationship.

Upon conclusion of this course, learners will be able to:
- Summarize basic information regarding dementia in Japan
- Summarize the information of the clinical research regarding gut microbiome
- Recognize the association between the gut microbiome and cognitive decline

Live Program Close

3:55 - 4:00pm
Thursday, February 3, 2022

Symposium 06: Highlighted SIG: Neuropsychological Test Translation, Adaptation, and Development:Lessons learned from Africa, Australia, Europe, South America, and South Asia

4:00 - 5:30pm
Thursday, February 3, 2022

22 Neuropsychological Test Translation, Adaptation, and Development:Lessons learned from Africa, Australia, Europe, South America, and South Asia

Chair

Tedd Judd
Universidad del Valle de Guatemala, Guatemala City, Guatemala

Discussant

Lingani Mbakile-Mahlanza
University of Botswana, Gabarone, Botswana

The history of psychological test translation includes problems of inaccuracy and unintentional or intentional racial, ethnic, and linguistic discrimination. Methods for accurate and fair psychological test translation, adaptation, and development have advanced, but neuropsychology has been slow to implement these methods. Inadequate translations and adaptations of neuropsychological tests may substantially impact their psychometric properties for target populations, increasing risk of clinical errors and other harms.
The International Test Commission's (ITC) 2017 Guidelines for Tests Translation and Adaptation summarize current technologies for tests whose constructs depend upon the semantic content of the items. This is helpful, but insufficient because many neuropsychological tests focus on cognitive, linguistic, and emotional constructs that are measured by processes other than semantic content. Neuropsychological tests may depend on word length, familiarity, written form, visual stimuli, culture-dependent behavioral expectations, or other features apart from meaning. Furthermore, the ITC Guidelines were developed primarily from experiences of translation and adaptation among European languages, with populations with a restricted range of education and cultures, hindering their generalization to more diverse populations.
To make the guidelines practical for neuropsychological users, the Assessment Workgroup of the INS Cultural Neuropsychology Special Interest Group has developed neuropsychological commentary on the ITC Guidelines. The Workgroup has also sponsored

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a discussion group among members involved in neuropsychological test translation, adaptation, and development projects around the world. Our objectives in this symposium are to present an overview of our neuropsychological commentary on the ITC Guidelines and illustrate the relevance of these guidelines and commentaries through presentations of projects from India, Africa, South America, Europe, and Australia in over 20 languages including Tamil, Lingala, Swahili, Surinamese Dutch, and Greek. Our panel will discuss lessons learned from these projects, including the following:

- Cognitive testing and effort are cultural experiences very much shaped by educational experiences, and relationships to authority and health care systems.
- Cultural values impacting test performance include speed-accuracy trade-off, shame, competitiveness, collectivism, and risk-taking.
- Successful test adaptation requires attention to contextualizing the testing process and adapting the nature of instructions, beyond focusing on test content.
- Years of education is a heterogeneous metric that often varies by language and across and within countries.
- Many well-known neuropsychological tests are inappropriate for translation and adaptation for use with culturally-distant populations.
- Accurate translation and adaptation do not guarantee construct validity, which must be independently reconfirmed.
- Differences in dialect and between formal, written versus informal, spoken language styles and registers can have significant impact in testing.
- Visual-spatial tasks and abilities are not universal or culture-fair.
- Drawing is a learned skill and not universally taught.
- Home country tests and norms may not be valid for use among long-time immigrant populations.
- Electronic assessment systems have potential for multicultural evaluations even for clients with limited formal education but require sensitive adaptations.
- Familiarity of stimuli, materials, and tasks is of fundamental importance but often can only be determined through extensive piloting.
- Testing multilingual clients present challenges that neuropsychology has not systematically resolved.

Keywords: cross-cultural issues**,** language: second/foreign*,* multiculturalism

991 Introduction - Symposium 06: Neuropsychological Test Translation, Adaptation, and Development: Lessons learned from Africa, Australia, Europe, South America, and South Asia

Tedd Judd
Universidad del Valle de Guatemala, Guatemala City, Guatemala

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638 Lessons Learned through the Development of the African Neuropsychology Battery (ANB)

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Objective: Researchers have shown that simply converting content of neurocognitive tests from Western countries into native languages failed to account for the impact of cultural context, salience of testing stimuli, availability of normative data, and administration procedures. This study examines lessons learned while developing a culturally appropriate neuropsychological battery for Sub-Saharan Africans (SSA).
Participants and Methods: The African Neuropsychological Battery (ANB) was developed in 6 steps:

1. neuropsychological domain selection
2. culturally appropriate task selection
3. culturally appropriate item selection

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4. English language version
5. French language version
6. and Lingala, Swahili, Tshiluba, and Kikongo versions

These languages were chosen because they are national languages of the Congo. Items were selected only when they are commonly found in Congo (and preferably other SSA countries) with identifying names that can be translated across the languages spoken in Congo. Tasks and items must have high cultural familiarity across SSA, and particularly in the DRC. Specifically, human images must be of indigenous African appearance; proper names must be of indigenous origin rather than from colonial languages; and objects, animals, plants, artificial or natural environments, or other stimuli pictured must be common in SSA. The ANB was used to assess 392 Congo subjects, age range 18-88 (mean 49.5), education range 1-22 years, 51% male.

Results: We collected norms, internal consistency, test retest reliability, and factors for the ANB. We developed age and education norms since performance declined with increasing age and decreasing education across most ANB tests. All but two ANB test scores were above the minimally acceptable Cronbach's alpha. The majority of mean inter-item correlations fell within the ideal range except for one test. Exploratory factor analysis revealed that the ANB primarily assesses three latent variables (i.e., visuospatial functioning, verbal learning and memory and verbal functioning, and expressive language/naming).

Conclusions: Psychometric properties (norms, reliability, validity, internal consistency) have shown that the ANB is a culturally valid neurocognitive battery for Congolese. These psychometric properties have led to a new adapted version of ANB and improved clarity of some test instructions. We have improved the African Naming Test (ANT), African Story Memory Test (ASMT), African List Memory Test (ALMT), African Contextual Visuospatial Memory Test (ACVMT), and Proverb Test. We changed the instruction of ASMT because it was similar to the Western instruction which was not understood in the same way by participants of a gestalt society. The instruction became to remember the details of the story as you remember the words of a song. We added 4 items on ALMT and ACVMT to avoid floor effects. We reduced items of the African Proverb Test because each item has good mean inter-item correlation. In the process of adaptation, some items of the ANT did not work in other cultures (e.g., Rwanda). To cope with the African concept of time, we use longer intervals of time between stimuli (e.g., 3 secs between words in ALMT, 10 seconds for ACVMT, and AVMT).

Keywords: cross-cultural issues**,** language: second/foreign**,** test development

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639 Cross-cultural adaptation of the Dutch Oxford Cognitive Screen (OCS-NL) for use in the Surinamese population

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[1]Anton de Kom University of Suriname, Paramaribo, Suriname. [2]Leuven Brain Institute, KU Leuven, Belgium. [3]University of Oxford, Oxford, United Kingdom

Objective: There are to date no validated tests to detect post-stroke cognitive impairment in Suriname, a culturally diverse developing country in South America. Being a former colony of the Netherlands, Dutch is the official language of Suriname. The Surinamese population consists of different ethnicities, and thus a wide variety of at least fifteen other languages besides Dutch are spoken, including Sranang Tongo, Sarnámi and Javanese. The OCS is a domain-specific cognitive screen designed for stroke patients and suitable for patients with aphasia and hemispatial neglect (Demeyere et al., 2015). It assesses five domains: attention, memory, language, numerical cognition, executive function and praxis. We aimed to culturally adapt the Dutch version of the Oxford Cognitive Screen (OCS-NL; Huygelier et al., 2019) for use in the Surinamese population, and to obtain normative data for the adapted screen.

Participants and Methods: First, the OCS-NL was independently reviewed by a multidisciplinary team consisting of a neuropsychologist, an anthropologist, a remedial educationalist and psychology students, all familiar with the cultural diversity of the Surinamese population. This team identified four main areas for cultural differences (i.e., the words, the pictures, and the level of education

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and comprehension of Dutch needed to understand the instructions) and developed a cultural adaptation, the OCS-SU. Second, the OCS-NL and OCS-SU were piloted on a small group of neurotypical individuals varying in age, educational level and socioeconomic status. Third, the OCS-SU was further adapted based on the performance and feedback of the pilot participants. Fourth, the OCS-SU was reviewed and approved by the research team of the OCS-NL. Finally, the OCS-SU was administered to neurotypical individuals recruited from regional health centers (pre-pandemic) and using advertisements in local communities (pandemic) in Suriname. To date, 42 men and 50 women from different educational levels with a mean age of 43.4 years (SD=16.1) completed the OCS-SU.
Results: Preliminary results suggest that performance of the Surinamese neurotypical individuals on the OCS-SU was worse than performance of Belgian neurotypical individuals on the OCS-NL. Furthermore, older and less educated participants seemed to perform worse.
Conclusions: The cultural adaptation process had strengths and weaknesses. The strength of the adaptation process was the inclusion of feedback from a multidisciplinary team, a heterogeneous group of individuals recruited in the community, and developers with expert knowledge about cognitive testing. A weakness was that we may not have paid sufficient attention to the test manual and training protocol in the cultural adaptation process. Furthermore,the impact of multilingualism and the differences between Surinamese-Dutch and Dutch may have been underestimated. That is, the Dutch spoken in Suriname is influenced by the different languages and cultures in Suriname and test administrators and participants had difficulties explaining and understanding instructions, respectively. Moreover, many participants did not speak Dutch as their first language. Thus, the OCS-SU and its test instructions may need to be further adapted to Surinamese-Dutch and other Surinamese languages. Further research is required to evaluate the effects of multilingualism on test performance.
Keywords: cross-cultural issues**,** language: second/foreign**,** test development

641 Assessing Cognition of Indians: Development of TAM Battery- a Neuropsychological Battery for Tamil Speakers with Linguistic Adaptation and Validation for Use in Other Major Indian Languages.

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Unified Brain Health Care, Chennai, Tamil Nadu, India

Objective: To develop the first comprehensive computer-assisted cognitive test battery for Tamil Speaking Adults in India.
Participants and Methods: Phases:
1 (completed): Identify tests, develop new tests, test battery software and manual
2 (completed): Testing the psychometric properties of the battery
3 (in process): Linguistic adaptation of the battery to major Indian languages.
4: Population-derived norms.
Results: The TAM Battery has shown robust psychometric properties. Test performance showed gradual decline with increasing age, was better with increase in years of formal education and increase in Premorbid Cognitive Abilities Score.
Conclusions: TAM Battery is a neuropsychological patient management system that includes a computer-assisted cognitive test battery for adults. It is the first battery that integrates technology for neuropsychological assessment in India.
It is a web-based application that can be administered on any large screen device and allows for tele-evaluation, enabling optimization of limited resources.
The high disease burden in India often limits primary care clinicians' time for making diagnostic decisions (approx. 10-20 minutes). Added to this is the patient's burden of private pay for neuropsychology services.
The TAM Battery has 15 tests; eight are novel or uniquely adapted. It takes two hours and 30 minutes to administer. All tests are stand-alone measures offering flexibility to clinicians who are short of time.

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Using a dynamic data pool that collects normative and clinical data from every test administered, the normative data evolves with sociodemographic and cognitive changes of the population ensuring richer data with time.
There are eight embedded sub-optimal performance measures including Visual Association Test, a new stand-alone test. The global cut off for Reliable Digit Span was not useful.
A questionnaire, Assessment of Premorbid Cognitive Abilities, is included for predicting baseline cognition, which is difficult to predict in India because education is non-standardised, it can be denied for reasons not related to cognitive abilities, and degrees can be bought for money.
In the Language module, average word output per minute was low when compared to English due to the nature of brevity in the language. Naming test had to accommodate all the names for the same object from different strata and regions of the population. For fluency, speech and naming tests provisions had to be made on how to score words generated in other languages due to influences of colonial history and multilingual society.
Standardising test instructions was challenging as subjects, even when performing well, required reminders and urging for optimal test performance. Instructions were made appropriate for colloquially spoken language that is different from textbook language. All tests have a trial to ensure understanding. Quick Screen Module helps sensitise subjects to testing.
One limitation of integrating technology arose when the Figural Memory Test was hindered by the novelty of drawing on the tablet even for people with higher technology proficiency. This test was modified to drawing on paper with digital capture of drawings.
This battery has proven that, with careful cultural adaptation, technological advances can be used to assess individuals irrespective of their proficiency in the use of technology, level of education and sociodemographic background.
Keywords: cross-cultural issues**,** language: second/foreign**,** test development

642 Translation and Home Country Norms are not Enough: Lessons from Greek Australians

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Objective: The absence of reliable and valid neuropsychological measures for culturally and linguistically diverse groups is a major challenge facing Australian neuropsychology. The aims of this study were to translate, adapt, and provide specific reference group norms for elderly Greek Australians for: WMS-IV Logical Memory and Visual Reproduction Subtests; The Hopkins Verbal Learning Test – Revised; Greek Naming Test; Semantic and Letter Verbal Fluency; Trail Making Test; Victoria Stroop Test; Months Forward & Backward; and the Depression Anxiety Stress Scale-21 (DASS-21).
Participants and Methods: A convenience sample of 90 healthy elderly Greek Australians (M = 77.14 ± 4.46; Range = 70-85; 39 Males & 51 Females), with a primary school level of education (M = 5.60 ± 0.68; Range = 4-6) were recruited throughout Melbourne.

Phase 1: WMS-IV Logical Memory, WMS-IV Visual Reproduction, The Hopkins Verbal Learning Test – Revised, and the Victoria Stoop Test were translated and adapted into Greek. Phase 2: All tests were piloted with using a sample of 20 elderly Greek Australians. Feedback was sought from this sample to determine cultural relevance, clarity of instructions to both the examiner and examinee, item bias, educational bias, and other relevant issues. Participants were not able to recall a majority of the two WMS-IV Logical Memory stories, particularly the second story, where the general pattern of responses was that it was too long and culturally irrelevant. Similarly, participants were not able to comprehend TMT-B instructions, which impacted their ability to perform this task. This finding was due to difficulty with automatisation and alphabetic sequencing incorporated in TMT-B in our low educated group. On the DASS-21 the sample displayed substantial difficulty completing a Likert scale, confusion with how to respond, and

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were not able to conceptualise mood across a 4-point spectrum. No issues were reported or observed on other tests.
Phase 3: For the WMS-IV Logical Memory we substituted the Kosmidis Story Memory Test (a shorter culturally appropriate measure), the Colour Trails Test for the Trail Making Test, and the DASS-21 for the Geriatric Depression Scale-15/Geriatric Anxiety Inventory. These tests were administered to the pilot sample and no issues were reported or observed.
Results: With these test substitutions, tests used in this study had satisfactory psychometric properties for use with the Greek-Australian sample. Some results were not comparable to similar demographic groups residing in Greece.
Conclusions: Utilising culturally-appropriate tests and specific reference group norms for Greek-Australians with limited education will facilitate accuracy of assessment findings and avoid potential underestimation and/or misinterpretation of cognitive impairment.
While ITC Guidelines were followed with respect to WMS-IV Logical Memory, the Trail Making Test, and the DASS-21, we found that these measures were not appropriate. We attributed these findings to level/quality of education, cultural/linguistic difference, acculturation, and familiarity with psychometric test-taking. These findings indicate that using existing tests, translating, adapting, and re-norming may not necessarily result in tests that measure the same cognitive constructs and thus lack clinical utility.
Keywords: cross-cultural issues**,** test development**,** diversity

643 Development and validation of the European Cross-Cultural Neuropsychological Test Battery (CNTB)

T. Rune Nielsen
Danish Dementia Research Center, Copenhagen, Denmark

Objective: To develop a neuropsychological test battery for assessment of middle-aged and elderly European ethnic minority and majority populations that (a) was relevant to assessment of cognitive impairment in Alzheimer's disease (AD) and other dementia disorders; (b) could be applied across ethnic groups and languages without need to change the content; (c) could be administered with an interpreter in a straightforward manner; and (d) be performed on people with limited or no education.
Participants and Methods: Phase 1: identification of tests through literature review, development of novel tests, test administration and scoring guidelines, translation/back translation of written test instructions.
Phase 2: Pilot testing in Turkish immigrant sample in Denmark (n=66).
Phase 3: Assessing the psychometric properties of the battery, including the influence of demographic variables on test performances (age, gender, years of education, literacy, ethnicity, acculturation), and development of normative data in a multiethnic sample (n=330).
Phase 4: Examining the diagnostic accuracy of the battery for all-cause dementia.
Results: The CNTB has proven to be useful for evaluation of AD and other dementia disorders in multicultural populations. It can be administered in approximately 60 minutes by trained personnel and covers global cognitive function, memory, language, executive functions, and visuospatial functions. The CNTB has been found to be appropriate for assessment of cognitively intact middle-aged and elderly Turkish, Moroccan, former Yugoslavian, Polish, and Pakistani/Indian Punjabi minority populations, as well as majority populations in Western European countries. Multicultural normative data is available and the CNTB measures have moderate to excellent diagnostic accuracy for all-cause dementia.
Conclusions: The main strength of this project is the design of a comprehensive neuropsychological test battery with potential applicability across diverse ethnic groups as it was recognized that designing unique tests for every ethnic minority population in western Europe would not only be too costly, but also hamper cross-cultural comparisons. The work complies with the following guidelines from the ITC Guidelines for Translating and Adapting Tests: PC-2, PC-3, TD-1, TD-2, TD-3, TD-4, TD-5, A-1, A-2, SSI-1, Doc-1, and Doc-2, but not with C-1, C-2, and SSI-2. We think that the guidelines PC-1 and C-4 are irrelevant to the study, and C-3 will be addressed in future studies.

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A limitation of the CNTB is that we cannot rule out the possibility that the use of broad ethnic classifications based on country of origin and equation of years of education across ethnic groups may have masked or emphasized ethnic differences. Equating education across cultures may be problematic as the length, quality, and content of the school day and year may vary considerably from country to country and even region to region (e.g. urban vs. rural) within countries, and in fact the proposed ethnic groups represent at least 20 different ethnicities. Also, visuoconstructional tests relying on drawing proved to be very difficult for illiterate participants with many receiving minimum scores. This indicates that normative correction of such tests may not be sufficient for interpreting performances of people who are illiterate.

Keywords: cross-cultural issues**,** language: second/foreign**,** test development

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992 Discussion - Symposium 06: Neuropsychological Test Translation, Adaptation, and Development: Lessons learned from Africa, Australia, Europe, South America, and South Asia

Tedd Judd
Universidad del Valle de Guatemala, Guatemala City, Guatemala

Symposium 04: Technology Based Interventions for Neurodegenerative Disease

4:00 - 5:30pm
Thursday, February 3, 2022

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8 Technology Based Interventions for Neurodegenerative Disease

Chair

Jared Benge
University of Texas at Austin, Austin, USA

Discussant

Russell Bauer
University of Florida, Gainesville, USA

Technologies including smartphones, social media, high speed internet access, and apps are rapidly changing many aspects of daily life. Those with Alzheimer's disease and related dementias (ADRD) and their care partners are not exempt from these trends. Connected devices, tech enriched environments, and long ingrained computer-based habits hold enormous potential for improving important outcomes for those with ADRD, such as promoting independence, safety, and efficacy in performing daily tasks. However, capitalizing on this potential requires development of a new set of skills, interventions, and evidence base for practice as well as thoughtful approaches for preventing disparities in access to and use of effective techniques. Neuropsychologists are uniquely equipped to help guide the development of such interventions and understand the complex interactions between cognitive impairment, technology use, and daily needs. To this end, this symposium presents 4 projects highlighting the potential of technology to meaningfully improve these outcomes in individuals with ADRD and their caregivers. First, we review the development and advances of the Electronic Memory and Management Aide (EMMA), an application that helps individuals with manage daily tasks and also incorporates health tracking and machine learning technologies to promote health and well being in those with ADRD and related conditions. Next, we will discuss the development of ActiviDaily, a smartphone app designed to help individuals with ADRD create, implement, and prompt for individualized activity goals. Third, we will review the outcomes from a randomized control trial that compared two app-based approaches for addressing prospective memory lapses in those with mild cognitive impairment and mild dementia. Finally, we will review an innovative study addressing how care partners are using technology to support those with ADRD.
In addition to highlighting the development and efficacy of these approaches, presenters will also reflect on the challenges and lessons learned from working at the interface of cognitive

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impairment and technology use in older adults. Pearls and pitfalls, including the need for developing rigorous research designs in a rapidly changing tech landscape, working in technology focused teams, methods for quickly processing large amounts of data, and issues related to usability, scalability, privacy, and value added to clinical care will be discussed. Designing interventions with the triad of patient, care partner and scientist will be a particular focus. These findings will help highlight the central role neuropsychology can play in developing technologies to treat ADRD.
Keywords: aging disorders**,** technology

29 Dementia Caregiver Insights on Use of Assistive Technologies

Andrew M Kiselica[1], Anna Boone[1], Michael Scullin[2], Jared F Benge[3]
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Objective: Dementia is a common age-related condition, characterized by declines in cognitive and functional abilities. It is a massive and growing public health and economic concern, wherein the responsibility of care for persons with dementia falls disproportionately on family and friends, who provide assistance in over 90% of cases. Of late, there has been an explosion of interest in the possibility of using assistive technologies to ease the strain of dementia care and improve quality of life for persons with dementia. For instance, smartphone applications, smart speakers, and wearable devices offer an array of features, including automated reminders, location tracking, and activity monitoring. These capabilities might be used to support performance in activities of daily living (e.g., managing medications, shopping), ensure safety (e.g., limit wandering, minimize falls), and promote health (e.g., increase access to treatment, facilitate physical activity). Thus, growth in availability of assistive technologies presents a unique opportunity to improve care of persons with dementia and limit negative consequences for caregivers. Unfortunately, there is scant research on use of technology for dementia care. Furthermore, caregivers' perceptions of and insights about technologies are poorly understood. Therefore, we conducted in-depth interviews with caregivers to persons with dementia.
Participants and Methods: Semi-structured interviews were conducted with 20 current caregivers to persons with dementia via Zoom or telephone. Participants included English-speaking adults in the United States, who provide care to a person with dementia on an at least weekly basis. Interviews focused on 1) Identifying technologies currently used in dementia care; 2) Highlighting barriers to and facilitators of assistive technology use; 3) Exploring ways that caregivers might be supported in using assistive technologies. Interview responses were transcribed and coded using a modified approach to grounded theory, which allows themes to be identified from qualitative data.
Results: Analysis of responses revealed that caregivers use technology for a variety of purposes. They included remotely monitoring of persons with dementia (e.g., via nanny cams), accessing healthcare (e.g., telehealth visits), assisting with managing medications (e.g., setting alarm reminders), assisting with managing finances (e.g., online bill pay), facilitating social interaction (e.g., Facetime with family), promoting cognitive activity (e.g., with smartphone-based games), and providing leisure/entertainment (e.g., streaming movies or music). The main facilitators of technology use included familiarity with technology and perceived usefulness, while the main barriers included financial cost and hesitancy on the part of the person with dementia. Caregivers also noted that the best way to expand use of assistive technologies is to provide easy instructions and access to technical assistance.
Conclusions: Findings reveal important lessons for researchers developing technology-focused interventions for persons with dementia and their caregivers. Specifically, it is important to support the existing efforts of caregivers, who incorporate assistive technologies into the care plan in a variety of ways. Supports might include financial assistance for purchasing technology and provision of easy-to-understand instructions and technical assistance to facilitate use.

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Keywords: technology, caregiver burden, dementia - Alzheimer's disease

39 A Randomized Controlled Trial of Smartphone Enabled Strategies to Improve Prospective Memory Functioning in Mild Cognitive Impairment and Mild Dementia

Jared F Benge[1,2,3], Winston E Jones[2], Richard Phenis[3], Samantha Beevers[3], Sabra Rosen[3], Kara Dinh[3], Andrew Kiselica[4,3], Francis J Keefe[5], Michael K Scullin[2,3]
[1]Dell Medical School, University of Texas At Austin, Austin, TX, USA. [2]Baylor University, Waco, TX, USA. [3]Baylor Scott and White Health, Temple, TX, USA. [4]University of Missourri, Columbia, MO, USA. [5]Duke University, Durham, NC, USA

Objective: Devices such as smartphones hold promise for addressing the day to day impact of memory impairment in individuals with Alzheimer's disease and related dementias (ADRD). However, rigorous empirical studies of technology enabled cognitive prosthetics are rare, and there is no clear evidence to guide clinicians and researchers on which technology strategies may be most feasible and acceptable to use in work with individuals with ADRD. Thus, the current study evaluated the feasibility of smartphone interventions and preliminary efficacy for supporting prospective memory in persons with mild cognitive impairment (MCI) and mild dementia to use a smartphone to support prospective memory for ecologically valid tasks.
Participants and Methods: Fifty-two persons meeting diagnostic criteria for MCI or mild dementia were recruited from neuropsychology and neurology clinics. Participants were randomly assigned to conditions involving a general smartphone orientation as well as training on how to use either a) a digital voice recorder app or b) personal assistant reminder app. Participants used their app for four weeks to off-load prospective memory intentions for both experimentally assigned and personally developed tasks. The primary measures of interest were measures of feasibility. In addition, several outcome measures were collected including: a) performance on experimenter-assigned tasks such calling the lab on a particular day or take a photo when at a particular location, and b) secondary outcome measures including subjective prospective memory, days of use, quality of life, and informant reported activities of daily living performance.
Results: Participant ratings indicated that the intervention was both feasible (90% of participants completed all study phases, smartphone use was noted on 81.5% of days in retained participants), and acceptable (69.2% of participants stated they would recommend the smartphone intervention to a friend). Participants performed relatively well on experimenter-assigned prospective memory tasks (51.7% ± 27.8%), with performance accuracy favoring the reminder app in Week 1, but reversing to favor the digital recorder app by Week 4 (p = .010, h_p^2 = .079). Participants in both conditions reported improvements in daily prospective memory functioning on standardized questionnaires (p<.001, h_p^2 = .285) and an ecologically valid structured interview (p < .001, d = 1.75). Correlational analyses indicated that in either condition, higher usage was associated with better prospective memory performance and more perceived independence in instrumental activities of daily living, even when controlling for condition, age, global cognitive functioning, and previous smartphone experience.
Conclusions: Older adults with cognitive disorders find smartphone-based memory strategies both feasible and acceptable. Also, use of these strategies provides benefit for both accuracy of completion of prospective memory tasks as well as subjective cognitive functioning. Further research is needed to identify optimum strategies for use. These results are discussed in the context of the technological reserve hypothesis, where the presence of technologically related habits, environments and devices may help to promote independence and well-being even in the face of cognitive decline. Limitations and considerations for clinical researchers interested in this area will be discussed as well.
Keywords: memory: prospective, aging disorders, technology

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41 Improving the Efficacy of Traditional Compensation Tools and Interventions for Individuals with Mild Cognitive Impairment with Technologies

Maureen Schmitter-Edgecombe, Catherine Luna, Diane J. Cook
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Objective: There is an urgent need for effective and scalable interventions that will help delay disability associated with Alzheimer's disease and related disorders (ADRDs) and reduce caregiver burden and health care costs. Training in compensatory aids (e.g., calendars and note-taking systems) can improve daily function, quality of life and independence for individuals with ADRD. Although recent advances in technology have the potential to improve the effectiveness of traditional compensatory aids, gaps in our knowledge base limit scalability and clinical translation of these technologies for compensation use, real-time health monitoring, and intervention.
Participants and Methods: Forty-two individuals, primarily with mild cognitive impairment (MCI), participated in iterative development of an Electronic Memory and Management Aid (EMMA) application and/or the associated training materials. Participants completed a series of tasks using EMMA followed by questionnaires that assessed satisfaction and usability. Thirty-two individuals with amnestic MCI completed a pilot clinical trial in which they were randomized to learn to use the EMMA app on its own or when partnered with real-time, activity aware, transition-based prompting delivered by a smart home. EMMA data metrics (e.g., daily distinct app usage) were collected continuously throughout the EMMA app training (1 month) and post-training (3 months) phases.
Results: The iterative development data revealed the EMMA app to be user-friendly despite individual differences in cognitive ability, familiarity with scheduling tools, and comfort with technology. The pilot clinical trial revealed that, in comparison to the EMMA-only condition, by week four of training, participants with amnestic MCI in the partnered condition were engaging with EMMA more times daily and using more basic and advanced EMMA features daily. The advantages found for the partnered condition were maintained throughout the post-training phase with less loss of EMMA app use over time compared to the EMMA-only condition. Removal of the smart home prompts during post-training month 2 did not lead to decreased use of EMMA in the partnered group.
Conclusions: This work demonstrates that intelligent technologies can improve the efficacy of traditional compensation tools and intervention training methods. The data also underscore the importance of building an overlearned and automatic habit associated with app use early in training. Opportunities associated with continuous real-time data collection, including the development of automated booster sessions, personalized learning, and health algorithms as well as challenges related to feasibility and scalability of such approaches will be discussed.
Keywords: technology**,** mild cognitive impairment**,** cognitive rehabilitation

239 ActiviDaily App: Turning Apathy into Action in Neurodegenerative Disease

Dawn Mechanic-Hamilton, Sean Lydon, Panpan Zhang, Sharon X Xie, Alexander Miller, Lauren Massimo
University of Pennsylvania, Philadelphia, PA, USA

Objective: Individuals with Alzheimer's Disease (AD) and related disorders (ADRDs), including behavioral variant Frontotemporal Degeneration (bvFTD), present with a constellation of cognitive and neuropsychiatric symptoms. Impairment of goal-directed behavior (GDB), often labeled as apathy, is one of the most common behavioral symptoms that has a significant negative impact on engagement in everyday functional activities and caregiver burden. ActiviDaily is a mobile app that was developed by our team to engage both patients and caregivers in order to: (1) increase goal-

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directed behavior (GDB) to improve everyday function, (2) reduce behavioral symptoms, and (3) decrease caregiver burden. ActiviDaily targets key and distinct components of GDB (motivation, planning, and initiation) to achieve individualized patient goals. This pilot study aimed to evaluate feasibility of ActiviDaily in ADRD patients with a range of cognitive and functional impairments.
Participants and Methods: Behavior, cognition, everyday functioning, and psychological distress were assessed in twenty-four dyads of patients and care partners diagnosed with Mild Cognitive Impairment (MCI), AD or bvFTD. Participants and partners used ActiviDaily at home for four weeks. Goal Attainment Scaling (GAS) was used to establish individualized goals and measure progress on a standard scale. Data collected from the ActiviDaily app included frequency of activity reminders, skips and completions as well as engagement with in-app motivational and reward features. A usability scale, the IBM Computer Usability Satisfaction Questionnaire, was completed to evaluate ease of interaction and acceptability of the app.
Results: GAS showed that most participants met their top two goals at or above expectations. Across all participants, they achieved their brain health goals ($p = 0.003$) and housework goals ($p = 0.02$). Higher ratings on the usability scale were associated with greater app use ($p = 0.04$) and goal achievement ($p = 0.06$). While not at the level of statistical significance, psychological outcomes showed improvement in depression, anxiety, and stress. For dyads who demonstrated consistent app use, qualitative responses from caregivers indicated reduced daily prompting for partner activities. There were no differences in goal achievement between diagnostic groups.
Conclusions: ActiviDaily is an innovative mobile intervention that individualizes treatment of apathy for patients with ADRD and has the potential to increase independence in daily activities and decrease caregiver burden. Patient and caregiver dyads were engaged and motivated to use technology to increase goal-directed behaviors. Future directions, include incorporation of training sessions to ensure consistent use of ActiviDaily and increase patient and caregiver satisfaction.

Keywords: aging disorders, technology, cognitive rehabilitation

990 Discussion - Symposium 04: Technology Based Interventions for Neurodegenerative Disease

Russell Bauer
University of Florida, Gainesville, FL, USA

Paper Session 05: Aging 1

4:00 - 5:30pm
Thursday, February 3, 2022

1 Longer Sleep Duration and Less Sleep Variability is Associated with Better Cognition and Lower Amyloid and Tau Burden in Healthy Older Adults.

Laura Fenton[1,2], Lisette Isenberg[2], Vahan Aslanyan[2], Daniel Albrecht[2], Joy Stradford[2], Teresa Monreal[2], Judy Pa[2,3]
[1]Department of Psychology, University of Southern California, Los Angeles, CA, USA. [2]Mark and Mary Stevens Neuroimaging and Informatics Institute, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA. [3]Department of Neurology, University of Southern California, Los Angeles, CA, USA

Objective: To evaluate relationships between sleep efficiency and sleep duration (means and variability), β-amyloid (Aβ) positron emission tomography (PET), tau PET, and cognition in healthy older adults. Moderating effects of ApoE4 status on these relationships were also explored.
Participants and Methods: Objective sleep efficiency, Aβ PET, tau PET, and cognitive performance on neuropsychological assessments (MoCA, Flanker, CVLT, and Complex Figure) were examined in a sample of 52 healthy, older adults (age=66.4+6.89, 67% female, 27% ApoE4 carriers). Sleep efficiency, defined as the percentage of time asleep within

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a given sleep period (i.e., time from sleep onset to wake up), and sleep duration, defined as the total time asleep within a given sleep period, were objectively measured using the GENEActiv tri-axis accelerometer for an average of 30.25 days. Sleep duration and sleep efficiency variability were characterized using an intra-individual coefficient of variation (standard deviation/mean x 100). Aβ and tau were measured in vivo using PET and the F-18 florbetaben (FBB) and flortaucipir (FTP) tracers to calculate composite SUVR scores. Composite FBB scores consisted of frontal, parietal, lateral temporal, and cingulate cortices. Composite FTP scores consisted of previously defined brain regions consistent with Braak stages I-VI. All analyses were adjusted for age, sex, ApoE4 status and education (for cognitive measures). **Results:** Longer sleep duration was associated with better visual memory (p=.02) and inhibitory control (p<.01). Greater variability in sleep duration was associated with higher Aβ burden (p=.04), lower MoCA scores (p=.02), and worse inhibitory control (p=.04). Greater variability in sleep efficiency was associated with higher Aβ burden (p<.01), lower MoCA scores (p=.01) and worse inhibitory control (p=.05). There was a significant moderating effect of ApoE4 status, such that higher sleep efficiency variability was associated with higher Aβ burden in ApoE4 carriers only (p<0.01). There was a trend towards a significant interaction between sleep duration and ApoE4 status (p=.08), suggesting that shorter sleep duration is more strongly associated with higher Aβ burden in ApoE4 carriers relative to non-carriers. There was also a trend towards an association between greater variability in sleep duration and higher tau burden (p=.07). No significant associations were observed between variability in sleep efficiency and tau burden or between mean levels of sleep efficiency and any brain or cognitive outcomes**.** **Conclusions:** These results provide evidence that longer sleep duration and lower variability in sleep duration and sleep efficiency are associated with lower levels of Aβ and tau burden, as measured with PET imaging, and better cognition. Additionally, the relationships between sleep duration and variability in sleep efficiency with Aβ burden appear to differ by ApoE4 status, suggesting that longer sleep duration and more consistent sleep quality may be protective against Aβ burden in ApoE4 carriers. Longitudinal and causal studies are needed to better understand these relationships. Future work should also investigate factors contributing to variability in sleep duration and sleep efficiency (e.g., lifestyle factors) in order to inform intervention studies.

Keywords: aging (normal)**,** sleep**,** dementia - Alzheimer's disease

2 CSF Markers of Synaptic Dysfunction and Axonal Injury Synergistically Predict Atrophy in AD-Sensitive Brain Regions in Clinically Normal Adults

Rowan Saloner[1,2], Nina Djukic[1], Corrina Fonseca[1], Johanna Nilsson[3], Ann Brinkmalm[3,4], Kaj Blennow[3,4], Henrik Zetterberg[3,4,5,6,7], Joel H Kramer[1], Kaitlin B Casaletto[1]
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Objective: Synaptic dysfunction and axonal damage may signal early pathological changes in age-related neurodegenerative disorders, including Alzheimer's disease (AD). These complementary components of neural injury are increasingly recognized as independent prognosticators of AD-related neurodegeneration, yet less is known regarding potential interactive effects of synaptic dysfunction and axonal damage on brain volume trajectories in AD-relevant brain regions.

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Participants and Methods: Forty-six clinically normal adults (baseline age mean [range]=70 [53-86]; 43% female; MMSE *M*=29; CDR=0) from the UCSF Memory and Aging Center completed baseline lumbar puncture and longitudinal brain MRI (mean [range] scans=2.6 [1-6]; mean [range] follow-up years=3.7 [0-8.7]). AD meta-ROI volumes at each MRI timepoint were computed as the sum of 10 bilateral gray matter FreeSurfer ROIs previously shown to be sensitive to clinical AD: amygdala, entorhinal cortex, fusiform gyrus, hippocampus, inferior parietal, inferior temporal, middle temporal, parahippocampal gyrus, precuneus, temporal pole. Cerebrospinal fluid (CSF) was analyzed for synaptic proteins (synaptotagmin-1, SNAP-25, neurogranin, and GAP-43) and axonal damage (neurofilament light [NFL]) via enzyme-linked immunosorbent assay (ELISA) or mass spectrometry. CSF AD proteinopathy biomarkers ($A\beta_{42}$ and $ptau_{181}$) were assayed with the Lumipulse platform. Controlling for $ptau_{181}/A\beta_{42}$ ratio, total intracranial volume, and demographics (age, sex, education), mixed-effects regressions modeled independent and interactive effects of synaptic proteins and NFL on AD meta-ROI trajectories.
Results: Six out of 46 (13%) participants had abnormal $ptau_{181}/A\beta_{42}$ ratios based on a validated Lumipulse cut-off of >0.068. Synaptic proteins exhibited statistically significant intercorrelations (*r* range: .63 to .86) but did not significantly correlate with NFL (|*r*s|<.30, *p*s>.05). AD meta-ROI volumes significantly declined with time (*b*=-0.65, *p*<.001). Higher baseline NFL, but not synaptic proteins, predicted steeper AD meta-ROI trajectories (NFL x time: *b*=-0.24, *p*=.001). Each synaptic protein further moderated the adverse effect of NFL on AD meta-ROI trajectories such that higher baseline synaptic protein and NFL levels synergistically predicted the steepest AD meta-ROI declines (synaptic protein x NFL x time; synaptotagmin-1: *b*=-0.16, *p*=.026; SNAP-25: *b*=-0.19, *p*=.005; neurogranin: *b*=-0.20, *p*=.003; GAP-43: *b*=-0.22, *p*=.005).
Conclusions: Synaptic dysfunction and axonal damage are dissociable mechanisms that synergistically predict atrophy in AD-sensitive brain regions in clinically normal adults. Examination of these complementary CSF markers of neural injury in tandem may enhance early detection of AD risk, even among older adults without overt cognitive deficits. To clarify the specificity of our findings to AD-related neurodegeneration, future studies with larger sample sizes should examine the combined effects of CSF synaptic markers and NFL on AD meta-ROI trajectories across the spectra of AD proteinopathy and other age-related pathophysiologies (e.g., cerebrovascular disease).
Keywords: brain structure**,** neurophysiology**,** temporal lobes

3 Cellular pathways connecting physical activity to the brain in humans: A window into cognitive reserve and resilience?

Kaitlin B Casaletto[1], Cutter Lindbergh[2], Alfredo Ramos-Miguel[3], Anna VandeBunte[1], Molly Memel[1], Julie Schneider[4], Aron Buchman[4], David Bennett[4], William Honer[5]
[1]UCSF, San Francisco, CA, USA. [2]University of Connecticut, Storrs, CT, USA. [3]University of the Basque Country, Biscay, Spain. [4]Rush University, Chicago, IL, USA. [5]University of British Columbia, Vancouver, Canada

Objective: Physical activity is associated with cognitive reserve and resilience, though the cellular and molecular mechanisms are unknown limiting potential therapeutic opportunities. We aimed to translate animal and *in-vitro* studies demonstrating causal links between physical activity and synaptogenesis and microglial homeostasis into humans. We hypothesized that greater levels of free-living physical activity would relate to better markers of synaptic and microglial functioning in older adults.
Participants and Methods: 404 decedents from the Rush Memory and Aging Project (MAP) completed actigraphy monitoring (average daily activity) and cognitive testing in life, and neuropathological examination at autopsy. Brain tissue was analyzed for synaptic protein levels (SNAP-25, synaptophysin, VAMP, complexin-I, synatotagmin-1, syntaxin) and in a subset (n=167), microglial activation markers.

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Proportion of morphologically activated microglia (PAM) was estimated via immunohistochemistry (anti-human HLA-DP-DQ-DR) and morphology (% stage I, II, or III) in the ventromedial caudate, posterior putamen, inferior temporal (IT), and middle frontal gyrus. Regression models evaluated the relationship between physical activity and synaptic proteins or PAM, adjusting for age, sex, education, and motor performance. In separate bootstrapped models, we evaluated the mediational effect of microglial activation on the relationship between 1) physical activity and synaptic integrity, and 2) physical activity and global cognition.
Results: Decedents averaged 90 years-old at death, two-thirds were nondemented, and 60% evidenced pathologic Alzheimer's disease (AD). Adjusting for age, sex, education, and motor performances, greater daily physical activity was associated with higher synaptic protein levels in brain tissue. Relationships were comparable across brain regions examined, and were not moderated by pathology burden. In contrast, greater physical activity related to lower PAM specifically in the ventromedial caudate and IT. The relationships between physical activity and lower PAM in the caudate or IT gyrus were particularly prominent in older adults evidencing microinfarcts or AD pathology, respectively. That is, adults with high physical activity demonstrated disproportionately lower microglial activation for their pathology burden compared to low activity peers. Mediation modeling indicated that PAM IT significantly mediated ~30% the beneficial relationship between physical activity and both 1) synaptic protein levels in the IT and 2) cognition in separate models. However, the size of the mediation was contingent on AD pathology burden and increased to >40% in adults with high AD burden, but <10% in adults with low AD burden. Caudate PAM did not relate to synaptic or cognitive levels.
Conclusions: Higher levels of late life physical activity are associated with markers of synaptic integrity and lower microglial activation in humans. Physical activity may promote synaptic and cognitive resilience in part through reduction of pro-inflammatory microglial states in the presence of AD pathology.
Keywords: cognitive reserve**,** dementia - Alzheimer's disease**,** brain plasticity

4 DNA-Methylation "GrimAge" Acceleration Mediates Sex Differences in Verbal Learning and Recall: Findings from the Health and Retirement Study

Deirdre M. O'Shea, Geoffrey Tremont, Brian R. Ott, Lori A. Daiello, Jonathan D. Drake
Brown University, Providence, Rhode Island, USA

Objective: Evidence from cognitive science support sex differences in verbal memory, that tend to favor women, and that these differences persist across the lifespan. These findings converge with epigenetic research that have shown slower rates of biological aging in women compared to men. Whether sex differences in biological aging mediate sex differences in verbal learning/memory in older adults has not been fully examined; the aim of the current study was to explore this.
Participants and Methods: Data was obtained from the Harmonized Cognitive Assessment Protocol, a sub-study of the 2016 wave of the Health and Retirement Study (HRS). A subset of participants also took part in the 2016 Venous Blood Study. Thirteen epigenetic "clocks" were constructed from these data and made publicly available by HRS staff. We selected the DNA methylation "GrimAge" clock as the indicator of biological aging, given that this clock has most consistently been associated with cognition in prior studies. Exclusion criteria included self or informant report of a prior diagnosis of dementia, Alzheimer's disease, Parkinson's disease, or stroke. A final sample of 1,505 participants (mean age= 75, *SD*= 6.8, male= 42%, White= 81%, Black= 13%, Hispanic= 6%), with full data were included in the analyses. The residual from age adjusted GrimAge (AgeAccelGrim) was used as the measure of biological age acceleration. Cognitive composites were constructed from the learning and delayed recall trials of the Consortium to Establish a Registry for Alzheimer's Disease Word List Memory Task and the Wechsler Memory Scale-IV, Logical Memory subtest and used as the outcome measures. T-tests were used to test

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sex differences in chronological age and AgeAccelGrim. Mediation analysis tested whether AgeAccelGrim mediated (5,000 resamples) the association between sex and learning/recall composites. Chronological age, years of education, smoking status, white blood cell count, and race/ethnicity were included as covariates.
Results: There was a significant difference between men and women in AgeAccelGrim, (t(1,504) = 13.78, p < .000), such that women showed slower biological aging (M = -0.31, SD = 0.89), compared to men (M = 0.37, SD = 1.01). There was no sex difference in chronological age (p = .36). Mediation analyses revealed a total direct effect of sex on learning (β = .32, 95% CI [.26, .37]), with a significant indirect effect of AgeAccelGrim, that explained 12.5% of the total effect of sex (95% CI [.02, .06]). A similar pattern was revealed for delayed recall (total effect of sex β = .26, 95% CI [.20, .32]), with AgeAccelGrim accounting for 11.5% of the total effect (95% CI [.01, .04]). In sum, women performed better on verbal learning/recall measures compared to men, and this association was partially explained by slower biological aging in women.
Conclusions: These findings demonstrate the potential for epigenetic markers of aging to increase understanding of sex differences in verbal learning and memory in older adults. More broadly, identifying epigenetic markers most pertinent to differences in cognition offers opportunities for further investigations into environmental exposures that contribute to variation in these markers.
Keywords: genetics**,** aging (normal)**,** memory: normal

5 Pulse Pressure Interacts with Tau PET to Predict Longitudinal Change in Memory and Executive Function Independently of Amyloid-Beta PET

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Objective: Several studies have demonstrated that tau, but not amyloid-beta, biomarkers are associated with cognitive decline and progression to dementia, despite the prominence of amyloid-beta in models of Alzheimer's disease (AD) pathologic progression such as AT(N). Additionally, although AT(N) includes a broad marker of neurodegeneration, it does not consider other specific pathologic contributions such as vascular pathology. Like tau, cardiovascular risk has been associated with progression to dementia. Thus, we explored the interactive effects of AD biomarkers with a specific vascular risk marker (pulse pressure, or PP) on longitudinal cognitive change.
Participants and Methods: Participants included 116 older adults without dementia from the Alzheimer's Disease Neuroimaging Initiative (ADNI). Biomarkers of tau and amyloid-beta at baseline were assessed using positron emission tomography (PET). Cardiovascular risk was indexed from blood pressure (BP) using the following formula: PP = (systolic BP – diastolic BP)/systolic BP, which indirectly reflects arterial stiffening. Neuropsychological assessment provided memory, language, and executive function domain composite scores at baseline and 1-year follow-up. Multiple linear regression examined interactive effects of baseline PP with (1) tau PET independent of amyloid-beta PET and (2) amyloid-beta PET independent of tau PET on 1-year cognitive outcomes. All non-normally distributed variables underwent Box-Cox transformation. Bonferroni correction was applied for cognitive domain comparisons such that alpha = .05/3 = .017.
Results: The interaction between pulse pressure and tau PET significantly predicted 1-year change in memory (p = .005) and executive function (p = .012) such that the combined effect of high pulse pressure and high tau PET levels was associated with lower cognitive scores at follow-up, after adjusting for baseline cognitive score, age, sex, cognitive diagnosis, amyloid-

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beta PET, and multiple comparison correction. In contrast, amyloid-beta PET did not significantly interact with pulse pressure to predict 1-year change in any cognitive domain after adjusting for the same demographic factors, tau PET, and multiple comparison correction. Notably, there was a nonsignificant interaction between pulse pressure and amyloid-beta PET on memory change that did not survive multiple comparison correction ($p = .020$).
Conclusions: Results indicate that tau and an indirect marker of arterial stiffening (PP) may synergistically contribute to cognitive decline, whereas amyloid-beta may have a lesser role in predicting clinical progression. Although historically neglected in clinical trials in favor of anti-amyloid therapies, both tau and vascular pathology (particularly in combination) may represent valuable targets for treatment intervention intended to slow cognitive decline.
Keywords: dementia - Alzheimer's disease**,** cerebrovascular disease**,** positron emission tomography

6 Clinical and Neuropathological Moderators of Longitudinal Change in Serial Position Scores in Older Adults

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Objective: The serial position effect refers to the tendency for healthy persons to better remember words at the beginning (primacy effect) and end (recency effect) of a list. A diminished primacy effect is associated with conversion to mild cognitive impairment (MCI) and Alzheimer's dementia. The primacy effect is thought to be hippocampal-dependent and therefore susceptible to disruption from Alzheimer's disease-related neuropathologies that first appear in the entorhinal cortex and hippocampus years before the onset of cognitive impairment. Tracking long-term changes in serial position scores may be useful for early disease detection. Thus, the current study aims to examine longitudinal change in serial position scores in older adults who were cognitively intact at study enrolment and who showed evidence of neuropathologies limited to the entorhinal and hippocampal regions at autopsy.
Participants and Methods: This study uses data from Rush University's Religious Orders Study and the Memory and Aging Project; two longitudinal clinical-pathologic cohort studies of older adults followed annually for up to 21 years. Participants in the current study (N = 117) were included if they (1) were cognitively intact at enrolment; (2) completed at least one follow-up annual neuropsychological assessment; (3) died and underwent autopsy; (4) met neuropathological criteria for Braak stage I or II; and (5) did not meet criteria for hippocampal sclerosis, TDP-43 (transactive response DNA-binding protein 43) stage 3 or 4, or Alzheimer's disease (using NIA-Reagan criteria).
The CERAD Word List Memory test was used to calculate serial position and total recall (immediate, delayed) scores. Cognitive status at death (not impaired, impaired [MCI or dementia]) was determined by a neurologist. A full neuropathological evaluation was performed to quantify eight age-related neuropathologies: diffuse amyloid plaques, neurofibrillary tangles, Lewy bodies, cerebral amyloid angiopathy, atherosclerosis, arteriolar sclerosis, gross infarcts, and microscopic infarcts. Mixed effects models were used to examine change in memory scores, adjusting for age, sex, education, and APOE e4 status. Cognitive status at death, neuropathologies, demographics, and clinical covariates were examined as moderators.
Results: Primacy scores showed the most decline over time ($b = -.048$, $p < .001$) followed by delayed total recall scores ($b = -.024$, $p = .038$). Middle, recency, and immediate total recall scores did not change. Greater primacy decline was noted among persons who were cognitively impaired at the time of death ($b = -.050$, $p = .027$). None of the covariates nor the neuropathologies moderated the primacy trajectories, though a non-significant effect was noted for tangle density ($b = -.041$, $p = .080$).

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Conclusions: A selective decline in primacy scores was observed, with greater decline for persons who eventually met criteria for cognitive impairment. These findings suggest that monitoring for change in primacy scores may help detect cognitive changes associated with incipient Alzheimer's disease earlier than can be attained with routinely used total recall scores. Future research should link amyloid and tau biomarkers with *in vivo* primacy score trajectories to better understand how accumulating neuropathologies may drive early cognitive change.
Keywords: aging disorders**,** hippocampus**,** memory disorders

Paper Session 06: TBI

4:00 - 5:30pm
Thursday, February 3 2022

1 Variations in white matter connectivity within and across functional brain networks in pediatric traumatic brain injury

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Objective: Pediatric traumatic brain injury (TBI) results in various social and cognitive impairments stemming from the injury itself and the subsequent cascade of physiological sequelae, including the direct impact on white matter connectivity of the brain. Here, we investigated the relationships among white matter connectivity within and between four white matter networks in children with orthopedic injury (OI), complicated-mild/moderate TBI (mTBI), or severe TBI (sTBI).
Participants and Methods: Participants included 24 OI (M_{age}=11.7; n_{male}=16), 18 mTBI (M_{age}=12.4; n_{male}=14), and 10 sTBI (M_{age}=10.9; n_{male}=5). TBI severity was determined using the Glasgow Coma Scale, with injury-related abnormalities on neuroimaging required for complicated-mild classification. Participants underwent MRI on a 3T Siemens scanner with 64-direction DTI. White matter connectivity was quantified using FMRIB's Diffusion Toolbox (FSL v6.0.4). Regions of interest (ROIs) for the default mode (DMN), central executive (CEN), salience (SN), and basal ganglia networks (BGN) were defined by the Desikan-Killiany atlas. Connectivity values were calculated as total number of fibers divided by waytotal per ROI.
Results: Significant ipsilateral connections were found within the BGN, with trends toward bilateral group differences from the pallidum to putamen (OI>mTBI>sTBI; *p*s<.02), and thalamus to putamen in the right hemisphere (RH; OI>mTBI>sTBI; *p*<.02). Many connections were significant within the CEN, most within the RH, with group differences in connections between frontal and parietal regions (OI>mTBI>sTBI; *p*s<.05). Other differences included the inferior parietal region to pars orbitalis (mTBI>OI>sTBI; *p*<.01) and rostral middle frontal to superior parietal (mTBI>sTBI>OI; *p*<.03). There were group differences in contralateral connections out of the left hemisphere (LH) and ipsilateral connections within the left hemisphere (OI>mTBI>sTBI; *p*s<.05). Within the DMN, there were group differences in contralateral connections from the left posterior cingulate to right medial orbitofrontal (OI>mTBI>sTBI; *p*<.03), right posterior cingulate to left frontal pole (mTBI>OI>sTBI; *p*<.03), and in the LH from the medial orbitofrontal to posterior cingulate (mTBI>OI>sTBI; *p*<.04). There were no group differences in SN connectivity.

The total number of connections was calculated for each participant and network. Total

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connections within each network and across all four networks did not differ by group.

Conclusions: These findings concur with previous research that connectivity of the DMN, CEN, and BGN are impacted by TBI. These networks are involved in internally focused activity, working memory and attentional control, and response selection and transfer, respectively. Based on these findings, we can elucidate the functional deficits of these higher-order cognitive networks. The sTBI group had fewer connections between ROIs compared to both OI and mTBI, consistent with the cognitive deficits in attention and memory that impact this population. We did not find group differences within the SN, which is invoked in the detection of salient stimuli and has been shown to mediate the activation of these other networks during cognitive tasks. The absence of group differences could be due to limitations in sample size or suggest that SN functionality is not apparent in the white matter connectivity alone as it is in other networks.
Keywords: child brain injury**,** neuroimaging: functional connectivity**,** traumatic brain injury

2 Stress Reactivity after Pediatric Traumatic Brain Injury: Relation with Behavioral Adjustment

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Objective: Increasing evidence links traumatic injury to alterations in stress response systems and to adverse psychological health outcomes. Stress reactivity is negatively related to adjustment, with higher reactivity associated with fewer behavior problems. Little is known about how post-traumatic changes in stress reactivity influence adjustment. This purpose of this study is to investigate the relation of salivary markers of stress reactivity to child- and parent-reported psychological health outcomes in children sustaining traumatic brain injury (TBI) or extracranial injury (EI).

Participants and Methods: Using the Trier Social Stress Test, we investigated reactivity based on salivary analytes of the hypothalamic-pituitary-adrenal axis (cortisol) and sympatho-adrenal-medullary component of the autonomic nervous system (ANS) (salivary alpha amylase, sAA). In a prospective cohort design, children ages 8 to 15 years hospitalized for TBI (n=74) or EI (n=35) were compared with healthy controls (n=51). Analytes were examined 7 months after TBI or EI in relation to concurrent parent (Child Behavior Checklist Internalizing and Externalizing Problems, BRIEF Emotional Control) and child (Screen for Childhood Anxiety and Related Emotional Disorders, Children's Depression Inventory-2) ratings. Reactivity was measured using area under the curve increase (AUCinc) to examine change in pre-stressor to post-stressor cortisol and sAA values. Controlling for preinjury behavior ratings, multivariable general linear models evaluated the influence of child and family factors (age at injury, pubertal status, sex, preinjury family functioning), group (TBI, EI, control) and cortisol or sAA AUCinc on internalizing, externalizing, and emotional control outcomes.
Results: For parent ratings, the 3-way interaction of sAA reactivity, sex, and group was significant for Internalizing Problems. The relation between sAA and Internalizing Problems was negative for female controls relative to males with TBI whereas the relation for other groups did not differ. Higher Externalizing Problems were associated with a greater increase in sAA across groups. The significant group x sAA reactivity interaction indicated Emotional Control scores were significantly lower and negatively related to sAA for Controls and positively related for the TBI group. Cortisol reactivity was not related to parent ratings and did not vary by group or demographic factors. For self-ratings, group x sAA reactivity interactions for Emotional Problems and General Anxiety were significantly more positive for TBI than control groups. Girls had higher Social Phobia and Negative Mood scores at higher levels of sAA reactivity compared to boys.
Conclusions: The relation of sAA, but not cortisol reactivity, with internalizing and emotional control ratings differed for TBI and control groups. The flattened and/or reversed direction of sAA reactivity with psychological

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health outcomes after TBI but not EI indicate stress system dysregulation related specifically to brain injury. Greater sAA dysregulation was noted in girls than boys on several internalizing measures. Our findings highlight altered sAA, but not cortisol reactivity, as a potential mechanism of biological vulnerability associated with poorer adjustment after TBI relative to healthy children. Future studies should characterize autonomic dysregulation after TBI in relation to psychological health outcomes.
Keywords: traumatic brain injury**,** child brain injury**,** pediatric neuropsychology

3 A Machine Learning Approach to Identifying Relevant Features of Metacognitive Deficit Following Moderate-Severe Traumatic Brain Injury

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Objective: Metacognitive deficits are common following traumatic brain injury (TBI), and this has important implications for recovery, social relationships, and rehabilitative outcomes (Chiou et al., 2011; Flashman & McAllister, 2002; Ownsworth & Fleming, 2005). Recent studies have demonstrated that over half of individuals sustaining TBI demonstrate metacognitive deficit (Grossner et al., under review; Prigatano, 2005). What remains unclear is which injury characteristics are most predictive of metacognitive deficit following brain injury. Using a random forest algorithm, a supervised machine learning approach that classifies data and ranks features by relative importance (Breiman, 2001), we examine individuals with moderate-severe TBI in terms of identifying the most relevant features that predict a deficit in metacognition. We use high-dimensional, heterogeneous data including demographic and clinical variables (i.e., age, education, time post injury, injury severity score), regional gray matter volume, neurocognitive task performance, and self-report questionnaires to predict performance on a task-based measure of metacognition and identify the most important features in predicting this performance. By identifying the most relevant features that predict metacognitive deficit following TBI, we can begin to isolate risk for metacognitive deficit and develop treatment plans for disruption in metacognitive processing.
Participants and Methods: Participants included 70 individuals with moderate-severe TBI ages 18-78 [M(SD)=49.23(18.43)] retrospectively collected from 3 parent studies. All participants had structural neuroimaging scans and received a neuropsychological test battery, including tests of executive functioning and working memory; self-report measures of anxiety and depression; and a task-based measure of metacognition. Relevant demographic and clinical variables, such as age, education, GCS, and time post injury, were included in the analysis. Gray matter volume from 3 brain regions demonstrated to be associated with metacognitive ability (Grossner et al., 2018) – orbitofrontal, dorsolateral frontal, and posterior regions – were also included as features in this analysis. The data was randomly sampled into training (75%) and testing (25%) datasets. The random forest algorithm used a regression approach and created 500 decision trees with randomly sampled input features. The Gini importance value, which is a measure of the importance of a given feature to the end model prediction by its proportional use within individual decision trees, was calculated to determine how important each feature is to the mean accuracy of the model prediction.
Results: The features input into the random forest algorithm explained 26.41% of the variance in task-based metacognitive ability. The five features identified as the most important via Gini importance test include Trail Making Test B, Digit Span Backward, VSAT, age, and gray matter volume of PCC, angular gyrus, and supramarginal gyrus.
Conclusions: By using prediction modeling with multidimensional and heterogenous input features, we can predict the most relevant variables that contribute to metacognitive deficit following TBI. A combination of executive functioning ability, age, and gray matter volume of posterior brain regions including PCC, angular gyrus, and supramarginal gyrus best predicted metacognitive deficit in this sample. Using such a predictive model can allow us to determine

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relevant risk factors for which individuals sustaining TBI may experience deficits in metacognitive ability.
Keywords: metacognition**,** neuroimaging: structural**,** executive functions

4 Relationship Between Cognition and Return to Driving After Moderate-to-Severe Traumatic Brain Injury

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Objective: Moderate-to-severe traumatic brain injury (TBI) often results in cognitive deficits that hinder the ability to drive a motor vehicle. Driving cessation creates significant burden and negatively impacts quality of life. Memory and executive function deficits are prevalent after injury and detrimental to function, but their impact on return to driving has not been well investigated. This study examined the relationship between cognitive function (memory and executive function) and driving status (driving vs. not driving) following moderate-to-severe TBI.
Participants and Methods: Participants were 517 adults aged 19-96 years (Mean age = 46 years; 72% male) who sustained a moderate-to-severe TBI and were enrolled in the TBI Model System. Cross-sectional driving survey data were obtained for participants ranging 1-30 years post injury, including questions on current driving status. The Brief Test of Adult Cognition by Telephone (BTACT), completed at the time of survey, was used to assess cognitive function. BTACT composite scores of verbal memory and executive function were standardized by age, sex, and education. The sample excludes 85 participants (due to missing data on variables) who were found to have lower scores of cognitive function compared to included participants, and 41% of those excluded were active drivers. The relationship between driving status and concurrent cognitive function was examined using hierarchical binary logistic regression, controlling for demographics (age, sex, education), injury characteristics (time since injury, injury severity, history of seizures in past year), and medical/social factors (family income, motor function, urban-rural classification). To examine the influence of each covariate on cognition as the outcome, significant cognitive predictors were followed up with univariate independent-samples t test, one-way analysis of variance, and linear regression.
Results: 72% of the sample were driving after TBI. Executive function significantly predicted driving status (OR=1.50, p<.001), whereas verbal memory did not (OR=1.21, p=.093). However, the relationship between executive function and driving status was not significant when the covariates were added to the model (OR=1.23, p=.084). Longer time since injury, absence of seizure, better motor function, greater family income, and rural classification were significantly related to active driving status (all p<.05). Additionally, injury severity, motor function, and family income were significantly related to executive function (all p<.001).
Conclusions: The findings indicate that executive function is significantly associated with driving status following TBI, whereas verbal memory is not. Much of this relationship is accounted for by covariates such as family income and motor function. Executive function, income, and motor function may be important factors to target for future research and development of intervention services that promote return to driving. These findings may not generalize to individuals with more severe cognitive impairment.
Keywords: brain injury**,** cognitive functioning**,** driving

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5 Effects of Perceived Discrimination on Cognitive, Neuropsychiatric, and Psychosocial Outcomes in People Aging with Traumatic Brain Injury

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Objective: We recently reported that perceived discrimination is associated with increased blood pressure in older people with moderate-to-severe traumatic brain injury (PwTBI) (Bernier et al., 2021, doi: 10.1037/rep0000379). The goal of the current study was to evaluate major and everyday experiences of discrimination (MED and EED, respectively) in relation to behavioral health outcomes in PwTBI.
Participants and Methods: Participants included 118 adults aged 50+ (age = 64.1 ± 8.3 years; 34 female; education = 13.6 ± 2.6 years; 29 Black, 89 White) and at least one year post TBI as defined by National TBI Model Systems criteria (24 complicated mild, 26 moderate, 68 severe; chronicity = 9.6 ± 6.7 yrs.). All participants underwent neuropsychological testing, from which we constructed a composite measure of global cognition (age-corrected z-score = -.79 ± .77). Participants also completed questionnaires assessing MED, EED, and commonly measured health outcomes of TBI: psychological distress, neurobehavioral symptoms, frequency of societal participation, and quality of life (QOL). MED and EED were first correlated with outcome measures, correcting for the false discovery rate. Of the relationships that survived, we examined hierarchical regression models controlling for age, sex, race, years of education, injury severity, and injury chronicity on the first block, and MED and EED on the second block to evaluate their incremental contribution to each outcome. In a sample subset with available geodata (N = 19; 6 Black, 13 White), we examined effect sizes for neighborhood socioeconomic deprivation (ND; the *Neighborhood Deprivation Index*) as a potential contributor to MED, EED, and behavioral health outcomes.
Results: EED and MED each showed significant zero-order correlations with psychological distress, neurobehavioral symptoms, and QOL after correction for multiple comparisons (|ρ|s = .23 to .42, *p*s < .001 to .015). Greater EED was also significantly associated with greater participation frequency. Neither form of discrimination was related to cognition (*p*s > .44). When entered together, EED, but not MED, made significant contributions beyond demographic and injury-related covariates to psychological distress (η_p^2 = .13, *p* < .001), neurobehavioral symptoms (η_p^2 = .11, *p* < .001), participation (η_p^2 = .04, *p* = .04), and QOL (η_p^2 = .10, *p* < .001). ND evinced negligible relationships with discrimination, but appreciable effects for cognition (ρ = -.53, *p* = .02), participation frequency (ρ = -.43, *p* = .07), and QOL (ρ = -.29, *p* = .24). In this sample, race was not significantly related to discrimination and was not a significant predictor in regression models but showed an association with ND (Black participant neighborhoods more disadvantaged than White; ρ = .62, *p* = .005).
Conclusions: Social determinants of health are emerging as critical considerations in the evaluation and treatment of neurological disorders. Our data support chronically experienced discrimination as an important factor in behavioral health after TBI. Outcomes may also reflect socioeconomic challenges and structural discrimination faced by diverse PwTBI, although more work in this area is urgently needed. Multiple sources of marginalization and disenfranchisement and their functional effects should be considered in TBI rehabilitation and outcome monitoring.
Keywords: traumatic brain injury**,** inclusion**,** diversity

6 Pre-Injury Intelligence, Cognitive Functioning, Amyloid Burden, and CSF Tau in Vietnam Veterans Decades Post Injury

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Objective: This study aimed to examine the relationship between pre-injury intelligence and documentation of traumatic brain injury (TBI) and/or post-traumatic stress disorder (PTSD) on late-life cognition and amyloid and tau burden.
Participants and Methods: Using data from the Alzheimer's Disease Neuroimaging Initiative (ADNI), we looked at Vietnam Veterans who had suffered from a service-connected closed TBI (N=39), which was documented in medical records, and compared them to Vietnam Veterans with PTSD only (N=39) and healthy controls (N=26) who also served in Vietnam. Participants included in these analyses had available pre-service intelligence data as assessed by the Armed Forces Qualification Test (AFQT), and this same test was administered upon enrollment in the present study decades later. We measured amyloid burden using a positron-emission tomography Ab florbetapir ligand and analyzed it as a continuous variable. For a subset of participants, CSF tau, pre-injury AFQT, and post-injury AFQT were available (N=68).
Results: We found no relationship between pre-injury AFQT score and current amyloid burden in any of the groups, and pre-injury AFQT scores consistently predicted present-day AFQT scores within each group. While there was not a significant effect of amyloid burden on AFQT change scores for either the PTSD or TBI groups, there was a significant effect within the control group ($\eta 2 = .37$, $p=.001$). There was not a significant interaction within any of the groups for amyloid burden and pre-injury AFQT on present-day AFQT scores, even with the removal of the AFQT vocabulary subtest, which is relatively preserved early in the course of Alzheimer's Disease, from post-injury AFQT scores. This same pattern persisted for CSF tau as well, where tau was not predictive of AFQT change scores for the TBI and PTSD groups, but was associated with AFQT change scores in the control group ($\eta 2=.27$, $p=.02$).
Conclusions: Our findings suggest that while exacerbated decline in intelligence is a significant risk for those with TBI, intelligence prior to the TBI is the most vital predictor of cognitive outcome decades after the injury. Amyloid burden and tau are not associated with decline in our TBI or PTSD groups, but this association exists for those without service-connected head injury or PTSD, suggesting that the cognitive decline seen in TBI and PTSD may not be associated with neurodegenerative processes. Because the deficit in these disorders is chronic, it may not track as well to this proteinopathy. Clinicians should be sure to evaluate any changes in patients' neurobehavioral status carefully so as to not confuse an exacerbated decline in function with the onset of a neurodegenerative disorder. Given the non-significant interaction between pre-injury intelligence and amyloid burden across each of the groups, further research on the relationship between biological indicators of disease burden and cognitive reserve is needed. However, while these data provide a unique opportunity to examine the effects of premorbid intelligence on late-life decline, there exist significant limitations, particularly with respect to data collection, and these results should therefore be interpreted cautiously within this context.
Keywords: traumatic brain injury**,** dementia - Alzheimer's disease**,** premorbid functioning

Paper Session 09: Neuroimaging

4:00 - 5:30pm
Thursday, February 3, 2022

1 Self-Awareness for Financial Decision Making Abilities is linked to Resting State Functional Connectivity in Cognitively Healthy Older Adults.

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Objective: Awareness of one's own financial decision-making abilities (i.e., financial awareness) is necessary for intact everyday functioning. Lowered awareness can result in financial mistakes (e.g., defaulting on bill payments, getting scammed) and lead to substantial financial loss. We previously reported that thinner medial temporal cortex and reduced integrity of the superior longitudinal fasciculus -temporal and -parietal bundles in older adults were associated with overconfidence in one's financial decision-making abilities. Similar anatomical regions have been identified in relation to financial exploitation. In the current study, we extended the imaging investigations of financial awareness to examine its association with resting functional brain connectivity in healthy older adults. Data suggests that the default mode network (DMN) and salience (SAL) networks are linked to aspects of self-awareness. We, therefore, hypothesized that between-network connectivity between the default mode network (DMN) and salience (SAL) networks would evidence the strongest associations with financial awareness.
Participants and Methods: ***Design*** **-** Cross-sectional, prospective study. ***Setting*** **-** Community-based. ***Participants*** **-** Forty three individuals were included with mean age=68.35 years (SD=5.50) and mean education=15.91 (SD=2.36). 61% were women, the majority were White (67%) while 30% were Black and 3% belonged to other races; 95% were non-Hispanic. ***Measures*** **-** *Financial Awareness:* Financial awareness was measured by integrating metacognitive ratings into the Objective Financial Competency Assessment Inventory. Before each item, we obtained the level of confidence for performance accuracy. Awareness was operationalized using a calibration score in which average performance was subtracted from average confidence to reflect the extent to which individuals were over- or under-confident. Positive scores reflect over-confidence whereas negative scores reflect under-confidence. *Resting state functional connectivity:* Network-based connectivity measures were computed based on an unbiased, external 10-network schema using Power et al (2011) parcellations. An average correlation approach for all 10 within-network and 9 DMN between-network correlations (i.e., Geerligs et al., 2015; King et al., 2017) was first used, followed by linear regression to probe significant associations between financial awareness and functional connectivity measures.
Results: As hypothesized, overconfidence in financial decision making was significantly associated with decreased between-network DMN-SAL connections ($r = -.307$ $p = .045$). No other correlations were significant. Interestingly, even after accounting for within network connectivity variables (DMN and SAL) in a multiple regression analysis, the association between financial awareness and DMN-SAL network remained significant ($t = -2.648$, $p = .012$).
Conclusions: This is the first study to examine the anatomic substrates of financial awareness using functional connectivity. We identified a link between reduced DMN-SAL connectivity and overconfidence in financial abilities. Current and previous imaging studies point to an intersection between constructs involving financial awareness and vulnerability to financial exploitation. Our findings suggest that the connection between financial awareness and financial exploitation requires in-depth investigation. It is possible that identifying those with lowered levels of financial awareness may help decrease their risk of financial susceptibility and thereby prevent financial loss.
Keywords: decision-making**,** neuroimaging: functional connectivity**,** metacognition

2 Influence of Endogenous Estrogen on a Network Model of Female Brain Integrity and Metabolic Health

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Objective: Network modeling of brain integrity and metabolic health variables indicates greater interconnectedness between cardiometabolic risk and brain health for females than males, consistent with higher rates of neurocognitive disorders in this group. The menopausal transition, resulting in a sharp drop in endogenous estrogen levels, is a crucial reproductive event in midlife females that could provide further information about this disparity. Estrogen has been found to have neuro- and cardio- protective effects, particularly in middle-aged peri- and post- menopausal females. Since many females emerge from the menopausal transition at increased risk for neurocognitive decline, endogenous estrogen levels may be a more robust biomarker of brain vulnerability than chronological age. In our study, we set out to compare the influence of endogenous estrogen, as measured by estradiol, to chronological age, over a network of brain and metabolic health, in separate network models.
Participants and Methods: Data were analyzed from 82 females (ages 40-62). Individuals with at least 1 copy of the Apolipoprotein ϵ4 allele or unknown genetic status were excluded, due to small sample size and the centrality of this marker in a previous network. The network consisted of known biomarkers of risk for late-life cognitive decline: the five components of Metabolic Syndrome (MetS); Brain-predicted age difference (BPAD) calculated on gray and white matter volume; white matter hyperintensities; functional connectivity in the Default Mode Network; cerebral concentrations of N-acetyl aspartate, Glutamate and Myo-inositol; and serum concentrations of estradiol. A second network replaced estradiol with chronological age. Networks were constructed using Extended Bayesian Information Criterion Graphical Least Absolute Shrinkage and Selection Operator (EBICglasso) to estimate partial correlations between variables. Estradiol was coded as a categorical variable based on established cutoffs.
Results: Expected influence (EI) of reproductive age measured by estradiol on the network was -1.189, relative to chronological age at -0.079, indicating that estradiol had a stronger, negative expected influence over the network than chronological age. A negative expected influence indicates that higher levels of estradiol would be expected to decrease the number of relationships in the model. A smaller number of relationships in a network is thought to indicate lower risk, since it demonstrates that alterations in one variable, such as metabolic health, do not impact another, such as brain integrity. Estradiol was negatively associated with waist circumference, triglyceride levels and white matter hyperintensities. There was an unexpected positive association between BPAD and estradiol, such that higher levels indicated greater brain-age gaps. Triglyceride levels, not estradiol or age, had the highest betweenness centrality in both models, serving as a bridge between other nodes in the network most often. Estradiol had the third highest EI over the network, after glucose levels and white matter hyperintensities.
Conclusions: Levels of estradiol appear more influential than chronological age at midlife for relationships between brain integrity and metabolic health; however, metabolic risk factors and brain health relate to each other in a manner that is not entirely hormone-dependent.
Keywords: hormone**,** aging disorders**,** neuroimaging: structural

3 White Matter Hyperintensity Volume and Amyloid-PET Synergistically Impact Executive Dysfunction and Memory Independently of Tau-PET in Older Adults Without Dementia

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Objective: Two commonly observed co-pathologies in older adults are Alzheimer's disease (AD) and small vessel cerebrovascular disease, the latter of which is reflected by white matter hyperintensities (WMH) on T2-weighted MRI. There is growing interest in disentangling the role of these pathologies on cognitive functioning; in particular, whether the effects of WMH and AD biomarkers (amyloid and tau) are additive or synergistic is highly debated. Few studies have investigated whether WMH volume moderates the independent association between each AD biomarker and cognition. Therefore, this study examined the tau-independent interaction between WMH volume and amyloid on cognition, as well as the amyloid-independent interaction between WMH volume and tau on cognition.
Participants and Methods: 559 older adults without dementia from the Alzheimer's Disease Neuroimaging Initiative (ADNI) underwent neuropsychological testing, T2-weighted MRI, 18F-flortaucipir tau positron emission tomography (PET), and amyloid-PET (18F-florbetapir or 18F-florbetaben). WMH volumes were normalized by total brain volume and natural log-transformed, and cortical amyloid-PET standardized uptake value ratios (SUVR) were converted to Centiloids. Cognition was characterized using composite scores for executive function (ADNI-EF) and memory (ADNI-MEM). Separate linear regressions tested the interaction between (a) amyloid-PET Centiloids and both the linear and quadratic effects of global WMH volume on cognition, while controlling for medial temporal lobe (MTL) tau-PET SUVR, and (b) MTL tau-PET SUVR and both the linear and quadratic effects of global WMH on cognition, while controlling for amyloid-PET Centiloids. All models additionally adjusted for age, sex, education, pulse pressure, and APOE ε4 carrier status.
Results: There was a significant interaction between amyloid-PET and the linear (β_{std} = -.093, p = .027) but not quadratic (β_{std} = .021, p = .49) effect of WMH volume on executive function, independent of MTL tau-PET. Furthermore, there was a significant interaction between amyloid-PET and the quadratic (β_{std} = .061, p = .031) but not linear (β_{std} = -.031, p = .43) effect of WMH volume on memory. Specifically, examination of simple slopes (SS) suggested that greater amyloid burden predicted poorer cognition at both average (ADNI-EF: SS = -.123, p = .016; ADNI-MEM: SS = -.165, p < .001) and higher levels (+1 SD; ADNI-EF: SS = -.195, p < .001; ADNI-MEM: SS = -.135, p = .008) of WMH burden. However, amyloid was not associated with cognition at lower levels of WMH burden (-1 SD; ADNI-EF: SS = -.009, p = .89; ADNI-MEM: SS = -.07, p = .23). There were no interactions between MTL tau-PET and either the linear or quadratic effect of WMH volume on any cognitive outcome measure (ps ≥ .31).
Conclusions: In this cross-sectional study of older adults without dementia, amyloid interacted with either the linear or quadratic effect of WMH burden to influence cognition independently of MTL tau. These findings suggest that prevention of cerebrovascular injury may attenuate the negative effects of amyloid on cognition. Both vascular and AD pathologies should be considered in the development of future treatment targets, especially for individuals with mixed pathologies.
Keywords: cerebrovascular disease**,** positron emission tomography**,** executive functions

4 White matter hyperintensities and tau, but not amyloid, are associated with memory performance in middle-aged, racially and ethnically diverse adults in a community-based cohort

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Objective: Amyloid and tau pathology develop decades prior to Alzheimer's disease (AD) dementia onset, characterized typically by early, progressive, memory loss, followed by more widespread cognitive impairment. Cerebrovascular disease emerges in midlife and has been increasingly implicated in AD pathogenesis in autosomal dominant AD, AD in adults with Down syndrome, and late-onset AD, prior to dementia onset. We hypothesized that

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amyloid, tau, and white matter hyperintensities (WMH) are present already during midlife, and that greater amyloid, tau, and WMH are related to worse performance on episodic memory, but not on other cognitive domains, in a racially and ethnically diverse, community-based cohort in Northern Manhattan.
Participants and Methods: In the Offspring study of Racial and Ethnic Disparities in Alzheimer's Disease, participants (51-79 years; 69% women; 13% Non-Latinx White, 28% Non-Latinx Black, 59% Latinx) underwent PET imaging for amyloid (Florbetaben; n=71) and tau (MK-6240; n=55), as well as T2 FLAIR MRI for WMH (n=72). Participants also underwent neuropsychological testing that included the Selective Reminding Test (SRT; n=42) for episodic memory, Digit Span Backwards (DSB; n=40) for working memory, and fluency measures (n=42) for animals, vegetables, and letters. A general linear model with amyloid, tau, and WMH on test performance was adjusted for age, sex, race/ethnicity, education, and APOE4 allele status.
Results: Amyloid burden was not associated with SRT total recall, SRT delayed recall, DSB total score, or fluency measures. Greater tau burden was associated with lower SRT total recall (B = -3.9 [-7.1, -0.7], p=0.04). Greater WMH was associated with lower SRT delayed recall (B = -3.5 [-6.2, -0.8], p=0.03). Tau and WMH burden were not associated with DSB total score or fluency measures.
Conclusions: In middle-aged racially and ethnically diverse adults, tau and cerebrovascular disease, but not amyloid, were associated with lower episodic memory scores, but not working memory or fluency measures. Neuroimaging-based biomarkers have clinical relevance in midlife, and tau and WMH in particular may represent potential therapeutic targets beyond amyloid.
Keywords: neuroimaging: functional, neuroimaging: structural
dementia - Alzheimer's disease

5 Socioeconomic Status and Brain Health in Racially/Ethnically Diverse Middle-Aged Adults

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Objective: Studies show that lower lifecourse socioeconomic status (SES) is associated with worse cognition and greater risk for Alzheimer's disease (AD). However, it is unclear the extent to which midlife SES (MSES) correlates with MRI markers of brain aging and AD, and whether the association is similar in White, Black, and Latinx people. SES is, on average, lower in Black and Latinx people, so even if the association of SES to brain health is similar, the population attributable risk for low SES may be greater for these groups. Assessing the relationship of SES to brain health during midlife is crucial to understand accelerated brain aging. The purpose of this study was, to investigate whether MSES predicts brain health and to determine whether this relationship is similar within race/ethnicity groups.
Participants and Methods: Participants were 374 racially/ethnically diverse middle-aged older adults drawn from the Offspring study of racial and ethnic disparities. In AD, who received MRI (mean age=55.1 (SD=10.7) years; 35 non-Latinx White, 120 non-Latinx Black, 369 Latinx; 65% women). We used general linear models to examine the relationship of MSES, measured as current midlife income, with MRI markers of neurodegeneration (cortical thickness in AD signature regions) and cerebrovascular disease (white matter hyperintensity volume; WMH) and to determine whether MSES is associated with these brain measures similarly across race/ethnicity groups. Income was divided into two groups (above or below the mean of annual income of $35,000). Sex/gender and age at scan were covariates in full and race/ethnicity stratified models.
Results: In the full sample, cortical thickness and WMH volume were similar across race/ethnicity. White (79%) participants were more likely to have higher MSES, followed by Black (62%) and Latinx (43%) participants (X^2=19.8, p<.001). MSES was not related to cortical thickness, but lower MSES was associated with greater WMH (B=0.09, CI=0.02,0.17). Models stratified by race/ethnicity

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revealed that Black participants with lower MSES had smaller cortical thickness (B=-0.06, CI=-0.10,-0.02), compared with Black participants with higher MSES. There was no relationship between MSES and cortical thickness in the White or Latinx stratified samples. Lower MSES was related to greater WMH volume in Black participants (B=0.20, CI=0.06,0.34). There was no relationship between MSES and WMH volume in the White or Latinx stratified samples.
Conclusions: Lower MSES was related to MRI markers of neurodegeneration in AD cortical regions and small vessel cerebrovascular disease among Black participants. Future work will further examine the lack of association between MSES and brain health in White and Latinx participants to determine whether additional resources may serve as a protective factor that could mitigate the impact of lower MSES on brain health. Nevertheless, interventions aiming to improve access to additional resources for better health may be particularly important for Black individuals. These interventions should be informed by a more complete understanding of the risk and resilience factors that may play differential roles in brain health across race/ethnicity and sex/gender groups.
Keywords: aging (normal)**,** neuroimaging: structural**,** ethnicity
;

6 Moving Beyond Movement: Contribution of Cerebellar Structure and Connectivity on Cognition and Mood in Multiple Sclerosis

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Objective: Recent examinations of the cerebellum have found relationships to higher level processes, including cognition and mood. This is particularly important in persons with multiple sclerosis (pwMS) due to the high prevalence of mood disturbance and cognitive impairment. Studies remain limited, however, especially in relation to within-cerebellum structural connectivity. Thus, the aim of the current study is to examine the relationship between cerebellar gray matter volume, white matter connectivity, and mood and cognition in MS.
Participants and Methods: Forty-eight participants were divided into three groups: MS with depression (MS+D; N=22), MS without depression (MS-D; N=11), and Depression without MS (D-MS; N=15). Each participant completed self-report mood questionnaires (Beck Depression Inventory-Fast Screen; Chicago Multiscale Depression Inventory) and comprehensive cognitive testing (Domains: processing speed, attention, working memory, executive functioning, memory). Multishell diffusion MRI and structural data (T1, T2 FLAIR) were collected. Deterministic tractography was performed and structural connectivity (i.e., graph theory) analyses were conducted within the cerebellum. Five graph theory metrics were calculated- density, clustering coefficient, path length, small worldness, global efficiency- for number of normalized streamlines and quantitative anisotropy (QA). Gray matter volume (mm3) was calculated for the anterior and posterior cerebellum and 16 separate cerebellar lobules. Bilateral cerebellar lobules were combined to limit the number of volumetric variables. Whole brain lesion volume was also calculated. Analyses of variance (ANOVA) determined group differences for self-report, cognitive, and brain measures. The two MS groups were also combined to conduct ridge regression analyses, which accounts for a high number of multiple comparisons, for brain metrics vs. mood severity and brain metrics vs. cognitive performance.
Results: Significant differences were found between groups on mood measures. MS+D and MS-D had significantly greater whole brain lesion volumes than D-MS. After correcting for multiple comparisons, MS+D had significantly lower streamline clustering coefficients and global efficiency compared to MS-D. MS+D showed significantly decreased volume in lobules I-IV, Vermis Crus II, and lobule VIIIb when compared to MS-D or D-MS, though they did not survive Bonferroni correction. The combined MS group showed less efficient

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connectivity (clustering, global efficiency) to be related to greater depression severity/proneness and apathy. Similarly, greater atrophy within the anterior cerebellum, Vermis Crus II, I-IV, lobule VIIIb, Vermis IIIb, and Vermis IX were related to depression severity/proneness and apathy. No significant differences were found between groups across cognitive tests. After correcting for age and education, the combined MS group showed less efficient connectivity (small worldness) to be related to poorer attention. Greater atrophy within VI was associated with poorer visual memory (immediate recall), verbal memory (immediate and delayed recall), aspects of executive functioning, and attention.
Conclusions: This study is among the first to examine both mood and cognition in pwMS through a cerebellar volumetric and structural connectivity lens. Results provide evidence for the contribution of cerebellar atrophy and structural network disruption to the presence and severity of mood disturbance and cognitive dysfunction in pwMS. These results have important implications for our understanding of the neural connectome, especially within the often overlooked cerebellum, and for future clinical interventions.
Keywords: multiple sclerosis**,** connectomics**,** neuroimaging: structural

Poster Session 10: Psych | Sleep | Child Assessment | Emotion | SUD

7:30 - 8:30am
Friday, February 4, 2022

1 Withdrawal Symptoms and Response Inhibition Across a Three-Week Monitored Abstinence in Adolescent and Young Adult Cannabis- and Alcohol-Users

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Objective: The use of cannabis and alcohol are highly prevalent among adolescents and young adults. Neuropsychological studies have provided evidence that alcohol and cannabis uniquely alter cognition (i.e. response inhibition) and behavioral functioning (i.e. withdrawal symptoms, sleep, depression, and anxiety). However, few studies have examined the synergistic effect of using both alcohol and cannabis on response inhibition and withdrawal symptoms, particularly among youth who are undergoing a time of brain development. Furthermore, less is known on the acute effects of both substances following abstinence. The present study investigated differences in behavioral aspects of withdrawal (i.e. mood, sleep, and withdrawal) and response inhibition (i.e. scores on the Color-Word Stroop Task) among a sample of young co-users (both alcohol and cannabis), cannabis-users, and control participants during the course of a monitored three-week cannabis abstinence period.
Participants and Methods: Forty-one adolescent and young adult participants provided past-month substance use and were split into cannabis-users (14), co-users (11), and a control group (16). Participants were examined throughout a three week monitored abstinence, confirmed via urine toxicology or sweat patch testing). Participants completed the Timeline Follow-Back for alcohol and cannabis to assess for recent substance use, the Cannabis Withdrawal Symptom Criteria, including two sleep items, State-Trait Anxiety Inventory, Beck's Depression Inventory, and the Color-Word Stroop Task (Golden & Freshwater, 1978), across the study period. Repeated measures and cross-sectional regressions were used to examine main effects of group and interactions with time.
Results: Overall, withdrawal symptoms and sleep demonstrated a quadratic trajectory across the three week abstinence period, showing an increase from baseline and a decrease in symptom severity across the next three sessions. Across abstinence, cannabis users reported greater total withdrawal symptoms ($p < .05$), sleep-related withdrawal symptoms ($p < .01$), depression ($p < .05$), and anxiety, ($p < .05$), but no significant differences among Stroop performance relative to controls.

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Co-users also reported greater withdrawal symptoms ($p < .01$), sleep withdrawal symptoms ($p < .05$), but not depression, anxiety, or Stroop Task differences relative to controls. Cannabis users and co-users did not significantly differ in any outcomes.
Conclusions: Cannabis and alcohol/cannabis co-using young adults reported significant total withdrawal symptoms and disrupted sleep symptoms during a 3-week sustained monitored abstinence period compared to controls. Specifically, cannabis-users and co-users demonstrated an increase in withdrawal symptoms during the first week followed by decreased symptoms from weeks two to three, relative to controls. The co-use of alcohol and cannabis did not appear to alter the withdrawal course compared to cannabis use alone; however future studies should investigate the independent and interactive effects in a larger sample. These findings suggest that abstaining from both alcohol and cannabis impacts mood, withdrawal, and sleep, and further research is needed to identify the synergistic effect of alcohol and cannabis withdrawal on cognitive and affective functioning.
Keywords: substance abuse**,** adolescence**,** executive functions

2 Risk-Taking and Alcohol Demand in College Binge Drinkers: Testing History of Mild Traumatic Brain Injury as a Predictor.

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Objective: Approximately 69,000,000 individuals sustain TBIs each year worldwide. Alcohol use is a known risk factor for TBI. Nearly 50% of individuals with TBI endorse binge drinking, alcohol-related negative consequences, or meet criteria for AUDs. One of the most pressing issues within the alcohol-TBI literature is predicting post-TBI alcohol-related problems, as this results in poorer recovery, rehabilitation, and functioning. Evidence for TBIs causing post-injury alcohol use in those without pre-injury problematic alcohol use is mixed; not all TBI survivors experience alcohol-related problems post-injury. Evidence is mounting that one of the most robust predictors of post-injury alcohol problems is childhood or adolescent TBI, including samples of adolescents and adults who sustained a TBI prior to initiating alcohol use. Informed by the dual process model, the study aimed to examine how adolescent/young adult mTBI predicts risk-taking and alcohol demand and how induced cognitive depletion may interact with mTBI history to impact these variables in a sample of college binge drinkers.
Participants and Methods: 93 college students (age m= 20.04; 52.7% female; 72.0% white) participated in a single laboratory session. Measures included demographics, OSU-TBI, BIS-11, SUPPS-P, DOSPERT, The Balloon Analogue Risk Task, and the Alcohol Purchase Task. Participants were randomized to an active or placebo cognitive depletion manipulation condition (0-back or 3-back, respectively) and immediately completed risk-taking and alcohol demand tasks. The aims of the study were to examine TBI history as a predictor of both self-reported and behavioral risk-taking, as well as alcohol demand; and to test cognitive depletion as a moderator of these relationships.
Results: Pearson's correlations revealed a significant ($p<.01$) positive bivariate relationship between TBI history and behavioral risk-taking, and non-significant ($p>.05$) bivariate relationships between TBI and self-reported impulsivity, risk perception, and alcohol demand. Moderation analysis was completed using ordinary least squares regression in Hayes' PROCESS macro for SPSS. The relationship between TBI history and behavioral risk-taking was not moderated by depletion condition ($p=.91$). Bootstrap confidence intervals based on 5,000 samples for these indirect effects included zero in the model, suggesting statistical non-significance for the moderation model.
Conclusions: Results indicated that history of TBI as measured by the OSU-TBI predicted greater behavioral risk-taking, but not self-reported impulsivity or alcohol demand. Further, a state of induced cognitive depletion (compared to a placebo) did not moderate the relationship between this relationship. Taken together, it is possible that behavioral measures of impulsivity/risk-taking may be more sensitive to

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TBI-related impulsivity than self-report measures. Findings of null effects of cognitive depletion indicate that such paradigms may not be strong enough to significantly deplete cognition. Conclusions and future directions will be further explored
Keywords: addiction or dependence**,** concussion/ mild traumatic brain injury**,** substance abuse

3 A Pilot Study of Change in Neuropsychiatric Factors and BDNF in Early Substance Abstinence

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Objective: Although it is generally known that brain-derived neurotrophic factor (BDNF) levels are related to cognition as well as mood and anxiety symptoms, as well as implicated in various facets of addiction, these factors have not been studied together in a longitudinal patient sample. This study followed a group of participants in a residential substance abuse treatment program across their first month of abstinence, with repeated cognitive testing, mood and anxiety measures, and blood samples to assess potential changes over time.
Participants and Methods: Participants were 29 adults (x age=35 years, SD=8.6; x education=17.6 years, SD=4.7) who had completed detoxification and were first assessed during their first week of residential treatment. Follow-up assessment was completed 4 weeks later. Participants were primarily male (86%) and Caucasian (66%). The majority of participants reported a history of polysubstance abuse, with opioids being the most common primary substance of abuse. Twenty participants remained in treatment through the end of the study and 9 dropped out of treatment early; there were no significant differences in baseline cognitive performance nor self-reported depression or anxiety between these two groups.
Participants completed the NIH Toolbox cognition battery, PROMIS depression and PROMIS anxiety measures at baseline and follow up. Participants also provided blood samples, with the primary analysis of interest being BDNF levels. Brain-derived neurotropic factor is a nerve growth agent that is essential for neuronal development, neurogenesis, and cognitive function. Many drugs of abuse lead to changes in endogenous brain-derived neurotrophic factor (BDNF) expression in neural circuits responsible for addictive behaviors.
Results: Results of t-test comparison between baseline and follow-up testing found a significant improvement in cognition as measured by the NIH Toolbox battery. Participants had statistically significant improvement in all summary cognition measures (p=.002-.003) and in most of the individual subtests. There was also a significant improvement in depression and anxiety symptoms. Interestingly, there were not significant correlations between BDNF levels and reported mood or anxiety symptoms at either baseline or endpoint (p=.160-.986). A number of factors, such as diet and activity level, have an impact on circulating BDNF levels and will be explored in future analyses.
Conclusions: In this small exploratory study of the relationship between BDNF levels, cognition, and mood and anxiety symptoms in early substance abuse abstinence, it was found that circulating BDNF levels (both pro and mature forms) were not correlated with the neurocognitive variables.
Keywords: cognitive functioning**,** depression

4 Potential for Inflated Norms in Neuropsychological Assessment of Individuals Who Use Methamphetamine

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Objective: Level of education is an important sociodemographic variable that impacts neuropsychological performance and contributes to normative data differences. Previous research has suggested that norms adjusted for years of education may be inappropriate for adults who use methamphetamine (MA) since adults who

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use MA may achieve fewer years of education due to substance use and other associated risk factors rather than lower premorbid intellectual or cognitive ability. This study compared neurocognitive test results of adults with and without previous MA use using education-corrected norms versus norms not corrected for education to examine potential differences in scores. A better understanding of the possibility for artificially inflated education-corrected standardized scores in the assessment of adults who use MA may help neuropsychologists choose norms that allow for accurate interpretation of test results in this population.
Participants and Methods: 241 adults were recruited from treatment centers and from the community in the Portland, Oregon metro area. Participants were enrolled into one of five study groups: 1) MA-active (n=44), 2) MA-remission (n=55); 3) polysubstance active (n=24); 4) polysubstance remission (n=55); and 5) control (n=63).
This study used the full Neuropsychological Assessment Battery (NAB), which includes the Attention, Language, Memory, Spatial, and Executive Functions modules. Following published procedures and norms, raw subtest scores were converted into two sets of t-scores, one set that was demographically corrected on the variables of age, gender, and education (demographically corrected norms), and one set that was only corrected for age (U.S. Census-matched norms).
Results: McNemar's tests were conducted for each group across all NAB Indexes to examine rates of impairment when using norms adjusted for age, education, and gender versus norms adjusted only for age. Across all groups, norms adjusted only for age identified impairment more frequently than norms adjusted for age, gender, and education. Norms adjusted only for age classified significantly more adults in the MA-REM group as impaired on the Attention, Memory, and Total Score indexes than the norms adjusted for age, education, and gender. Impairment rates were similar for all other groups across indexes.
Separate analysis of covariance (ANCOVA) were conducted for each NAB Index using age, education, and gender-adjusted norms and age-only adjusted norms to examine group differences. The two sets of norms yielded typically similar scores. The means were slightly higher for all groups when using the age, education, and gender-adjusted norms except for the polysubstance active group, which saw a slightly higher group mean score on the Spatial Index using the age-only norms.
Conclusions: The findings of the present study suggest that age-only and demographically (age, gender, education) corrected norms yield similar enough scores to warrant the use of either in the assessment of adults who use MA, depending on the aims of the assessment. When using education-adjusted norms, the neuropsychologist should consider how similar the adult who uses MA matches the normative sample and whether years of education adequately reflects their quantity and quality of education. Neuropsychology as a profession has an obligation to continue to identify sociodemographic influences and refine normative data sets to most accurately reflect the factors that impact cognitive test performance.
Keywords: substance abuse**,** normative data**,** methamphetamine
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5 Developmentally-Informed Recall & Executive Assessment of Memory (DREAM)

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[1]Boston Children's Hospital, Boston, MA, USA. [2]Medical College of Wisconsin, Milwaukee, Wisconsin, USA. [3]Children's National Hospital, Washington, DC, USA

Objective: The purpose of this pilot study was to examine how strategic pictorial[GG1] learning and memory abilities develop at different ages in children. Despite advances in the developmental literature of learning processes over the past five decades, this body of work has not been fully captured in the current pediatric memory measures. As a result, our clinical measures

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have lagged behind our understanding of developmental memory processes. We introduce a measure that is developmentally guided in terms of identifying strategy use during the learning/ acquisition phase as well as at the point of recall. We examine how children of different ages use varying types of organizational strategies to elucidate developmental trends.

Participants and Methods: Participants included 20 healthy children, ages 5-16 years (M=11,SD=3.42) who were recruited to pilot a new sort-recall measure of learning and memory. Pictures were selected from the Revised Snodgrass and Vanderwart pictorial set and Multilingual Picture database, with consideration for developmental appropriateness, name-ability, universal cultural identification, norms of word associativity, and classification within perceptual, thematic, and semantic clusters. Children were presented with an array of 20 pictures to remember with an instruction to perform any activity (e.g., moving, sorting, rehearsing) that will assist their learning. Children's memory recall was assessed immediately after two learning trials and following a 30min delay. Organizational grouping of the picture stimuli during learning trials (referred to below as "sort") were coded as was immediate verbal recall (referred to below as "recall") by adapting established scoring methodology from the CVLT3 that adjusts for grouping based on chance. Organizational themes included thematic, perceptual (i.e., similar in color), and semantic (i.e., belongs to the same category, such as food).
Results: The organizational algorithm for the sort and recall were similar for all organizational strategies. Correlations revealed an interaction between age and organizational sorting strategy. Thematic and perceptual organizational sorting followed a negative trajectory indicating that children were less likely to sort in thematic and perceptual ways as they were older. Whereas, the semantic ratio clustering increased with age, indicating that as children got older, they were more likely to sort semantically (table 1 & figure 1).

Table 1 Correlation Coefficients

Figure 1

		Thematic Ratio Sort	Thematic Ratio Recall	Semantic Ratio Sort	Semantic Ratio Recall	Perceptual Ratio Sort	Perceptual Ratio Recall
Age	Pearson Correlation	-.623*	-.660**	.502	.408	-.776**	-.486*
	Sig.(2-tailed)	.041	.002	.116	.074	.005	.030
	N	11	20	11	20	11	20

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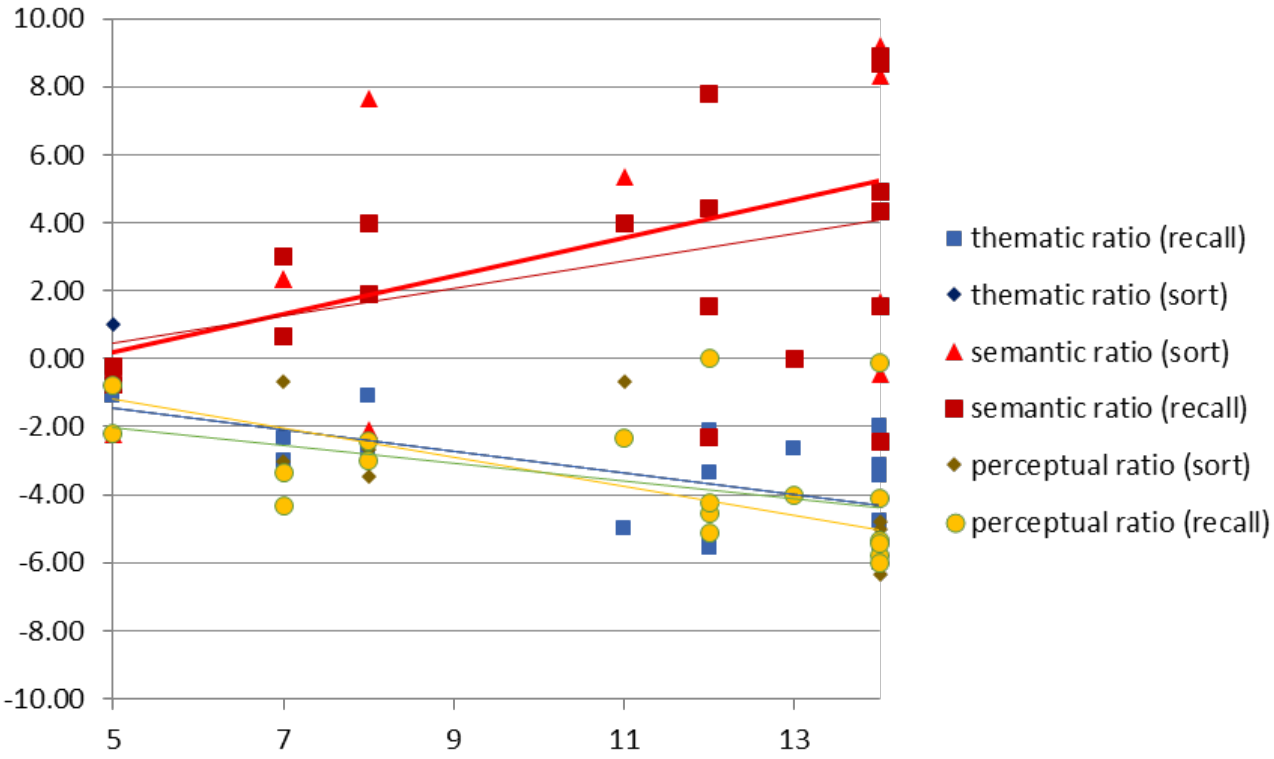

Conclusions: This pilot study demonstrates developmental trends in children's strategic approaches to learning and memory recall using thematic/perceptual and semantic sort classifications. These findings have potentially important implications for developmental systems approaches to assessing and intervening in disorders of learning and memory. The findings from this pilot study will be used to further develop and refine a developmental measure of learning and memory.

Keywords: memory: normal**,** child development (normal)

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6 Keeping the Debate Alive: What Does Verbal Fluency Measure in Youth with Epilepsy?

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Objective: Literature regarding characterization of verbal fluency (VF) has produced variable findings indicating it is a measure of executive functioning (EF), language, or both. Other constructs, such as verbal memory (VM), also may contribute significantly to VF. Different findings are at least partially attributable to study sample characteristics and statistical analyses utilized. The purpose of this study was to take an exploratory approach and test multiple mediation models using path analyses to determine the relative contribution(s) of EF, language, and VM to VF in a sample of youth with epilepsy.

Participants and Methods: Study sample consisted of 130 youth with epilepsy referred for neuropsychological evaluation with the following characteristics: ages 8-18 years (mean = 12.15 ± 2.95), 54% female, 81% right-handed, 44% focal/56% generalized epilepsy, taking at least one seizure medication (mean = 1.45 ± 0.66), and verbal IQ >70. Simple, serial, and

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parallel mediation models were tested using Delis-Kaplan Executive Function System (D-KEFS) Letter Fluency (LF) and Category Fluency (CF) as dependent variables. Predictors and mediators were Expressive One Word Picture Vocabulary Test (Naming; representing language), a composite EF score calculated from D-KEFS Trail Making Test Number-Letter Switching and Color-Word Interference Inhibition, and a composite VM score. All neuropsychological standardized scores were converted to z-scores before testing mediation. **Results:** VM was not statistically significant in any instance, which eliminated all serial and parallel mediation models. Results from simple mediation using ordinary least squares path analyses with 10,000 bootstrap samples are reported. The largest effects were found with Naming as the predictor and EF as mediator. Naming was positively related to EF (a = 0.740, p = 0.0001), EF positively predicted VF while controlling for Naming (b = 0.146, p = 0.003 for LF; b = 0.153, p = 0.001 for CF), the direct effect of Naming on VF was statistically significant (c' = 0.341, p = 0.001 for LF; c' = 0.283, p = 0.005 for CF), and the standardized indirect effects of Naming on VF through EF were 0.089 (95% bootstrap CI = 0.03-0.17) for LF and 0.098 (95% bootstrap CI = 0.03-0.18) for CF. Overall, the indirect effects of Naming and EF accounted for 24.1% of the mediation for LF and 28.6% for CF. **Conclusions:** Of all models examined, Naming best predicted VF directly and through EF as a mediator; however, effects were only mildly smaller when EF was the predictor and Naming the mediator. This was true for both LF and CF as outcomes, although some studies have shown language and EF contribute differentially to each LF and CF. Current results may be impacted by utilization of mediation analyses, the measures selected to represent EF, EF being more prone to dysfunction across epilepsy syndromes than Naming, or the stability of Naming relative to EF in this age range. These findings and potential explanations must be considered in a developmental context, as the relationship between VF and other constructs may be more dynamic in childhood and adolescence relative to adulthood. Additionally, epilepsy may be unique in that clinical seizure characteristics (e.g., epilepsy syndrome, age of seizure onset) could be independent contributors or covariates to the neural substrates of VF.

Keywords: verbal abilities**,** executive functions**,** epilepsy / seizure disorders

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7 Evaluating Children and Youth Who are Deaf/Hard of Hearing: A Survey of Psychologists and Neuropsychologists

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Objective: Children and youth who are deaf/hard of hearing (DHH) are vulnerable to more risks, present with higher rates of neurodevelopmental and behavioral disorders, and face greater barriers to accessing care as compared to their hearing peers. DHH youth are a highly heterogeneous group and well-qualified providers are rare, especially if the child's primary language is not spoken English. Clinicians must appreciate and integrate a wide range of language preferences and levels of skill, intersecting cultural identities, and complex medical histories. Practitioners differ in how they are introduced to this unique population and approach their work, including justifications for preserving or modifying standardized assessment procedures. Thus, the characteristics, attitudes, and practices of experts in the field require further exploration and description. Our aim is to inform care and generate ideas for future research. **Participants and Methods:** This is a fully-mixed, concurrent, dominant-status design using purposive sampling strategies. A web-based survey was distributed via email and professional listservs for DHH mental health and psychological/neuropsychological assessment. Snowballing was encouraged. Responses were anonymous; no incentives were offered. Psychologists/neuropsychologists who completed the survey and reported providing assessment services to DHH youth were

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included in final analyses. Univariate and multivariate descriptive statistics were used to summarize the sample and explore relations among variables.
Results: Thirty-one participants across 18 states were included (age *M* [*SD*] = 41.6 [7.3]; 16.2% people of color; 16.1% Hispanic/Latino; 77.4% female). Most (*n* = 27) identified as clinical, child clinical/pediatric, and school psychologists. Eight (25.8%) identified as neuropsychologists. Most said that ≥ 50% of their assessment practice is with DHH youth (*M* [*SD*] = 54.5 [36.7]; mode = 100). Twenty (66.7%) reported competency to assess in ASL without an interpreter, four (13.3%) in Spanish. Overall, more than half (58%) said they work with children ages 0-3 years. However, of these, only half (*n* = 9) reported competence to assess in ASL and even fewer in Spanish (*n* = 3). Roughly one third reported providing tele-assessment (*n* = 10), and almost all (*n* = 8) expected to continue. The highest frequency referrals, presenting concerns, and instruments all related to general intelligence, social-emotional/personality functioning, and educational/vocational needs. Closed- and open-ended follow-up items helped judge the significance of low-frequency responses. Cross-tabulation results yielded tentative hypotheses and inferences about relations between participants' characteristics, experiences, practices, and attitudes.
Conclusions: Results from this mixed-method survey of psychologists/neuropsychologists serving DHH youth informs practice and future research. Purposive sampling increases credibility of inferences about this exceptionally unique community of providers, counter-balancing concerns about representativeness and generalizability. Patterns of referral concerns and measurement strategies align with broader pediatric trends. Tele-assessment offers opportunities to reduce barriers, especially for children from underserved regions. In this survey, very few practitioners reported assessing DHH children ages 0-3 years in ASL or Spanish. Increased availability of services for the youngest children is crucial because early identification/intervention is key to optimizing early language development. It is vital to train more psychologists/neuropsychologists from different linguistic and cultural backgrounds to serve this population.
Keywords: assessment**,** teleneuropsychology**,** cross-cultural issues
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8 The Impact of Intelligence and Age across Performance Validity Tests in a Mixed Clinical Pediatric Sample

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Objective: Performance validity tests (PVTs) are becoming more widely applied to pediatric clinical settings, similar to adult standard practices, but the impact of intelligence on PVTs remains understudied. Prior work demonstrated that applying adult cut-scores of Reliable Digit Span (RDS) to pediatric patients with intellectual disabilities results in questionable validity, and children who fail PVTs tend to show significantly poorer performance across neuropsychological tests. Recently, IQ was found to be related to Test of Memory Malingering-Trial 1 (TOMM-T1) performance in only those with IQ below 70 and to all Digit Span (DS) validity indicators from the Wechsler Intelligence Scale for Children regardless of IQ. Age may also influence TOMM pass/fail rates, although findings are mixed. Unsurprisingly, age significantly influences performance on DS indices that are not age-corrected. This study aimed to expand prior work by examining the relationship between IQ, age, and performance on several freestanding and embedded PVTs in a mixed clinical pediatric sample.
Participants and Methods: This cross-sectional study included data from 236 referrals with a mean age of 11.25 (*SD*=4.04), mean education of 5.64 years (*SD*=3.87), and mean IQ of 85.3 (*SD*=17.6). The sample was 64% male, 21% White, 41% Hispanic, 33%

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Black and 4% Asian American. PVTs included in this study were: 1) TOMM-T1; 2) DS indices (RDS; Reliable Digit Span-Revised [RDS-R]; age-corrected scaled score [ACSS]); 3) Child and Adolescent Memory Profile General Validity Index (ChAMP-Gen); 4) California Verbal Learning Test-Forced Choice (CVLT-FC); and 5) Dot Counting Test (DCT). Hierarchical multiple linear regression models were conducted as follows: IQ alone (model 1), IQ and age (model 2), and IQ, age, and their interaction term (model 3). Model comparisons were conducted to determine model fit and appropriate interpretability of fixed effects versus interaction terms.
Results: IQ significantly predicted TOMM-T1 (R^2=.10, F(1,180)=18.92, p<.0001, β=.31) and ChAMP-Gen performance (R^2=.08, F(1,61)=5.20, p=.031, β=.28). For DS indices, only IQ predicted a significant percent of the variance in ACSS performance (R^2=0.54, F(1,225)=264.17, p<.0001, β=.73), whereas both age and IQ accounted for 52% and 51% of the variance in RDS and RDS-R performance, respectively (Fs(2,221)>115, ps<.0001, βs>.49). For DCT, both IQ (p=.007, β=-.39) and age (p=.002, β=-.47) explained 42% of the variance in performance (F(2,31)=11.36). About 24% of the variance in CVLT-FC performance was explained by age and IQ (F(2,76)=12.06, ps<.001, βs>.50).
Conclusions: Very little variance in TOMM-T1 or ChAMP-Gen were explained by IQ, highlighting the potential for utilizing these instruments in populations with varying ages and IQ. In contrast, RDS/RDS-R were highly influenced by both age and IQ, thereby warranting caution when using them for younger and lower functioning children. ACSS, however, may be better suited for these groups. Interestingly, DCT was similarly influenced by age and IQ, and it is possible that numeracy and counting skills may play a role in these findings. Future efforts should examine numeracy skills in relation to performance on DCT, RDS, and RDS-R. Finally, both age and IQ explained some of the variance in CVLT-FC performance, highlighting the influence of memory-based PVTs on validity for populations of diverse IQ/age ranges.
Keywords: pediatric neuropsychology**,** psychometrics

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9 Clinical Multi-Group Examination and Comparison of Multivariate Base Rates of Score Elevations on the BRIEF2

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Objective: Multivariate base rates (MBRs) reflect probability information based on multiple variables (e.g., frequency of ≥4 low/high scores within a battery of 10 possible scores). There is sparse research examining MBRs in rating scales of cognition. We provide novel MBR information on the Behavior Rating Inventory of Executive Function, Second Edition (BRIEF2) for clinical groups including: Attention-Deficit/Hyperactivity Disorder Combined Type (ADHD-C); ADHD Inattentive Type (ADHD-I); Autism Spectrum Disorder (ASD); and Learning Disorder (LD).
Participants and Methods: We analyzed data from the ADHD-C (Parent=218; Teacher=110; Self-Report=22), ADHD-I (Parent=159; Teacher=113; Self-Report=71), ASD (Parent=262; Teacher=106; Self-Report=22), and LD (Parent=113; Teacher=100; Self-Report=27) pediatric clinical samples included in the BRIEF2 *Professional Manual*. Number of scale elevations (j) were tallied separately at three T-cutoffs (T≥60, ≥65, ≥70) for each BRIEF2 form (Parent, Teacher, Self-Report). Cumulative percentages were generated to determine MBRs for each j as a function of T-cutoff, form, and subgroup. Chi-squared tests, with Cramér's V (φ_c) effect size, were used to compare MBRs among groups. We also used general linear models to compare j across forms.

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Results: On the Parent Form, the presence of at least one elevated score (*j*≥1) was very common across clinical groups (*T*≥60=78.4-98.7%; *T*≥65=64.0-97.2%; *T*≥70=44.1-89.4%). This was also observed for the Teacher (*T*≥60=60.0-90.9%; *T*≥65=52.0-88.2%; *T*≥70=36.0-80.0%), and to a lesser extent, Self-Report forms (*T*≥60=69.2-90.9%; *T*≥65=38.5-77.5%; *T*≥70=26.9-64.8%). Conversely, the MBR of elevated scores on all BRIEF2 scales was much less frequent on the Parent (*T*≥60=2.7-30.6%; *T*≥65=0.9-14.4%; *T*≥70=0.0-3.7%), Teacher (*T*≥60=5.0-24.5%; *T*≥65=0.9-15.5%; *T*≥70=0.0-5.5%), and Self-Report (*T*≥60=0.0-12.7%; *T*≥65=0.0-4.8%; *T*≥70=0.0-4.5%) forms. The ADHD-C group consistently yielded the highest MBR of elevated scores across forms, whereas the opposite was seen for LD. MBRs produced by the ADHD-I and ASD groups were generally comparable. Between one-third and one-half of the ADHD-C, ADHD-I, and ASD groups had *j*≥4 at *T*≥70. The aggregated (average) effect size was largest for Parent report ($M\varphi_c$=.313), *T*≥60 ($M\varphi_c$=.295), and *j*≥1 ($M\varphi_c$=.326), indicating strongest group differentiation of MBRs at these parameters. Additional comparison showed MBRs significantly differed according to form, even after controlling for ADHD-C, where Parent>Teacher>Self-Report-Report. Finally, we observed a stable trend of lower effects as a function of increasing cutoff scores as well as number of elevated scores (*j*).
Conclusions: We provide novel MBR information to enhance clinical interpretation of BRIEF2 data. Results indicate that elevated scores are quite common in clinical groups on the BRIEF2 forms. However, children with LD (and their informants) had much lower prevalence of elevations than other groups. In contrast, the ADHD-C group had high MBRs to the extent that it is common for this population to have elevated scores on at least half of the BRIEF2 scales. Parents, followed by teacher-raters, endorse observing much greater executive dysfunction in everyday life than do the children themselves. Together, MBRs provide useful information about the frequency of scale elevations on the BRIEF2 that can be expected in common pediatric clinical groups. These data also provide preliminary evidence that MBRs may be helpful in discerning clinical groups (particularly ADHD-C) from others.
Keywords: executive functions**,** pediatric neuropsychology**,** psychometrics

10 Validity of Attention Measures in Young Children with Neurofibromatosis type 1: A Preliminary Investigation

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Objective: Attention and executive difficulties are commonly described as part of the cognitive phenotype for young and school-age children with neurofibromatosis type 1 (NF1). However, no study to date has demonstrated the validity of commonly used attention and emerging executive measures in young children with NF1. It is important to identify measures with strong psychometric properties because attention problems in early childhood may lead to difficulties later in life, such as poorer academic outcomes. Thus, this pilot study examined aspects of the validity of several measures of attention to help demonstrate which measures may be most appropriate to use in young children with NF1.
Participants and Methods: Participants were 20 young children (ages 4-6 years) with NF1 (*M*=5.45, *SD*=0.75; 12 males) who completed the following measures of attention: NIH Toolbox Flanker, Dimensional Change Card Sort task (DCCS), List Sort Working Memory task (LSWM) and Picture Vocabulary Test (TPVT); Cogstate Identification Task; Conners Kiddie Continuous Performance Test - Second Edition (K-CPT 2); Differential Abilities Scale - Second Edition General Cognitive Ability (DAS-II GCA) and Digits Forward task (DAS-II DF). Parent-report of attention and executive functioning was examined using the Behavior Rating Inventory of Executive Function - Preschool Edition or Second Edition (BRIEF) and Conners Early Childhood Behavior Inattention/Hyperactivity Scale (Conners I/H). Convergent and discriminant validity of these measures were explored. Spearman correlations were

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conducted 1) between each computerized measures' outcome scores, 2) between each computerized measure's outcome scores and parent-report scales and 3) between the NIH Toolbox TPVT and DAS-II GCA and all the performance-based measures' outcome scores.
Results: Convergent validity analyses of performance-based measures found that many of K-CPT 2 outcome scores and the NIH Toolbox tasks were at least moderately correlated (|*rho*|≥0.35) with one another and with several other performance-based attention measures . However, the Cogstate Identification, DAS-II DF, and K-CPT 2 Commissions and Hit Reaction Time Block Change demonstrated mostly weak correlations (|*rho*|<0.35) with other performance-based attention measures. Several performance-based attention measures were at least moderately correlated to the BRIEF scales and Conners I/H (|*rho*|=.47-.64). Discriminant validity analyses found the NIH Toolbox DCCS was moderately correlated with the NIH Toolbox TPVT (*rho*=.606). All other performance-based attention measures demonstrated weak correlations (|*rho*|<0.35) with the NIH Toolbox TPVT. Several performance-based attention measures were moderately to highly related with DAS-II GCA (|*rho*|=.42-.61).
Conclusions: The K-CPT 2 as well as the NIH Toolbox Flanker and LSWM tasks emerged as computerized attention measures with evidence of validity for use in young children with NF1 based on convergence across attention measures and convergence of attention measures with parental report of attention and executive functioning. Divergence from a measure of vocabulary was observed, though significant relations with general cognitive functioning were evident. Future research should expand on the sample size of the current investigation and explore the validity of attention measures in school-age and adolescent children.
Keywords: genetic disorders**,** attention**,** validity (performance or symptom)
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11 Relationship Between Caregiver-Reported Emerging Social Attention, Social Communication, and Attentional Orienting/Regulation at 6 Months of Age

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Objective: Cognitive processes including social attention, social communication, and attentional orienting/regulation (AOR) begin developing in infancy. Important social and attentional skills, including response to joint attention (RJA), begin developing at 6 months of age. Despite early signs of atypical social development, diagnosis of neurodevelopmental disorders such as autism spectrum disorder (ASD), occurs much later, between ages 3 and 5 (Baio et al., 2018). Early infancy could serve as a critical period for identification of the earliest markers of atypical social development. This study examines pertinent and measurable social attention behaviors that precede RJA emergence at 6 months of age and may be predictive of difficulties with social communication and attentional development. The study examined emerging social attention at the newborn and 2-month periods and its relation to AOR and social communication at 6 months. It was hypothesized that early, emerging social attention would be significantly, positively correlated with both social communication and AOR at 6 months.
Participants and Methods: The study sample was comprised of a diverse sample of 571 caregiver/infant dyads from a longitudinal, multi-site study (site 1: n=100; site 2: n=239; site 3: n=232). The sample included 331 full-term and 240 preterm infants, 52.2% of the infants are male. Mean maternal age at enrollment was 30.1 years (SD= 6.0) and maternal level of education included 23.3% some/completed high school, 28% some college/trade, 23.8% college graduate, and 24.9% some/completed postgraduate/professional. Social attention development was assessed using the Social-Sensory Information Processing (SSIP) domain of PediaTrac™ v3.0 (PT), an experimental tool to measure infant and toddler development. Social communication was assessed via the

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social, symbolic, and total scales of the Communication and Symbolic Behavior Scales-Developmental Profile (CSBS-DP), and AOR was assessed via the Infant Behavior Questionnaire-Revised Short Form (IBQ-RSF) duration of orienting composite at 6 months. Pearson correlations were computed to examine relationships between SSIP scores at newborn (NB) and 2 months and CSBS-DP social, symbolic, and total scores and AOR on the IBQ-RSF at 6 months.
Results: As hypothesized, scores at NB and 2 months on PT SSIP were significantly, positively correlated with CSBS-DP social (r= .18, p< .001), symbolic (r= .19, p< .001), and total (r= .20, p< .001) scores with small effect sizes, and IBQ-RSF AOR score (r= .30, p< .001, medium effect size). Scores on PT SSIP at NB and 2 months also were significantly, positively correlated with CSBS-DP social (r= .14, p= .002), symbolic (r= .15, p= .001), and total (r= .16, p< .001) scores with small effect sizes, and IBQ-RSF AOR score (r= .31, p< .001, medium effect size) at 6 months.
Conclusions: Findings suggest that there are social attention behaviors that emerge before RJA that are related to social communication and attentional development at 6 months, measurable via caregiver report using SSIP as early as the newborn period. Early, sensitive identification of behaviors most predictive of atypical social development presents opportunities for early intervention that could ultimately improve developmental outcomes.
Keywords: social cognition**,** attention**,** assessment
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12 Comparison of the NIH Toolbox Cognition Battery and Traditional Neuropsychological Assessment in Pediatric Hematology/Oncology Patients

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Objective: The NIH Toolbox Cognition Battery (NIHTB-CB) is a brief computerized assessment of executive function (EF), episodic memory, and language. Although the NIHTB-CB has been well validated in typically developing individuals across the lifespan, little is known about its validity in other clinical populations, including pediatric cancer and blood disorder patients. Due to disease characteristics and treatments, hematology/oncology patients are at increased risk for EF impairment. The objective of the current study is to assess frequency of impairments, and convergent and discriminant validity of the NIHTB-CB in two pediatric hematology/oncology populations, cancer survivors and patients with sickle cell anemia (SCA).
Participants and Methods: Nineteen pediatric cancer survivors (15 male, ages 9-15, ≥ 2 years post-treatment, 14 acute lymphoblastic leukemia) and 16 patients with SCA (7 male, ages 10-16) participated in the current study. Descriptive statistics and frequency of impairments (defined as ≥1 standard deviation below the mean) were examined separately for each group. Convergent and discriminant validity were assessed by conducting partial correlations, controlling for sex and diagnosis type. Specifically, correlations compared NIHTB-CB subtests (Flanker, Dimensional Change Card Sort, List Sorting, Pattern Comparison, Picture Vocabulary) with traditional neuropsychological tests, included Wechsler Intelligence Scale for Children, 5th Edition (WISC-V) Digit Span, Coding, Symbol Search, and Vocabulary subtests and indices, and Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference Test Condition 3: Inhibition.
Results: 89.5% of cancer survivors and 87.5% of patients with SCA demonstrated impairment on at least one NIHTB-CB subtest. Among cancer survivors, the majority of patients demonstrated impairment on either two or three subtests (52.6%). In patients with SCA, 25% of patients demonstrated impairment on five or more subtests, compared to none in cancer survivors. In both groups, impairment was most frequently demonstrated on Flanker, Picture

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Sequence Memory Test, and Pattern Comparison. Regarding convergent validity, the NIHTB-CB Picture Vocabulary subtest was significantly correlated with the WISC-V Vocabulary subtest in cancer survivors (r=.797, p<.001) and patients with SCA (r=.613, p=.008). In cancer survivors, Flanker was significantly correlated with WISC-V measures of attention and processing speed (r=.448, p=.036), and approached significance with D-KEFS inhibition (r=.389, p=.068). In patients with SCA, Flanker was significantly correlated with inhibition (r=.540, p=.019), but not attention and processing speed. Compared to cancer survivors, patients with SCA demonstrated better convergent validity, but poorer discriminant validity across the NIHTB-CB. **Conclusions:** Consistent with studies of pediatric cancer and blood disorder patients, impairment was most common on measures of EF, including attention and processing speed. With respect to existing validation studies in typically developing children, the current findings indicate reduced validity between NIHTB-CB subtests and traditional measures in hematology/oncology patients. In cancer survivors, convergent validity was strongest among NIHTB-CB and WISC-V measures of language, compared to EF, possibly due to altered trajectory of EF development related to cancer treatment. Poor discriminant validity in SCA patients suggests decreased differentiation among NIHTB-CB and specific cognitive domains. Overall, the NIHTB-CB has potential for screening pediatric hematology/oncology patients for general cognitive difficulties, but may be less effective in identifying specific cognitive domains of impairment.

Keywords: cancer**,** sickle cell disease**,** executive functions

13 Examining the Contribution of Processing Speed Abilities on Performance of Executive Functioning and Sustained Attention in a Mixed Pediatric Clinical Population

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Objective: Attention/executive dysfunction is very common across various childhood neurological and neurodevelopment disorders. However, measurements of both of these things (attention and executive functioning) are traditionally designed in a manner that requires intact processing speed. These tasks are either timed (e.g., DKEFS) or they are administered at a pace in which the child is unable to regulate (e.g., CPT). For example, in the case of the CPT, it is reasonable to assume if a child does not have a requisite level of processing speed, their performance is likely to be negatively impacted regardless of whether they can sustain their attention or not. While it is understood that time constraints are necessary to measure these domains, it is important to acknowledge that this is a potential confound in understanding an individual's performance on these measures. The Trail Making subtest of the DKEFS contains several conditions along with contrast scores in a probable attempt to address these confounds. As such, it is important to understand these relationships and how they present in a mixed clinical sample where processing speed deficits are also very common. The present study sought to examine the relationship between test performance across processing speed and EF/attention measures in a mixed clinical pediatric sample to identify how much variance is explained by processing speed.
Participants and Methods: Participants included 119 children (M_{age}= 11.99; SD_{age}=2.53) who were administered the *Delis Kaplan Executive Function System* (D-KEFS)-Number-Letter Switching Condition, Conners' Continuous Performance Test-3 (CPT-3), and Weschler Intelligence Scale for Children-V (WISC-V)-Processing Speed Index, as part of a comprehensive neuropsychological evaluation. Participant's diagnoses included various neurodevelopmental disorders (ADHD, learning disabilities, etc.), mood disorders, and neurocognitive disorders. Correlation analysis was used in order to examine the relationship between test performance across processing speed, executive function, and attention.
Results: A Pearson bivariate correlation analysis was computed to assess the

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relationship between processing speed, executive function, and attention. Results indicated a moderate positive relationship between processing speed and EF, r (119) =.46, p<.01 and an inverse relationship between processing speed and attention, r (119) = -.25, p<.01. 21% of variance in EF is accounted for by processing speed. 6% of the variance in attention is accounted for by processing speed. **Conclusions:** Results suggest that as processing speed performance increased so did performance on a measure of EF. Additionally, results revealed that within this sample as processing speed performance decreased, inattentiveness (as measured by detectability; d') increased. Individuals with lower processing speed had more trouble with this measure of attention. These results highlight the need to account for the possible influence of processing speed on performance on measures of EF and attention. Positive correlation between PSI and EF appear to support the notion that contrast scores may be helpful in parsing out these contributions. Future studies may explore the benefits of contrast scores to account for these relationships in the trail making task. Furthermore, consideration should be given to computerized sustain attention tasks that might incorporate some measure of processing speed in its assessment of sustained attention.

Keywords: executive functions**,** attention**,** pediatric neuropsychology

14 Perceived Cognitive Impairment in High School Students in the United States

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Objective: The purpose of this study is to examine the correlates of perceived cognitive impairment among high school students who completed a national survey conducted by the United States Centers for Disease Control and Prevention (CDC) in 2019.

Participants and Methods: The subjects were high school students (grades 9-12) who completed the Youth Risk Behavior Survey (YRBS) in 2019. The CDC uses this survey to monitor risk behaviors. Students answered the following question "Because of a physical, mental, or emotional problem, do you have serious difficulty concentrating, remembering, or making decisions?" as either "yes" or "no." Student responses to this question were analyzed in relation to demographic variables and variables pertaining to adversity, mental health problems, lifestyle behaviors, and drug usage.
Results: The sample included 8,349 students between the ages of 14 and 18 (M=16.03 years, SD=1.21), with 4,093 boys (49%) and 4,256 girls (51%). A large proportion of high school students reported having serious difficulty concentrating, remembering, or making decisions due to physical, mental, or emotional problems (37.8%). A significantly larger proportion of girls (45.4%) than boys (29.9%) reported experiencing these cognitive impairments [$\chi^2(1)=212.23$, $p<.001$; Odds Ratio=1.95, 95% confidence interval=1.78-2.13]. Perceived cognitive impairment was endorsed by approximately half to three-quarters of youth who reported experiencing bullying (boys=47.0%, girls=61.7%), depression (boys=54.2%, girls=69.0%), or suicidality (boys=62.4%; girls=74.4%) in the past year. Binary logistic regression was used to examine the associations between perceived cognitive impairment and adversity, mental health, and lifestyle variables. These analyses were conducted separately for boys [$\chi^2(9)=570.09$, $p<.001$; Nagelkerke $R^2=.211$] and girls [$\chi^2(9)=1,016.69$, $p<.001$; Nagelkerke $R^2=.317$]. Significant independent predictors of perceived cognitive impairment, for boys and girls, included depression, suicidality, being bullied, using illicit drugs, insufficient sleep, and obtaining very low grades. Youth who participated in sports were significantly less likely to report cognitive impairment. Youth who denied experiencing mental health problems, adversity, and using illicit drugs reported much lower rates of perceived cognitive impairment (boys=15.1%, girls=18.2%).
Conclusions: Perceived cognitive impairment was reported by a substantial percentage of high

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school students in the United States, and it was associated with mental health problems, being bullied, getting insufficient sleep, receiving very low grades, and using illicit drugs.
Keywords: adolescence**,** cognitive functioning**,** depression

15 Youth with Weaker Language Processing Show Poorer Performance on Both Verbal and Visual Memory Tasks

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Objective: The Child and Adolescent Memory Profile (ChAMP) is a tool developed for comprehensive evaluation of memory processes in pediatric populations using both verbal and visual learning and memory tasks. While clinicians utilizing the ChAMP may intuitively expect specific deficits in verbal memory among language-impaired youth due to the role of language processing for encoding and storing verbally presented information, the test authors reported worse performance across *both* verbal and visual memory tasks in youth diagnosed with Language Disorder compared to healthy controls. This finding is consistent with broader research examining the relationship between language processing and memory impairment in language-disordered youth, but much remains to be understood. Therefore, the current study examines the relationship between language processing and learning and memory performance on the ChAMP in a heterogeneous clinical pediatric sample.
Participants and Methods: Archival clinical data was examined from 55 participants referred for comprehensive neuropsychological evaluation at a large-scale academic medical center (ages 5-20; 62% male, 82% Caucasian). All participants received both the ChAMP and the Clinical Evaluation of Language Fundamentals - 5th Edition (CELF-5), an assessment of core language processing abilities. Correlational analyses were conducted to explore any association between language processing (CELF-5 Core Language Score) and memory performance patterns across ChAMP Index Scores (Immediate, Delay, Visual, and Verbal).
Results: Pearson correlations indicated there is a significant moderately positive association between the CELF-5 Core Language Score and ChAMP index scores: Immediate Memory [r(55)=.56, p<.001], Delayed Memory [r(55)=.56, p<.001], Verbal Memory [r(55)=.53, p <.001], and Visual Memory [r(55)=.45, p=.001].
Conclusions: Current study results indicate a relationship between language processing skills on the CELF-5 and learning/memory skills on the ChAMP. Moderate effect sizes across *both* verbal and visual memory index scores highlight that weaker language processing may undermine performance even for visual memory tasks. Review of relevant research identifies several possible explanations for this relationship, including memory deficits occurring as some primary consequence of language impairment or memory deficits occurring as the result of other comorbid factors common to language impairment (such as attentional disorders). Current findings warrant consideration of the potential utility of normative data specific to youth with language impairments, which would allow for identification of memory impairment above and beyond those imparted by language dysfunction alone and which might shed further light on the mechanism by which youth with language impairment experience memory deficits.
Keywords: verbal abilities**,** memory complaints**,** pediatric neuropsychology

16 "Teenagers Don't Like to Go to Bed Early:" An Analysis of Family Implementation of Pediatric Neuropsychological Recommendations

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Objective: While the provision of recommendations is a core component of

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pediatric neuropsychological reports and feedback, family follow-through on recommendations remains understudied. There is some evidence that recommendation implementation is moderate, with approximately half of all recommendations implemented. The aim of the present study was to investigate rates of implementation, parental perceived helpfulness and appropriateness of recommendations, and themes in reasons provided for non-implementation.
Participants and Methods: Participants included 62 parents of children who had undergone clinical neuropsychological evaluation within 3-12 months of study participation. Parents were administered an individualized survey coded to the specific recommendations provided to them at the time of feedback. For each recommendation, parents indicated whether they had implemented, attempted to implement, or declined to implement the recommendations. Parents were also given the opportunity to provide open responses (e.g., why a recommendation had not been implemented). Finally, parents scored each recommendation in terms of helpfulness and appropriateness on a scale from 1 (not at all) to 5 (very). Multiple regression was utilized to examine relationships between perceived helpfulness and appropriateness and implementation status. Qualitative content analysis was conducted to identify key themes in open responses related to implementation.
Results: Overall, 67.8% of total recommendations were implemented. Of those not implemented, 8.1% were attempted unsuccessfully and 20.1% were declined by the family. Parents reported not knowing the outcome of the other 4% of recommendations. School recommendations were most likely to be implemented (72.3%), followed by family (65.2%) and medical (20.0%). Perceived appropriateness of recommendations significantly predicted implementation ($F[1,60] = 7.12$, $p = .010$, $r^2 = .106$), but perceived helpfulness did not ($F[1,60] = 0.50$, $p = .484$, $r^2 = .008$). Two primary themes of non-implementation of family/home-related recommendations emerged: limited time, energy, or feasibility due to child's medical needs and child disinterest or refusal to engage with the recommendation. For school-related recommendations, two primary themes emerged: lack of communication or cooperation from school and restrictions due to COVID-19.
Conclusions: Generally, recommendation implementation was higher in the present study than has been reported in previous samples. Perceived appropriateness, but not helpfulness, of recommendations predicted likelihood of recommendation implementation. Based on these findings, and a qualitative analysis of themes for non-implementation, pediatric neuropsychologists are encouraged to: 1) confirm family understanding of the rationale for recommendations; 2) consider how family and child factors peripheral to child's referral question may impact feasibility of recommendations (e.g., parental fatigue in caring for a child with high medical needs); and 3) consider further follow-up of school recommendations to assist families in problem-solving with changing levels of access due to school closures and re-openings, including consideration of how these recommendations could be implemented in the absence of school-based services.
Keywords: assessment

17 Does the Embedded ChAMP Validity Indicator Need New Cut Scores?

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Objective: The Child and Adolescent Memory Profile (ChAMP) provides an embedded performance validity score to identify possible invalid test performance. Cut scores for the ChAMP Validity Indicator were derived by the test authors from the multinomial probability of responses falling in the below-chance range (<0.33). Cross-validation of the ChAMP Validity Indicator's ability to discriminate between simulated feigning (N=45, ages 8-21) and matched controls found the tool to have perfect specificity (1.0) and suboptimal sensitivity (0.556). Since the ChAMP was first published in 2015, there has been no known investigation of

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the ChAMP Validity Indicator's performance in a mixed clinical pediatric sample. The current study explores the criterion validity of the ChAMP Validity Indicator against a 'gold-standard' PVT and investigates alternative cut scores to optimize sensitivity and specificity.
Participants and Methods: Archival clinical data was examined from 101 participants (ages 6-20; 56% male; 78% Caucasian) referred for comprehensive neuropsychological evaluation. All participants were administered the ChAMP and the Test of Memory Malingering (TOMM). Receiver operating characteristic analysis was used to explore the criterion validity of the ChAMP Validity Indicator with the TOMM (Pass N=95, Fail N=6) and identify a potential ChAMP Validity Indicator cut score for optimization of sensitivity and specificity in detecting those likely to have noncredible testing performance.
Results: No participants yielded a failing score on the ChAMP Validity Indicator using manual-based cut scores, while approximately 6% of participants failed the TOMM. The ChAMP Validity Indicator thus demonstrated poor discrimination of TOMM performance (AUC = .71, *p*=.089). AUC inspection identified the most optimal potential cut score as 49.5 (sensitivity = .99, specificity = .33). Based on a cut-off of ≤49, the ChAMP Validity Indicator identified 3 failures, 2 of which agreed with TOMM failures.
Conclusions: The published cut scores for the ChAMP Validity Indicator demonstrated poor convergent validity with the TOMM in a mixed clinical pediatric sample. In fact, the lack of failures on the ChAMP Validity Indicator compared to the TOMM (which performed close to expected base rate with 5% failing Trial 2) suggests the published cut scores for the ChAMP Validity Indicator may be too lenient and fail to identify instances of possibly invalid performance. The current findings are limited by the use of only one PVT as the 'gold-standard' for classification of invalid performance. Current literature on performance validity assessment suggests agreement across 2-3 tests is a stronger indicator of invalid test performance than failure on a single PVT. Thus, future studies could investigate the psychometric performance of the ChAMP in discriminating possible invalid performance identified by agreement between 2 or more PVTs that have well-established validity for use in pediatric populations.
Keywords: validity (performance or symptom), pediatric neuropsychology

18 Development and Validation of the Social Reward Questionnaire – Early Childhood Version (SRQ-EC)

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Objective: Early social engagement contributes to the development of social skills, emotional regulation, and executive function. Like other rewarding stimuli, social stimuli engage unique reward phases including 'wanting' (incentive to seek out rewards) and 'liking' (pleasure when a reward is received) (Rademacher et al., 2010). The Social Reward Questionnaire for adults (SRQ; Foulkes et al., 2014) and adolescents (SRQ-A; Foulkes et al., 2017) assess liking of several distinct social scenarios (e.g. being admired), but a comparable measure doesn't exist for early childhood. We adapted the SRQ into a parent-report measure for early childhood (age 3-7 years), creating a new research tool for investigating early socialization.
Participants and Methods: The SRQ-EC was based on the SRQ with developmentally appropriate question modifications. We retained items related to 'liking', as in the original SRQ, and developed an additional item set measuring 'wanting'. Parents of 3 to 7-year-old children were recruited via Prolific (www.prolific.co). The SRQ-EC was completed by Sample 1 (N = 126) for exploratory factor analysis (EFA) and Sample 2 (N = 321) for confirmatory factor analysis (CFA). All factor analyses were conducted for separate Wanting and Liking models using mean and variance adjusted weighted least

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squares (WLSMV) in MPlus. Factor solutions were evaluated using the X^2 statistic, Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Internal consistency was assessed in Sample 2 with Cronbach's alpha.
Results: A 3-factor EFA solution was the most parsimonious while providing good data fit for both models: Wanting ($X^2(273) = 418.56$, $p < 0.0001$; CFI = 0.94; RMSEA (90% CI) = 0.065 (0.052 – 0.077)), Liking ($X^2(273) = 425.77$, $p < 0.0001$; CFI = 0.95; RMSEA (90% CI) = 0.067 (0.054 – 0.079)). Substantive interpretation, for both models, identified that the three factors related to the original SRQ subscales *Sociability* (group socialising), *Admiration* (praise) and a new subscale that combined the original *Passivity* and *Prosocial Interactions* subscales (submissive and prosocial behaviors).
The EFA solution from Sample 1 had good fit in Sample 2 for Social Reward Wanting ($X^2(87) = 194.64$, $p < 0.0001$; CFI = 0.97, RMSEA (90% CI) = 0.063 (0.051 – 0.075) and good fit for Social Reward Liking as assessed by the X^2 and CFI ($X^2(87) = 287.23$, $p < 0.0001$; CFI = 0.96), but mediocre fit as assessed by the RMSEA (RMSEA (90% CI) = 0.085 (0.074 – 0.096)). Cronbach's alpha for all subscales were acceptable (mean = 0.83, SD = 0.05, range = 0.76 – 0.89).
Conclusions: The SRQ-EC is a valid and reliable measure for assessing social wanting and liking in children aged 3-7 years. In early childhood, social reward behaviors can be broadly described as relating to the wanting and liking of Sociability, Admiration, and Passivity/Prosocial Interactions. Future work using the SRQ-EC could illuminate how wanting and liking of social rewards relates to atypical social behaviour in early childhood, including children with antisocial behaviour or neurodevelopmental disorders like autism spectrum disorder. With the SRQ and SRQ-A, the SRQ-EC could also be used to assess development of social reward valuation across the lifespan.
Keywords: assessment**,** social cognition**,** pediatric neuropsychology
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19 Do Depression Symptoms and Sex Moderate Associations Between Cannabis Use and Episodic Memory Performance Among Adolescents?

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Objective: Prior literature consistently documents a negative relationship between cannabis use and episodic memory among both adolescents and adults. However, there remains substantial variability in the strength of these associations across studies, underscoring the need to identify individual characteristics that may influence the association between cannabis use and episodic memory, such as mental health symptoms and sex differences. Furthermore, few studies have examined these associations during adolescence, a time of rapid neurodevelopmental growth. The current study addresses these concerns by examining symptoms of major depression and sex as moderators of the relationship between cannabis use and episodic memory in a sample of adolescents.
Participants and Methods: Cross-sectional data from 360 adolescents (M_{age} = 17.38, *SD* = .75) were analyzed at the final assessment of a two-year longitudinal study. The sample population were majority male (53.1%) and Hispanic/Latino (89.2%). Depression was quantified as the number of symptoms of major depression in the last year reported on the Computerized Diagnostic Interview Schedule for Children, Fourth Edition. Lifetime frequency of cannabis and nicotine use (number of days) was assessed through the Drug Use History Questionnaire. We used the average immediate and delayed free recall scores from both the Wechsler Memory Scale, Fourth Edition, Logical Memory and Designs Memory subtests, and the California Verbal Learning Test, Second Edition to generate average immediate and delayed free recall outcome variables. Multiple regression analyses were run to test the three-way and all two-way interactions, while controlling for lifetime frequency of nicotine use and age.

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Results: We did not find a significant three-way interaction effect of lifetime frequency of cannabis use, symptoms of major depression, and sex on episodic memory performance. However, follow-up analyses revealed a significant two-way interaction effect between lifetime frequency of cannabis use and symptoms of major depression for both immediate free recall (p = .010) and delayed free recall (p = .003) Post-hoc simple slopes difference test revealed that lifetime frequency of cannabis use was significantly associated with poorer performance on immediate free recall at low (p < .001) and average (p = .001) levels of major depression symptoms in the last year, but not at high (p = .323) levels. Similarly for delayed free recall, lifetime frequency of cannabis use was significantly associated with poorer performance on delayed free recall at low (p < .001), and average (p = .002) levels of major depression symptoms in the last year, but not at high (p = .592) levels.
Conclusions: These results provide further evidence of the negative association between lifetime frequency of cannabis use and episodic memory among adolescents. However, contrary to our hypotheses, we found that as major depression symptoms increased, the association between lifetime frequency of cannabis use and episodic memory diminished. Future studies should explore why higher levels of depression symptoms appear to obfuscate the association between cannabis use and poorer episodic memory in a sample with more clinically significant levels of depression.
Keywords: cannabis**,** adolescence
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20 The Different Effects of Mindfulness-Based Relapse Prevention Group Therapy on QEEG Measures in Various Severity Substance Use Disorder Involuntary Clients

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Objective: The incidence of behavioral addictions, especially substance use disorders (SUDs), is gradually be taken seriously with various physical health problems. Mindfulness-based relapse prevention (MBRP) is a treatment option for promoting long-term health behavior change in recent years. MBRP is a structured protocol that integrates formal meditation practices with the cognitive-behavioral approach of relapse prevention treatment by teaching participants not to engage in reappraisal or savoring techniques. However, considering SUDs as a complex brain disease, questionnaires and symptom evaluation are not sufficient to evaluate the effect of MBRP. Neurophysiological biomarkers such as quantitative electroencephalogram (QEEG) may improve accurately represent the curative effects. This study attempted to find out the neurophysiological indicator of MBRP in various severity SUD involuntary clients.
Participants and Methods: Thirteen participants (all males) completed 8-week mindfulness-based treatment provided by trained, licensed clinical psychologists. The behavioral data were from the Severity of Dependence Scale (SDS) and Negative Mood Regulation Scale (NMR) before and after MBRP treatment. The QEEG data were simultaneously recorded with executive attention tasks, called comprehensive nonverbal attention test (CNAT). The two-way repeated-measures (treatment * severity) ANOVA and independent t-test were used for statistical analysis.
Results: Thirteen participants regrouped into high substance dependence (HS) and low substance dependence (LS) by SDS cut-off. The HS group showed more SDS total score and lower gamma wave in the Go/No Go task of CNAT at pretest. Both groups showed the main effect that they had a lower frontal theta/beta ratio (TBR) during the simple reaction time task

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of CNAT. The main effect showed that the delay errors of CNAT were lower after MBRP. There was no other difference in CNAT between groups. However, after MBRP, compared to LS, the HS group have resonant progress in improving SDS and NMR scores. The neurophysiological index, the frontal TBR of the HS during the Go/No Go task of CNAT decreased than that of the LS group. Otherwise, the LS group's gamma wave was a significant reduction on the Go/No Go task of CNAT.
Conclusions: The QEEG data supports the MBRP can restore the prefrontal function of involuntary addicts and lower their errors in executive attention tasks. However, the improvement of MBRP for the addict with high addiction severity is significantly more than that with low severity, including QEEG's indicators and negative emotion regulation. Future directions include investigating the reasons for differences in efficacy among different severity of the addiction.
Keywords: drug / toxin-related disorders**,** electroencephalography**,** treatment outcome

21 Differences in the Association of Moderate Alcohol Use and Cognition by Sex/Gender and Race/Ethnicity

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Objective: Alcohol use has increased among adults over the past 20 years in the United States. However, the relationship between moderate alcohol consumption and cognitive functioning remains unclear. While heavy alcohol use is associated with cognitive impairment, more recent studies explored the effect of moderate use (<14 standard drinks/week) on cognition with conflicting results as to whether moderate alcohol use could be harmful or protective. The effect of moderate alcohol use on central nervous functioning may differ by sex, such that men demonstrate worse outcomes compared to women. However, little is known whether these sex differences in moderate alcohol use and cognition vary as a function of race/ethnicity. In this study, we investigated the relationship between alcohol use and cognition in a diverse sample of middle-aged non-alcohol-dependent community-dwelling adults. We hypothesized that, when controlling for sociodemographic and health factors, greater alcohol use would be associated with lower cognition and the relationship would differ by sex/gender and race/ethnicity.
Participants and Methods: We assessed 850 middle-aged community-dwelling adults in New York City (*M*age=55.6, *SD*=10.5; 64.6% women; 23% non-Latinx White; 23% non-Latinx Black; 54% Latinx). Alcohol use was assessed by the Alcohol Use Disorder Identification Test–Concise (AUDIT-C) and between-group differences were assessed by one-way ANOVA. Individuals at risk for alcohol dependence (AUDIT-C>9) were excluded from the current study (n=5). Participants completed a neuropsychological evaluation which assessed letter and animal fluency, attention and working memory with the Digit Span Test, and episodic memory with the Selective Reminding Test. General linear models stratified by sex/gender and race/ethnicity groups evaluated alcohol use on cognitive test performance covarying for age, years of education, and medical comorbidities (diabetes, hypertension).
Results: Alcohol use differed by sex/gender and race/ethnicity groups with Latinx (mean=2.99, SD=2.40, n=152) and non-Latinx White (mean=2.88, SD=2.17, n=72) men having the highest average AUDIT-C scores, followed by non-Latinx Black men (mean=2.46, SD=1.97, n=72), non-Latinx White women (mean=2.27, SD=1.63, n=118), non-Latinx Black women (mean=1.64, SD=1.44, n=125), and Latinx women (mean=1.62, SD=1.65, n=306). Greater alcohol use was positively associated with letter fluency in both non-Latinx Black (B=0.759, 95%CI=[0.304,1.214]) and Latinx women (B=0.412, 95%CI=[0.130,0.693]). Alcohol use was positively associated with animal fluency among non-Latinx Black women (B=0.901, 95%CI=[0.259,1.543]). Among non-Latinx White

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men, alcohol use was positively associated with working memory (B=0.337, 95%CI=[0.037,0.637]). Alcohol use was not associated with other cognitive scores among the other sex/gender and race/ethnicity groups (all *p*'s>.10).
Conclusions: In this cross-sectional study of middle-aged community-dwelling adults, contrary to our hypothesis, increasing alcohol use was associated with better verbal fluency and working memory scores. Nevertheless, this is consistent with some previous work that has shown a protective effect of moderate alcohol use. However, the level of alcohol use and its association with cognition differed by sex/gender and race/ethnicity. Extension of this work should evaluate sociocultural factors associated with alcohol use (i.e., context of use, alcohol type, and duration of alcohol use).
Keywords: alcohol**,** cognitive functioning

22 Multiple Drug Consumption and Executive Performance in a Sample of Hispanic Women

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Objective: Polydrug consumers are the name given to individuals who consume more than one illicit drug. A considerable amount of literature has reported that polydrug drug consumers exhibit more neurocognitive impairments on executive function than those who prefer one type of drug. Most of the studies with polydrug consumers have been conducted with male samples and a few with the Hispanic population. As a result, there is a lack of knowledge of the impact of multiple drug consumption on neurocognitive performance in Hispanic women. Considering these limitations, the objective of this study was to compare executive performance between polydrug Hispanic women with nondrugs consumers.
Participants and Methods: In this cross-sectional study, twenty women participated and were divided into two groups according to the category: polydrug consumers and non-consumers. Polydrug consumers were recruited from rehabilitation centers and had to meet the criteria of consumed multiple illicit drugs. Non-consumers were recruited from the university community. Participants completed the neuropsychology test Trail Making Tests (TMT) part A and B to assess executive performance.
Results: The Mann-Whitney U test reveals no difference between polydrug consumers on Trail A, associated with motor speed skill (*U*=16.50, z=-1.81, *p*=.070). Nevertheless, significant differences were reported between both groups on neurocognitive flexibility measured on Trail B. Polydrug consumers exhibit lower performance than non-consumers (*U*=3.00, z=-3.10, *p*=.003).
Conclusions: These findings suggest that the use of multiple drugs can impact more on neurocognitive flexibility than motor speed in polydrug Hispanic women compared with his counterpart's non-consumers. Future studies are necessary.
Keywords: substance abuse**,** cognitive functioning**,** executive functions

23 Neuropsychological Functioning and Interferon Gamma Levels in Veterans with Gulf War Illness from the Gulf War Illness Consortium (GWIC)

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Objective: Veterans of the 1991 Gulf War (GW) have experienced chronic health symptoms including fatigue, joint pain, gastrointestinal disturbances, respiratory problems and cognitive dysfunction, categorized as Gulf War Illness (GWI). Prior studies in GW veterans have found

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decrements in neuropsychological domains such as attention, memory, visuospatial, executive and motor function. To date, studies of GW veterans have suggested GWI and related symptoms to be driven by underlying chronic neuroimmune dysfunction. Further, recent research on the pro-inflammatory cytokine INF-γ found that adults who had lower levels of INF-γ were more likely to develop Alzheimer's (AD). Thus, we investigated INF- γ levels in a large cohort of GW veterans to examine the relationship with neuropsychological function.
Participants and Methods: Participants were recruited from the large, multi-site Gulf War Illness Consortium (GWIC) of 1991 Gulf War veterans. A total of 269 GW veterans participated in GWIC. Participants were categorized into GWI cases (n = 223), and healthy GW veteran controls (n = 46) based on the Kansas GWI case definition. The study protocol included blood draws for neuroimmune markers and cognitive assessments. Fasting blood samples were collected and the pro-inflammatory cytokine INF- γ levels were measured using a quantitative ELISA-based test. Cognitive assessments included measures from each cognitive domain.
Results: Blood biomarker results showed a significant difference between INF- γ levels between GWI cases (mean (SD) = 12.43 (12.49)) and GW controls (mean (SD) = 24.36 (40.04)). GWI cases and controls also were significantly different with regard to memory functioning on the California Verbal Learning Test – II (CVLT-II). In addition, INF- γ was significantly correlated with CVLT-II- long delay, Rey Osterreith Complex Figure –Delay and the WAIS-4 Block Design subtest in the GWI cases.
Conclusions: INF- γ levels were significantly different between GWI cases and controls with controls showing nearly double the amount of INF- γ compared to cases in this cohort of middle-aged veterans. In addition, INF- γ levels were significantly correlated with memory and visuospatial functioning in veterans with GWI suggesting further study and follow-up for the risk of neurodegenerative disorders is warranted in these veterans.
Keywords: dementia - Alzheimer's disease, environmental pollutants / exposures, neurotoxicity

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24 Thinking Makes it so: Cognitive Control and Emotion Regulation

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Objective: Recent research has highlighted the contributions of cognitive control processes in emotion regulation. Influential models of cognitive control purport that the ability to inhibit prepotent responses, update information held in working memory, and effortfully shift attention between tasks are integral and distinguishable components of cognitive control. Cognitive reappraisal and expressive suppression are frequently investigated emotion regulation strategies with divergent impacts on cognitive performance and overall well-being. Thus far, the components of cognitive control have been differentially implicated in laboratory tasks of emotion regulation in which participants are specifically instructed to use one emotion regulation strategy over another; however, few studies to date have investigated how habitual and long-term emotion regulation strategies interact with specific cognitive control measures. The objective of this study was to investigate the relationship between cognitive control and habitual emotion regulation. Based on prior research, only working memory capacity was expected to be positively associated with habitual cognitive reappraisal and expressive suppression; set-shifting error rate was hypothesized to be negatively associated with habitual cognitive reappraisal.
Participants and Methods: Data from the cognitive and neuroscience substudy of the national Midlife in the U.S. Study refresher sample (MIDUS-R1) was used to investigate the study aim (n = 127, M = 47 years, SD = 12 years). A within-subjects design was used with working memory capacity (Digit Span Backwards), inhibition (total commission errors in the Affective Go/No-Go task) and set-shifting (total errors in the Intra-Extra Dimensional Set Shift task) as independent variables. Habitual

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cognitive reappraisal and expressive suppression were dependent variables measured by the Emotion Regulation Questionnaire. General linear modeling was used to investigate the study aim; non-parametric analysis was used when parametric assumptions were violated.
Results: Results showed that inhibition ability and working memory capacity were not significantly related to either habitual cognitive reappraisal or habitual expressive suppression (*ps* > .05). However, set shifting error rate showed a significant negative relationship with expressive suppression (r_s = -.22, p < .01). Moreover, within set-shifting ability, further analysis showed that habitual expressive suppression was significantly associated with extra dimensional shift errors (r_s = -.19, p = .03) but not with pre-extradimensional shift errors (r_s = -.07, p = .41). This relationship remained significant when statistically controlling for other set-shifting measures, age, and gender.
Conclusions: Findings from the current study did not support the hypotheses. Overall, findings may be different from prior research because we investigated long-term and habitual emotion regulation instead of specifically instructing subjects to effortfully exert emotional control when confronted with evocative stimuli. Moreover, we extended previous research by investigating cognitive demands within a set-shifting task and their relationship to emotion regulation. Results suggest that habitual expressive suppression may be adaptive particularly during tasks that place higher demands on set-shifting abilities. Future research should replicate and extend these findings conjointly using habitual and task-based emotion regulation paradigms.
Keywords: cognitive control**,** emotional processes
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25 Cortisol Reactivity and Working Memory in Adolescents from Low-Income Environments

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Objective: The Hypothalamic-Pituitary-Adrenal (HPA) axis is an important stress regulation system, with dysregulation of glucocorticoid secretion negatively impacting psychological and physical well-being. Chronic stressors (e.g., poverty) can contribute to HPA axis dysfunction. While poor executive function (EF), particularly working memory, has been linked to emotion regulation, there is limited research examining relations between EF and stress-reactivity in adolescents from low-income environments. Adolescence is a vulnerable developmental period where chronic stress can adversely impact HPA-axis regulation and associated cortical brain area development, including the prefrontal cortex (PFC) and hippocampus. Thus, this study aimed to examine associations between EF, objective and subjective stress reactivity, chronic stress, and mindfulness in adolescents from low-income environments.
Participants and Methods: Adolescents (N=57; M age= 13.4; 54.4% females, 56.1% White, 33% Black) and a guardian were part of a larger study examining stress and eating behaviors in low-income families at or below the 200% U.S. Poverty Threshold. Guardians completed adolescent demographic information. Adolescents completed the Child and Adolescent Mindfulness Measure (CAMM; .89), Adolescent Stress Questionnaire (ASQ; .96), NIH Toolbox Flanker Inhibitory Control and Attention Test, Dimensional Change Card Sort Test, List Sorting Test, and Picture Vocabulary Test. The Trier Social Stress Test (TSST) was administered to adolescents to induce an acute stress response. Saliva samples were collected from adolescents at 7 time points (before and after the TSST), along with subjective stress ratings on a visual analog scale. Area under the curve (AUC) was calculated for cortisol reactivity with respect to ground (AUG_g) and subjective stress reactivity. Both AUC stress-reactivity variables were positively skewed and log-transformed.
Results: Pearson correlations with bootstrapping were conducted among study variables. NIH Toolbox List Sorting Test performance (r=-.24, p<.05), chronic stress (r=.28, p<.05), and subjective stress reactivity (r=.29, p<.05) significantly correlated with AUC_g. Chronic stress (r=.33, p<.01), and

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mindfulness (*r*=-.29, *p*<.05) correlated with subjective stress reactivity. Controlling for age, sex assigned at birth, NIH Toolbox Picture Vocabulary Test performance, and income-to-needs, partial correlations found chronic stress (*r*=.29, *p*<.05) and subjective stress reactivity (*r*=.31, *p*<.05) remained significantly correlated with AUC_g, with List Sorting Test performance trending towards significance (*r*=-.22, p=.06). Chronic stress (*r*=.38, *p*<.01) and mindfulness (*r*=-.32, *p*<.05) also remained correlated with subjective stress reactivity. **Conclusions:** Working memory, chronic stress, and subjective stress reactivity were associated with higher cortisol reactivity in adolescents from low-income backgrounds. Mindfulness was only associated with subjective experiences of stress reactivity. Adolescents from low-income backgrounds with higher chronic stress, as well as poor working memory, may be at particular risk for HPA-axis dysfunction. These findings extend the emerging literature on relations between HPA-axis dysfunction and human cognition, which may have important implications on targeting healthy adaptive stress-regulation and brain development in adolescents from low-income environments.
Keywords: adolescence**,** emotional processes**,** working memory

26 At the Heart of State Rumination: a Novel Physiological Index of the Construct

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Objective: Rumination, the tendency to perseverate on the cause, experience, and implications of dysphoric moods, is a transdiagnostic risk factor linked to reduced connectivity in the left medial orbito-frontal cortex and other default mode network regions. The construct is predominantly measured through self-report measures. Although an accepted methodology, its pitfalls are well known, particularly during adolescence, a time of increased ruminative tendencies. The parasympathetic nervous system-mediated cardiac orienting response may provide means to measure rumination that circumvents issues associated with self-report data. The cardiac orienting response is a stereotyped deceleration of the heart to novel external stimuli, mediated by the vagus nerve, that precedes cardiac acceleration when attention is directed away from the environment and towards defensive behaviors, problem solving, or mental operations; engagement with an external event rather than engagement with internalized thoughts appear to induce a vagal slowing of heart rate. As rumination reflects an inward focus from which attention is slow to disengage, it may be expected that ruminative tendencies would be linked to an attenuated orienting response following non-reward or personal failure, events known to elicit rumination. We test the feasibility of objectively measuring state rumination through the cardiac orienting response following personal failure among youths with various depression histories. **Participants and Methods:** Three hundred-nine adolescents with depression histories (probands, M_{age}=16.03, 67% male), their siblings (siblings, M_{age}=16.16, 50% male) and those with no psychiatric histories (controls, M_{age}=17.09, 55% male) completed the Children Response Style Scale (CRSS), two computer puzzle tasks (Solvable & Unsolvable) and an attention refocusing task involving a Kaleidoscope. Affect ratings were collected following each task and ECG were collected throughout. Indexed via the first 13 inter-beat-intervals (IBIs) (*M* = 16 seconds), the cardiac orienting response was quantified via latent quadratic growth models following the Solvable Puzzle and Kaleidoscope task onsets. To evaluate whether phasic modulation of the heart reflects a ruminative state when dysphoria is present, we conducted two multi-level factor analyses in which IBIs served as within-subjects dependent variables (level 1), and IBI growth parameters along with the Reflection and Broodings subscales of the CRSS as indicators of a latent rumination factor at the between-subjects level (level 2). **Results:** As hypothesized, the latent rumination factor explained covariation between the two CRSS subscales and IBI growth parameters in response to the Kaleidoscope task, but not during the Solvable Puzzle when subjects' affect

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was euthymic; elevated rumination levels were associated with a blunted cardiac response during the Kaleidoscope task (b_{slp}=-3.48, b_{quad}= .32, *ps*<.05), but unrelated to IBI trajectories during the Solvable Puzzle (b_{slp}=1.64, b_{quad}=-.16, *ps*=.28-.32). These results suggest that ruminative tendencies inhibit attentional engagement with external sources in the presence of dysphoria, and imply that a blunted cardiac response during such emotional states may reflect a physiological substrate of rumination. In support of its validity, probands (*b* = .39, *p* = .04) and unaffected siblings (*b*=.34, *p*=.04) evidenced higher levels than controls on the latent rumination factor (*bs*=.34-.39, *ps*=.04).
Conclusions: Our results suggest that ruminative tendencies inhibit attentional engagement with external sources in the presence of dysphoria, and imply that a blunted cardiac response during such emotional states may reflect a physiological substrate of rumination. Clinical implications will be discussed.
Keywords: emotional processes

27 Differences in Emotional Lability Between Attention-Deficit/Hyperactivity Disorder Subtypes

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Objective: While the core symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD) involve dysregulated attention and/or impulsivity, about 25-45% of youth with the disorder also experience emotion dysregulation (ED; Shaw et al., 2014). Among youth with ADHD, co-occurring ED is associated with greater psychosocial and academic difficulties (Wehmeier et al., 2010). In the current study, we tested a theory of ED in ADHD that proposes emotionality or lability may be more associated with hyperactive/impulsive symptoms of ADHD than inattentive symptoms (Martel, 2009). Specifically, we examined differences in newly derived Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997) subscales scores (Silverman et al., in press) between youth with ADHD predominately inattentive presentation (PIP) and youth with ADHD either predominately hyperactive/impulsive or combined presentation (HCP).
Participants and Methods: Data were analyzed retrospectively. Parents of children with ADHD ages 5- to 9-years-old (n=148, mean age = 7.46 years) completed the ERC as part of two larger studies exploring emotion dysregulation in children. Diagnoses were determined via the Schedule for Affective Disorders and Schizophrenia – Child Version (KSADS-PL; Kaufman et al., 1997). The ERC includes 24 items related to emotional functioning rated on a 4-point Likert scale (from 1 "never" to 4 "almost always"). Including age as a covariate, one-way ANCOVAs were used to test group differences on the four subscales identified in our previous work: Negative Emotion Lability (e.g. "is prone to angry outbursts/tantrums easily"), Positive Emotion Lability (e.g. "displays exuberance that others find intrusive or disruptive"), Socially Appropriate Affect (e.g. "responds positively to neutral or friendly overtures by peers"), and Socially Incongruent Affect (e.g. "displays negative emotions when attempting to engage others in play"). Bonferroni correction with a threshold for significance of 0.0125 (0.05/4 comparisons) was used.
Results: The HCP group included 118 children and the PIP group included 30 children. Children in the HCP group were younger (7.32 ± 1.11 years) than those in the PIP group (8.01 ± 1.14 years), $t(246)=2.97$, p<0.003, and emotion regulation is expected to improve with age; thus, age was included as a covariate in the analyses. The groups did not differ in biological sex, race, or ethnicity. Children with HCP were reported by parents to have more difficulty with negative emotion lability, $F(1,144)=8.44$, $p=0.004$, positive emotion lability, $F(1,143)=13.49$, $p<0.001$, and socially appropriate affect, $F(1,145)=13.60$, $p<0.001$, than children with PIP. The groups did not differ in socially incongruent affect $F(1,145)=2.65$, $p>0.05$.
Conclusions: Consistent with posited theories of emotion dysregulation in ADHD subtypes, results indicate that children with HCP demonstrate more frequent emotional lability of

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positively and negatively valanced emotions than children with PIP. In addition, findings indicate that children with HCP display less socially appropriate affect, but comparable incongruent affect (e.g. displaying negative emotions in a friendly social environment), relative to children with PIP. Further research is needed to characterize ED in ADHD subtypes in greater detail and exploration of regulation skills and strategies, in addition to lability, would be beneficial.

Keywords: attention deficit hyperactivity disorder**,** emotional processes**,** child development disorders

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28 Loneliness and Cardiovascular Disease Indicators in U.S. and Japanese Adults

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Objective: Loneliness is associated with elevated risk for cardiovascular disease (CVD). The Cognitive Model of Loneliness posits that loneliness increases CVD risk via overactivation of the hypothalamic-pituitary-adrenal axis. However, this model does not consider how sociocultural factors (e.g., nationality, collectivism) influence the experience or consequences of loneliness. We suspect that loneliness may be associated with worse health in a collectivist (e.g., Japanese) versus individualist (e.g., United States [U.S.]) culture but little is known about cross-cultural associations of loneliness. Gender is another important factor to consider in this context. Associations between loneliness and health may be stronger in U.S. females (USFs) compared to U.S. males (USMs), and in Japanese males (JMs) compared to Japanese females (JFs), but more research is needed. This study determined if loneliness would be positively associated with CVD indicators (e.g., metabolic dysregulation biomarkers [MDBs], inflammatory dysregulation biomarkers [IDBs], and sleep) and if these associations would be stronger in (1) Japanese than US adults, (2) individuals higher in collectivism, and (3) USFs and JMs compared to USMs and JFs.

Participants and Methods: U.S. (n = 644; 321 females) and Japanese (n = 296; 158 females) participants (aged 36 to 78) completed the baseline and biomarker appointments of the Midlife in the United States (MIDUS) Refresher and Midlife in Japan (MIDJA) 2 studies, respectively. Participants completed the Pittsburgh Sleep Quality Inventory (PSQI), a physical exam, and provided blood samples. Participants were categorized as 'not lonely' and 'lonely' based on how often they felt lonely in the past week. Collectivism was measured with the Singelis Self-Construal Interdependence Scale. We extracted latent constructs from MDBs (e.g., body mass index, waist circumference, high-density lipoprotein cholesterol), IDBs (e.g., interleukin-6, c-reactive protein, and fibrinogen values), and sleep from the PSQI items. We tested path models using structural equation modeling that regressed CVD indicators on loneliness, nationality (e.g., Japan, U.S.), interdependence, gender (e.g., male, female), and the two-way interactions between loneliness and nationality, interdependence, and gender. Our interaction model was conceptually similar to PROCESS Model 2 from Hayes (2012). Covariates included age, marital status, income, education, anxiety, depression, ethnicity (e.g., U.S. white, U.S. non-white, and Japanese) and CVD-related medications.

Results: As expected, loneliness was associated with increased MDBs for females and USMs (ps < .05). Unexpectedly, for lonely adults, Japanese had lower MDB values compared to U.S. (p < .01). Associations between loneliness and MDBs increased as interdependence decreased for females and USMs, which was inconsistent with our expectations.

Conclusions: Partially in line with our hypothesis, loneliness was associated with higher risk for CVD for females and U.S. males, but not for Japanese males. Loneliness may be associated with lower appetite in Japanese males, which may explain there were no significant associations in this group. For lonely individuals, higher interdependence may be protective against poor health. A logical next

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step in this line of work would be to examine how lonely individuals engage in health behaviors (e.g., exercise, nutrition) to determine mechanisms potentially underlying the association between loneliness and risk for CVD.

Keywords: multiculturalism**,** cross-cultural issues**,** cardiovascular disease

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29 Communication Efficacy and Confidence Across Modalities Throughout the Lifespan

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Objective: Communication is essential for social relationships, and technology has expanded communication modalities to include phone calls, emails, and brief text exchanges. People vary widely in their communication skills; however, little is known regarding abilities, preferences, and effectiveness across communication modalities. Understanding comm unication across modalities and loneliness, as well as communication preferences in relation to demographic factors (age, gender, education) may inform strategic interventions to improve communication skills.

Participants and Methods: 1033 adults (out of 2935 participants in a multi-component, online study) completed a questionnaire on communication confidence and efficacy and the UCLA Loneliness Questionnaire. The communication questionnaire covered four domains (face-to-face, phone calls, text messages, and email). On average, participants were 52.74 (SD = 20.47; range 18-99) years old, 64% women, and had a range of educational achievement.

Results: Communication preferences and confidence were significantly related to loneliness, with greater loneliness associated with lower confidence in face-to-face (r = .272, p < .001) and phone (r = .281, p < .001) communication as well as lower efficacy ratings in all four communication domains (face-to-face: r = .299; phone: r = .313; text: r = .256; email: r = .174, all p values < .001). Greater loneliness also was associated with lower confidence/efficacy for face-to-face/phone versus text/email communication (r = -.265, p < .001).

Men rated their face-to-face communication confidence significantly higher than women (t = 3.37, p = .001), but there were no differences in confidence in the other three domains or in efficacy in any modality. Men also endorsed the statement “I communicate better face-to face than I do via technology (phone/text/email)” more strongly than women (t = 5.53, p <.001).

Age negatively correlated with communication confidence for text messaging (r = -.274, p <.001), endorsement of the statement “I'm more comfortable communicating via text/email than via phone/face-to-face” (r = -.381, p < .001), and feeling that one’s communication abilities have improved over time due to technological advances (r = -.195, p < .001). Education level also was related to communication confidence and preference, with confidence in face-to-face and email communication significantly higher in people with more education.

Conclusions: Communication skills (i.e., greater efficacy and confidence) are significantly associated with loneliness across the lifespan. Specifically, skills in real-time, face-to-face and phone communication are more strongly linked to loneliness as compared to text and email communications, suggesting that features of spontaneous, non-verbal communication (e.g., body language, facial expression, and prosody) may be particularly important for promoting interpersonal connections and reducing feelings of isolation. With respect to demographics, older adults prefer communication in-person or by phone, men report greater confidence (but not greater efficacy) in face-to-face communications, and people with higher educational attainment report greater efficacy and confidence across all communication modalities. Further research is needed to determine whether our results were influenced by the COVID-19 pandemic. If

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replicated, the findings suggest that interventions for loneliness and communication skills should focus on real-time conversation abilities and that communication assessments should consider demographic factors.
Keywords: activities of daily living**,** everyday functioning**,** social processes

30 Relationship Between Self-Reported Affect and Emotion Perception Following Acquired Brain Injury

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Objective: Current mood can affect emotion perception. For example, depression is associated with better memory for sad and angry faces as compared to happy faces (Gilboa-Schechtman et al., 2002). However, although mood disorders and impairments with emotion perception are common after acquired brain injury (ABI), little is known about how self-reported affect can alter emotion perception following ABI. The present study compared the relationship between the self-reported affect and emotion perception between adults with and without history of ABI.
Participants and Methods: Participants were 226 adults (107 men, ages 18-79): neurologically healthy (NH; *n* = 112) or with history of acquired brain injury (ABI; *n* = 114). Participants completed the Brief Symptom Inventory-18 (BSI-18) and the Positive and Negative Affect Schedule (PANAS), as well as the Multicultural Facial Emotion Perception Test (MFEPT), a computer-administered task that requires labeling facial emotions (sad, angry, disgusted, or fearful). Formal tests for moderation were conducted using Hayes' PROCESS macro for SPSS. The analyses tested Group (NH or ABI) as a moderator of the relationship between self-reported affect and MFEPT accuracy.
Results: There was a significant interaction between Group and BSI Depression on MFEPT performance $F(1, 222) = 8.50$, $p = .004$, $R^2_\Delta = .03$. There was a significant positive relationship between BSI Depression and MFEPT accuracy for the NH group ($\beta = 0.24$, $p = .009$) but a negative trend among the ABI group ($\beta = -0.13$, $p = .171$). The interaction of BSI Anxiety and Group showed a similar pattern and trend, $F(1, 222) = 3.87$, $p = .051$, $R^2_\Delta = .01$. Again, there was a significant positive relationship between BSI Anxiety and MFEPT accuracy for the NH group ($\beta = 0.14$, $p = .095$) but a negative trend for the ABI group ($\beta = -0.09$, $p = .267$). There was also a significant interaction between PANAS Positive Affectivity and Group $F(1, 222) = 4.02$, $p = .046$, $R^2_\Delta = .01$. Consistent with the findings for depression, there was a significant *negative* relationship between PANAS Positive Affectivity and MFEPT accuracy for the NH group, ($\beta = -0.31$, $p < .001$), but not for the ABI group, ($\beta = -0.08$, $p = .370$).
Conclusions: For neurologically healthy adults, experiencing negative affect facilitated accuracy in perceiving negative emotions, whereas experiencing positive affect hindered perception. This pattern may reflect that sensitivity to one's own negative emotions facilitates sensitivity to the emotions of others. In addition, some research has linked positive affect to denial and avoidance, which could account for its inverse relation to accurate identification of negative emotions. For adults with ABI, however, negative affect was not only unhelpful in perceiving negative emotions, heightened affect (positive or negative) was inversely associated with accuracy in labeling emotional expressions. Adults with ABI may have difficulty detaching and distinguishing their own emotions from others' emotions. This difficulty may underlie psychosocial and relational difficulties common following ABI. Emphasis on accurate emotion perception may be an important target of rehabilitation.
Keywords: stroke recovery**,** traumatic brain injury**,** emotional processes
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31 Is School In or Out? Education and Parent/Caregiver Stress During COVID-19

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Objective: The primary purpose of this exploratory study is to investigate the impact of different educational delivery systems (e.g., hybrid, online, in-person instruction) over the 2020-2021 school year on parent/caregiver stress during COVID-19. The secondary goal of this study is to determine whether there is a relationship between parent/caregiver stress and child executive dysfunction.
Participants and Methods: A 45-item survey was administered to 27 parents/caregivers of children (*M*age=10.77; 51.9% male) who were referred for a neuropsychological evaluation for various neurologic or medical conditions affecting cognitive functioning (e.g., epilepsy, prematurity, chromosomal conditions). Data was collected from 06/2021 through 09/2021. The survey assessed stressors associated with COVID-19 (e.g., job loss, exposure to COVID-19), self-efficacy/satisfaction, and social supports and included the Patient Health Questionnaire-4 item (PHQ-4) and the COVID Stress Measure (CSM). The impact of educational delivery systems was compared using mean scores on the CSM, PHQ-4, and Total Self-Efficacy/Satisfaction (TSES; sum of scores on social supports and self-efficacy questions). Executive functioning was measured through parent/caregiver reports on the Brief Rating Inventory of Executive Functioning, Second Edition (BRIEF-2). The Global Executive Composite (GEC) was correlated to ratings of parent/caregiver stress. Mean scores were used to compare parent/caregiver stress across educational delivery systems.
Results: Of our sample, 70.3% of parents/caregivers were employed, 14.8% were stay-at-home parents/caregivers, and 11.1% were single. Findings indicate that parents/caregivers of children who attended school full-time in person (n=15) and through a hybrid model (n=5) reported lower scores on the CSM (*M=9.0*, *M=7.0*) and PHQ-4 (*M*=6.4, *M=6.0*) and higher scores on the TSES (*M*=38.9, *M*=40.2). Parents/caregivers of children who attended school full-time online (n=7) indicated higher scores on the CSM (*M*=14.0) and PHQ-4 (*M*=9.1) and lower scores on the TSES (*M*=30.0). Correlational analyses revealed that the CSM and PHQ- were negatively and significantly correlated with TSES (*r*=-.498, p=.008; *r*=-.660, *p*<.001). The GEC was did not significantly predict ratings on the CSM or TSES. Bivariate correlations indicated a significant and positive correlation between GEC and PHQ scores (r=.46, p=.016).
Conclusions: Results from this exploratory pilot study suggest that parents/caregivers of children who engaged in online schooling report significantly higher COVID-related stress and anxiety, as well as lower levels of self-efficacy and social supports as compared to parents/caregivers of children who attended school part-time or full-time in-person. In addition, findings suggest that higher levels of executive dysfunction are associated with greater mood concerns. Our study is significantly limited due to low sample size but indicates the need for future research that investigates the impact of educational delivery systems and executive dysfunction on parent/caregiver stress. Study results can be used to inform interventions and recommendations for parent/caregiver support.
Keywords: executive functions**,** emotional processes**,** pediatric neuropsychology
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33 Association of Emotional Symptoms and Community Integration Following Combat Deployment

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Objective: Recent military operations have been defined by multiple and lengthy

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deployments with greater exposure to urban combat. These conflicts have seen an increase in survival compared to past operations but with significant physical, emotional, and functional consequences upon return from deployment. About 40% of combat veterans report limitations in overall community integration including family/social relationships, self-care activities, and employment. These limitations are more prevalent among combat veterans experiencing significant stress and mood symptoms and there is need for additional research addressing such relationships. However, the assessment of post-deployment community integration can be challenging due to possible contributions from comorbidities (e.g., pain, sleep problems, alcohol use misuse). The main objective of this study is to examine the impact of emotional symptoms on community integration following combat deployment.
Participants and Methods: This study sample included 115 veterans and service members who had been deployed to combat zones after 2001, reported a history of mild traumatic brain injury (mTBI), and passed symptom validity screening. Community integration was measured with the Community Integration Questionnaire (CIQ). Emotional symptoms were examined using total scores from the PTSD Checklist-Civilian Version (PCL-C) and Center for Epidemiologic Studies-Depression (CES-D) scale. Demographic, deployment, injury, pain intensity, and alcohol consumption characteristics were also collected. Univariate linear regression analyses were used to analyze the relationship between the PCL-C and CES-D on community integration separately. Bivariate correlations were conducted with demographic, pain intensity, alcohol use, injury-related, military-related, emotional, and community integration variables. Bivariate correlations showed a strong correlation between the PCL-C and CES-D ($r=0.847$, $p < 0.01$). Therefore, PCL-C and CES-D were not included in the same model. A hierarchical regression analysis was conducted to determine the unique role of PTSD symptoms in community integration while considering the influence of demographic variables (age and education), years since deployment, pain intensity, and alcohol consumption.
Results: Participants had the following demographic characteristics (mean age [years] = 31.85 [SD=7.09], mean education [years] = 13.76 [SD= 1.85], 94.8% male, 86.1% veterans). In univariate regression, the PCL-C score significantly accounted for 31% of the CIQ score ($p<0.001$) and the CES-D significantly accounted for 37% of the CIQ score ($p<0.001$). In hierarchical regression, the PCL-C score significantly improved the model ($p<0.001$), uniquely accounting for 13.6% of the variance in CIQ score over and above that of demographic variables, years since deployment, pain intensity and alcohol use. The full model accounted for 33% of the variance within the CIQ score ($p <0.01$).
Conclusions: The results of this study demonstrate that emotional distress symptoms are meaningfully related to limitations in community integration among military service members and veterans with mTBI, even after considering demographic and military service characteristics, pain intensity, and alcohol use. The continuing influence of combat-related stressors and inadequate coping strategies, as reflected by scores on measures of PTSD symptoms and depression, likely contribute to long-term difficulties with post-deployment reintegration. Further study of the influence of emotional symptoms on distinct domains of the CIQ is warranted.
Keywords: emotional processes**,** post-traumatic stress disorder
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34 Temporal Dynamics of Attention Bias in Anxiety: An Eye-Tracking Study

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Objective: Behavioral reaction time (RT) measures, like the dot-probe and spatial cueing tasks, have shown that individuals with anxiety tend to bias their attention toward threatening stimuli as compared to neutral stimuli. However, the literature has revealed mixed findings due to

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the overly simplistic calculation of attention bias (AB; i.e., Mean RT Threat – Mean RT Neutral). Research has shown that attention bias fluctuation (i.e., patterns of both vigilance and avoidance), is indicative of attention dyscontrol, which is evident in those with psychopathology. As such, the purpose of this study was to evaluate whether AB fluctuation via behavioral RT measures and eye-tracking, stands as a more viable and consistent measure of AB in predicting overall symptom severity.
Participants and Methods: Participants were recruited from three different studies: contamination phobia (*n*=52), social phobia (*n*=43), and spider phobia (*n*=72). Behavioral RT measures were evaluated using the trial-level bias score (TL-BS; i.e., bias toward and away from threat at mean and peak intertrial intervals) to calculate AB fluctuation. In terms of eye-tracking, participants were shown four pictures in four quadrants, which included target threat, general threat, pleasant, and neutral photos. Basic individual eye-tracking indices consisted of dwell time, fixation count, and average fixation duration. These eye-tracking indices captured both the frequency and duration of time spent on the target threat stimulus. However, to evaluate the time course of AB fluctuation, we created novel eye-tracking ratio indices, which consisted of (1) dwell time/net dwell time (2) glance count/fixation count, and (3) average fixation duration/fixation time.
Results: The results showed that more than traditional AB indices in behavioral RT measures or basic individual eye-tracking indices, AB fluctuation measures (i.e., TL-BS, temporal eye-tracking ratio indices), significantly predicted overall symptom severity after controlling for general emotional symptoms (p<.05). Notably, the temporal eye-tracking ratio indices explained an additional 3-5% of the variance in overall symptom severity, which suggests that temporal eye-tracking fluctuation ratio indices may be a useful predictor of anxiety symptom severity in tandem with other establish AB fluctuation measures.
Conclusions: Overall, the findings suggest that beyond traditional measures of AB to threat, temporal AB fluctuation indices should be given greater consideration when developing future theoretical, assessment, and intervention work related to anxiety disorders. Future research in attention bias modification may consider incorporating attention control components, which may be a promising treatment to reduce anxiety psychopathology. Replication of these findings must be done to better understand the diverse roles of attention on anxiety.
Keywords: anxiety**,** attention**,** cognitive control

35 The Prevalence of Post-Traumatic Stress Disorder Among Dementia Caregivers

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Objective: The increase of illnesses that cause cognitive decline, such as Alzheimer's disease and other forms of dementia, will in turn increase the number of people caring for these individuals. Caregivers can experience negative outcomes in multiple aspects of their lives — such as in their physical health, emotional/psychological health, cognitive health, interpersonal relationships, and financial security — as a result of caregiving. Post-traumatic stress disorder (PTSD) is a disorder that develops in some individuals who have experienced a shocking, scary, or dangerous event. It is estimated that the lifetime prevalence rate of PTSD in US adults is 6.8%. Despite caregiver organizations campaigning for awareness of caregiver trauma, little to no research has been conducted regarding the presence of PTSD among dementia caregivers. This lack of existing research is surprising, as research regarding caregivers has indicated that caregivers often meet criteria for acute stress disorder and PTSD diagnoses according to the DSM-5. For example, witnessing a traumatic event — defined as death, threatened death, or serious injury — is the first criterion for PTSD. Caregivers can witness their care recipients experience a serious injury or threatened death throughout the duration of providing care. This is especially apparent for caregivers of patients with dementia/Alzheimer's disease, in which safety is often compromised by the loss of memory and cognition, such as when a patient forgets how to

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swallow or walk, touches a hot stove, or wanders away and goes missing. Due to witnessing these traumatic events, caregivers can initiate further actions or behaviors that meet diagnostic criteria for PTSD, such as unwanted flashbacks, hypervigilance, and difficulty sleeping. The purpose of this study was to survey dementia caregivers to gather prevalence rates of those suffering from PTSD. It was hypothesized that dementia caregivers would have a prevalence rate of PTSD that is equivalent or greater than the general US population, emergency medical responders, nurses, and military veterans.
Participants and Methods: An online survey containing the PTSD-Civilian Checklist (PCL-C) and questions about the traumatic event were administered to informal (familial) dementia caregivers across the United States.
Results: Initial data (n = 23) revealed that 26.1% of caregivers surveyed met criteria for a PTSD diagnosis based on the scoring criteria of the PCL-C.
Conclusions: These preliminary results reveal that more than one in four dementia caregivers might be experiencing PTSD. Additionally, this percentage is greater than the PTSD prevalence rates for the general US population, emergency first responders, nurses, and military veterans, which supports the hypothesis. These findings can greatly benefit dementia caregivers by spreading awareness and helping allocate resources to assist those struggling with PTSD. It is possible that caregivers have long suffered from PTSD, and that the lack of research in this field has left this distress to remain undetected.
Keywords: caregiver burden**,** anxiety**,** affective processing disorders
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36 A Brief Screening Measure of Peritraumatic Cognitive Load: Relationship to Memory Intrusion and Disorganization in an Experimental Paradigm & Implications for Assessment and Treatment.

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Objective: According to the cognitive model of posttraumatic stress disorder (PTSD), PTSD symptomatology is at least partially sustained by a disturbance of autobiographical memory of the traumatic event. Research suggests that this memory is impacted by peritraumatic cognitive processes such as attention, working memory, and memory consolidation. One potential predictor of PTSD symptomatology in this framework is cognitive load (CL), or the amount of cognitive information held in one's mind. Peritraumatic diversion of cognitive resources to emotion regulation is thought to increase CL and inhibit attention, working memory, and memory consolidation, contributing to the fragmentation and intrusion processes which underpin PTSD. Despite the emergence of CL as a factor of interest, no measures of peritraumatic CL exist. To address this, we created a brief measure of peritraumatic CL by adapting and combining two existing measures of CL.
Participants and Methods: 245 adults in the United States completed a web-based study that utilized a distressing film paradigm to create a pseudo-peritraumatic condition. Two existing measures of CL, the Students' Mental Load and Mental Effort in Biology Education-Questionnaire and the Paas Scale of Cognitive Load, were adapted into a composite measure of CL. This was created by first ensuring that the two measures were highly correlated, converting them into Z-scores, and averaging them. Measures of stimulus memory disorganization and intrusion, distress, cumulative trauma exposure, PTSD and depression symptomatology, and attention and working memory functioning were also administered.
Results: A moderated regression was conducted; the composite measure of peritraumatic CL was tested as a moderator between distress and trauma memory disorganization and intrusion. The overall model was significant $F(4, 229) = 22.54$, $p < .001$, and the interaction term between distress and CL accounted for a significant proportion (28.25%) of the variance in trauma memory disorganization and intrusion, $\Delta R^2 = .01$, $\Delta F(1,$

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229) = 4.43, p = .037. There was a significant positive effect of CL on trauma memory disorganization and intrusion, *b* = 0.12, *t*(229) = 2.06, p = .04, 95% CI [0.0056, 0.2411]. While the overall effect of distress on trauma memory disorganization and intrusion was not significant (*b* = -0.02, *t*(229) = -1.91, p = .06, 95% CI [-0.0321, 0.0005]), there was a significant positive interaction of distress on trauma memory disorganization and intrusion when CL was high, *b* = 0.003, *t*(229)= 2.44, *p* = .015, 95% CI [0.0005, .0047]. Examination of the interaction plot revealed that as distress and CL increased, trauma memory disorganization and intrusion significantly increased. The effect was not significant at mean and lower levels of CL.
Conclusions: Data obtained from this experimental paradigm suggest that this measure of CL is psychometrically sound and appropriate for versatile applications. Administering this screening measure to individuals who have recently experienced trauma may help clinicians to target assessment of memory features possibly associated with development of PTSD symptomatology. Further, we argue that this measure can contextually inform neuropsychological processes, particularly when assessing for neurocognitive or psychiatric disorders that impact attention and memory functioning in the context of emotional activation.
Keywords: post-traumatic stress disorder**,** cognitive processing**,** memory: normal

37 Tele-Neuropsychological Evaluation of Comorbid Anxiety and Depression

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Objective: The objective of this study was to elucidate the effect comorbid depression and anxiety might have on neuropsychological performance. Comorbid disorders have been documented to produce extra strain when compared to a single disorder. An example of common comorbid disorders are depression and anxiety that overlap in some symptomology and etiology. Brain areas that overlap in these two disorders also suggest that there are common cognitive deficiencies in individuals with depression and anxiety. It was hypothesized that depression and anxiety scores would serve as predictors for neuropsychological performance. Additionally, it was hypothesized that individuals who have comorbid depression and anxiety would perform worse on the neuropsychological battery than individuals with non-comorbid depression or anxiety scoring, and that individuals with low levels of anxiety and depression would perform the best on the battery.
Participants and Methods: This study compared neuropsychological functioning among participants who had anxiety alone, depression alone, or high levels of both disorders. Of the total participants (*N*=19), 89.5% were female (*n*=17), and the average age was 34 years (*SD*=15.7). Participants were administered the Beck Anxiety Inventory (BAI), the Beck Depression Inventory-II (BDI-II), and a demographics questionnaire via SurveyMonkey, and an online neuropsychological battery administered over Zoom. The neuropsychological battery included the RAVLT, story memory, digit span, FAS, animal fluency, a go-no/go task, the Stroop, and the NAART-R all slightly modified to fit an online method of delivery.
Results: Multiple regressions and one-way ANOVAs were used to evaluate the hypotheses. BDI-II was a significant predictor of estimated FSIQ (*p*=0.50). BAI and the interaction of BDI-II/BAI were not significant predictors of any neuropsychological tests (*p*s>.05), but the interaction did significantly predict errors committed across tests (*p*=0.026). ANOVAs showed no significant differences between the low depressed/low anxious, anxious, depressed, and comorbid group on any neuropsychological tests or measures (*p*s>.05).
Conclusions: The goal of this study was to investigate the differences between individuals who had depression, anxiety, or both on the cognitive measures of a selected neuropsychological battery. The hypothesis that BDI-II and BAI scores would serve as predictors for neuropsychological performance was not supported as only BDI-II was found to be borderline predictive of one neuropsychological measure, FSIQ. Additionally, the interaction of

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BDI-II and BAI scores, representing comorbid depression and anxiety, did not predict neuropsychological performance and only predicted errors across tests. Contrary to the hypothesis, however, participants with low depression/low anxiety committed the most errors, and those with comorbid depression and anxiety committed the fewest. Group comparisons showed no significant differences between any level of depression, anxiety, or comorbid presentation showing no support for the hypothesis that the comorbid group would perform the worst. Lack of sample size and a restricted range of anxiety and depression symptoms may have increased the chance of Type II errors and led to the lack of significant findings. Future research with participants experiencing a wider range of depression and anxiety can expand on potential neuropsychological differences between individuals with comorbid depression and anxiety and those with anxiety or depression alone.

Keywords: teleneuropsychology, anxiety, depression

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38 The Intersection of Mood and Finger Tapping in Traumatic Brain Injury

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Objective: The Finger Tapping Test (FTT) assesses motor speed. Traumatic brain injury (TBI) is associated with declines in motor and cognitive speed as well as greater symptoms of anxiety and depression. We sought to examine the relationship between depression, anxiety, and FTT performances in persons with TBI. We also examined differences in these variables between persons with TBI and healthy comparison participants. It was expected that the healthy comparison group would outperform individuals with TBI on the FTT. Additionally, we expected that symptoms of anxiety and depression would influence FTT performances.
Participants and Methods: The sample consisted of 59 healthy comparison participants, 44 participants with acute TBI, and 31 participants with chronic TBI. Participants with acute TBI were tested at 6 months post-injury and participants with chronic TBI were tested 12 months or more post-injury. All participants passed performance validity testing. Participants completed the Hospital Anxiety and Depression Scale in addition to the FTT. ANOVAS were conducted to examine FTT performance between groups using demographically corrected T-scores. ANCOVAS, controlling for age, were used to examine differences in symptoms of depression and anxiety between groups. Finally, Pearson's correlations were used to examined if depression and anxiety impacted FTT performance in each group.
Results: Healthy comparison participants outperformed both TBI groups on the dominant FTT performances, $p = .013$, $\eta p^2 = .06$. Whereas non-dominant hand FTT performance differed between healthy comparison participants and participants with acute TBI, $p = .021$, $\eta p^2 = .06$. ANCOVAs revealed the acute TBI group reported lower levels of anxiety compared to the healthy comparison group, $p = .030$, $\eta p^2 = .05$. However, the acute TBI reported higher levels of depression in contrast to the healthy comparison group, $p = .028$, $\eta p^2 = .05$. Correlation coefficients revealed anxiety symptomatology were inversely associated with FTT performances in the healthy comparison group, $r = -.30$, $p = .023$. However, mood did not correlate with FTT performances in either TBI group.
Conclusions: As expected, the healthy comparison group outperformed individuals with TBI; dominant hand performances for persons with acute and chronic TBI and non-dominant hand performances in individuals with acute TBI. Our data revealed that acute TBI sample

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reported lower anxiety and higher depressive symptomatology as compared to the healthy participants. No differences in anxiety or depression symptomatology were found between persons in the chronic TBI group and either other group. Anxiety symptomatology negatively correlated with dominant hand FTT performance in the healthy participants, but not in any other group. Surprisingly, depressive symptoms did not correlate with FTT performances, although this would likely be different in persons with more clinically significant depressive symptoms. Future studies with a larger sample size should examine mood and other factors that may partially moderate the relationship between TBI and FTT.

Keywords: traumatic brain injury**,** mood disorders

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39 Central Autonomic Network Predictors of Self-Reported Sleep Quality and PTSD Symptoms in a Sample of Veterans with and Without a History of TBI

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Objective: Individuals with PTSD are more likely to have maladaptive autonomic responses (e.g., parasympathetic withdrawal) both at rest and in response to stressors. PTSD is also associated with poor sleep quality. Autonomic dysregulation and subsequent sleep disruption may be a mechanism through which PTSD symptoms are perpetuated and therefore is a target for treatment. The Central Autonomic Network (CAN) consists of brain regions hypothesized to be involved in “top-down” regulation of the autonomic nervous system. However, it is not yet known how the CAN interacts with sleep in PTSD and how that interaction may be associated with different symptom profiles. The current study aims to provide clarity regarding these relationships by examining structural magnetic resonance imaging (MRI) data of brain regions involved in the CAN and how those relate to self-reported sleep quality and PTSD symptom severity in patients with and without history of traumatic brain injury (TBI). We predicted that lower volumes of CAN regions including the anterior cingulate cortex (ACC), amygdala, and insula would be associated with poorer sleep quality. We also predicted that higher symptoms of PTSD, specifically hyperarousal and reexperiencing, would be associated with lower volumes in the CAN and worse sleep quality.
Participants and Methods: We gathered volumetric MRI data, self-report sleep quality (Pittsburgh Sleep Quality Index; PSQI) and mood/symptom questionnaires including the PTSD Checklist Military (PCLM) from group of 38 participants with PTSD (23 with a history of TBI with LOC) and 32 healthy controls (HC). We performed t-tests to compare HC to PTSD/TBI on the variables of interest. We performed partial correlations to examine the relationships between MRI regions of interest, mood measures, and sleep variables.
Results: Compared to HC, the PTSD/TBI group had lower left insula volume ($t = -2.124$, $p = 0.031$). Higher reexperiencing and avoidance symptoms were associated with lower bilateral insula volumes ($r = -4.50$ to $–0.333$). Greater left ACC volume was associated with lower PSQI global scores ($r = -0.4717$, $p = 0.031$) – better sleep. Higher scores on all symptom clusters of the PCLM were associated with higher PSQI scores. All volumetric analyses were conducted controlling for total intracranial volume (ICV).
Conclusions: Our hypothesis was partially supported in that we found associations between the CAN and sleep quality and PTSD symptoms. However, we did not find that hyperarousal symptoms were associated with CAN volume. Instead, other symptoms of PTSD including reexperiencing and avoidance may be associated with lower volume in this network. Left ACC volume may be a better predictor of sleep quality than the insula or the amygdala with greater ACC volume being associated with better self-reported sleep.Future studies should focus on the connectivity within this network between this network and others to understand the role that these structures play in modifying sleep and PTSD symptoms.

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Keywords: post-traumatic stress disorder**,** traumatic brain injury**,** neuroimaging: structural
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40 Disentangling Boredom from Depression Using Involuntary Autobiographical Memories

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Objective: Boredom is the emotional experience of wanting, but failing to, engage in satisfying activity. It has consistently been found to be positively correlated with depression. Although both are characterized by affective dysregulation and involuntary cognitions, work has shown that boredom and depression are substantially statistically independent. However, it remains unclear what specifically distinguishes the two. We explored involuntary autobiographical memories (IAMs) to address this conundrum. IAMs are a form of involuntary cognition, often affectively salient, and predictive of mental health even at the subclinical level. We tested whether the topics present in recurrent IAMs could differentiate boredom proneness and depression symptoms. Analyzing the unique associations of boredom proneness and depression symptoms with the content of IAMs might disambiguate the experiences of boredom and depression.
Participants and Methods: Over two years, 9157 undergraduates responded to online surveys in which they indicated whether they had experienced any recurrent IAMs (i.e., personal memories retrieved unintentionally and repetitively) within the past year. If so, they described their one most frequently recurrent IAM in text, and rated its autobiographical properties (e.g., valence). Participants also completed scales measuring trait boredom proneness and symptoms of depression. To analyze content of recurrent IAMs, we used structural topic models (STM)—a method of unsupervised machine learning—to identify topics in participants' memories and examine the unique relationships between these topics and both boredom proneness and depression.
Results: Of the participants, 4364 (48%) experienced at least one recurrent IAM within the past year. As expected, boredom proneness was significantly and positively correlated with depression symptoms (r = .58, p < .001). Further, both were significantly correlated with more negative recurrent IAMs (rs = .14-.22, ps < .001). Accounting for these correlations, boredom proneness uniquely predicted distinct topics in recurrent IAMs, including content related to interpersonal interactions and less content related to recreation. In contrast, depression uniquely predicted content related to accidents and less content related to excursions.
Conclusions: Using computational text analysis, we show that boredom proneness and depression symptoms are distinct in that they uniquely predict the prevalence of different topics in recurrent IAMs. Experiential foci, as reflected in recurrent IAMs, can effectively disambiguate boredom and depression. Our work may open avenues for practitioners to distinguish boredom more easily from depression symptoms.
Keywords: depression**,** memory: normal**,** emotional processes
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41 Self-Reported Cognitive and Functional Change is Associated with Depressive Symptom Trajectories During Psychotherapy for Late Life Major Depressive Disorder

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Objective: Late Life Major Depressive Disorder (LL-MDD) is a debilitating illness impacting cognition and functional ability, often with limited objective cognitive recovery despite clinical

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response to intervention and functional improvement. Subjective cognitive change with depressive symptom improvement is less well-described. Whereas traditional metrics examining pre- to post-intervention change assume linear change in depression severity, novel methodological approaches evaluating the spectrum of change across the intervention can account for variation in depression severity over time engaged in treatment, which may differentially relate to cognitive and functional outcomes. The present study in LL-MDD leveraged intra-individual variability in depression severity at multiple time points throughout a weekly psychotherapy intervention and examined depression severity relationships with cognitive and functional outcomes.
Participants and Methods: Eighty-three adults ages 65-91 with LL-MDD participated in 12 sessions of Problem-Solving Therapy (PST) and completed a battery of neuropsychological tests and self-report measures of cognition and daily functioning at baseline and post-intervention. Participant depression severity ratings were obtained using the Hamilton Depression Rating Scale at sessions 1-6, 8, 10, and 12. A series of linear mixed-effects regressions examined whether longitudinal changes in cognitive and functional measures were associated with nonlinear change in depression severity across the intervention. To capture departures from linearity in depression severity trajectories, continuous time from baseline was parameterized using a 3-knot restricted cubic spline (knot placement: baseline; median PST session; post-intervention). Interactions between the 2 spline parameters for time and change in the cognitive or functional variables of interest modeled associations between depression severity trajectories and longitudinal change in cognitive or functional measures. Likelihood ratio tests of model fits with and without interaction terms with time evaluated whether longitudinal change in depression severity was associated with change in the cognitive or functional variable of interest and were adjusted for multiple comparisons.
Results: Likelihood ratio tests revealed significant model interactions such that longitudinal reductions in depression severity were associated with improved self-reported cognition (Perceived Deficits Questionnaire, Cognitive Change Index, Perceived Stress Scale; all $p<.007$), daily functioning (Late-Life Function and Disability Instrument, World Health Organization Disability Assessment Schedule-II; all $p<.05$), and verbal list-learning performance (Hopkins Verbal Learning Test-Revised, $p=.04$) post-intervention, after Hochberg correction for multiple comparisons. Longitudinal changes in task-based measures of verbal memory, attention, processing speed, and executive functioning were not associated with individual depression trajectories.
Conclusions: Greater and more consistent interval decreases in depression severity related to improved self-ratings of cognition and daily functioning, whereas smaller magnitudes of depression severity decline which became incrementally smaller as the intervention progressed were associated with poorer self-ratings post-intervention. However, depression severity trajectories were not associated with objective cognitive outcomes. Nonetheless, perceived cognitive and functional improvement likely contribute substantially to quality of life and reduced disability. Although broad-based cognitive recovery was not apparent, improvement in depression severity may represent a more modifiable risk factor for disability in LL-MDD that can be effectively addressed with psychotherapy intervention. Additional longitudinal following in future work will be important to investigate maintenance of self-reported cognition and daily functioning as well as potential improvement of task-based cognitive performance with sustained remission.
Keywords: depression**,** aging disorders**,** cognitive functioning

42 State Anxiety is Negatively Correlated with Fusiform Gyrus Volume

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Objective: The fusiform gyrus is a brain region most commonly implicated in high-level visual processing, particularly in face and object perception. More recent research has shown structural and functional alterations in the fusiform related to negative emotion. For example, people with anxiety and depression consistently exhibit abnormal fusiform activity when perceiving emotional faces (e.g., fearful, happy, sad, angry). Interventional studies have revealed that antidepressant drug treatment can help normalize these atypical activation patterns. In addition, surface area of the fusiform has been shown to be negatively associated with mixed depression and anxiety. The goal of the current study was to examine the relationship of mixed anxiety and depression with volume in the fusiform gyrus. Based on previous literature, we hypothesized a negative association between anxiety-depression and fusiform gyrus volume.
Participants and Methods: In this study, 25 community-dwelling adults (aged 18 to 81) underwent structural magnetic resonance imaging. All participants also completed the Center for Epidemiological Studies-Depression (CES-D) scale and the State-Trait Anxiety Inventory (STAI). We created an anxiety-depression composite score by averaging the z-scores across both measures. Next, we ran separate regression analyses with the anxiety-depression composite predicting left and right fusiform gyrus volume, controlling for age and total brain volume. For significant results, follow-up analyses were conducted to determine if depression, state anxiety, or trait anxiety was driving the relationship between anxiety-depression and fusiform volume.
Results: The anxiety-depression composite score was negatively associated with left fusiform volume (p = 0.014), though this relationship was not significant for right fusiform gyrus (p = 0.148). Follow-up analyses indicated that anxiety drove this relationship: Higher levels of state anxiety were associated with smaller left fusiform gyrus volume (p = 0.001), and trait anxiety had a similar association but did not reach significance (p = 0.088).
Conclusions: Our findings suggest that anxiety, even at subthreshold levels, is associated with volume reduction in the fusiform gyrus. It is not clear why state but not trait anxiety reached statistical significance, but social anxiety evoked in the research setting could be a factor considering previous evidence that the fusiform gyrus is linked to social anxiety symptoms in particular. Additionally, we may have found significant trait anxiety results with a larger sample size. Future research should explore these questions in different age groups (i.e., young, middle-aged, older adults) and in racially diverse populations.
Keywords: neuroimaging: structural**,** anxiety**,** depression
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43 Depression, Anxiety, and HIV Status are Associated with Impairment in Aspects of Everyday Functioning

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Objective: Despite widespread uptake of antiretroviral therapy and increased rates of viral suppression, functional impairment in people living with HIV (PLWH) is highly prevalent. Moreover, mood disorders disproportionately affect PLWH, potentially contributing to functional impairment. However, literature on the relationship between mood symptoms and specific aspects of functional impairment is limited, especially in PLWH. For the present study, our aims were twofold: 1) Determine if mood symptoms associate with impairments in basic self-care, role/work responsibilities, and social functioning while controlling for various demographic and health-related factors and 2) Examine if HIV interacts with mood symptoms to differentially affect odds of self-care, role/work responsibility, and social functioning impairments.
Participants and Methods: The sample included 150 individuals (87 PLWH, 76% undetectable; 39% female, M_{age}=43.81). Self-reported functional impairment was measured from the Medical Outcomes Study HIV Health Survey (MOS-HIV). We selected three items that explicitly measured the following: impairments in

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eating, dressing, bathing, or using the toilet (i.e. self-care); inability to do certain kinds or amounts of work, housework, or schoolwork because of health (i.e. role functioning); health limitations impacting social activities over the past 4 weeks (i.e. social functioning). Binary logistic regressions were completed in SPSS, controlling for HIV status, sex, race, age, years of education, 90-day drinking total, and body mass index (BMI). The Center for Epidemiological Studies Depression Scale (CES-D) and Beck Anxiety Inventory (BAI) measured depressive and anxiety symptoms, respectively.
Results: Higher depressive and anxiety symptoms were both uniquely associated with impairments in social functioning but did not associate with impairments in basic self-care. While higher anxiety symptoms were associated with impairments in the overall sample's role/work functioning (OR = 1.09, $p < 0.05$), each one unit increase in PLWH's self-reported depressive symptoms increased their odds of experiencing role functioning impairments 3-fold (OR = 2.85, $p < 0.05$). Additionally, PLWH were 5x more likely to experience impairment in role functioning than individuals without HIV (OR = 4.96, $p < 0.05$). HIV status did not interact with depression or anxiety to influence basic self-care or social functioning.
Conclusions: The analyses reveal a robust effect of mood symptoms on role and social functioning, but no associated impairment in basic self-care. While higher anxiety symptoms were more robustly associated with role functioning impairments in the general sample, current depressive symptoms may uniquely serve as an indicator of impairments in PLWH's ability to perform work, housework, or schoolwork. Screening and early intervention for mood symptoms are crucial to limit the impact they may have on aspects of everyday functioning. Future longitudinal studies in larger samples will be necessary to assess the impact of psychological symptoms on change in functional status in individuals living with and without HIV.
Keywords: everyday functioning**,** mood disorders**,** HIV/AIDS
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44 Prospective association between PTSD and decline in Executive Functioning in World Trade Center responders

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Objective: Prevalence rates of posttraumatic stress disorder (PTSD) in the U.S. are high, ranging from 6 to almost 10% in the general population, and up to 30% in high-risk groups, such as veterans and first responders. PTSD is known to have long-term impacts on cognitive health. Among World Trade Center (WTC) responders, PTSD has been associated with a two-fold increase in cognitive impairments on the Montreal Cognitive Assessment at a 14 year follow up. Specifically, re-experiencing symptoms of PTSD were most prominently associated with cognitive impairment. The present study extends this literature by investigating whether PTSD symptoms predict changes in executive functioning assessed using the Trail Making Test (TMT) in a WTC responder sample.
Participants and Methods: Participants came from the World Trade Center (WTC) Health Program at Stony Brook University and consisted of responders who aided in rescue and recovery efforts following the September 11th, 2001 WTC attacks (N=386, mean age=55.26, SD=8.6, 89% male, 90% White). Data collection began in 2016 and included a baseline assessment and two yearly follow up assessments (3 waves). Measures included the self-reported PTSD Checklist for DSM-5 (PCL-5) and the Trail Making Test, for which a difference score between performance times on Tests B and A was computed to capture executive functioning. Higher TMT difference score indicates poorer executive functioning. A longitudinal regression model was conducted to test whether PTSD symptom severity at wave 1 predicted residualized change in TMT difference

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score at wave 3. Additional analyses were also conducted to test whether specific PCL-5 subscales (re-experiencing, avoidance, negative alterations of cognition, and arousal) at wave 1 predicted residualized change in TMT difference score at wave 3. All analyses adjusted for participants' age, sex, and the TMT difference score at wave 1.
Results: Baseline PTSD severity was associated with decreased executive functioning at wave 3 (β=.119, *p*=.037). Upon further evaluation, only symptoms of re-experiencing were associated with decreased executive functioning at wave 3 (β=.134, *p*=.019).
Conclusions: Findings are consistent with previous literature suggesting that PTSD is associated with longitudinal changes in cognitive impairment, although the present study demonstrates this relationship among executive functioning abilities alone. Furthermore, longitudinal analysis demonstrates that re-experiencing symptoms of PTSD are likely driving the association between PTSD and executive dysfunction. Understanding the relationship between PTSD and executive function, and the specific role of re-experiencing symptoms, is of high clinical importance, as adequate cognitive abilities are crucial for daily functioning and participating in interventions targeting PTSD symptoms.
Keywords: post-traumatic stress disorder**,** executive functions

45 Posttraumatic Growth is Related to Worse Cognitive Performance in Combat-Related PTSD

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Objective: Research examining the relationship between adaptive psychological functioning and cognitive abilities among trauma survivors remains scarce. The aim of this project was to explore the relationships between post-traumatic growth as well as resilience and neurocognitive functioning in a residential treatment sample of combat Veterans.
Participants and Methods: Participants included 68 predominantly male Iraq/Afghanistan combat veterans (M_{age} = 40.44, SD_{age} = 9.95) who completed neurocognitive testing prior to their admission to a residential treatment program for veterans and active duty service members diagnosed with combat-related PTSD. Participants completed a 2-hour test battery and the following variables were included in the present analyses: digit span forward/backward/total (DSF, DSB, DST); Paced Auditory Serial Addition Test total score (PASAT); Conners' Continuous Performance Task-II (CPT-II) omission errors, commission errors, and discriminability; California Verbal Learning Test-II (CVLT-II) Trial 1-5 Total, Short Delay Free Recall, Long Delay Free Recall; phonemic fluency; semantic fluency; Trail Making Test time in seconds (TMT-A, TMT-B); PTSD Checklist- Military (PCL-M); the Posttraumatic Growth Inventory total score (PTGI); and Connor-Davidson Resilience Scale-25 (CDR). All participants included in analyses were valid based on an embedded performance validity measure (CVLT-II Forced Choice Recognition). Pearson correlations among raw scores were calculated; cognitive variables significantly associated with CDR and PTGI scores were entered into multiple linear regression analyses that included age (given the use of raw scores). Given the exploratory nature of present analyses, $p < .05$ was used.
Results: PTG total score was significantly negatively correlated with DSF, DSB, DST, PASAT, (*r*'s = -.28 to -.35) and positively correlated with TMT-B (*r* = .32). PCL-M score was not significantly associated with neurocognitive variables, PTG, or CDR, and was therefore not included as a covariate in regression analyses. Regressions accounting for age revealed significant associations between DSF (*b* = -2.65, R^2 = .09), DSB (*b* = -2.88, R^2 = .10), DST (*b* = -1.82, R^2 = .12), PASAT (*b* = -.18, R^2 =.17), and TMT-B (*b* = .13, R^2 = .14). Only DSB correlated negatively with CDR (*r* = -.24); however, after accounting for age, this association was no longer significant.

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Conclusions: Consistent with prior null findings of memory and posttraumatic growth, findings did not reveal significant associations between learning and memory, and adaptive psychological outcomes. Findings also demonstrated that worse performance on measures of simple attention, working memory, and executive functioning were associated with greater posttraumatic growth in a unique sample of combat PTSD, treatment-seeking veterans. This stands in contrast to the limited available research reflecting an association between better executive functioning and posttraumatic growth. Various explanations for these surprising findings will be discussed though specific precipitants may be unique to this sample of treatment-seeking, combat PTSD veterans. Future research with this population is strongly recommended to further assess cognition and posttraumatic growth.
Keywords: post-traumatic stress disorder**,** executive functions

46 Higher Childhood Trauma is Related to Lower Cognitive Functioning at Baseline with Similar Rates of Longitudinal Change in Bipolar Disorder

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Objective: To evaluate relationships between childhood trauma and longitudinal cognitive functioning in bipolar disorder (BP). Childhood trauma is thought to have a negative impact on cognitive development; however, less is known about the long term impact of childhood trauma on cognition in BP. This study evaluates the impact of childhood trauma on cognitive functioning in BP at a baseline neuropsychological evaluation and over a five-year period.
Participants and Methods: Participants included 416 with BP (I, II, NOS) and 169 controls (no mental health diagnosis) from the Prechter Program Longitudinal Study of Bipolar Disorder. All participants completed a neuropsychological evaluation at baseline, one- and five-years, in addition to the Childhood Trauma Questionnaire (CTQ) at baseline. Data reduction techniques were used to reduce the total number of neuropsychological data points, resulting in eight factors (auditory memory, visual memory, fine motor dexterity, emotion processing, conceptual-reasoning and set-shifting, processing speed with inference resolution, verbal fluency and processing speed, and inhibitory control). The presence of childhood trauma was defined as those with scores on the CTQ at one standard deviation above the control group mean ($\bar{x}$ = 31.65, SD = 8.13). BP participants with high CTQ scores (BP High, n = 238) were compared to BP participants (BP Low, n = 178) and controls (n = 148) with lower CTQ scores. Each of the eight neuropsychological factors were individually evaluated as dependent variables in multilevel models, which tested for differences between BP High vs BP Low or between BP High vs controls at baseline and rate of change over the five-year study period.
Results: Multilevel model analyses demonstrated that BP High, compared with BP Low, had lower cognitive functioning in six of the eight cognitive factors (all p-values < .05), with comparable performance in the conceptual-reasoning and set-shifting and the inhibitory control factors (p > .05). BP High, compared with controls, demonstrated lower cognitive functioning across all eight cognitive factors (all p-values < .05). There were no significant differences in rates of change between BP High compared with BP Low (all p-values > .05). There was one significant difference (p < .05) between BP high and controls in rate of change related to the conceptual-reasoning and set-shifting factor, whereas BP High did not demonstrate a change over the five-year study, while controls declined. A post-hoc multilevel analysis that evaluated this difference for the conceptual-reasoning and set-shifting factor, while controlling for age and estimated intelligence, no longer demonstrated a significant difference (p > .05).
Conclusions: BP participants with higher levels of childhood trauma have lower cognitive functioning, compared to BP participants with lower levels of childhood trauma and controls at baseline, though those with high levels of

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childhood trauma experience a similar rate of change in cognitive functioning over a five-year period. These results demonstrate a relationship between childhood trauma and worse cognition in adults with BP above and beyond diagnosis alone and suggest that occurrence of trauma may impact cognition during development.
Keywords: bipolar disorder**,** cognitive functioning**,** mood disorders

47 Cognitive Functioning and Community Reintegration in Iraq and Afghanistan Veterans with Mental Health Conditions at Risk for Homelessness

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Objective: Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) Veterans often have conditions such as PTSD, anxiety, depression, history of traumatic brain injury (TBI), and substance use disorder. These conditions can be associated with cognitive dysfunction, relationship problems, dangerous driving, financial difficulties, homelessness, and unemployment, which may make it challenging for Veterans to adjust to life at home or in their community. A primary goal of rehabilitative efforts in Veteran populations is to promote community reintegration, which has been defined as successfully adjusting to life at home and in one's community and achieving desired social roles. We sought to examine associations between cognitive performance and community reintegration in OEF/OIF/OND Veterans with mental health conditions who were unstably housed.
Participants and Methods: 58 OEF/OIF/OND Veterans with mental health conditions who were at risk for homelessness and receiving treatment at a VA Residential Rehabilitation Treatment Program completed a baseline neuropsychological assessment (an expanded MATRICS Consensus Cognitive battery measuring speed of processing, attention/vigilance, working memory, verbal learning, visual learning, and reasoning and problem solving) and the Community Reintegration for Service Members – Computer Adaptive Test (CRIS-CAT). Bivariate Pearson correlations between neuropsychological variables and three community reintegration scales (i.e., extent of participation, perceived limitations, and satisfaction) were used to determine significant bivariate predictors of community reintegration using a p-value cut-off of 0.025. Subsequently, three separate regression models were used to examine associations between bivariate-significant neuropsychological predictors and community reintegration.
Results: Although tests of processing speed, attention/vigilance, and executive function were significantly associated with extent of participation in the community at the bivariate level, the regression analysis was not significant. At the bivariate level, tests of processing speed were associated with perceived limitations in community reintegration; the regression analysis was significant and better performance on the D-KEFS Color-Word word reading subtest was significantly associated with fewer perceived limitations. In terms of satisfaction with community reintegration, processing speed tests were again significantly correlated at the bivariate level; the overall regression was significant, although there were no individually significant predictor variables.
Conclusions: Veterans who performed better on neuropsychological tests of processing speed reported fewer perceived limitations and greater satisfaction with their community functioning. Neuropsychological performance may help inform risk for community reintegration difficulties in Veterans with mental health conditions who are at risk for homelessness. Cognitive rehabilitation efforts aimed at

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improving both cognition and real-world community functioning skills may be beneficial to returning Veterans. Future longitudinal research examining associations between cognition and community reintegration in unstably housed Veterans with mental health conditions is warranted.

Keywords: cognitive functioning**,** neuropsychological assessment**,** everyday functioning

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48 Cognitively Impaired Patient Psychiatric Symptoms Impact Caregiver Burden

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Objective: The purpose of this study is to examine the relationship between psychiatric symptom severity of cognitively impaired individuals and caregiver burden.

Participants and Methods: As part of a larger study, 48 next-of- kin caregivers of patients diagnosed with dementia and cognitive impairment were administered the Neuropsychiatric Inventory Questionnaire (NPI-Q). Caregivers indicated whether the patient presented with symptoms of specific psychiatric illnesses and rated the severity of those illnesses. For the purpose of this study, a total NPI-Q symptom severity score was used for symptoms of delusions, hallucinations, agitation/aggression, depression/dysphoria, anxiety, elation/euphoria, apathy/indifference, disinhibition, irritability/lability, motor disturbance, nighttime behaviors and appetite/eating. Additionally, caregivers were administered the Caregiver Burden Inventory (CBI) assessing five dimensions of caregiver burden: time-dependence, development, physical, social, and emotional burden. Furthermore, caregivers were administered the Brief Symptom Inventory (BSI) and the Beck Depression Inventory – II (BDI – II), self-rated measures designed to assess symptoms and levels of depressions and anxiety.

Results: Correlation analyses were conducted, with age used as a covariate in the regression analysis. Results of Pearson correlations found significant positive associations between NPI total severity score and Caregiver Burden Inventory total score, $r(47) = .515$, $F(3, 44) = 5.28$, $p < .05$, Time-Dependence Burden, $r(47) = .476$, $F(3, 44) = 4.29$, $p < .05$, Development Burden, $r(47) = .473$, $F(3, 44) = 5.576$, $p < .05$, Physical Burden, $r(47) = .423$, $F(3, 44) = 3.196$, $p < .05$, Social Burden, $r(47) = .244$, $F(3, 44) = 2.92$, $p < .05$, and BDI – II total score, $r(46) = .522$, $F(3,44) = 5.38$, $p < .05$.

Conclusions: These results indicate that psychiatric symptom severity is related to caregiver burden and clearly affect caregiver's well-being. As burden experienced by caregiver is found to be related to increased levels of patient behavior disturbances, this highlights the importance to provide support to caregivers as it affects their own health and has an impact in the overall healthcare and social care systems.

Keywords: caregiver burden**,** cognitive functioning**,** quality of life

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49 Antidepressant Treatment Response and Remission Rates in Depressed Older Adults with Neurocognitive Deficits

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Objective: Response and remission rates following antidepressant treatment in older adults are low. Neuropsychological deficits in executive functioning (EF) and processing speed (PS) further compound poor treatment response. The specific response rates, however,

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are unclear and generally unreported. The present study documented the antidepressant response and remission rates of depressed older adults with EF/PS deficits.
Participants and Methods: Data was analyzed from four randomized clinical trials conducted at the New York State Psychiatric Institute. Patients had a Hamilton Rating Scale for Depression (HRSD) score of ≥ 20 and were aged 50 years and older. Patients were considered to have EF/PS deficits if they scored one SD below the mean on any measure of EF or PS. Treatment response was defined by a 50% decrease in HRSD score and remission was defined as HRSD ≤ 7 post-treatment.
Results: 96 out of 297 patients presented with a deficit in EF or PS. Averaged between the four samples, 36% of patients responded to treatment and 25% met criteria for remission.
Conclusions: Depressed older adults presenting with EF/PS deficits have a one in four chance of achieving remission following treatment with antidepressant medication. Knowledge of the response and remission rates are useful in effectively treating geriatric depression. This 25% remission rate suggests the need for alternative or augmentative methods in remedying the problem of poor treatment response, including computerized cognitive training, transcranial magnetic stimulation, and other novel approaches.
Keywords: depression, treatment outcome, executive functions
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50 Perceived Stress and Delay Discounting in Schizophrenia, Cannabis Use Disorder, and Dual Diagnosis

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Objective: Ability to appropriately weigh the benefits of immediate versus future reward is an important component of effective decision-making. The tendency to discount a reward that is temporally distant in favor of a more immediate reward, as a function of the temporal distance, is known as delay discounting. Steeper delay discounting has been demonstrated in some studies among people with schizophrenia (SCZ) and with substance use disorders (SUD) compared to healthy controls. Although previous research has found that greater perceived stress is related to increased preference for immediate reward in healthy adults, few studies considered the effect of perceived stress on delay discounting in SCZ, cannabis use disorder (CUD), or comorbid SCZ and CUD (SCZ+CUD), subgroups with known high levels of stress. The present study examined (1) whether patients with SCZ, CUD, SCZ+CUD, and healthy comparison (HC) subjects differ in delay discounting; and (2) the extent to which current perceived stress is associated with group differences in delay discounting.
Participants and Methods: Participants were SCZ+CUD (n=40), SCZ (n=21), CUD (n=61), and HC (n=31), primarily White (88%), male (79%), right-handed (79%), with 14.35 years (SD=2.33) of education. Groups did not differ in age (mean 32.77±9.51 years), but HC had more years of education than clinical groups. After one week or more of verified abstinence from cannabis, alcohol, and other drugs, participants completed the Delay Discounting Questionnaire, which assesses preferences for smaller immediate versus larger delayed hypothetical monetary rewards. Log-transformed *k* values were analyzed separately for small, medium, and large reward amounts, with a smaller *k* value representing preference for delayed but higher rewards. Extent of perceived stress within the past month was measured with the Perceived Stress Scale.
Results: Stronger preference for higher delayed rewards (i.e., lower delay discounting) was seen for the HC relative to the SCZ+CUD and CUD groups, but not SCZ, for both small and medium rewards. At the largest reward size, HC preferred delayed rewards more than SCZ+CUD. HC reported lower perceived stress than all three clinical groups (mean PSS scores: HC=9.33±6.69; SCZ+CUD=16.54±7.86; SCZ=13.57±6.56; CUD=12.48±5.49), and CUD endorsed lower stress than SCZ+CUD. Correlational analyses revealed a negative

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association in the SCZ+CUD group at the medium reward level only and no relationship for the HC, SCZ-only, and CUD-only groups.
Conclusions: Results were consistent with previous research demonstrating lower delay discounting in HC. Comparatively, participants with SCZ, CUD, and SCZ+CUD showed preference for a smaller, immediate reward; however, this was not consistent across reward levels. Thus, inconsistencies in the literature on delay discounting in SCZ may be partly due to failure to adequately consider SUD history. Furthermore, HC reported significantly lower perceived stress than the clinical groups, though stress showed a minimal relationship with delay discounting. This suggests that the increased stress commonly seen in individuals with psychiatric and substance use disorders is unlikely to account for the patterns of steeper delay discounting typically found in these populations.
Keywords: decision-making**,** cannabis**,** schizophrenia
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52 Childhood Physical Neglect and Earlier Age at Attempted Suicide, Among Individuals Later Diagnosed with a Psychotic Disorder, Predict Deficits in Working Memory, Executive Functioning, and Processing Speed.

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Objective: Trauma and psychiatric symptoms early in life may disrupt cognitive development, leading to neuropsychological deficits in adulthood. Executive functioning (EF), processing speed (PS), and working memory (WM) may be particularly vulnerable due to disruptions in frontal lobe development at a critical age. While psychotic disorders are characterized by deficits in these domains, a history of childhood trauma has been associated with even greater cognitive impairment. The present study investigated the degree to which childhood trauma and factors related to psychiatric illness (age at most severe suicide attempt, age at first psychiatric hospitalization, and age at psychotic symptom onset) predicted EF, WM, and PS for adults diagnosed with a psychotic disorder.
Participants and Methods: Participants were 365 adults diagnosed with a psychotic disorder (41.1% schizophrenia, 42.1% schizoaffective disorder, and 16.8% bipolar with psychotic features) who were recruited from the community as part of a larger study (M_{age}=38.53; 52.9% male, 47.1% female; 40.8% Caucasian, 42.2% African American, 17.0% Other). The Digit Sequencing, Symbol Coding, and Tower of London subtests from the Brief Assessment of Cognition in Schizophrenia (BACS) battery were used to measure WM, PS, and EF, respectively. Childhood trauma was assessed with the Childhood Trauma Questionnaire (CTQ).
Results: Multivariate multiple regression analyses indicated that a younger age at most severe suicide attempt, but not age at psychotic symptom onset or first psychiatric hospitalization, significantly predicted slower PS; [β=.022, t(151)=2.28, SEM=.01, p=.024, η_p^2=0.03]. Greater overall endorsement of childhood trauma significantly predicted lower WM and EF scores; [β= -.007, t(347)=-2.13, SEM=.003, p=.034, η_p^2=0.03; β=-.008, t(347)=-2.097, SEM=.004, p=.037, η_p^2 = 0.01]. However, when individual CTQ sub-scales (emotional, physical, and sexual abuse; physical and emotional neglect) were examined, only physical neglect was a significant predictor of poor cognitive performance; [β=-.067, t(352)=-3.22, SEM=.021, p=.001, η_p^2=0.03; β=-.047, t(352)=-2.117, SEM=.020, p=.035, η_p^2 = 0.01]**.**
Conclusions: Certain experiences during development, such as earlier age at attempted suicide and physical neglect, are associated with small but significant impairments in WM, EF, and PS, perhaps via disrupted cognitive development during formative years. Our results indicate that the severity of early psychiatric symptoms, rather than the presence of early psychiatric symptoms, may have a larger impact on cognitive development. Our finding of physical neglect being a significant predictor of poor cognitive performance over other types of childhood trauma is consistent with prior studies

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and may reflect the detrimental effects of deprivation on the developing brain. Future work may benefit from examining how potential shared mechanisms of childhood trauma and neuropathological alterations in psychotic disorders, such as dysfunction in stress-response and immune pathways, may contribute to worse cognitive outcomes in psychosis populations.
Keywords: childhood maltreatment**,** cognitive functioning**,** psychosis
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53 Differences Between In-Person and Telehealth Symptom and Neuropsychological Presentation in First Episode Psychosis

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Objective: The occurrence of the COVID-19 pandemic prompted changes in the administration of neuropsychological evaluations and many adopted telehealth practices. Previous research has identified the general effectiveness of telehealth neuropsychological evaluation. Furthermore, telehealth neuropsychological evaluation has been shown to be effective in assessing cognitive functioning in dementia and general populations across a variety of measures. However, the effectiveness of assessing psychiatric symptoms and neuropsychological functioning in the first episode psychosis (FEP) population remains unclear. This study sought to identify if any differences exist in the performance of people with FEP between traditional assessment and telehealth assessment administration.
Participants and Methods: Data was extracted from records from a FEP treatment program. All participants were administered a standard battery of clinical symptom and neuropsychological measures as part of the standard of practice in the program, including the Structured Clinical Interview for DSM-IV Disorders (SCID), the Brief Psychotic Rating Scale (BPRS), Test of Premorbid Functioning (TOPF), and Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Thirty-nine participants were assessed utilizing in-person administration, and 41 were assessed via telehealth procedures. All participants were diagnosed with a primary schizophrenia spectrum disorder within the past three years. There were no differences in age, TOPF, or duration of untreated psychosis (DUP) between groups ($p > .05$).
Results: Results showed higher overall BPRS scores in the group receiving in-person assessment ($p = .001$), which included domains of Total Psychosis ($p = .047$), Thought Disturbance ($p = .026$), and Hostility/Suspiciousness ($p = .001$). Performance on RBANS elicited significantly better performance from the telehealth administration group in the List Learning ($p = .011$) and Figure Copy ($p = .028$) tasks. No other differences were found between groups, although the List Recall subtest ($p = .071$) and Immediate Memory domain ($p = .054$) scores approached significance in the same direction. There was no significant correlation between BPRS total score and performance on either the List Learning task or the Figure Copy task ($p > .05$) for the group receiving in-person assessment. There was also no correlation in the telehealth group for the List Learning task; however, a significant positive correlation ($r = .49$) was observed between BPRS total score and performance on the Figure Copy task ($p = .009$) for that group.
Conclusions: Identification of increased psychotic symptoms in the in-person assessment group shows the value of face-to-face assessment of clinical syndromes given that these measures are based on clinician observations, and possibly indicating that nuances of symptom identification may be missed when assessed via telehealth. While there was not strong evidence for differences in cognitive assessment between the administration method, the overall findings support the utility of telehealth administration and detail the impact of untreated psychosis.
Keywords: teleneuropsychology**,** cognitive functioning**,** assessment

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54 Relationship of Nicotine and Cannabis to Neuropsychological Predictors of Treatment Response in First-Episode Psychosis

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Objective: Antipsychotic drugs (AP) are the primary treatment for psychosis, but response to these medications is highly variable. Cannabis and nicotine use among patients with psychosis are at significantly greater levels than in healthy populations, but the impact of these substances on neural mechanisms of clinical improvement is poorly understood. Cognitive functioning is disrupted as a result of psychosis and research has demonstrated that neuropsychological capacity may be predictive of AP drug response. Nicotine and cannabis use are known to influence cognitive functioning but despite this overlap, no previous research has investigated the association between cannabis, nicotine and the cognitive functions implicated in predicting AP treatment response. The present study aimed to explicate the relationship between recent cannabis and nicotine use, and previously established predictors of effective AP treatment outcomes for patients with psychosis.
Participants and Methods: The study used a sample of 76 first-episode psychosis patients who used cannabis and nicotine at varying rates. Patients were administered the MATRICS Cognitive Consensus Battery to evaluate five cognitive domains previously demonstrated to predict AP treatment response in patients with psychosis: Attention and Vigilance, Working Memory, Verbal Memory, Visual Memory, and Reasoning and Problem Solving. The Timeline Followback Interview and urine toxicology screen were used to measure substance use in the previous six weeks. Linear regressions were performed to examine the relationship between cumulative uses of cannabis, nicotine, and our neurocognitive domains of interest prior to the start of AP treatment. Age and sex were included as covariates in all models.
Results: Of the 76 participants, 43 were cannabis users, 28 were nicotine users, 22 used both cannabis and nicotine, and 27 used neither in the six weeks prior to AP treatment. Average number of nicotine uses per day had a significant relationship with working memory (p = .004, β = -.36), verbal memory (p = .03, β = -.26), and visual memory (p = .04, β = -.26), in that a greater amount of nicotine use per day was associated with weaker cognitive functioning in these domains. Neuropsychological functioning was not associated with the frequency of recent cannabis use for any of the five cognitive domains evaluated.
Conclusions: Our findings are in contrast to prior research that has demonstrated that nicotine is associated with improved cognition in patients with psychosis. Counterintuitively, our results suggest a negative relationship between nicotine, but not cannabis, and neuropsychological domains that have been previously demonstrated to predict treatment response for patients with psychosis. Additionally, given the association between nicotine and cognitive functioning, the results highlight the importance of accounting for nicotine use in the development of neuropsychological biomarkers, in order to ensure that biomarkers are generalizable to the significant proportion of psychotic patients who regularly use nicotine.
Keywords: psychosis**,** cannabis

55 Psychotic-Like Events Associated with Poorer Attention but Unaffected by Marijuana Use

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Objective: Marijuana use increased over the last decade. Marijuana is often lauded for its medicinal effects; it has also been associated with psychotic disorders. This association is not fully understood. Individuals with psychosis frequently exhibit disorganized cognition, including deficits in attention. Moreover, reductions in cognitive abilities predate the onset of psychotic disorders. Marijuana users can exhibit similar but transient reductions in cognition. Marijuana use may contribute to activation of a predisposition for developing a psychotic-disorder. This study posited that one-way marijuana use may do this is through further disruption in cognition. This study examined cognitive differences in healthy adults with psychotic-like events (PLE), with or without comorbid marijuana (THC) use. It was expected that those with PLE or THC use alone would display differences from controls in tasks of executive functioning. Further, those who met both conditions (PLE+THC), would display the most difficulty.
Participants and Methods: The sample was collected from the Human Connectome Project, healthy young adult database. Participants were sorted into four groups based upon responses to the Achenbach Self-Report and drug screen results. Urinalysis detects marijuana use within two-weeks of last use. Attention was measured using a continuous performance task (CPT) from the Penn Computerized Neurocognitive Battery. A 2x2 between subjects MANOVA was conducted with dependent variables of CPT commissions and omissions. Independent variables were PLE, THC, PLE+THC, and control. The final sample included 316 individuals similar across age, gender, and income. 36% held 16 years of education, 22% held 12 years of education, and the remainder were equally distributed across other levels of education. 65% identified as Caucasian, 24% identified as African American, and the remainder were equally distributed across other cultural identities.
Results: MANOVA produced a statistically significant multivariate effect. There was a main effect for PLE condition, Pillai's Trace= .047 $F(6, 624) = 2.505$, $p=.021$, partial $n^2= .024$. Subsequent between-subjects results revealed a significant main effect between PLE condition and number of commissions $F(3, 312)= 3.061$, $p= .028$, partial eta squared= .029. There was also a significant main effect for PLE condition and number of omissions, $F(3, 312)= 2.589$, $p= .055$, partial eta squared= .024. Follow-up analyses of simple effects revealed that those in the PLE group made significantly more errors, both commissions and omissions, on attentional tasks when compared to controls.
Conclusions: These data suggest that, when compared with controls, individuals reporting PLEs had increased difficulty inhibiting responses, producing more commission errors on an attention task relative to controls. They made greater omission errors, suggesting reduced sustained attention. Even in healthy individuals, the presence of PLEs is associated with challenges in attention. In healthy individuals with PLEs, marijuana use did not compound inattentiveness; however, future studies examining marijuana use within a prodromal stage may reveal different results. Prospective studies controlling for timeline and dosing of marijuana, as well as level of psychotic symptoms, may find significance. PLEs were associated with poorer attention, but history of marijuana use with PLEs was not associated with worsened functioning.
Keywords: psychosis**,** substance abuse**,** attention
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56 Frontotemporal Connectivity and Working Memory Deficit in Schizophrenia

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Objective: Schizophrenia (SZ) is a severe mental illness affecting 1-2% of the global population. Aside from psychiatric symptoms, SZ patients are also vulnerable to

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neurocognitive impairments, especially in the domains of processing speed, working memory, language, and learning. Previous study demonstrated that frontotemporal functional dysconnectivity, as indicated by impaired theta-phase coupling, may reflect the mechanism of memory impairment in schizophrenia. The present study aims to further examine this hypothesis.
Participants and Methods: The current study consists of artifact-free EEG data of 12 SZ patients (DSM-IV-TR criteria) and 17 healthy controls (HC) during the single-pulse transcranial magnetic stimulation (TMS) paradigm. All SZ patients had been receiving medication treatment but still experienced active positive symptoms. There were no significant differences (p values > 0.05) in age (SZ: mean = 38, SD = 11.7; HC: mean = 34, SD = 14.0), education, and gender composition. Neuropsychological testing included the Wechsler Test of Adult Reading (WTAR), Wechsler Adult Intelligence Scale (WAIS-IV) subtest of coding, Hopkins Verbal Learning Test (HVLT), and Boston Naming Test (BNT). Neuronavigated (using MR images) TMS single pulses were administered at the Broca's area and the Wernicke's area during EEG recordings. Phase locking values (PLV) between the Broca's area and the Wernicke's area across 5 frequency bands were calculated to indicate the frontotemporal functional connectivity.
Results: SZ group did not show significantly different performances on most neurocognitive tasks including naming (BNT, $p > 0.05$), working memory (1st trial of HVLT, $p > 0.05$), learning (Total recall of HVLT, $p > 0.05$), and memory retention (retention% of HVLT, $p > 0.05$), except for the test of processing speed (Coding, $t(28) = -3.095$, $p < 0.01$, Cohen's $d = 1.2$). There was no significant difference between the two groups regarding neural synchronicity; however, considering the sample size, there was a trend in significant difference in beta-band neural synchronicity with a large effect size ($t(27) = -2.023$, $p = 0.053$, Cohen's $d = -0.763$). Regression models revealed that, theta- and gamma- band frontotemporal neural synchronicity explained 24.9% of total variance of the performance on the 1st trail of HVLT ($p < 0.05$, $F(26, 2) = 3.978$, $R^2 = 0.249$), theta-band neural synchronicity significantly predict the performance on the 1st trial of HVLT ($\beta = 0.408$, $p < 0.05$). However, there was no significant group difference.
Conclusions: The results did not support the frontotemporal dysconnectivity hypothesis. One possible explanation is that patients in the SZ sample were relatively high-functioning given the complexity of the study protocol. Nevertheless, the results indicated the importance of theta- and gamma-bands phase coupling in learning and memory functioning. Further studies with larger samples are needed to explore the role of frontotemporal functional connectivity in neurocognitive deficits in SZ.
Keywords: neurocognition**,** schizophrenia**,** neurophysiology
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57 Language-based Deficits Observed Across the Psychotic Spectrum

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Objective: Language-based deficits are observed across psychotic-spectrum disorders (PSDs) in individuals who have experienced psychosis and those who are at-risk, although it is not clear which aspects of language evidence the greatest deficits. Moreover, relatively few studies have compared language performance in individuals who are at-risk for developing psychosis but have not met criteria for a psychotic episode and those who have recently experienced a first episode of psychosis (FEP). Our aim was to elucidate language-based deficits across the psychotic-spectrum. We compared low schizotypy controls (C), those who possess a high number of schizotypal personality traits and are at-risk for developing a psychotic-spectrum disorder (HS), and an FEP group across several language-based domains, including semantic ability, verbal abstract reasoning, and verbal working memory. We hypothesized that both the FEP and HS groups would perform worse than Cs across all language domains and that negligible

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differences would exist between HS and FEP groups.
Participants and Methods: The FEP (*n* = 13) group was recruited from an early psychosis intervention center while C (*n* = 41) and HS (*n* = 45) groups were undergraduate students. All were participating in a larger study on PSDs (ages 18-43, 68% female, 85% White). Participants completed the Schizotypal Personality Questionnaire-Brief Revised Updated (SPQ), which was used to categorize the C and HS groups. Semantic ability was measured via semantic fluency (animals, fruits, and vegetables), verbal abstract reasoning via Wechsler Adult Intelligence Scale-IV (WAIS-IV) Similarities subtest and Delis-Kaplan Executive Functions System (DKEFS) Proverb Test, and verbal working memory via WAIS-IV Digit Span. We used standardized data in analyses. C and HS groups also completed the Prodromal Questionnaire-Brief (PQB) to assess for prodromal psychotic symptoms. The three groups were first compared across all language measures. Subsequent analyses compared the FEP group with only those who scored above established cutoffs on the PQB (*n* = 57). In these analyses, we also examined frequency of atypical semantic content across semantic fluency tasks by creating semantic corpora and assigning rank-ordered values to fluency responses, with higher number values representing more infrequent responses.
Results: Both FEP and HS groups performed significantly worse on the Proverb Test, verbal working memory, and animal fluency compared to Cs (all *p*'s <.05, *d's*= .79-1.21) but did not differ from each other across nearly all tasks, (*p*'s >.05, *d's* <.3). When comparing those with elevated risk for conversion to psychosis and FEP, the FEP group generated significantly more atypical semantic content on semantic fluency for the vegetables category (*p* = .03, *d* = .57), and marginally more on the fruits category (*p* = .07, *d* = .46) than the elevated risk group. Their performance did not differ on the remaining language measures.
Conclusions: Generally, findings suggest that language-based deficits exist prior to psychosis onset and occur in a variety of language domains. Given our semantic content findings, qualitative analyses may provide additional insights into neurocognitive performance in PSDs even prior to onset of a first psychotic episode.
Keywords: language, psychosis, neuropsychiatry
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58 Impact of PTSD and Obstructive Sleep Apnea on Cognition in Older Adult Veterans

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Objective: Posttraumatic stress disorder (PTSD) and obstructive sleep apnea (OSA) are highly prevalent and comorbid among older adult veterans. Both PTSD and OSA are independently associated with cognitive deficits in older adults, but little research regarding the impact of comorbid PTSD and OSA among older adults exists. The current study aimed to examine the independent and interactive effects of PTSD and OSA on cognitive functioning in older adult veterans.
Participants and Methods: Participants were 175 community dwelling male veterans aged 55 years or older, who were recruited for the presence (CAPS-IV scores ≥40) or absence (CAPS-IV scores ≤19) of PTSD. Participants underwent polysomnography evaluation to assess OSA symptoms and completed comprehensive neuropsychological evaluation. Multiple regression analyses were used to assess associations between PTSD status, OSA severity, and cognitive domain functioning.
Results: The interaction between PTSD and OSA did not predict cognitive performance. However, positive PTSD status significantly predicted poorer attention and processing speed (β = -0.29, SE = 0.12, *t* = -2.41, *p* = 0.017), and increased OSA severity predicted poorer learning and memory (β = -0.19, SE = 0.08, *t* = -

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2.36, p = 0.019) and global cognition (β = -0.14, SE = 0.06, t = -2.24, p = 0.027).
Conclusions: While PTSD and OSA did not have a synergistic detrimental impact on cognition, each independently predicted poorer cognitive functioning within certain domains, suggesting that older adults with these comorbid conditions may experience a wider array of cognitive difficulties.
Keywords: post-traumatic stress disorder**,** sleep disorders**,** neurocognition

59 The Role of Emotional Distress in the Relation between Sleep and Physical Symptom Reporting

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Objective: Short duration and poor-quality sleep are known to increase emotional distress and experience of physical symptoms, but little is known about the degree to which emotional distress mediates these relations. In chronic pain patients, negative affect fully mediates the relation between sleep and pain, but it is unclear whether this finding will extend from pain to general symptom reporting. The purpose of this study was to examine whether emotional distress mediates the relation between sleep quantity/quality and physical symptom reporting.
Participants and Methods: Participants were 278 healthy undergraduate students (35% male; 61% Caucasian, 14% Middle Eastern, 11% Asian; M_{age}=21.8, SD_{age}=5.0; M_{edu}=14.3, SD_{edu}=1.9) from a mid-sized Canadian university. Data were collected in an online survey for which students received bonus points toward eligible courses.
Results: Groups based on sleep quantity (<7 h, 7-9 h, and >9 h) had no differences in depression, anxiety, stress, total emotional distress, or physical symptoms. Dichotomous groups based on presence or absence of subjective sleep disturbance showed medium to large differences on depression, anxiety, stress, total emotional distress, and physical symptoms. Although females reported marginally, but significantly, more symptoms than males, there was no interaction between sex and either sleep quality or sleep quantity on physical symptoms. Lastly, the relation between sleep quality and physical symptoms was partially mediated by total emotional distress.
Conclusions: Free-living sleep quantity was unrelated to depression, anxiety, stress, total emotional distress or physical symptoms, but free-living subjective sleep quality was strongly related to all of these variables. There was a small effect of sex on physical symptom reporting (females>males), but there was no interaction between sex and either sleep quality or sleep quantity. This is contrary to other studies demonstrating an effect of free-living sleep quantity and symptom reporting, as well as those demonstrating an interaction between sleep and sex. However, the finding that subjective sleep disturbance is related to emotional and physical symptom reporting is consistent with the literature. The primary outcome of this study demonstrates that emotional distress explains some of the variance in the relation between sleep quality (but not quantity) and report of physical symptoms. Because effects are likely to be seen in the groups with shortest duration sleep and such short duration sleep was uncommon in this sample, future studies should examine this question experimentally by manipulating sleep quantity.
Keywords: sleep**,** emotional processes**,** self-report

60 Impact of Obstructive Sleep Apnea Disease Duration on Neuropsychological Performance During the Chronic Recovery Stage After Traumatic Brain Injury: A VA TBI Model Systems Study

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Objective: Obstructive Sleep Apnea (OSA) diagnosis is associated with poorer cognition among individuals without brain injury. Although OSA commonly co-occurs with traumatic brain injury (TBI), there is a paucity of research in this regard. Thus, the purpose of this study is to describe the impact of OSA on cognition in persons with TBI after controlling for known predictors of cognitive recovery.
Participants and Methods: A secondary analysis of the multicenter Veterans Affairs (VA) TBI Model Systems longitudinal study. Participants in this analysis were drawn from a single site in which participants took part in a time-limited sub-study (April 2018 – January 2021) focused on cognitive outcome assessed with the Brief Test of Adult Cognition by Telephone (BTACT) during annual follow up interviews. Multiple regressions were conducted examining impact of OSA duration on cognition controlling for age, education, and TBI severity via Time to Follow Commands (TFC). Participants (N=89) were mostly male (96.6%), non-Hispanic (77.5%) White (80.9%) with an average of 14.6 years of education (SD=2.1), and an average age of 45.1 years (SD=10.3) at the time of BTACT testing which occurred on average 3.6 years following their TBI (SD=1.7; range 2-7 years). The sample ranged in TBI severity based on TFC (M=10.6; SD=35.8) days.
Results: Duration of OSA diagnosis accounted for significant variability after controlling for age, education, and TFC [$R^2\Delta$ = .053, F(1,84) = 5.479 p = .022] such that longer duration of OSA diagnosis was associated with poorer performance on Word List Delayed Recall (β = -.236, t = -2.341, p = .002), as was longer TFC (β = -.198, t = -1.986, p = .050). Lower years of education predicted poorer Word List Delayed Recall (β = .272, t = 2.744, p = .007). Age was not significantly associated with Word List Delayed Recall (β = -.139, t = -1.380, p = .171). Duration of OSA failed to account for significant variability after controlling for age, education, and TFC on the remaining BTACT subtests: Word List Immediate Recall [$R^2\Delta$ = .017, F(1,84) = 1.844 p = .178], Digit Span Backwards [$R^2\Delta$ = .000, F(1,84) = 0.025 p = .874], Category Fluency [$R^2\Delta$ = .012, F(1,84) = 1.281 p = .261], Number Series [$R^2\Delta$ = .001, F(1,84) = 0.149 p = .700], and Backwards Counting [$R^2\Delta$ = .013, F(1,84) = 1.479 p = .227].
Conclusions: This study extends the literature on OSA and cognition by examining duration of OSA disease on cognitive outcome after TBI. Longer OSA duration predicted worse delayed recall, consistent with research suggesting there are neuropathological changes in the hippocampus and subcortical white matter in persons with OSA. Future research should examine the impact of OSA treatment on cognitive recovery after TBI. Limitations of this analysis include self-report measure of OSA and potentially limited sensitivity of the BTACT compared to conventional neuropsychological assessments.
Keywords: sleep disorders**,** traumatic brain injury**,** teleneuropsychology
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61 The Effect of Restricted and Habitual Sleep on Cognition in Healthy Adults

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Objective: Sleep affects a wide range of cognitive functions. Although the effects of sleep loss have been documented, less is known about the effects of stable levels of adequate sleep on cognition. Further, few studies have examined both sleep restriction and stable habitual sleep and their impact on cognitive function using an experimental design. The goal of this study was to examine the extent to which restricted sleep and habitual adequate sleep affects cognition in healthy adults.
Participants and Methods: This study used a randomized, crossover, outpatient design. Adults who regularly slept at least 7 h/night, verified by 2 weeks of screening with actigraphy, completed 2 counterbalanced phases of 6 weeks each separated by a 6-week washout

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period: habitual sleep (>7 h/night) or sleep restriction (habitual sleep minus 1.5 h). During the sleep restriction phase, participants were asked to delay their bedtime by 1.5 h /night while maintaining their habitual wake time. During the habitual sleep phase, participants were asked to maintain both their habitual sleep and wake times consistently over a 6 week period to ensure sleep >7 h/night. Neuropsychological function was evaluated with the NIH Toolbox Cognition Battery at baseline of each phase (week 0) and endpoint (week 6) of each intervention phase. The NIH Toolbox evaluates a range of cognitive abilities, including attention, executive functioning, and working memory. General linear models were used to assess demographically-adjusted test scores prior to and following each sleep condition; by including the second baseline (prior to the second phase intervention) we were able to evaluate practice effects (i.e., difference in performance from the first baseline to the second baseline) explicitly.
Results: At the time of analyses, 65 participants completed all study procedures (age 35.9±4.9 years, 58 women, 32 (52%) non-White race, 16 (25%) Hispanic/Latinx ethnicity). Analyses of sleep condition and testing session revealed that individuals performed better on List Sorting, a test of working memory, after habitual sleep compared to baseline and compared to practice effects. On the other hand, after sleep restriction, participants' scores also improved, but not as much as with practice (main effect of study phase, F=5.15, p=0.002).
Conclusions: In healthy adults, we demonstrated that stable habitual adequate sleep has a positive impact on working memory, or the ability to temporarily hold information in mind while executing task demands. In addition, individuals in the sleep restriction condition failed to benefit from practice to the same degree as they did in the habitual sleep condition. This finding contributes to our understanding of the complex interplay between different aspects of sleep quality (i.e., both sleep restriction as well as the maintenance of stable sleep patterns) on cognition and suggests that consistent, stable sleep of at least 7 hours a night can improve working memory in healthy adults.

Keywords: sleep**,** sleep disorders**,** working memory
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62 Sleep Apnea Contributes to Racial and Intersectional Disparities in Cognition Among Older Adults

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Objective: To determine whether (1) obstructive sleep apnea (OSA) is a mediator of racial disparities in cognition among non-Hispanic Black and non-Hispanic White older adults and (2) whether associations among race, OSA, and cognition are modified by socioeconomic status (SES).
Participants and Methods: Cross-sectional data were obtained from 465 socioeconomically diverse community-dwelling adults ages 55+ (53% Black) from the Michigan Cognitive Aging Project. Physician-diagnosed OSA was a self-reported dichotomous variable with no OSA as the reference group. Risk for OSA was assessed using the STOP-BANG questionnaire (range=1-8). Global cognition was a z-score composite of five factor scores (episodic memory, executive function, language, visuospatial function, and processing speed) obtained through a confirmatory factor analysis of raw test scores from a comprehensive neuropsychological battery. SES was operationalized as self-reported years of formal education (≤12yrs=low, >12yrs=high). Mediation models assessed for racial disparity in cognition through risk for OSA (Model 1) or OSA diagnosis (Model 2), controlling for age and gender. Subsequent models controlled for continuous education (range=7-20), a potential contributor to disparities. Stratified models assessed for moderation by SES.
Results: Blacks evidenced lower global cognition scores (β =-.585, SE=.031, p<.001), and this association was partially mediated by risk for OSA. Specifically, Blacks exhibited

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greater risk for OSA (β=.101, SE=.046, p=.028), which was associated with lower cognition (β=-.126, SE=.044, p=.004). This racial difference in risk for OSA was no longer significant after accounting for education (β=.072, SE=.050, p=.148). In contrast, Blacks were less likely to report having received an OSA diagnosis than Whites (β=-.158, SE=.066, p=.016), and OSA diagnosis was not reliably associated with cognition (β=-.097, SE=.051, p=.056). Stratified models revealed racial disparities in cognition in both high- and low-SES groups. However, risk for OSA only partially mediated racial disparities in cognition among high-SES individuals, even after accounting for within-group differences in years of education. Specifically, Blacks in the high-SES group reported greater risk for OSA (β=.111, SE=.056, p=.048) than Whites, which was associated with lower cognition (β=-.139, SE=.053, p=.009). There were no associations between race and risk for OSA (β=-.048, SE=.092, p=.605) nor between risk for OSA and cognition (β=-.074, SE=.079, p=.346) in the low-SES group. Blacks were less likely to be diagnosed with OSA than Whites in the low-SES (β=-.325, SE=.109, p=.003) but not high-SES (β=-.085, SE=.084, p=.314) group. OSA diagnosis was associated with lower cognition in the low-SES (β=-.183, SE=.084, p=.029) but not high-SES (β=-.086, SE=.061, p=.154) group.
Conclusions: These results support prior research that identify OSA as a modifiable risk factor for cognitive impairment in later life and implicate OSA as a mechanism underlying racial disparities in cognition among older adults. Our findings also highlight the importance of race-by-SES intersectionality in research on racial health inequalities and may reflect diminished returns to education for Blacks, particularly regarding OSA risk. Finally, OSA diagnosis status may not accurately reflect the presence of OSA among Blacks older adults given the contrasting results for self-reported OSA diagnosis versus a measure of OSA risk that incorporates objective health information. This finding is consistent with prior research showing that Blacks are underdiagnosed with OSA despite being at higher risk, which likely reflects racial and intersectional inequalities in access to quality healthcare.
Keywords: aging disorders**,** sleep disorders**,** minority issues

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63 Sleep regularity, attention, and executive functioning in adolescents with spina bifida

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Objective: Sleep is a modifiable health behavior that may contribute to impairments in cognitive functioning. Emerging work suggests that sleep regularity, or consistent sleep timing from day to day, may be associated with optimal brain function and development. Spina bifida (SB) is a congenital condition that is commonly associated with impairments in attention and executive functioning (EF; Rose & Holmbeck, 2007). In addition, individuals with SB exhibit poor sleep behaviors and worse sleep trajectory compared to typically developing (TD) youth (Murray et al., 2016; Murray et al., 2018). However, no studies have investigated if sleep is more irregular among adolescents with SB compared to TD youth. Further, no studies have considered if sleep regularity is associated with attention and EF problems among adolescents with SB. Therefore, the present study aimed to (1) compare sleep regularity in TD and SB adolescents and (2) explore concurrent and longitudinal associations between sleep regularity and attention and EF within a SB sample.
Participants and Methods: The present study collected data from adolescents with SB (*n* = 37) and TD adolescents (*n* = 37) that were matched based on demographic characteristics. Participants were on average 16 years old (*SD* = 1.4), 58% female, 70% Caucasian, and 77% Non-Hispanic. To capture sleep duration, bedtime, and wake time, participants wore actigraphs for 10 days. The sleep regularity index (SRI) was derived using these data as a measure of sleep regularity. Additional data were collected from the SB sample who were part of a larger longitudinal study and these data

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were used to address Aim 2. Multi-informant ratings of attention (CBCL; Achenbach & Rescorla, 2001) and EF (BRIEF-2; Gioia et al., 2015) were collected across two timepoints, two years apart.
Results: Sleep regularity did not differentiate adolescents with and without SB, even when accounting for how long youth slept. In the SB sample, less regular sleep was associated with lower EF concurrently (reported by parents), and more EF problems (reported by teachers and self-report) and attention problems (reported by parents or self-report) two years later.
Conclusions: These findings suggest that adolescents with SB experience similar levels of irregular sleep patterns when compared to their peers. Further, among adolescents with SB, these findings suggest that less regular sleep may be associated with greater difficulties with EF and attention. Future work is needed to understand the directionality of these associations, since the current study only collected actigraphy at one time point. This poster will discuss how to best capture sleep regularity among adolescents and the impact of sleep on cognitive outcomes in both pediatric and TD adolescents.
Keywords: sleep**,** spina bifida**,** executive functions

64 Associations of Wake Time, Physical Activity and Task Switching in Adolescent Girls

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Objective: Executive functioning (EF) is impacted by sleep, particularly during adolescence when rapid developmental changes take place (Kuula et al., 2015). Adolescent girls may experience heightened levels of sleep disruptions around menarche (Tarokh et al., 2019). One aspect of sleep, wake-time (WT), is known to shift during adolescence (Crowley et al., 2018). Although many studies have considered how WT affects EF, few studies have considered the impact of wake times on EF among adolescents despite the known impact menarche has on sleep (Kazama et al., 2015). In addition, data from adult samples suggest that levels of physical activity (PA) may attenuate how much effect sleep variability has on EF (Lambiase et al.,2014). The current study will examine relations between EF and average WT utilizing objective measures of sleep (i.e., actigraphy data) among a sample of peri-menarchal female adolescents and consider whether PA buffers this relation.
Participants and Methods: Adolescent girls were recruited from a midwestern US city via community advertisements prior to menses onset (*n*= 51). Parents reported on demographics and executive functioning using the Behavior Rating Inventory of Executive Function (BRIEF) working memory, emotional control, shift, and inhibit subscales, with higher scores indicating more executive dysfunction. Waketimes and sleep duration were measured across 7 days using wrist-worn actigraphy devices and self-reported daily diaries. Average WT was calculated utilizing actigraphy and diary data and coded into an integer, with higher values representing later WT. For PA, activity counts averaged across 7 days via wrist-worn actigraphy devices were utilized, with higher values representing more PA
Results: After adjusting for age and average sleep duration, hierarchical linear regressions demonstrated significant relations between WT and the BRIEF shift subscale (β = -.355, *p*=.009). The negative association between WTs and the BRIEF shift subscale demonstrate that in this sample later WTs are associated with better task switching and switching attentional focus from one activity to the next. There were no other significant relations with other subscales. The interaction between PA and WT on the BRIEF shift subscale was investigated but was not significant.
Conclusions: Results suggest that peri-menarchal adolescent's WT is differentially related to aspects of executive functioning. The results of this study suggest that later waketimes are associated with better task switching ability even when accounting for the quantity of sleep. Interestingly, PA was not associated with

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executive functioning or average WTs. Although these results are cross-sectional, they align with previous research that suggests later waketimes in adolescent girls may foster better executive functioning. Future prospective studies should investigate the multiple components of sleep including WT to consider its relation to EF, particularly among adolescents.
Keywords: executive functions**,** adolescence**,** sleep
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65 Sleep Quality and Mental Health in People Recovered from COVID-19 Versus Non-Infected People

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Objective: The purpose of this study was to know if the sleep quality, in relation with stress, anxiety and depression, is different between people who had COVID-19 and those who did not have COVID-19.
Participants and Methods: Were 938 adults, 371 participants who had previously been recovered from COVID-19 disease (mean age = 44 years, SD = 13; 133 males, 238 females) and 567 (mean age = 38 years, SD =14; 115 males, 452 females) who hadn´t had the disease up to the date of the questionnaire application. The instruments were the Informed consent, the sociodemographic data sheet, the Pittsburgh Sleep Quality Index (PSQI), the Beck's Depression, Anxiety and Stress Scale (DASS-21), and the Stressor Impact Scale (EIE-R). All the instruments were administered on a Google Form Survey.
Results: The groups were different in all evaluated aspects through t student tests, observing that participants who have suffered COVID-19 infection exceeded the cut point of anxiety (9.7, SD = 6.2), depression (9.9, SD = 8.1), and stress (10.4, SD = 7.7) of the DASS-21, while in the EIR-R and the PSQI both groups overpassed the cut point which indicated high levels of stress (with COVID-19: mean=44.7, SD = 27 and without COVID-19: mean=28.2, SD = 20.4) and low quality of sleep (with COVID-19: mean = 13.4, SD = 6.2, and without COVID-19: mean = 8.4, SD = 4.4.) in all participants
Conclusions: In these pandemic times, the high levels of stress are related to problems of sleep and mental health, it is imperative that population attend to medical care to palliate these alterations, with priority for who have been sick of COVID-19.
Keywords: sleep**,** anxiety**,** depression
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66 Effect of Cognitive Fatigue on Clinical Performance in Flight Medicine

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Objective: The triad of circadian rhythm disturbance, poor sleep, and continuous task persistence commonly experienced in the healthcare and airline industries have been shown to contribute to cognitive fatigue (i.e., decrements in attention). Further, the effect of cognitive fatigue has been implicated in decision-making errors impacting clinical performance in the broader emergency medical service (EMS) industry. Yet, no studies to date have investigated the cognitive fatigue-performance relationship in flight medicine within EMS. As such, the objective of this study was to examine the effect of cognitive fatigue on medical error in aeromedicine. A potential protective factor against medical error when fatigued (i.e., team cohesion) was also examined.
Participants and Methods: Participants were flight medical providers stationed across the western United States. Medical performance was assessed through a high-consequence, low-frequency simulation activity (i.e., emergent intubation) conducted in a mobile replica of a helicopter while participants were on and off duty. Cognitive fatigue and team cohesion were examined using measures administered before

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the simulation activity. Linear and hierarchical regressions and multilevel modeling were selected to examine the relationship between cognitive fatigue, medical performance, and team cohesion.
Results: Ninety-three air medical professionals elected to participate in the study across six states and 13 bases. Results of the study showed that at lower levels, cognitive fatigue did not impact medical performance, $F(1, 86) = .26$, $p = .61$. Task cohesion was positively and significantly related to medical performance ($r = .20$, $p = .03$) and intubation procedures ($r = .21$, $p = .03$), but the relationship was weak at the individual level of analysis. However, a positive and moderate relationship between medical performance and task cohesion was shown to be significant at the team level of analysis ($r = .35$, $p < .001$). Finally, the relationship between cognitive fatigue and medical error was not significantly moderated by team cohesion, and the variability in medical performance shared by cognitive fatigue and team cohesion was low ($R^2 = .016$).
Conclusions: The results emphasize the need for future studies to investigate how levels of cognitive fatigue may be more influential on medical performance than the experience itself. As such, future research should investigate the point at which decrements in medical performance are more likely to occur and the effect of task cohesion on medical performance when analyzed at the team level. Through ongoing investigation, it is hoped that more comprehensive evidence-based practices can be established to ensure patient-centered outcomes and protect flight providers who care for those in critical condition.
Keywords: attention**,** reaction time**,** sleep
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CE Workshop 11: Elucidating the Neurocognitive Effects of Electroconvulsive Therapys

Presenter: Shawn M. McClintock

8:00 - 9:30am
Friday, February 4, 2022

Abstract & Learning Objectives:
Electroconvulsive therapy (ECT) is one of the most effective antidepressant therapies for adults across the lifespan who have major depressive disorder (MDD). Since the late 1930s, ECT has been used as an acute, continuation, or maintenance treatment either alone or in combination with other antidepressant therapies as a treatment for MDD, suicidality, psychotic features, and catatonia. Consistent evidence has found ECT to have high response and remission rates. However, ECT also results in adverse cognitive effects. Such effects include decreased attention, verbal dysfluency, executive dysfunction, anterograde amnesia, and retrograde amnesia. While the exact mechanisms of action of such cognitive adverse effects remain unknown, evidence suggests that select ECT parameters, underlying neurocircuitry, demographic factors, and preexisting conditions may play a role. This session will provide up-to-date information regarding the refinement of ECT practice to maximize safety and efficacy, the antidepressant effects of ECT, the cognitive effects of ECT, and role clinical neuropsychologists can serve on integrated healthcare ECT treatment teams.

Upon conclusion of this course, learners will be able to:
- Describe the cognitive adverse effects of electroconvulsive therapy
- List the electroconvulsive therapy parameters that are associated with cognitive adverse effects
- Explain how clinical neuropsychologists can serve on integrated healthcare ECT treatment teams

CE Workshop 12: Medical, Educational, and Psychosocial Impacts of COVID-19 on Children

Presenter: Christine Koterba

8:00 - 9:30am
Friday, February 4, 2022

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Abstract & Learning Objectives:
The COVID-19 pandemic has had significant medical, educational, and psychosocial impacts on children. With the new Delta variant and rising cases in children, we are learning more about the possible long-term impact of this virus on children's health and functioning. While most children with COVID-19 do well, a subset can experience more severe symptoms and in some cases can go on to develop long-term issues or multisystem inflammatory syndrome (MIS-C). In addition to the medical impact of the pandemic, recent research suggests that a multitude of children have lost learning opportunities due to a variety of factors, including school closures, variability in virtual instruction, and limited access to technology. Certain groups are also particularly vulnerable, including those with special learning needs, those who were too young to start school before the pandemic, and children from lower income and/or rural communities. On top of the medical and educational consequences of COVID-19 is the impact on children's mental health and well-being. While living through a pandemic has been difficult for everyone, the greatest impact may be on the youngest of us who have been cut off from friends and peers and have had to cope with much stress and uncertainty. In the face of these challenges, neuropsychologists are uniquely positioned to offer assessment and monitoring of outcomes, provide recommendations and support to address new learning difficulties, and recommend appropriate interventions to optimize children's psychosocial functioning.

Upon conclusion of this course, learners will be able to:
- Describe findings from early research examining the medical impact of COVID-19 on children.
- Identify which groups of children are at greatest risk for educational, emotional, behavioral, and social difficulties due to COVID-19.
- Apply new strategies in the assessment and intervention of children during the COVID-19 pandemic and beyond.

LIVE Student Mentoring Event
Host: Robin Green

8:00 - 9:00am Friday, February 4, 2022

Poster Session 11: mTBI | CVA | Forensic

8:30 - 9:30am
Friday, February 4, 2022

01 Adult Cognitive Outcomes Following Childhood Mild Traumatic Brain Injury: A Scoping Review

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Objective: Pediatric mild traumatic brain injury (mTBI) has recently gained increased attention because of concern regarding possible long-term difficulties, such as cognitive impairment in adulthood, and late-life neurodegenerative disorders. However, few studies have assessed cognitive functioning into adulthood and substantially less attention has been paid to the long-term consequences of pediatric mTBI. This review aimed to (1) summarize the existing literature regarding cognitive outcomes in adults with a history of pediatric mTBI and (2) identify gaps in the literature to provide directions for future research.
Participants and Methods: A search of published original, peer-reviewed studies was conducted on November 8, 2020, to identify studies that examined adult cognitive outcomes after childhood mTBI, and was updated on March 25, 2021. Searches were conducted in MEDLINE Ovid and PsycINFO Ovid. To be eligible for inclusion in the review, each study was required to meet the following criteria: (1) participants sustained childhood concussion/mTBI before the age of 18; and (2) participants underwent a cognitive assessment (using self-ratings or objective measures) at or after the age of 18, at least 1-year post-injury. Studies were excluded if the sample included individuals with significant comorbid neurological or psychiatric disorders that are known to affect cognition (e.g., depression, diabetes, stroke,

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brain tumor, etc.). Participants with a history of multiple concussion/mTBIs were not excluded. **Results:** A total of 4214 articles were screened, leading to the inclusion of 8 studies for review, with 131,537 participants (mTBI = 7384; controls = 124,153). Six studies compared cognitive outcomes after childhood mTBI with a comparison group of adults without a history of mTBI. Review of the included articles suggests that adults with a history of childhood mTBI perform more poorly than non-head-injured comparison groups on a variety of cognitive measures, but their performance still falls within the normal range expected for adult cognitive functioning. Injury-related factors, such as requiring EEG within 24 hours of injury and post-traumatic amnesia lasting longer than 30 minutes, as well as noninjury-related factors, such as IQ, may be associated with the observed differences in adult cognitive outcomes. No evidence was found to suggest that adults with a history of childhood mTBI have a higher incidence of later-life neurodegenerative diseases than non-head-injured adults.
Conclusions: The evidence provided by this review suggests that mTBI sustained in childhood may result in lower scores in several domains on neuropsychological assessment, but that cognitive performance typically still falls within the normal range expected for adult cognitive functioning. However, the findings must be regarded as tentative given the small number of included studies, most of which had small sample sizes and differed widely in terms of cognitive assessment measures, outcome domains, and mTBI definitions. This review highlights the paucity of research in this area and the significant gaps in our understanding of the long-term impact on cognition following pediatric mTBI. Further research is needed to provide a more comprehensive understanding of the long-term cognitive outcomes of childhood mTBI and to identify predictors of those outcomes in adulthood.
Keywords: concussion/ mild traumatic brain injury**,** cognitive functioning

02 Relationship between coping and social participation following mild TBI: preliminary study of mediating effects of anxio-depressive and pain symptoms

Sarah Lussier[1,2], Sylvain Miljours[3], Michelle McKerral[1,2]
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Objective: A non-negligeable proportion of individuals who have sustained a mild traumatic brain injury (TBI) are at risk of developing persistent symptoms. Reduced social participation often extends beyond the acute recovery period and has been found to be associated with poorer quality of life for many months following mild TBI (Emanuelson et al., 2003). The variables of perceived stress and depression were also linked directly and indirectly to mild post-TBI adjustment in terms of their return-to-work status (Strom and Kosciulek, 2007). Coping was found to be essential in order to decrease physical symptoms, have better psychological health, as well as increase social participation (Vos et al., 2019). This present study aimed to investigate the association between coping and social participation according to anxiety, depression, and pain symptomatology, before and after rehabilitation in a mild TBI population benefiting from an outpatient rehabilitation program. This project also measured the progress of users from beginning to end of rehabilitation on all measures.
Participants and Methods: Seventy adults aged between 18 and 78, all of whom were at least three months post diagnosis of mild TBI, having received interdisciplinary outpatient rehabilitation services at a major trauma program in the Greater Montreal area. Measures administered pre and post intervention included the Rehabilitation Survey of Problems and Coping (R-SOPAC), the Mayo-Portland Adaptability Inventory-4 (MPAI-4), the Depression Anxiety Stress Scales 21 (DASS-21), and the Brief Pain Inventory-Short Form

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(BPI-SF). Mediation analyses were carried out via PROCESS macro for SPSS, model 4. Paired t tests were calculated to measure the pre- and post-intervention relationships.
Results: Outpatient interdisciplinary rehabilitation services significantly improved the level of coping and social participation, in addition to reducing the rate of anxiety-depressive symptoms and pain experienced by users. Mediation analyses indicated a partial indirect link between coping, anxiety, and pain on the level of social participation at the pre-intervention time point. Post-intervention, a significant mediating relationship regarding the impact of pain on the link between coping and social participation was found. Relationships were not moderated by gender or previous mental health diagnoses. These relationships suggest that low level of coping appear to lead to a higher self-reported level of psychological distress and pain, resulting in lower social participation.
Conclusions: The intervention program targeted the level of coping and social participation, while reducing symptoms of anxiety, depression, and pain. However, the mediating effects studied were not complete. Thus, anxiety and pain only partially explained the relationship between coping and social participation. These results suggest that paying close attention to the level of coping and emotional distress during rehabilitation may be beneficial.
Keywords: concussion/ mild traumatic brain injury**,** activities of daily living**,** adaptive functioning

03 Blast Exposure and Transdiagnostic Symptom Clusters: Associations with Elevated Systemic Inflammation

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Objective: Chronic elevation of systemic inflammation is observed in a wide range of disorders including PTSD, depression, and traumatic brain injury. Although previous work has demonstrated a link between inflammation and various diagnoses separately, few studies have examined transdiagnostic symptoms and inflammation within the same model. The objective of this study was to examine relationships between psychiatric and health variables and systemic inflammation, and to determine whether mild traumatic brain injury (mTBI) and/or exposure to blast munitions moderate these relationships.
Participants and Methods: Participants were recruited as part of the TRACTS cohort study at VA Boston Healthcare System, a TBI National Network Research Center. The final sample included 357 post-9/11 Veterans who were 90% male and were 33 years old on average (SD = 9).
Results: Confirmatory factor analysis demonstrated good fit to a four-factor model reflecting traumatic stress, affective, somatic, and metabolic latent variables. Hierarchical regression models revealed that each of the latent variables was associated with higher levels of systemic inflammation. However, the strongest relationship with inflammation emerged among those who had both war-zone blast exposures and metabolic dysregulation, even after adjusting for mental health latent variables. Exploratory analyses showed that blast exposure was associated with metabolic dysregulation in a dose-response manner, with self-reported closer blast proximity associated with the greatest metabolic dysregulation.
Conclusions: The results provide a greater understanding of the types of symptoms most strongly associated with inflammation, and underscore the importance of maintaining a healthy lifestyle to reduce the impact of obesity and other metabolic symptoms on future chronic disease in younger to middle-aged Veterans.
Keywords: concussion/ mild traumatic brain injury

04 Associations Between Health-Related Behaviors and Self-Reported Cognitive Symptoms in U.S. Military Personnel Injured on Deployment

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Sarah M Jurick[1,2], Cameron T McCabe[1,2], Jessica R Watrous[1,2], Andrew J MacGregor[2], Samuel R Walton[3], Ian J Stewart[4], Lauren E Walker[5], Michael R Galarneau[2]
[1]Leidos, San Diego, CA, USA. [2]Naval Health Research Center, San Diego, CA, USA. [3]University of North Carolina, Chapel Hill, NC, USA. [4]5Uniformed Services University, Bethesda, MD, USA. [5]David Grant USAF Medical Center, Fairfield, CA, USA

Objective: Mild traumatic brain injury (mTBI) is common in military personnel. Despite anticipation of a full recovery, many individuals experience persistent cognitive and mental health issues. Engaging in health-promoting behaviors, such as physical activity and healthy sleep, and reducing risky health behaviors, like alcohol use, may mitigate risk of poor outcomes. The objectives were to examine whether health behaviors differ in injured military personnel with or without deployment-related mTBI history and the relative contributions of health behaviors and deployment-related mTBI history to current self-reported cognitive and mental health outcomes.
Participants and Methods: Participants included military personnel (*N*=3,265) injured on deployment. Individuals were excluded if they had a history of moderate-to-severe TBI during deployment or self-reported current severe alcohol use. Participants self-reported mental health symptoms (Posttraumatic Stress Disorder [PTSD] Checklist for the DSM-5; Patient Health Questionnaire-8 for depression), cognitive functioning (Neuro-QoL™ v2.0 Cognitive Function-Short Form), and health behaviors (physical activity via the Rapid Assessment of Physical Activity; sleep quality via a single item from the Pittsburgh Sleep Quality Index; and alcohol use problems via the 10-item Alcohol Use Disorders Identification Test). Chi-square and independent sample *t* tests were used to examine health-promoting behaviors among those with and without deployment-related mTBI history. Covariance analyses were used to determine the associations of mTBI history and health behaviors (physical activity, sleep, problematic alcohol use) with cognitive functioning and symptoms of PTSD and depression. Demographic and injury characteristics were included as covariates.
Results: Military personnel with history of deployment-related mTBI were just as physically active (56.5% vs. 57.5%, respectively, p = .594) and reported similar levels of alcohol problems (M=3.98, SD = 4.04 vs. M = 4.11, SD = 4.05, respectively, p = .384) as those without history of deployment-related mTBI, but they were less likely to report good sleep quality (34.6% vs. 41.9%, respectively, p < .001) compared to those without deployment-related mTBI history. While controlling for age, gender, education level, active duty versus veteran status, rank, injury characteristics, and deployment-related mTBI, better sleep quality was associated with better self-reported cognitive functioning, fewer PTSD and depressive symptoms, and it had large effect sizes (h_p^2=.13–.21, ps < .001). Being physically active was associated with better self-reported cognitive functioning and fewer PTSD and depressive symptoms, with small effect sizes (h_p^2=.02–.04, ps < .001). Lower levels of alcohol problems were associated with fewer PTSD and depressive symptoms, with small effect sizes (h_p^2=.00(3), ps < .003); however, problematic alcohol use was not associated with self-reported cognitive symptoms (h_p^2=.00(1), p = .129). Experiencing one or more deployment-related mTBI was associated with worse self-reported cognitive difficulties, PTSD, and depression; however, effect sizes were small (h_p^2=.00(1)–.00(4), ps < .001).
Conclusions: Targeting sleep through preventive and interventive measures has the potential to improve long-term outcomes in this population. Engaging in physical activity and reducing problematic alcohol use may confer better outcomes related to PTSD and depressive symptoms. Of note, good-quality sleep alone, and all health-promoting behaviors in conjunction, had stronger relationships with outcomes of interest compared with deployment-related mTBI history, suggesting that modifiable factors have the potential to mitigate risks of poor long-term outcomes following deployment-related mTBI.
Keywords: brain injury**,** sleep**,** self-report

05 Different characterizations of repetitive head impact exposure in contact and non-contact sport athletes

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and their associations with neurocognitive testing

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Objective: There is growing concern that exposure to repetitive head impacts (RHI) due to participation in contact sport may be associated with negative long-term consequences, such as cognitive impairment. Prior work has used a variety of methods to operationalize RHI exposure. Many studies simply categorize athletes based on their current or primary sport. Other proposed metrics include age of first exposure to contact sport, cumulative years of participation in all contact sports, and newly developed criteria based on recent traumatic encephalopathy syndrome (TES) guidelines. The purpose of this study was to compare current contact versus non-contact sport athletes across these different RHI exposure metrics. The secondary objective was to determine the extent to which different characterizations for quantifying RHI exposure influence associations between exposure and cognition.
Participants and Methods: A total of 137 (mean age=21.33±1.677) collegiate athletes completed a semi-structured interview about their current and prior participation in contact sports (football, ice hockey, lacrosse, rugby, soccer, and wrestling) across the lifespan. Athletes were categorized as contact sport (CS; n=93) or non-contact sport (NCS; n=44) based on their current sport. The following exposure variables were estimated in each athlete: 1) cumulative number of years of contact sport participation (years exposure); 2) age at first exposure (categorized as 'no exposure', '12+ years', or '<12 years'), and TES exposure categories ('less than substantial', 'substantial', or 'extensive'). Indices from the NIH Toolbox Cognition Battery reflecting fluid cognition were used to assess the following domains: attention, episodic memory, working memory, executive function, processing speed). Independent samples t-tests or chi-square tests compared exposure metrics between CS and NCS. General linear models were fit to identify associations between exposure variables and fluid cognitive metrics, controlling for sex, age, and number of prior concussions.
Results: Relative to NCS, CS athletes had more cumulative years of exposure (M(SD)=15.54(6.01) versus M=2.09(3.81), p<.001), were more likely to have substantial or extensive exposure based on TES criteria (98.9% substantial or extensive versus 9%, p<.001), and were more likely to have an age of first exposure before 12 years old (81.7% versus 29.5%; p<.001;). However, a notable subset of NCS athletes reported prior CS exposure. Regardless of metric, more RHI exposure was associated with better episodic memory (Picture Sequence Memory test; ps<.05). In contrast, performance on the attention task (Flanker Inhibitory Control and Attention test) was inversely associated with RHI only when assessed as cumulative years of contact sport exposure across all sports (β=-.145, p=.04).
Conclusions: Current results suggest that comparing CS versus NCS athletes as a proxy for RHI exposure may be an oversimplification that does not account for prior CS experience in some NCS athletes. Furthermore, we find conflicting associations of RHI exposure with cognitive performance, with more exposure associated with better episodic memory but worse attention. The latter association was only observed when operationalizing RHI exposure as the cumulative years of exposure, highlighting the effect that the operational definition of exposure can have on studies investigating potential cumulative effects of RHI.
Keywords: sports-related neuropsychology, cognitive functioning

06 Cognitive Intraindividual Variability in Collegiate Athletes at Baseline and Post-Concussion

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Objective: Clinicians often utilize the well-established knowledge of base rates of impairments when assessing the results of a comprehensive hybrid neuropsychological evaluation including computerized and paper-and-pencil tests. However, neuropsychological research has begun to increasingly explore how intraindividual variability (IIV) in cognitive performance (or "cognitive IIV") may be an important—and possibly more sensitive—marker of functional impairment across a wide range of clinical populations. The present study examines differences in cognitive IIV performance of athletes before and after they sustained a concussion using neuropsychological test batteries of various sizes.
Participants and Methods: Participants included 102 (78.4% male) student-athletes who were involved in a sports concussion management program at a Division I university. Athletes were tested with the same hybrid neuropsychological battery at baseline and post-concussion. The average amount of time between injury and testing was 8 days (SD=14; Median=2). The raw test scores from the neuropsychological battery were converted to standard scores with normative data. Two indices of IIV were calculated: Maximum Discrepancy (MD) and Intraindividual Standard Deviation (ISD). MD is calculated by subtracting the lowest score from the highest score obtained in the battery. ISD is the standard deviation of the individual's standard scores across the battery. Paired samples t-tests were conducted to determine if MD and ISD values differed between the athletes at baseline compared to post-concussion. Three different test battery sizes were examined: 15-test, 10-test, and 6-test batteries. All three batteries included a mix of memory and attention/executive functioning tests.
Results: On both the 10- and 15-test batteries, the athletes demonstrated significantly greater MD values post-concussion compared to their performance at baseline, $t(101)=2.37$, $p=.020$, $d=.24$ and $t(97)=2.04$, $p=.044$, $d=.21$, respectively. However, the groups did not differ on ISD values. On the 6-test battery, athletes demonstrated significantly larger ISD values ($t(101)=2.23$, $p=.028$, $d=.23$) and MD values ($t(101)=2.68$, $p=.009$, $d=.27$) post-concussion, compared to their baseline performance.
Conclusions: The results of this study indicate that there are significant differences in cognitive IIV between concussed and non-concussed athletes, particularly when examining MD values. This was also generally consistent across test battery sizes. In the future, this research and data could be used to calculate "base rates" of variability, which clinicians could then utilize as objective, quantitative cut-offs when determining whether an athlete's variable performance falls outside the range of expected variability.
Keywords: cognitive functioning**,** normative data**,** test theory
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07 Athletic Status Predicts Neuropsychological Performance in College Students

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Objective: Studies have reported that athletic conditioning or training may have neuropsychological benefits for adult athletes, including enhanced processing speed, executive function, and working memory and attention. However, others have reported that these benefits may be attenuated by an athlete's level of exposure to repetitive, subconcussive head impacts, such as heading the ball in soccer. The objective of this study was to determine how athletes exposed to repetitive head impacts (soccer players) performed in comparison to non-contact athletes (track, swimming, rowing, squash, and basketball) and non-athlete controls on a battery of neuropsychological tasks.
Participants and Methods: Division 1 varsity and club team university soccer players (n = 50, M_{age} = 19.58, female = 50%), Division 1 varsity non-contact athletes (n = 24, M_{age} = 20.66, female = 67%) and non-athlete undergraduate students (n = 194, M_{age} = 20.42, female = 69%)

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completed a neuropsychological battery consisting of 13 cognitive tests divided into four cognitive domains; executive function, processing speed, learning and memory, and working memory and attention.
Results: After controlling for the effects of gender, intellectual function, and history of head injury, an analysis of covariance (ANCOVA) found that athletic involvement was associated with better performance across three tasks (Identification, 1-back, 2-back) in the domain of working memory and attention (η^2 = .035, p = .002). Contact and non-contact athletes averaged higher standardized scores (M = 96.39, SD = 8.51) compared to non-athletes (M = 92.31, SD = 10.37). Further analyses found that no significant differences existed between contact (M = 96.50, SD = 7.83) and non-contact athletes (M = 96.15, SD = 9.96) (η^2 = .002, p = 0.74).
Athletes also performed better than non-athletes across all four trials of the Delis-Kaplan Executive Function System (DKEFS) Color Word Interference (CWI) task. On the first two trials measuring processing speed (Color Naming and Word Reading), athletes averaged a significantly higher standardized score (M = 106.11, SD = 8.24) than non-athletes (M = 103.23, SD = 9.92) (η^2 = 0.02, p = .026). On the third and fourth trials measuring executive function (Inhibition and Switching/Inhibition), athletes averaged a higher standardized score (M = 110.90, SD = 7.54) than non-athletes (M = 108.34, SD = 9.48) (η^2 = 0.021, p = .021). Non-athletes also registered significantly more errors across all 4 DKEFS CWI trials (M = 3.19, SD = 2.41) than athletes (M = 2.53, SD = 1.81) (η^2 = 0.24, p = .013). No significant differences existed between contact and non-contact athletes for any of the DKEFS CWI measures.
Conclusions: Similar to prior findings that aerobic exercise may enhance cognitive performance, both contact and non-contact college athletes performed better on tasks of working memory and attention, processing speed, and executive function compared to non-athlete college students. However, no significant differences were found between non-contact athletes and contact athletes who were exposed to repetitive subconcussive heading events. These findings suggest that athletic performance in college-aged athletes may improve certain aspects of neuropsychological performance despite exposure to repetitive subconcussive head impacts.
Keywords: sports-related neuropsychology
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08 Preinjury Psychiatric History is Associated with an Increased Quantity of Post-Concussion Symptoms

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Objective: To examine the relationship between preinjury psychiatric history and post-concussion symptoms among adults presenting for concussion care.
Participants and Methods: A retrospective observational study was completed with a clinical dataset using the initial evaluation at an academic medical center concussion clinic. Participants were 104 adults with a concussion or mild traumatic brain injury confirmed by clinicians and data regarding preinjury psychiatric history. Three participants were removed due to missing data on two or more presenting symptoms. The final sample consisted of 101 participants, of which 19 had a preinjury psychiatric history. Preinjury psychiatric history, determined by medical records and clinician interview, was used to group participants into those with and without preinjury psychiatric history. There were 25 symptoms, which could be grouped into physical, cognitive, and emotional clusters. Statistical examination of differences in demographic and injury-related variables by preinjury psychiatric history was conducted to determine need for covariates in main analyses. T-tests were used to evaluate group differences on total concussion symptoms and concussion symptom clusters. Cohen's d effect sizes were calculated for interpretive meaning.

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Results: The gender representation was nearly even between men (54%) and women (46%). Almost 90% of the sample self-identified as Caucasian. The average age of participants was 36.7 years. The mean years of education was 13.7 years. The median days since concussion was 107 days. There were no differences (*p*s>.05) in demographic or injury-related characteristics (loss of consciousness and days since injury) between patients with (*n*=19) and without (*n*=82) a preinjury psychiatric history. When evaluating differences in presenting symptoms, individuals with preinjury psychiatric history reported more total symptoms (*p*=.035; *d*=0.54), cognitive symptoms (*p*=.023; *d*=0.61), and emotional symptoms (*p*=.022; *d*=0.59). However, there was no meaningful difference in physical symptoms (*p*=.291; *d*=0.26).
Conclusions: Adults with preinjury psychiatric history presented with a greater number of post-concussion symptoms, particularly emotional and cognitive symptoms, compared to adults without a preinjury psychiatric history. Individuals with a preinjury psychiatric history reported similar number of physical symptoms as those without a preinjury psychiatric history. These findings may suggest an underlying vulnerability to specific symptom clusters related to preinjury psychiatric history. Further research is needed to understand potential mechanisms supporting the relationship with psychiatric history and concussion symptom burden at clinic presentation.
Keywords: concussion/ mild traumatic brain injury**,** traumatic brain injury**,** assessment
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09 Neuropsychologists' Perceptions of Chronic Traumatic Encephalopathy (CTE)

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Objective: Chronic Traumatic Encephalopathy (CTE), a neurodegenerative disorder purportedly caused by repetitive (sub)concussive events, has received significant media coverage as a major health concern for collision sport athletes and combat veterans. Leading proponents and opponents of CTE have acknowledged the limitations of the current evidence base and the need for stronger research designs (i.e., well-controlled longitudinal designs). Until findings from such designs are produced and disseminated, key questions surrounding CTE will remain unanswered, and public understanding of CTE will be directly influenced by information provided by the media and healthcare professionals. This survey study investigated neuropsychologists' perceptions of CTE.
Participants and Methods: Neuropsychologists were contacted via electronic advertisement posted to popular neuropsychology professional listservs. All participants (N = 325) completed a brief (i.e., < 10 minutes) electronic survey with questions regarding basic demographics, professional qualifications, and their perceptions of CTE. Specifically, items focused on the effects of repeated concussions (i.e., uncomplicated mild traumatic brain injuries), the strength of the CTE research base, and its media coverage.
Results: Most participants (91.4%) were at least somewhat familiar with the concept of CTE. The majority of their knowledge was derived from published research/textbooks (64.9%) or didactics (27.7%). A moderate level of uncertainty was reported (i.e., up to 29.8%) regarding the effects of repeated concussions. A small majority (51 – 60%) disagreed that repeated concussions can directly cause long-term cognitive difficulties, behavioral change, or increased risk of suicide. Twice as many participants (46.8 vs. 23.4%) agreed repeated concussions could cause neural pathology; however, there was an even split (39% disagreed vs. 38% agreed, with 23% unsure) regarding whether this pathology could cause mood disturbance. Most felt the research in support of CTE was unreliable (80.3%) and weak regarding claims that repeated concussions cause CTE (90.5%), independently cause behavioral/emotional/cognitive

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dysfunction (85.5%), or increase the risk for neurodegeneration (78.8%). Participants agreed that patients are concerned about CTE (92%), concerns are influenced by the media (96.3%) that presents a biased/alarmist view of CTE (96%), and patient recovery is influenced by their CTE beliefs (82.2%).
Conclusions: There was strong agreement that the media presents an alarmist/biased view of CTE that influences patients concerns and outcomes following concussion. Moreover, this presentation is incongruent with the perceptions of surveyed neuropsychologists who find the research in support of CTE to be weak and unreliable. More research is clearly needed to determine the potential effects of repeated (sub)concussive events. As public knowledge will continue to be influenced by the media and healthcare professionals, future research should explore CTE perceptions across other healthcare disciplines.
Keywords: concussion/ mild traumatic brain injury**,** sports-related neuropsychology**,** dementia - other cortical

10 Psychosocial Moderators of the Relationship Between Concussion History and Neurobehavioral Function Among Former National Football League (NFL) Players

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Objective: Greater neurobehavioral difficulties, including depression, subjective cognitive decline (SCD), and emotional-behavioral dyscontrol (EBD) have been observed among former contact sport athletes with a greater history of concussions. In the general population, more adaptive psychosocial functioning has been observed as a protective factor against these neurobehavioral decrements. We investigated the moderating influence of psychosocial function on the association between concussion history and neurobehavioral function in former professional football players.
Participants and Methods: Former National Football League players (N = 1600) who completed all measures of interest had a mean age of 51.36±15.94. Concussion history was categorized as the following: 0 (n=196; 12.3%), 1-2 (n=273; 17.1%), 3-5 (n=383; 23.9%), 6-9 (n=338; 21.1%), 10+ (n= 410; 25.6%). Neurobehavioral outcomes of interest (corresponding measure) included: EBD (Neuro-QoL Emotional-Behavioral Dyscontrol-short form [SF] v1.0), SCD (PROMIS Cognitive Function-SF v2.0), and depression (PROMIS Depression-SF v2.0). Psychosocial moderators of interest (corresponding measures) included: emotional support (PROMIS Emotional support-SF v2.0), social role and activity participation (PROMIS Ability to Participate in Social Roles and Activities-SF v2.0), and meaning and purpose in life (PROMIS Meaning and Purpose-SF v1.0). Linear regression models examined the association between concussion history, psychosocial moderators, and interaction effects across neurobehavioral outcomes of interest. The Johnson-Neyman technique was used to determine the point along the significant moderators at which the relationship between concussion history and outcomes reached statistical significance.
Results: Concussion history was significantly associated with depression (unstandardized beta[standard error]; B=1.99[.18], p<.001), SCD (B=-2.68[.18], p<.001), and EBD (B=2.19[.20], p<.001). Across all models, psychosocial factors were significantly associated with neurobehavioral outcomes (all p<.01). The effect of concussion history on depression was attenuated by higher scores on emotional support (B=-.039[.02], p=.033), and ability to participate in social roles/activities, B=-.049[.02], p=.002). There was no significant association between concussion history and depression

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among those endorsing an ability to participate in social roles and activities with T-scores ≥60. Concussion history and depression remained significantly associated, although to a lesser degree, at all levels of emotional support. Ability to participate in social roles/activities significantly moderated the association between concussion history and SCD (B=.036[.02], p=.022) and EBD (B=-.057[.02], p=.001). Concussion history and SCD remained significantly associated, but to a lesser degree, at higher levels of ability to participate in social roles/activities. The association between concussion history and EBD was no longer significant among those endorsing an ability to participate in social roles and activities at T-score of ≥60.
Conclusions: Psychosocial factors may attenuate the associations between cumulative concussions and neurobehavioral function. The ability to participate in social roles and activities was the most robust protective factor, and emotional support distinctly moderated depression. Although psychosocial factors attenuated the associations of concussion history with adverse neurobehavioral outcomes, relationships remained at all levels of select psychosocial factors, suggesting these factors may be helpful, but not entirely protective. Optimizing psychosocial functioning can be included in the multifaceted approach to treating modifiable neurobehavioral difficulties in former contact sport athletes with a history of multiple concussions.
Keywords: concussion/ mild traumatic brain injury**,** sports-related neuropsychology**,** depression
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11 The Silent Epidemic: Head Injury in Women due to Domestic Violence seen in Pennsylvania Trauma Centers

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Objective: The National Violent Death Reporting System notes that, in homicides of women, 43% were caused by a current or former partner (2016). The CDC also estimates that one in four American women will experience Domestic Violence (DV) in their lifetime; however, DV is underreported and difficult to detect, in part because it usually occurs in the home. Furthermore, Traumatic Brain Injury (TBI) due to DV remains vastly understudied in comparison to military and sports-related TBI.
Participants and Methods: We sought to approximate potential DV-related trauma admissions from an existing registry (Pennsylvania Trauma Outcome Study (PTOS)) collecting injury data from trauma centers throughout Pennsylvania between 1986 and 2019. We identified 3995 women (age 18-60) assaulted in a private residence, admitted for either TBI or Orthopedic Injury (OI). We describe demographics, assault mechanisms, mortality, and pre-existing conditions (PECs) for these patients.
Results: Of the sample identified (1.2% of all women in the registry), 52% were patients of color, mean age = 35.3 years (±11), with 44% admitted for TBI (81% mild TBI). This is in contrast to all other women in the registry aged 18-60 (Total N=134,138), who were 20% patients of color, mean age = 38.9 years (±13), with 50% admitted for TBI (83% mild TBI). For women injured due to DV, the mean Glasgow Coma Scale for TBI admissions was 13.1, and the mean Injury Severity Score for OI admissions was 8.7. Women sustaining TBI were injured by: unarmed physical fights (47.3%), blunt objects (17.5%), or firearms (14.3%), contrasting with OI patients (by cutting instruments (35.1%), unarmed physical fights (26%), or firearms (18.8%)). The most frequently endorsed PECs for all patients were psychiatric disorders (23.8%), substance use disorder (22.2%), and pulmonary disease (10.7%); 2.3% of all patients, regardless of injury type, reported prior admissions for trauma. 94% of women were discharged alive, and 85% were discharged to home. Although overnight injury did confer slight risk for TBI over OI, χ^2 (1, 3994) = 6.3, p = 0.01, φ = 0.04), it did not elevate risk for moderate-severe TBI specifically (χ^2 (1, 1369) = 0.29, p = 0.6). As expected, upon visual inspection of residential zip codes, DV incidence

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increased along with population density, as a majority of the women in the sample live in or around major cities rather than in rural areas.
Conclusions: Given the difficulty in identifying female DV survivors within a state-funded mechanism like PTOS, there is clear need to improve methods of detecting at-risk women in hospital settings, both to ensure that survivors receive appropriate interventions and to support further DV-related research efforts. These results suggest that 1) women seek medical treatment for DV-related injuries at low rates, 2) women of color have a higher risk of sustaining DV-related physical trauma requiring treatment relative to Caucasian women, and 3) older survivors are more likely to seek medical treatment than their younger counterparts.
Keywords: concussion/ mild traumatic brain injury

12 Depression, Anxiety, and Mild Traumatic Brain Injury History are Associated with Cannabis Use, but not Alcohol Use, in Varsity Athletes

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Objective: University athletes are more likely than their non-athlete peers to engage in risky substance use behaviour, experience symptoms of depression or anxiety, and sustain mild traumatic brain injuries or concussions through sport exposure. However, to date, these factors have been examined in isolation and associations between them remain elusive. Examining these associations is particularly important for young women, who are at greater risk of experiencing anxiety and depression and have been found to endorse greater symptoms of depression following mild traumatic brain injury (mTBI) compared to males. This study aimed to understand the relationships between mTBI history, mental health, and substance use (i.e., cannabis and alcohol use) and the influence of biological sex on these factors.
Participants and Methods: 418 university athletes involved in various sports (basketball, football, hockey, soccer, rugby, tennis track and field, volleyball, and wrestling) completed comprehensive baseline testing during the 2019 pre-season. Athletes completed a self-reported depression scale (Personal Health Questionnaire-9 item;PHQ9), mental health history, mTBI history, and substance use history questionnaires. Separate logistic regression models were performed with alcohol use and cannabis use as the outcome variables and PHQ-9 scores, anxiety endorsement, mTBI history, as predictors. Sex was included as a moderator.
Results: Both mTBI history and depression were significant predictors of cannabis use (*B*=.984, *SE*=.346, *p*=.004, OR = 2.676, 95% CI [1.358, 5.275]; and *B*=.092, *SE*=.044, OR = 1.096 , 95% CI [1.006, 1.194], *p*=.035; respectively). Sex was not a significant moderator of either of these predictors in this model. MTBI history and anxiety were also significant predictors of cannabis use (*B*=.899, *SE*=.330, OR = 2.457, 95% CI [1.286, 4.693], *p*=.006); and *B*=1.315, *SE*=.469, OR = 3.726, 95% CI [1.487, 9.335], *p*=.005 respectively), but again, sex was not a significant moderator of these predictors. When examining alcohol use, MTBI history but not depression was a significant predictor of alcohol use in university athletes (*B*=1.183, *SE*=.330, OR = 3.265, 95% CI [1.708/, 6.240], *p*=.000); however, sex was not a significant moderator of either of these predictors for alcohol use. Similarly, mTBI history but not anxiety was a significant predictor of alcohol use (*B*=1.224, *SE*=.335, OR = 3.400, 95% CI [1.798, 6.426], *p*=.000); and sex was not a significant moderator of either of these predictors for alcohol use.
Conclusions: In university athletes, mTBI history was associated with greater current alcohol and cannabis use, though sex was not found to moderate this relationship. In addition, greater self-reported depression symptoms and anxiety endorsement was associated with cannabis use but not alcohol use. This study highlights the need for a greater understanding of the associations between substance use, mental health, and mTBI history. It also suggests a need for better screening tools during baseline athlete assessments to help identify early risk factors for athletes who may

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be at risk for potentially hazardous substance use.
Keywords: brain injury**,** substance abuse**,** mood disorders

13 Altered Brain Functional Connectivity in Female Athletes over the Course of a Season of Collision or Contact Sports

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Objective: Athletes who engage in contact and collision sports are exposed to repetitive head impacts (RHIs). These impacts often lack visible signs of injury and/or may result in subthreshold clinical symptoms in comparison with hits resulting in concussion, however, there is growing concern over the potential cumulative effects of RHIs on athletes' physical, cognitive, and emotional health. Several studies have identified changes to resting-state functional connectivity (rsFC) following exposure to RHIs. Despite accounting for almost half of the collegiate athlete population, female athletes have been severely understudied in this literature. This study examined rsFC of brain networks in female varsity athletes over the course of a season.
Participants and Methods: Resting-state functional magnetic resonance imaging (fMRI) scans were collected from 19 female university athletes involved in collision (N = 12) and contact (N = 7) sports at both pre- and post-season. Athletes completed baseline and post-season testing including self-reported psychological measures. RsFC was compared between groups using a group-level independent component analysis (ICA) within the default mode (DMN), frontoparietal (FPN), dorsal attention (DAN), salience (SN), and sensorimotor (SMN) networks to investigate differences in rsFC over the course of a season and between contact and collision sport athletes.
Results: Contact athletes reported significantly higher baseline total SCAT symptom scores (M=4.71, SD=3.4) compared to collision athletes (M=1.33, SD=3.11). There were no significant differences in scores between pre-season and post-season scores (ps > .05). Decreased rsFC was observed over the course of the season between the DMN and the superior parietal lobule (pFDR = .001), the supramarginal gyri (left, pFDR = .004; right, pFDR = .043), the left superior frontal gyrus (pFDR =.006) and the superior parietal lobule (pFDR = .043), and increased rsFC with the DMN was observed with a cluster in the right frontal pole (pFDR = .043), driven by differences in the contact group. There was also a main effect of group on the rsFC of the DAN, which had increased rsFC bilaterally with the superior frontal gyrus (pFDR = .035) and decreased rsFC with the right supramarginal gyrus (pFDR = .037). Follow-up analyses indicated that these effects were driven by differences between contact and collision groups at pre-season.
Conclusions: Observed changes in the DMN in particular following a season of play emphasizes the robust nature of associations between contact exposure and DMN connectivity. Our findings suggested network differences between collision and contact athletes, which may be driven by pre-season differences, potentially as a result of inherent differences in sport requirements and training. Changes were also seen in a pre- vs. post-season analysis in contact athletes, which revealed decreases in rsFC between the DMN and other brain regions at post-season. These findings highlight the complexity of examining changes directly associated with RHIs and emphasize the need for considering multiple factors (e.g., pre-season and sport differences) that might be associated with cognitive and neural changes observed over the course of a season, beyond just the suspected effects of RHIs.
Keywords: brain injury**,** neuroimaging: functional connectivity**,** sports-related neuropsychology

14 Long-term neuroimaging correlates of mild traumatic brain injury and repetitive head injuries: A systematic review

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Objective: To systematically review the literature on the long-term (i.e., >10 years) neuroimaging findings for exposure in adulthood to mild traumatic brain injury (mTBI) and repetitive head impacts (RHIs) using neuroimaging across all available populations.
Participants and Methods: Four electronic databases were searched for articles published from any date up until January 12th of 2021. These databases included MEDLINE, SPORTDiscus, PsycINFO, and EMBASE. Grey literature searches were also conducted using google and ProQuest Dissertations and Theses, as well as snowball searches through PsycINFO. Studies were included if they examined adults with exposure to mTBI and/or RHIs from ten or more years ago in addition to reporting on neuroimaging acquired at least ten years post-injury. Parameters mainly included participants' population, age, years since head injury, race, sex, education level, and any neuroimaging findings. Scores for the level of evidence and risk of bias were calculated independently by two authors. All included articles were original research, published in English.
Results: 5,521 studies were reviewed, of which 34 met inclusion criteria and were included in this study. Most of the included studies reported some positive neuroimaging findings for participants after one or more decade since their mTBI/RHI exposure. This was consistent across populations which included veterans, athletes, and the general population. However, there was variability in findings across brain areas and neuroimaging modalities. There was evidence for altered protein deposition, micro- and macro-structural, functional, neurochemical, and blood flow-related differences in the brain for those with remote mTBI/RHI exposure.
Conclusions: Findings from these studies suggest that remote mTBI/RHI exposure is associated with neuroimaging findings, though consistency of findings was often limited. That is, given the methodological constraints related to relatively small sample sizes and the heterogeneity in injury types/exposure and imaging techniques used, conclusions drawn from this review are limited. Well-designed longitudinal studies with multimodal imaging and comprehensive review of health and demographic information will be required to better understand whether these findings are replicable in terms of any long-term neurological sequalae following remote mTBI/RHI.
Keywords: neuroimaging: structural, neuroimaging: functional, traumatic brain injury

15 No Association Between Age Started and Total Years Played on Neuropsychological Functioning Among Older Retired Professional Football Players

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Objective: The literature remains mixed on whether earlier age of beginning tackle football (ABTF) or greater total years of playing tackle football (TYPF) contribute to worse neuropsychological functioning later-in-life. Despite several ongoing longitudinal studies of National Football League (NFL) retirees, no study has reported on whether head-injury exposure relates to neuropsychological change over time. We evaluated whether younger ABTF and more TYFP was a) negatively associated with neuropsychological performance, and b) related to greater declines over time in a small sample of older retired NFL players.
Participants and Methods: Participants consisted of 19 older (age 54 to 79, Mean=67.1, SD=8.6) NFL retirees that underwent clinical interview, neuroimaging, and comprehensive neurological and neuropsychological evaluation. Fourteen retirees returned for follow-up evaluation 15-51 months later (Mean=23.4, SD=8.8). Eleven retirees were cognitively normal, 4 had mild cognitive impairment, and 4 had a clinical diagnosis of Alzheimer's dementia, but all reported some cognitive decline per self/informant report. Retirees were mostly white (2 of 19 were African-American) and had 15 to 19 years of education (Mean=16.6, SD=1.2). ABTF ranged from 5-14 years-old (Mean=11.0, SD=2.3) and TYFP ranged from 10-26 years (Mean=19.3, SD=4.1). The neuropsychological

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battery consisted of the Trail Making Test (TMT), WAIS-IV Coding (CD) and Digit Span (DS), phonemic verbal fluency (FAS), animal fluency (AF), Boston Naming Test (BNT), Rey-Osterrieth Complex Figure Test (ROCFT), and California Verbal Learning Test-2nd Edition (CVLT-II). Neuropsychological composite scores for the domains of executive functioning (TMT+DS+CD; Mean T=47.0, SD=8.2), language (FAS+AF+BNT; Mean T=48.2, SD=7.9), and episodic memory (CVLT-II total and delayed recall+ROCFT immediate and delayed recall; Mean T=45.5, SD=11.3) were computed to reduce the number of analyses. Mixed-linear models were used to evaluate the association between ABTF/TYFP and neuropsychological composites (main effect), and neuropsychological functioning over time (time x head-injury exposure interaction).
Results: TYFP was not significantly associated with executive functioning (F [1,16.3]=0.508, *p*=.486), executive functioning over time (F [1,7.9=1.997, *p*=.196), language functioning (F [1,15.4]=1.195, *p*=.291), language functioning over time (F [1,9.1]=3.657, *p*=.088), memory functioning (F [1,16.8]=0.161, *p*=.693), or memory functioning over time (F [1,10.0]=4.704, *p*=.055). Similarly, ABTF was not significantly associated with executive functioning (F [1,16.8]=0.145, *p*=.708), executive functioning over time (F [1,8.4=0.959, *p*=.355), language functioning (F [1,13.9]=0.189, *p*=.670), language functioning over time (F [1,8.4]=0.520, *p*=.824), memory functioning (F [1,16.1]=2.958, *p*=.105), or memory functioning over time (F [1,9.8]=0.074, *p*=.791). In a post-hoc analysis, we did not observe significant differences in neuropsychological composite scores between those ABTF <12 and >=12 years old (all *p's* >=0.475) or between those with TYFP <19 or >=19 years played (median split; all *p's* >=0.208).
Conclusions: No significant associations between ABTF, TYFP, and neuropsychological performance were observed in this cohort of older NFL retirees. Despite our small sample, no published studies have evaluated the relationship between head-injury exposure and neuropsychological performance over two time points, and our findings suggest that ABTF and TYFP do not appear to be related to neurocognitive decline later in life. However, longitudinal research is needed with larger samples to improve confidence in these findings.
Keywords: sports-related neuropsychology**,** concussion/ mild traumatic brain injury**,** aging disorders
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16 Multi-Domain Assessment of Concussion Recovery: A Scoping Review

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Objective: This scoping review explores the scholarly literature on multi-domain paradigms used in concussion recovery, with an ultimate goal of informing evidence-based and ecologically valid return-to-play assessment. As such, the current review asks: *What simultaneous, dynamic multi-domain measures are used to assess recovery of children and adults following concussion?*
Participants and Methods: A comprehensive search was conducted across five databases (CINAHL, EMBASE, MEDLINE, PsycInfo, and SPORTDiscus) until September 28, 2021. Records collected were limited to those published in peer-reviewed journals, in English, between 2002 and 2020. Included studies were required to describe the assessment of concussion recovery using paradigms that were dynamic and that spanned multiple domains simultaneously. Reference tracking was completed for included articles, and relevant references were also collected from colleagues with expertise in the field.
Results: Of the 7098 unique articles identified, 64 were included in the analysis. Included articles described 36 unique assessments which were carried out on 1910 concussed participants. These assessments were deconstructed into their constituent parts: 13 physical tasks, 18 cognitive tasks, and one

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socio-emotional task. Different combinations of these “building blocks” formed the basis of the multi-domain assessments. Forty-seven studies implemented level walking with a concurrent cognitive task to construct their multi-domain assessment. The most frequently implemented cognitive tasks were 'Q&A' paradigms, which required participants to respond to a question continuously aloud while completing a physical task.
Conclusions: Among studies a preference emerged for dual-task assessments, specifically combinations of level walking and Q&A tasks. Future research should strive to strike a balance between ecological validity and clinical feasibility in multi-domain assessments, and work to validate these assessments for use in practice.
Keywords: concussion/ mild traumatic brain injury**,** ecological validity**,** sports-related neuropsychology
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17 College Athlete Ceiling and Floor Effects on The Immediate Post-concussion and Cognitive Testing (ImPACT) and Sport Concussion Assessment Tool 5th Edition (SCAT-5)

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Objective: The Immediate Post-concussion and Cognitive Testing (ImPACT) and Sport Concussion Assessment Tool 5th Edition (SCAT-5) are two assessments commonly used in concussion management assessment (Petit, Savage, Bretzin, et al., 2020; Guadet, Konin & Faust, 2020). Currently, research has examined ImPACT ceiling effects in a pediatric population, but research is needed to examine ceiling and floor effects on subtests of both ImPACT and the SCAT-5 in a college athlete population.
Participants and Methods: Division II College Athletes (*n* = 1,212; 36% female) completed their first annual pre-participation baseline assessment. Athletes were administered ImPACT and the SCAT-5 (10-word list) among other measures.
Results: Ceiling effects were determined using the same criteria as Guadet, Konin & Faust (2020). Floor effects were determined by examining the percentage of athletes who scored the minimum score on the measure. On ImPACT, ceiling effects were present for the following subtests (% of sample at ceiling): Word Memory Total Percent Correct (20.4%), Symbol Match Total Correct Hidden (26.6%), Three Letters Total Percent Correct (58%), Design Memory Total Percent Correct (5.1%), and X’s and O’s Total Correct Memory (11.2%).ImPACT Symptom Score was the only measure that demonstrated a floor effect (50%). On the SCAT-5, ceiling effects were noted on Orientation (95%), Concentration (26%), and Balance Errors (no errors present, 15%). Floor effects were present on SCAT-5 Total Symptoms (41%) and Symptom Severity (41%).
Conclusions: Our results reveal that a similar pattern of ceiling effects on ImPACT are present in a college athlete population as a pediatric population from Gaudet, Konin & Faust (2020), but it appears that the proportion of college athletes reaching the ceiling is relatively less prominent within the college athlete sample. Of note, all verbal and visual memory subtests of ImPACT appear subject to ceiling effects, which is important to note as these subtests comprise two of ImPACT’s primary composite scores. Interestingly, the word list on the SCAT-5 was not subject to ceiling effects, perhaps because a 10-word list is used with spontaneous recall rather than recognition. Both ImPACT and the SCAT-5 revealed floor effects for symptom scale measurements.
Keywords: sports-related neuropsychology**,** concussion/ mild traumatic brain injury**,** psychometrics

18 The Neuropsychological Function in Chronic Traumatic Brain Injury Patients With and Without Post-Error Slowing

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Objective: Post-error slowing (PES) is a post-error adjustment, which shows the individual's cognitive control process, including continuous monitoring and adjustment. The impact of traumatic brain injury on frontal lobe vulnerabilities to PES; however, the performance of PES is unknown in those patients. The present study explored the PES in chronic TBI patients and further investigated which neuropsychological functions are related to the PES.
Participants and Methods: Eighty-eight TBI patients were enrolled in the study. Physicians and neuropsychologists retrospectively analyzed medical records. A total of 28 healthy controls were recruited from the community. The PES was examined by the Comprehensive Nonverbal Attention test (CNAT). The PES is defined as the reaction time (RT) of the post-error trial that is longer than the average RT of the correct in CNAT. To calculate a slowing index (S), which is the difference of RT between the post-error and the average correct trials. Neuropsychological assessments included CNAT, Comprehensive Nonverbal Memory test (CNMT), Wisconsin Card Sorting Test (WCST), Tower of Landon (ToL), and Stroop. The assessment was conducted at 19.25 months (SD=4.46) post-injury.
Results: The PES in patients with TBI was significantly weaker than the controls in the dual-task of CNAT. The awareness group, which was defined as the presence of PES in TBI patients, had better performances on CNAT and CNMT.
Conclusions: The findings suggested that as the increasing attention capacity required to complete a complicated attention task, the PES was decreased in TBI patients. Poor attention and memory were detected in those patients without PES. Such findings might provide meaningful information for assessments and intervention.
Keywords: brain injury**,** cognitive functioning**,** computerized neuropsychological testing

19 Difference Between History of Single vs Multiple TBI on Rate of Cognitive Decline in Clinically Normal Older Adults

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Objective: History of traumatic brain injury (TBI) may be a risk factor for cognitive decline and neurodegenerative disease later in life. Having multiple TBIs is thought to increase the likelihood of long-term cognitive deficits compared to single TBI. We evaluated whether clinically normal older adults with a history of multiple (2+) TBIs show a faster rate of cognitive decline compared to those with a single prior TBI.
Participants and Methods: Participants were 144 clinically normal (CDR = 0) older adults (age at baseline: M = 71.1, SD = 7.8) with a history of either single TBI (n = 85) or multiple TBI (n = 59). A comprehensive neuropsychological battery of memory, processing speed, and executive functioning measures were administered longitudinally (number of visits: M

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= 4.9, SD = 2.9). Composite z-scores were derived for each cognitive domain. Linear mixed effects models assessed the TBI history x Age interaction to determine associations with rate of longitudinal cognitive changes.
Results: At baseline, clinically normal older adults with a history of multiple TBIs did not perform differently than those with a single prior TBI in any cognitive domain (executive functioning, p=0.87; memory, p=0.95; processing speed, p=0.06). However, clinically normal older adults with multiple prior TBIs declined more rapidly over time than those with a single TBI in executive functioning (p=0.01). No significant differences were found in memory (p=0.57) or processing speed (p=0.57) cognitive domains.
Conclusions: History of multiple TBIs may be associated with measurable effects on rates of executive functioning decline even among clinically normal older adults. These findings suggest that brain regions important for executive functioning may be particularly susceptible to the effects of lifelong TBI exposure.
Keywords: traumatic brain injury**,** aging (normal)**,** executive functions
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20 Does Frequency of Baseline Testing Influence Concussion Diagnostic Decision-Making Among College Athletes?

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Objective: Concussion is a growing public health concern given the large number of youth and collegiate athletes participating in collision sports. Sport-related concussions can have an adverse impact on student-athletes' health and academic performance. Athletic programs within academic organizations are motivated to employ the most effective and efficient diagnostic and recovery procedures to minimize the duration and impact of these symptoms on student-athletes' functioning. The present study seeks to further our understanding regarding the value and frequency of conducting baseline assessments when evaluating sport-related concussions.
Participants and Methods: A total of 41 athletes (24 male, 17 female) between the ages of 18-22 were evaluated following a suspected concussive injury between 2015-2018. Post-injury test results were compared to baselines that had been collected either within one year or within two years prior, and to normative data, to determine consistency in diagnostic outcomes.
Results: Baseline test/re-test reliability using Pearson's bivariate correlations revealed modest correlations on measures of verbal and visual memory (0.437-0.569) and very strong correlations on measures of reaction time and visual-motor speed (0.811-0.821). Meanwhile, minimal if any differences in clinical decision-making regarding diagnostic outcome were observed when comparing post-injury test results to different baselines and to normative data. Specifically, only 1 out of 41 (2%) concussion diagnoses changed when using a baseline from within one year versus a baseline from within two years, and no concussion diagnoses changed when using a baseline from within one year versus normative data.
Conclusions: These findings suggest that repeating baseline testing on a yearly basis may not improve diagnostic accuracy, and in many cases, normative data may be adequate. Although some degree of fluctuation in repeated baseline performances was observed, concussion diagnoses often appeared to remain stable due to reported symptoms. Further research should explore the potential benefit of baseline testing in making a return-to-play decision, and among broader athletic populations.
Keywords: concussion/ mild traumatic brain injury

21 Postconcussive Cognitive Complaints is Associated with Anterior Cerebral Blood Flow Changes in Veterans with Mild TBI Histories

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Objective: The neurophysiological changes underlying persisting cognitive sequelae in individuals who sustained a mild traumatic brain injury (mTBI) are not well understood. Alterations of cerebral blood flow (CBF) represent one potential factor; however, previous research has not consistently shown resting CBF changes in mTBI samples, and the cumulative impact of multiple injuries on the relationship between CBF and cognition is unknown. We therefore examined CBF in frontal and temporal regions of interest (ROIs) in mTBI-predilection sites and their associations with cognitive postconcussive symptoms (PCS) in Veterans with mTBI histories.
Participants and Methods: 51 Veterans with mTBI underwent clinical interview, neuroimaging, and neuropsychiatric testing, including the Neurobehavioral Symptom Inventory (NSI) and Posttraumatic Stress Disorder (PTSD) Checklist. Resting CBF was measured using multi-phase pseudo-continuous arterial spin labeling (MPPCASL). T1-weighted structural and MPPCASL scans were co-registered and CBF estimates were extracted from 6 lateralized parcellations of mTBI-vulnerable frontal (orbital frontal cortex, superior and inferior frontal gyrus) and temporal (superior, middle, and inferior temporal gyrus) ROIs defined via FreeSurfer. Collapsed across the TBI sample, hierarchical linear regressions examined the relationship between NSI cognitive subscale scores and regional CBF, adjusting for age, sex, and PTSD symptom severity. To assess the effect of multiple injuries, the sample was divided into two groups: those who had sustained 1-2 lifetime mTBIs (*n*=28, mTBI$^{1-2}$) and those who had sustained 3 or more lifetime mTBIs (*n*=23, mTBI^{3+}).
Results: Across the mTBI sample, hierarchical regression analyses showed that elevated cognitive complaints were associated with higher CBF in the bilateral middle frontal gyrus (left: β =0.737, *p*=0.010; right: β=0.817, *p*=0.001), and bilateral superior frontal gyrus (left: β =0.936, *p*=0.035; right: β=0.560, *p*=0.023). However, there were no significant associations between cognitive subscale scores and lateralized CBF estimates in the orbitofrontal cortex or temporal ROIs (*ps*>0.182). These results were driven by those with fewer TBIs. Specifically, within the mTBI$^{1-2}$ Veteran group, higher cognitive subscale scores were associated with higher CBF of the bilateral middle frontal gyrus (left: β =1.058, *p*=0.018; right: β=1.057, *p*=0.005), and bilateral superior frontal gyrus (left: β =0.685, *p*=0.021; right: β=0.776, *p*=0.017). There were no significant associations between cognitive symptoms and CBF estimates of frontal (*ps*>0.295) or temporal (*ps*>0.483) ROIs in the mTBI^{3+} Veteran group. When comparing the TBI subgroups, there were no differences in age (*p*=0.488), NSI cognitive subscale score (*p*=0.111), resting frontal ROIs CBF (*ps*>0.117), resting temporal ROIs CBF (*ps*>0.103), time since injury (*p*=0.203), or LOC (*p*=0.658); however, mTBI^{3+} Veterans reported more PTSD symptoms (*p*=0.022).
Conclusions: In our mTBI sample, elevated cognitive complaints were associated with a hyperemic CBF response in specific frontal ROIs and this association was restricted to those reporting fewer mTBIs (1-2 mTBI events). Results suggest a possible compensatory process for those with fewer mTBIs whereby perceived cognitive loss is offset by greater recruitment of CBF in anterior brain regions commonly involved in complex high-order functions (e.g., planning, problem solving). Future work will further clarify patterns of regional CBF changes and objective neurocognitive performance in those with head injury histories.
Keywords: cerebral blood flow**,** traumatic brain injury
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22 PTSD Symptom Severity and Decreased Right Hemispheric Fronto-

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Limbic White Matter Integrity Predict Greater Migraine-Related Pain and Disability in Combat-Exposed Veterans With and Without Mild TBI

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Objective: Migraine headaches are often reported as a source of pain and disability for veterans following combat deployment. Veterans are routinely exposed to potentially harmful and trauma-inducing situations that increase risk for mild traumatic brain injury (mTBI) and Post-Traumatic Stress Disorder (PTSD). These conditions are in turn associated with a greater likelihood of developing migraines and other headache disorders. mTBI and PTSD have also been linked to decreased white matter integrity of the uncinate fasciculus (UNC), a key structure in the limbic system. The right hemisphere is critical in the regulation of negative emotions and white matter integrity differences in the right hemisphere have been previously reported in patients with migraine. The current study examined the relationship between PTSD symptom severity, lateralized uncinate fasciculus integrity, and headache-related pain and disability.
Participants and Methods: Participants include 74 combat veterans between the ages of 23-45 (90.5% male) with and without PTSD and mTBI. Freesurfer and Tracula were used to establish specific white matter ROI integrity via 3-T MRI. The Migraine Disability Assessment Test (MIDAS) was used to assess pain and disability caused by headaches over the prior three months, and the PTSD Checklist- Military version (PCL-M) was used to assess the severity of symptoms of PTSD. A linear regression was performed with right uncinate fractional anisotropy (derived from DTI) and PCL-M scores as predictors and MIDAS total score as the dependent variable.
Results: Increased PTSD symptom severity and decreased fractional anisotropy in the right uncinate fasciculus were both significantly associated with greater self-reported pain and disability caused by migraines ($p < 0.001$).
Conclusions: Greater PTSD symptom severity and decreased right uncinate fasciculus integrity are associated with greater self-reported pain and disability levels caused by migraine headaches in combat veterans with and without history of TBI. As an important part of the limbic system, the integrity and function of the right uncinate fasciculus could modulate the severity of and debilitation caused by headaches when damaged. It is unclear whether TBI contributed to differences in white matter integrity observed in this cross-sectional study, but if damage to this region modifies the experience of migraines, it may suggest a conduit via which TBI could affect symptoms of associated with PTSD.
Keywords: concussion/ mild traumatic brain injury**,** post-traumatic stress disorder**,** neuroimaging: structural connectivity
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23 The Relationship Between T-Tau and Amyloid Beta in Blood and Subacute Outcome from Mild Traumatic Brain Injury

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Objective: Researchers and clinicians have substantial interest in blood biomarkers of mild traumatic brain injury (MTBI) that may predict recovery following injury. The current study focused on blood-based total tau (t-tau) and amyloid beta (AB40, AB42), assessing their relationship with functional outcome and post-concussion symptoms at one week following MTBI.
Participants and Methods: The study included an initial cohort of 325 participants with suspected MTBI. Participants were excluded for missing biomarker data; blood drawn >24 hours from injury; Glasgow Coma Scale <14; having surgery, another head injury, or dying within a week of injury; reporting pre-injury functional impairment; or having a preexisting diagnosis of dementia or movement disorder. The final sample included 167 participants (*M*=56.9±23.1 years-old, range: 18-100; 49.7% men) who were evaluated at one-week post-injury by phone on the Glasgow Outcome Scale Extended (GOSE), Rivermead Post-Concussion Symptoms Questionnaire (RPQ), and the Modified Rankin Scale (MRS). There were two rankings on the MRS: retrospective pre-injury and current post-injury, with a difference score calculated for analysis (ΔMRS). A GOSE ≤6 was considered poor outcome (upper-moderate disability or worse) and a GOSE ≥7 was considered good outcome (lower-good recovery or better). Participants with good (*n*=89) and poor outcome (*n*=46) were compared in blood levels of t-tau, AB40, AB42, and AB42/AB40 ratio (measured by Single molecule array assays) using non-parametric analyses of covariance, controlling for age and gender. Follow-up analyses stratified participants by findings on computed tomography (CT) at the emergency department (complicated MTBI, *n*=17; confirmed uncomplicated MTBI, *n*=92; and no head CT, *n*=58).
Results: In the full sample, the biomarkers did not correlate with RPQ or ΔMRS. The GOSE correlated with AB40 (*rho*=.30, *p*<.01) and AB42 (*rho*=.27, *p*<.01), but not AB42/40. Age was significantly associated with AB40 (*rho*=.51, *p*<.01), AB42 (*rho*=.25, *p*<.01), and AB42/40 (*rho*=-.39, *p*<.05), but not t-tau. Women had lower GOSE scores (*U*=3542.5, *p*=.007, *r*=.22), greater change in MRS scores (*U*=2,272, *p*=.017, *r*=.19), and higher RPQ scores (*U*=1,335.5, *p*<.001, *r*=.33) than men. Controlling for age and gender, there were no significant differences between participants with good and poor outcomes in levels of t-tau (*F*=1.46, *p*=.229, η^2=.01), AB40 (*F*=0.82, *p*=.367, η^2=.01), AB42 (*F*=3.19, *p*=.076, η^2=.02), or AB42/AB40 (*F*=2.31, *p*=.131, η^2=.02) in blood. When participants were stratified by CT findings, there were similarly no differences between participants with good and poor outcomes in biomarker levels. The abnormal head CT group analysis was underpowered and group differences were non-significant, but there was a medium effect size difference for t-tau (*F*=1.31, *p*=.271, η^2=.08) and a medium-to-large effect size difference for AB42 (*F*=2.04, *p*=.174, η^2=.12), with participants with poor outcome having higher levels of each biomarker.
Conclusions: The current study findings indicate no relationship between t-tau, AB40, AB42, and AB42/AB40 and one-week outcome following MTBI after controlling for age and gender. There were medium-to-large effect size differences in tau and AB42 among participants with complicated MTBI, with higher biomarker levels associated with worse outcome. Future research should explore the prognostic value of t-tau and AB42 among larger samples with complicated MTBI.
Keywords: traumatic brain injury**,** aging disorders**,** apolipoprotein E
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24 Sports-Related Concussion Results in Brain Network Changes in Collegiate Athletes

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Objective: Concussions have been associated with alterations in functional connectivity, particularly in the default mode network (DMN), as well as changes in neuronal integrity and psychiatric health. Previous research suggests that functional connectivity of the DMN changes throughout the course of recovery, and may not return to baseline, even in those who show clinical improvements. Graph theory measures represent one approach to examining network changes following brain injury. We explored changes in betweenness centrality – the frequency with which a node is included in the shortest path between two other nodes – after sports-related concussion. A decrease in a network's betweenness centrality after concussion would suggest that the efficiency of a network has decreased and may reflect deficits integrating information from other networks. We evaluated changes in betweenness centrality after injury and again after clinical recovery and tested the extent to which those changes were related to post-injury symptom severity.
Participants and Methods: Resting state functional magnetic resonance imaging data were obtained for football players (n=38; M age = 20.0, SD age= 1.79) at three time-points: baseline, post-injury (~48 hours after concussion), and at recovery (i.e., cleared for return to contact practice but prior to resuming). Functional connectivity matrices were constructed using 264 brain regions (Power et al., 2011). Baseline to post-injury, post-injury to recovery, and baseline to recovery comparisons were performed for the network mean betweenness centrality for each subject. Multiple comparison corrections were performed using a false discovery rate ($p < 0.05$). We calculated the change in betweenness centrality from baseline to post-injury and correlated the difference score (Spearman's rho) with post-injury symptom severity measured by the Post-Concussion Symptom Scale.
Results: There were significant differences in betweenness centrality from baseline to post-injury in multiple networks. The mean betweenness centrality increased in the DMN, somatomotor, and visual networks, but decreased in the cingulo-opercular, dorsal attention and ventral attention networks. However, none of these changes were significantly related to post-injury symptom severity in a subset of participants. Comparisons from post-injury to recovery revealed significant increases in betweenness centrality in the auditory and somatomotor networks, but no changes were observed in the DMN. Baseline to recovery comparisons revealed significant betweenness centrality increases in the DMN, auditory, and fronto-parietal networks, whereas the somatomotor network showed a significant decrease.
Conclusions: These results suggest that there are functional brain network changes following sports-related concussion, and throughout recovery. Specifically, betweenn ess centrality increased in DMN post-injury, and did not return to baseline at the time of recovery, suggesting DMN topology may be disrupted even beyond clinical recovery. Other brain networks show varied responses to injury. It is possible that the betweenness centrality decrease in some networks networks is being compensated for by betweenness centrality increases in the DMN and other networks. Future directions include continued data collection and examining additional clinical measures that may be more sensitive to injury changes, and how they are related to the course of recovery.
Keywords: concussion/ mild traumatic brain injury**,** neuroimaging: functional connectivity

25 Apolipoprotein E (APOE) ε4 Genotype Impacts Prospective Memory Performance in Veterans with Histories of Mild Traumatic Brain Injury

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Objective: Identification of factors affecting cognitive outcomes in mild traumatic brain injury (mTBI) remains a crucial area of study. Recent findings indicate that the apolipoprotein E (APOE) ε4 allele may have an adverse effect on cognitive outcomes in Veterans with mTBI. Additionally, prospective memory (PM), or the fulfillment of delayed intentions, has emerged as an area of interest in mTBI recovery, and studies suggest the presence of the APOE ε4 allele can affect PM performance. In this study, we investigated the effect of the APOE-ε4 allele on PM performance in Veterans with a history of mTBI. We hypothesized that mTBI participants with at least one copy of the APOE-ε4 allele would perform more poorly on tests of PM compared to mTBI participants without the ε4 allele.
Participants and Methods: 59 Veterans (mTBI=33, Military Controls [MCs]=26) underwent APOE genotyping and completed a structured TBI history interview, the Posttraumatic Stress Disorder Checklist-Military Version (PCL-M), and a comprehensive neuropsychological assessment. All participants demonstrated sufficient scores on performance validity tests. The Memory for Intentions Test (MIST) measured PM across multiple subscales including PM tasks with 2 minute and 15 minutes delays, and time- and event-based PM cues, as well as an aggregate PM performance score. APOE-ε4 subgroups (ε4+ vs. ε4−) did not significantly differ in age, education, sex, ethnicity, PCL-M scores or in the reported mechanism and number of TBIs (*p*'s>.05). All TBIs occurred at least 1 year prior to assessment. ANCOVA, adjusting for age and PCL-M scores, tested the effect of ε4 status (ε4+ vs. ε4−) on MIST scores separately within the mTBI and MC groups.
Results: Within the mTBI group, ANCOVA showed a significant effect of ε4 status on the 15-minute delay subscale (p=.031, ηp^2=.15), where ε4+ Veterans (n=11, M=5.4, SD=1.3) performed worse than ε4− Veterans (n=22, M=3.8, SD=1.8). No significant differences were found on other MIST subscales, on recognition testing of the PM tasks, or when the 15 minute delay subscale was separated into time- or event-based subcomponents (*p*'s>.10). Within the MC group, no significant differences were found between ε4+ (n=8, M=6.5, SD=1.5) and ε4− (n=18, M=6.0, SD=1.1) allele groups on any MIST subscale (*p*'s>.05).
Conclusions: Results suggest that the presence of the APOE-ε4 allele may portend worse prospective memory functioning in Veterans with a history of mTBI. Specifically, performance on tasks with delay intervals of 15 minutes appears particularly impacted in APOE-ε4 allele carriers with mTBI, while short-term PM tasks up to 2-minutes appeared robust to APOE-ε4 allele effects, regardless of whether the PM cue was time- or event-based. Of note, ε4 subgroups did not significantly differ in recognition testing scores, indicating that PM failings of the ε4+ subgroup were not due to greater difficulty with task encoding. Further research with larger samples is needed to verify the effect of APOE-ε4 on PM in this Veteran cohort.
Keywords: memory: prospective**,** genetics

26 Disruptions within and between network connectivity involving the default mode network following acute sports-related concussion

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Objective: Disruptions in the brain's functional connectivity have been identified after sports-related concussion (SRC), particularly within the default mode network (DMN). However, inconsistencies in the DMN connectivity have been reported due to various ways of assessing connectivity; for instance, within network connections or connections from the DMN to other brain networks. Alterations in connectivity involving the DMN, specifically neural hubs – brain regions that are especially well-connected to other areas of the brain – may be linked to the diverse symptoms experienced following SRC. The current project systematically examined the influence of SRC on both within and between network functional connectivity of the DMN. We aimed to determine whether functional connectivity involving the most well-connected nodes in the DMN and the connections between those nodes to other networks are disrupted by SRC.
Participants and Methods: We collected resting-state functional magnetic resonance imaging data from male football student-athletes. Athletes (n = 38) were scanned at baseline prior to contact practices and within 48-hours of a diagnosed SRC. Participants ranged in age from 18-24 years (*M* = 20.0, *SD* = 1.79). We constructed functional connectivity matrices using 264 brain regions (Power et al., 2011) and explored changes within the DMN from baseline to post-SRC. Hub regions were identified for each individual participant using a principal component analysis which weighted three different hub measures: participation coefficient, betweenness centrality, and between network global connectivity. For each participant, hubs were defined as nodes with a hub metric in the top 25% of their network. The somatomotor network (SMN) was used as a within participant comparison to ensure changes in the hub and non-hub connectivity was specific to the DMN. Further, we measured SRC-related changes between the DMN hubs and the remaining brain networks.
Results: Functional connectivity within the DMN significantly increased following SRC (p = 0.014). When we assessed specific connections within the DMN, there were significant increases in connections between hubs and non-hubs (p < 0.001) and between non-hubs (p = 0.021), but no significant differences in connections between hubs (p = 0.060). We did not find any significant differences in connections between hubs, between non-hubs, or between hubs and non-hubs in the SMN. Finally, the DMN hubs showed a significant decrease in connectivity to the cingulo-opercular (FDR-corrected p = 0.005) and salience (FDR-corrected p = 0.008) networks following SRC.
Conclusions: Our results suggest connectivity within the DMN increases during the acute phase of SRC, but connectivity decreases between the DMN and the cingulo-opercular and salience networks. This decrease between networks may suggest the DMN is more segregated and therefore, less efficient at regulating the shift between externally focused and introspective states. This change in brain network organization may be related to cognitive symptoms involving task switching or emotion regulation commonly reported after concussion. Future analyses will focus on continued data collection to increase our sample size and incorporation of neurocognitive assessments and self-reported concussion history to account for within and between subject differences to further understand the neurological underpinnings of SRC symptomology.
Keywords: concussion/ mild traumatic brain injury**,** neuroimaging: functional connectivity**,** brain function
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27 Total Learning on the California Verbal Learning Test, Second Edition as a Performance Validity Measure in Retired Football Players

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Objective: The California Verbal Learning Test, Second Edition (CVLT-II) is a verbal memory test. Assessment of performance validity is critical to assure that neuropsychological performances are an accurate reflection of cognitive ability. Performance validity is routinely assessed via free standing tests and embedded indicators gleaned from clinical tests of ability. Performance validity is often questioned in cases of mild traumatic brain injury (mTBI). mTBI can be caused by a number of events, including contact sports like football. This study aimed to evaluate a proposed cut-off score by Shura et al., (2015) for learning trials on the CVLT-II as an embedded performance validity indicator for retired professional football players.
Participants and Methods: The sample consisted 65 retired professional football players who had suffered mTBI and 29 neurologically healthy comparison participants. We further subdivided into speed player groups. Specifically, retired football players were classified as speed players (*n*=25) [persons in positions associated with greater head trauma (e.g., quarterbacks) and non-speed players (*n*=40). Failure rates between groups on the proposed CVLT-II performance validity indicator were examined (Shura et al., 2015) via chi square. ANOVA was used to evaluate group differences on the demographically corrected CVLT-II total learning (trials 1-5) scores. All participants passed performance validity testing.
Results: Speed and non-speed player groups were older and had more education than the healthy comparison group. On the CVLT-II total learning, no differences were found between groups. Chi square showed a trend toward a difference between our groups on the Shura et al., (2015) cut-off score, $X^2 = 5.111$, $p = .078$. While non-significant, the proposed CVLT-II performance validity cut-off score resulted in numerically different failure rates in our sample where 60% of the speed players, 53% of the non-speed players, and 31% of the healthy comparison group indicated performance validity failure.
Conclusions: The proposed CVLT-II cut-off score, related failure rates did not differ between groups. However, this may have been due to insufficient statistical power, the groups displayed different failure rates that varied by 7-29%. Additionally, retired professional football players with a greater likelihood of head trauma (i.e., speed players) exhibited the highest failure rates followed by non-speed players and neurologically healthy participants. Our data suggest that Shura's et al., (2015) cut-off should be evaluated with a larger sample of contact sports athletes to determine if it is appropriate to use with persons with mTBI due to sport-related head injury.
Keywords: validity (performance or symptom)**,** traumatic brain injury**,** memory: normal
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28 An Initial Study of the Examination of Public Knowledge of Symptoms and Sequelae of Traumatic Brain Injury

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Objective: The objective of this study was to better understand public knowledge regarding mild Traumatic Brain Injuries (mTBI). Further, this study sought to understand knowledge within certain populations (i.e., psychology students, athletes).
Participants and Methods: Individuals were recruited through 1) an institutional research recruitment system, 2) Amazon MTurk, 3) listservs and social media. Participants were divided into three main samples: college students, general public, and psychology trainees/clinicians. After completing informed

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consent, individuals provided demographic information as well as TBI history. The Boston Assessment of Traumatic Brain Injury- Lifetime Questionnaire (BAT-LQ) was utilized to assess lifetime history of TBI. Next, participants answered knowledge questions about mTBIs focusing on symptoms, mechanism, and treatment and recovery. There were 620 valid and complete responses to the survey. Knowledge accuracy was calculated as the percent of questions correctly answered by the participants out of the total number of questions.
Results: Overall, the mTBI knowledge accuracy rate for this sample was 69.1%. Accuracy was highest for the symptoms questions (76.7%), and lowest for the treatment and recovery questions (53.9%). The most commonly incorrect question was: “People can forget who they are and not recognize others but be normal in every other way,” with only 17.8% of the sample correctly answering “False.” Factors affecting mTBI knowledge accuracy were also explored through regression analysis. Gender, suspected TBI, and TBI knowledge confidence were all positively related to mTBI accuracy cores, while age, identity as an athlete, and prior mTBI training were all negatively related to mTBI accuracy scores.
Conclusions: These data suggest major deficiencies of mTBI knowledge in the general public, specifically surrounding mTBI treatment and recovery. Additionally, several factors appear to be strongly related to mTBI knowledge accuracy. Further explanations for the results and clinical implications will be discussed.
Keywords: concussion/ mild traumatic brain injury**,** traumatic brain injury

29 "The brain not working as it had in the past": A Qualitative Study of the Cognitive Challenges following Sport-Related Concussion

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Objective: Sport-related concussion (SRC) and its effects on cognitive processes have primarily been investigated using quantitative methods. Most cognitive deficits that an athlete experiences following SRC resolve within 7 – 10 days, although some athletes experience prolonged recovery and long-lasting cognitive challenges. Considering the variation in cognitive difficulties faced by athletes following SRC and the commonly quantitative methods in which they are researched, the purpose of this study was to explore the impacts of SRC on athletes’ cognitive functioning using qualitative interviews.
Participants and Methods: Participants were 19 Canadian varsity soccer, rugby, volleyball, and basketball athletes (*M*age=21.74 years, *SD*=2.13; 37% female). All athletes had experienced at least one SRC within the last 4 years (*M*=1.44 years, *SD*=0.81). Athletes completed individual, one-hour semi-structured interviews via Zoom teleconferencing. Once transcribed, thematic analysis was used to identify patterns across athletes’ interviews with emphasis on their lived experiences of post-concussive cognitive challenges.
Results: Four themes were identified: (1) immediate disorientation, (2) persistent emotional dysregulation, (3) persistent memory impairments, and (4) executive dysfunction. In terms of the initial moments following impact, disorientation was the first cognitive symptom experienced by 84% of athletes. As athletes progressed through recovery, emotional dysregulation was frequently reported as disturbances in mood (e.g., irritability) and behaviour (e.g., impulsivity) lasting up to four years post-concussion. While most athletes reported sub-clinical depressive and anxious symptoms, a few (*n*=3) attributed SRC to their later mood disorder diagnoses. Similar to emotional dysregulation, athletes reported difficulties with both short and long-term memory years after their injuries. Many athletes described these perceived deficits with a sense of permanency, demonstrating that they view their impaired memory as an irreversible outcome of SRC. The final theme, executive dysfunction, manifested primarily as difficulties with higher order processes (e.g., planning and decision-making) which were transient for some athletes (i.e., days to weeks) and persistent for others (i.e., months to years). Lastly, long-term difficulties with speech articulation emerged as a

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unique cognitive symptom for a subgroup (*n*=8) of athletes. On-going, non-premorbid difficulties with word-finding and stuttering were identified within this subgroup.
Conclusions: Our results found that athletes are experiencing cognitive challenges following SRC for far longer durations than the seven-to-ten-day average. While distinct, the four themes are related in that each affected domain shares similar neural correlates (e.g., fronto-limbic and fronto-basal-thalamic pathways) which may explain their coexistence. However, the neurophysiological underpinnings of SRC fail to explain athletes' shared experience of long-lasting deficits. Further, while generally not considered an outcome of SRC, long-term difficulties with speech were reported for a portion (42%) of our sample. Altogether, these findings have important implications for sports neuropsychologists and related professionals assessing and explaining SRC to athletes in the future. Not only do they provide athlete-generated language that can be used to explain complex cognitive deficits, but they provide critical insight into long-term difficulties which may be commonly missed by traditional neuropsychological measures.
Keywords: concussion/ mild traumatic brain injury**,** sports-related neuropsychology**,** cognitive functioning

30 Loss of Consciousness Interacts with Psychiatric Diagnoses to Reduce Objective Memory Performance in Military Veterans with Mild TBI Histories

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Objective: Mild traumatic brain injury (mTBI) is highly prevalent in Veteran populations and often presents with comorbid psychiatric conditions, including posttraumatic stress disorder (PTSD) and major depressive disorder (MDD). Our understanding of this diagnostic cross-section in patients with neurotrauma is incomplete, and further research is needed to disentangle how mTBI injury characteristics or severity (e.g., loss of consciousness [LOC]) interact with psychiatric presentations in the chronic phase of injury (i.e., months to years after injury). Therefore, in this study, we investigated the contribution of injury characteristics (presence of LOC) and current psychiatric diagnoses on memory functioning in a sample of Veterans with a history of mTBI.
Participants and Methods: 74 Veterans (age: M=33.34, SD=7.80; 85% male) with a history of mTBI (months since injury: M=97.85, SD=69.35) completed a structured TBI history interview, the Mini International Neuropsychiatric Interview (MINI), and a neuropsychological battery including the California Verbal Learning Test-II (CVLT-II) with sufficient effort testing scores. 58% reported experiencing LOC during their most significant TBI. Based on the MINI, 46 participants (63%) met diagnostic criteria for PTSD and 33 (45%) met criteria for MDD. ANOVAs were conducted to investigate the interaction of psychiatric diagnosis (separate models for PTSD and MDD) and LOC status on select CVLT-II measures (Trials 1-5 Learning and Long Delay Free Recall).
Results: ANOVA revealed no main effects of psychiatric diagnostic status **(**MDD *p*'s>0.756; PTSD *p*'s>0.490) or LOC status (*p's*>0.537) on CVLT-II scores. However, significant interactions between LOC status and psychiatric diagnoses were observed. Specifically, there was a LOC x MDD interaction on the CVLT-II Learning ($p<0.001$) and Long Delay Free Recall ($p=0.004$) subscales. There was also a LOC x PTSD diagnosis interaction for the Learning ($p=0.037$) but not the Long Delay Recall subscale ($p=0.247$). Follow-up simple main effects revealed that participants with both a psychiatric diagnosis and LOC performed significantly worse on the Learning subscale (p=0.009) compared to those without a psychiatric diagnosis and LOC (*p*s>.05). LOC status was not associated with the presence of either MDD or PTSD (*p*'s>0.231).
Conclusions: Results suggest that Veterans with both a history of LOC and psychiatric diagnoses in the chronic phase of TBI perform

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worse on a sensitive test of verbal memory, particularly with respect to learning. These findings could be clinically beneficial in the diagnosis and treatment of mTBI and comorbid mental health issues by underscoring the importance of addressing the intersection of physical and emotional trauma, especially in the context of MDD which tends to receive less focus in Veteran TBI samples. Future studies should longitudinally examine links between LOC and psychiatric distress on cognitive outcomes, and leverage brain imaging data to examine neuroanatomical substrates underlying these associations.

Keywords: memory disorders**,** neuropsychiatry**,** concussion/ mild traumatic brain injury

31 Using Heart Rate Variability in the Follow-Up of Concussed College Athletes: Exploring the Effects of Symptoms and Cognitive Functions

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Objective: To explore the use of heart rate variability (HRV) in the follow-up of concussions among college athletes. To provide a foundation for interpreting changes following a concussion by exploring the effects of symptoms and cognitive functions on HRV values at baseline and after a concussion. The influence of sex is also examined.
Participants and Methods: Data was prospectively collected within a pre-existing concussion management program. Baseline assessments included psychological questionnaires, the computerized cognitive evaluation ImPACT, and, for contact sports' athletes, six minutes of HRV recording. When a concussion occurred, the athlete was re-tested within 72 hours. 147 (48 females) athletes aged 17 to 22 years old completed the baseline testing and 30 (8 females) concussion cases were followed until return to play.
Results: At baseline, females displayed higher symptom scores and a higher relative power of the very low-frequency bands (%VLF) ($p < 0.05$) compared to males. For the male group, while in standing position, the low-frequency/high-frequency ratio (LF/HF) and the relative power of LF (%LF) were positively correlated with the ImPACT Impulsivity Score and Visuomotor Score as well as with many concussion-like symptoms such as balance problems, trouble sleeping, drowsiness and visual problems ($p < 0.05$). The relative power of HF (%HF) was negatively correlated with those measures. For girls, the very low-frequency power values (VLF) while breathing at a paced rate was positively correlated with many symptoms such as headaches, nausea and emotional symptoms. VLF was also correlated to the Impulsivity score.
Within the concussed group, there was no significant difference in ImPACT Index Scores after the concussion. There was an increase in some individual symptom scores such as headaches, balance problems, dizziness, drowsiness, and sensitivity to noise ($p < 0.05$). There was also a significant decrease in the Percentage of successive heartbeats intervals that differed by more than 50 ms (PNN50) ($p < 0.05$) while sitting. In post-concussion measures, females displayed lower HRV values than males ($p < 0.05$). However, the evolution of measures from baseline to post-concussion did not differ between the sexes. Pearson correlations were significant between PNN50, root mean square of successive heartbeats interval differences (RMSSD) and standard deviation of normalized time between two heartbeats (SDNN) while sitting and Verbal and Visual Memory Index Scores ($p < 0.05$). Symptoms like dizziness and feeling slowed down showed strong positive correlations with VLF paced. The difference in Visual Memory Scores was positively correlated with changes in LF/HF and %LF and negatively correlated with changes in PNN50, NN50 and %HF while sitting. The change in Visual Memory Score is the ImPACT Index Score correlated with the most changes in symptoms scores.
Conclusions: HRV measures were found to have a significant relationship with concussion-

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like symptoms and cognitive function scores. VLF and LF values were usually associated with more symptoms and worse cognitive functioning. HF was inversely correlated to symptoms. Lower HRV values following a concussion support the idea that higher HRV may reflect better functioning of the autonomic nervous system (ANS), and that the activity of the ANS is disturbed following a concussion.
Keywords: sports-related neuropsychology**,** traumatic brain injury**,** assessment
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32 Intra-individual Variability in Performance Across Neuropsychological Tests Among Military Veterans and Civilians with Chronic Phase Traumatic Brain Injury

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Objective: Dispersion, or intra-individual variability (IIV) has been examined less frequently as an indicator of impairment in the traumatic brain injury (TBI) literature, compared to the aging and cognitive decline literature (e.g., Thaler et al., 2015). Two studies (Hill et al., 2013; Merritt et al., 2018) have investigated IIV in a traumatic brain injury (TBI) population and only a single study (Merritt et al., 2018) has researched IIV in a veteran population. Merritt and colleagues (2018) administered a battery of neuropsychological tests to veterans with and without a history of mild TBI (mTBI). In comparison to the healthy veteran controls, the veterans with TBI had greater levels of IIV. To our knowledge, no study to date has investigated dispersion in both civilian *and* veteran groups with TBI. The current study aimed to replicate and extend the findings of Merritt and colleagues (2018) by investigating IIV in three groups: (1) healthy civilian controls, (2) civilians with chronic phase TBI, and (3) veterans with chronic phase TBI.
Participants and Methods: 62 healthy control participants, 62 civilians with a record of TBI, and 63 military veterans with active-duty related TBI were included in the current study. All participants in the current study completed a single-day, comprehensive neuropsychological battery. Two IIV indices were calculated using 17 norm-referenced variables: an average standard deviation (ASD) score and a maximum discrepancy (MD) score.
Results: One-way ANOVAs found group differences in education and PTSD symptoms. Kruskal-Wallis H tests found group differences in race/ethnicity and employment. ANCOVAs controlling for education, PTSD symptoms, race/ethnicity, and employment revealed significant mean differences on 6 of the 17 individual neurocognitive scores. Contrary to expectations, overall test battery mean ($F(2, 179) = 1.44$, $p = .239$, $\eta p2 = .016$), ASD ($F(2, 179) = .356$, $p = .701$, $\eta p2 = .004$), and MD ($F(2, 179) = .288$, $p = .750$, $\eta p2 = .003$) were not significantly different between groups. ASD and MD were positively correlated with each other ($p<.001$, $r=.910$), overall test battery mean ($p=.013$, $r=.183$), and a measure of premorbid intelligence ($p<.001$, $r=[.038-.288]$). Among participants with a TBI history, ASD and MD were not associated with any TBI characteristics ($ps>.05$).
Conclusions: Overall, the results of the current study are not supportive of prior IIV research with TBI participants (e.g., Hill et al., 2013; Merritt et al., 2018). Given the current study attempted to extend previous findings in a combined civilian and veteran population and included individuals with a history of moderate and severe TBI, IIV may still be a promising measure of health within mild TBI populations.
Keywords: traumatic brain injury
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33 Somatic, Psychiatric, and Cognitive Symptom Markers of Intimate Partner Violence-Related Brain Injury

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Objective: Physical forms of intimate partner violence (IPV) are often inflicted to the head and neck, resulting in increased risk for brain injury (BI). However, IPV-related BIs often remain undetected or are misdiagnosed. This results from diagnostic challenges in differentiating between symptoms that follow BI and those associated with psychiatric and/or behavioral health issues that are also commonly experienced by survivors of IPV. While it is acknowledged that there is substantial overlap between BI and trauma symptoms, relatively little is known as to whether some of these symptoms may stand out as unique markers of IPV-related BI. The purpose of this study is to identify symptoms that are present and particular to IPV-related BI.
Participants and Methods: Female survivors of IPV utilizing services from community agencies in 2 urban, Midwestern cities completed a modified version of the HELPS Brain Injury screening tool. Screens from survivors who reported experiencing a blow to the head or strangulation within the past year were selected for inclusion in the analyses. Determinations about group membership (those with probable IPV-related BI versus no BI) were made based upon positive screening criteria published by the developers of the tool. Modifications to the HELPS tool consisted of including queries about commonly experienced somatic, psychological, cognitive, and functional symptoms following BI, which allowed for the assessment of symptom presence following IPV-related BI. Descriptive statistics were calculated to identify the most frequently experienced symptoms endorsed by each group. Additionally, Pearson's chi-square tests were used to determine which symptoms were related to screening positive for probable IPV-related BI.
Results: Survivors who screened positive for probable IPV-related BI (*n*=50) most frequently reported experiencing anxiety (92% of group), depression (84%), headache, (80%), memory difficulties (78%), and dizziness (72%). Survivors who screened negative for probable IPV-related BI (*n*=23) most commonly reported experiencing depression (83% of the group), anxiety (70%), headache (65%), changes in relationships (65%), and insomnia (61%). Results of the Pearson's chi-square tests showed that endorsing the experience of dizziness ($\chi^2 = 7.20$, $p = 0.007$), numbness of limbs ($\chi^2 = 4.79$, $p = 0.029$), anxiety ($\chi^2 = 6.20$, $p = 0.013$), confusion ($\chi^2 = 6.30$, $p = 0.012$), and difficulty with memory ($\chi^2 = 10.57$, $p = 0.001$) were significantly related to screening positive for probable IPV-related BI.
Conclusions: The results indicate that survivors from both groups shared commonly reported symptoms of anxiety, depression, and headache. However, results from the chi-square tests identified a specific profile of somatic, psychiatric, and cognitive symptoms that when present, increased the likelihood of the presence of a probable IPV-related BI. These findings suggest that this discrete constellation of symptoms may serve as possible markers specific to IPV-related BI. Future research could benefit from the use of more sophisticated factor/cluster analyses to empirically identify other potential latent symptom profiles indicative of IPV-related BI. Nonetheless, findings from the current study provide a preliminary step to informing service providers in making more accurate differential diagnoses and effective personalized treatment plans for survivors of IPV.
Keywords: brain injury**,** traumatic brain injury
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34 Efficacy of Intensive Outpatient Program for Cognitive Impairment in Service Members with a History of Traumatic Brain Injury

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Objective: Detection of cognitive changes presents a challenge for clinicians and researchers working with military services members with a history of mild traumatic brain injury (mTBI). Comprehensive neuropsychological batteries are time consuming and difficult to re-administer. As a result, assessing outcome often rely on self-report questionnaires. Given the co-morbidity between mTBI and psychological disorders in service members, solely relying on self-report measures for detection of cognitive changes can lead to inaccurate interpretation. The Automated Neuropsychological Assessment Metrics (ANAM), a computerized neurocognitive test widely used by the Department of Defense, can potentially be an alternative tool. The purpose of this study was to assess the efficacy of the ANAM for measurement of treatment outcomes in service members with cognitive impairment following mTBI.
Participants and Methods: Participants were recruited from the Intrepid Spirit Center (ISC) at Marine Corps Base Camp Pendleton. A Global Deficit Score (GDS) was calculated to determine cognitive impairment. Participants with a GDS $\geq$ 0.5 were identified as impaired at baseline and selected for this study. Participants consisted of 43 active duty service. Mean age of participants was 33 years (SD=7.6). Years of active duty service was 10.5 years with 2.5 combat deployments, and 2.7 lifetime concussions. 38.9% of participants experienced 5 or more blasts within close proximity (within 50 yards). Patients completed the ANAM prior to and following treatment. The ANAM assesses the following domains: Reaction time, memory, delayed memory, processing speed, working memory, and visuospatial memory. Improvement in GDS was defined as > 0.57 from baseline, which was the median split for all patients. All participants performed within the normal range on the effort index of the ANAM.
Results: 24 patients were classified as "improved" and 19 were classified as "no change." Those who demonstrated improvement, all cognitive measures significantly improved with notably large effect sizes (Reaction Time 1 p <0.0001, d = 1.14; processing speed p =0.0003, d =0.97; Learning p <0.0001, d = 1.40; Delayed Memory p =0.0042, d =0.78; spatial memory p=0.0038, d =0.70; Working Memory p =0.0015, d =0.79; Reaction Time 2 p =0.0119, d =0.64). Overall cognitive improvement effect size was substantially large (GDS d= 1.39). Group comparisons between those who demonstrated improvement verse those who did not show improvement revealed no differences in demographic factors, no significant difference for number of combat deployments, years of active duty service, and total number of concussions. However, those who did not improve were 6.7 times more likely to have reported experiencing $\geq$ 5 close proximity blast exposures (p=0.0085).
Conclusions: We were able to demonstrate the utility of the ANAM as a measure sensitive to cognitive rehabilitation in mTBI. Some patients had notably larger improvement in overall performance as well as performance on individual cognitive measures. Those individuals who benefited less from treatment had a substantially higher rate of lifetime close proximity blast exposures, which may suggest diminished neuro-resiliency.
Keywords: traumatic brain injury**,** assessment**,** cognitive functioning

35 Multi-Disciplinary Approach to Performance and Symptom Validity in Pediatric Patients with Persistent Post-Concussion Symptoms

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Objective: Assessment of validity is the standard of care in neuropsychological evaluation, but there is very limited guidance regarding how to assess validity across aspects of multi-disciplinary concussion care, including the physical therapy (PT) evaluation. PT is often used in evaluation and treatment for vestibular dysfunction, dizziness, balance problems, and neck/upper back pain in individuals with concussion. In the current study, we sought to identify whether there are specific aspects of a PT evaluation that may be potential indicators of

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symptom and/or performance validity in a multi-disciplinary clinic for pediatric patients with persistent post-concussion symptoms (PPCS).
Participants and Methods: Retrospective chart review was completed for 76 patients (M age = 14.9, SD = 2.3; 62% female) who presented to a multi-disciplinary clinic that includes providers in Neuropsychology, Neurology, and Physical Therapy between August 2019 and January 2021. Patients were classified into a "non-credible" validity group if they had doubtful validity on the Medical Symptom Validity Test (N = 14), a neurological exam that was determined to be functional (N = 18), or doubtful validity on both (N = 8). 32% of patients in this sample were classified as non-credible. Patients in the non-credible group were significantly younger (M = 14) than patients in the credible group (M = 15.29), and groups did not differ based on sex or race. Groups were compared with independent sample t-tests on several PT variables, including the Functional Gait Assessment (FGA), Activities-Specific Balance Confidence (ABC) scale, Dynamic Visual Acuity (DVA), convergence/divergence, and gait speed. Sensitivity and specificity for identifying "non-credible" group membership were also calculated for PT variables that showed group differences.
Results: Patients in the non-credible group had significantly more impaired postural stability on the FGA (t = -3.487, p < .01) and reported significantly less balance confidence on the ABC scale (t = -3.845, p < .01). Patients did not significantly differ in DVA, convergence/divergence, or gait speed. The area under the curves (AUC) were .758 for the FGA and .784 for the ABC scale. A cut-off score of 25.5 on the FGA (scores range from 0-30, with higher scores indicating better balance) resulted in 61% sensitivity and 81% specificity. A cut-off score of 73.2% on the ABC (scores range from 0-100%, with higher scores indicating more confidence) resulted in 63% sensitivity and 82% specificity.
Conclusions: Aspects of a PT evaluation may be helpful to consider as indicators of validity in multi-disciplinary assessment of PPCS. Current results suggest that the FGA and ABC self-report scale should be further investigated (e.g., using simulation methods) to determine if these measures can be regularly used to differentiate valid and invalid symptom presentations. This study fills a gap in the field because there is no existing research investigating aspects of validity within PT evaluations for pediatric patients with concussion. Furthermore, though several organizations advocate for assessment of validity, this study is the first to target youth with PPCS from a multi-disciplinary approach.
Keywords: concussion/ mild traumatic brain injury**,** validity (performance or symptom)**,** pediatric neuropsychology
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36 Pre-Injury Sleep as a Moderator of Post-Acute Cognitive Functioning and Post-Concussive Symptoms in Children and Adolescents with Mild Traumatic Brain Injury.

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Objective: Sleep disturbance is a common and significantly impairing post-concussive symptom. Although past studies have suggested that sleep disturbance following mild traumatic brain injury (mTBI) in children is associated with poorer

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recovery, few studies have investigated pre-injury sleep as a predictor of post-injury outcomes. This study sought to investigate the role of pre-injury sleep disturbance as a possible moderator of cognition and symptoms post-acutely in school-aged children and adolescents with mTBI and orthopedic injury (OI).
Participants and Methods: Participants were 143 children with mTBI and 74 children with OI aged 8-16 years old recruited from the Emergency Department's of two children's hospitals in Ohio, USA at the time of their injury. Participants returned for additional testing within 2 weeks of injury (*m* = 10.31 days, *SD* = 2.81). Parents rated their children's sleep retrospectively using the Sleep Disorders Inventory for Students. Children completed the NIH Toolbox Cognition Battery. Parents and children completed symptom ratings using the Health and Behavior Inventory. Hierarchical linear regression was conducted to determine whether injury type and pre-injury sleep significantly predicted cognition and symptoms at post-acute assessment
Results: After controlling for those variables, injury group and pre-injury sleep explained a significant amount of variance in fluid cognition (R^2change= .030, *p* = .036), child-rated post-acute cognitive (R^2change = .048, *p* = .005) and somatic symptoms (R^2change = .118, *p* < .001), and parent-rated post-acute cognitive (R^2change = .094, *p* < .001) and somatic symptoms (R^2change = .123, *p* < .001). Injury group and pre-injury sleep did not explain a significant amount of variance in crystalized cognition (R^2change= .003, *p* = .632). The interaction between injury group and pre-injury sleep did not account for significant variance in the outcome variables.
Compared to the OI group, the mTBI group showed significantly lower fluid cognition (β = .167, *p* = .016), and more child-rated cognitive (β = -.220, *p* = .002) and somatic symptoms (β = -.353, *p* < .001), and parent-rated cognitive (β = -.107, *p* = .036) and somatic symptoms (β = -.338, *p* < .001). Injury group did not significantly predict crystalized cognition (β = .011, *p* = .865). Pre-injury sleep disturbance was positively related to parent-rated cognitive symptoms (β = .318, *p* < .001), but did not significantly predict fluid cognition (β = -.053 *p* = .494), crystalized cognition (β = -.065, *p* = .358), child-rated cognitive (β = .035 *p* = .652) and somatic symptoms (β =. -085, *p* = .248), or parent-rated somatic symptoms (β = .105, *p* = .126).
Conclusions: Children with mTBI and OI with greater sleep disturbance pre-injury have greater parent-rated cognitive problems at post-acute assessment. mTBI was found to be significantly predictive of lower cognitive performance and more symptom ratings post-acutely. Sleep disturbance did not moderate the effects of mTBI. Together these results suggest that pre-existing sleep difficulties and mTBI are both associated with outcomes post-injury.
Keywords: sleep**,** cognitive functioning**,** concussion/ mild traumatic brain injury
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37 R2Play Development: Fostering User-Driven Technology that Supports Return-to-Play Decision-Making Following Pediatric Concussion

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Objective: Following concussion, traditional return-to-play (RtoP) protocols rely on a battery of single-domain assessments and self-reporting of symptoms to discern whether the injury has resolved. Yet, single-domain assessments may fail to detect symptoms and changes that are elicited by the cognitive, physical, and emotional multi-domain demands when an athlete returns to sport.
Our team at Holland Bloorview sought to bridge this gap by creating the *R2Play* system, which facilitates the implementation of a multi-domain RtoP assessment for youth athletes. Initial objectives for the *R2Play* system were that it should be: (1) sport-like, (2) easy-to-use, (3) fun for young athletes, (4) low-cost, (5) flexible, and (6) clinically informative. Moving forward with

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these aims, we engaged in an iterative design process with key stakeholders including sports coaches and clinicians to develop a testable *R2Play* system prototype.
The assessment was conceptualized as a physical embodiment of an existing neuropsychological assessment: the Trail Making Test. As it stands now, the *R2Play* system is made up of two parts: a clinician tablet, and six tablet "buttons" that display numbers and letters. While completing *R2Play*, athletes run in a zig-zag pattern to complete the trail by pressing buttons in alpha-numeric order (1-A-2-B-3-C). Their performance across a series of trails of increasing difficulty is logged by the system and displayed on the clinician tablet.
Participants and Methods: The *R2Play* system was developed using a user-centered approach that leveraged various methodological and design strategies. An overarching design-thinking framework was adopted, and research activities carried out included: structured brainstorming within our research team, needs-assessment interviews with clinician and youth sports coaches, building a testable prototype, and interface testing through cognitive walkthroughs.
Results: Clinician participants (*n*=6) provided feedback on the *R2Play* concept, which was integrated into the design process and provided future directions for research. Coach participants (*n* = 4) contributed feedback surrounding key elements of sport that the multi-domain assessment should aim to tax. Following refinement based on stakeholder feedback, the *R2Play* system was outlined in detail and a testable prototype was developed. In initial testing with five clinicians, the system's interface was found to have good-to-excellent usability with a score of 81% (SD = 8.02) on the System Usability Scale.
Conclusions: This work contributes a description of the *R2Play* system prototype, which facilitates the implementation of a multi-domain RtoP assessment for young athletes. This type of assessment aligns with best practice guidelines for RtoP, which emphasize the importance of a multi-modal approach to assessment that incorporates both neuropsychological and physiological measures. With further testing and refinement, *R2Play* may provide clinicians with richer clinical data due to the complexity of integrating across domains simultaneously, as opposed to assessing in silos. Lastly, this work suggests the potential of low-cost technologies to assist in clinical assessment in the future, as well as highlighting the benefits of a user-centered approach to design.
Keywords: concussion/ mild traumatic brain injury**,** ecological validity**,** sports-related neuropsychology
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38 Prolonged Symptom Duration in Pediatric mTBI: Exploring Differences in Inflammation and Kynurenine Pathway Metabolites

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Objective: Many youth experience persistent postconcussive symptoms (PCS) following mild traumatic brain injury (mTBI), and there is interest in identifying physiological markers of this prolonged recovery. Blood levels of inflammatory markers and neuroactive metabolites from a well-characterized metabolic pathway known as the kynurenine pathway (KP) have been associated with symptom reporting in a variety of mood disorders, as well as adult mTBI. This project evaluated differences on clinical measures and blood-based biomarkers of inflammation and KP metabolites between adolescents with (PCS+) and without (PCS-) prolonged concussion symptoms following mTBI and healthy controls (HC).
Participants and Methods: Adolescents with mTBI (*n*=63, m_{age}=16.14, days since injury [DSI], m_{DSI} =49.90) and HCs (*n*=41, m_{age}=16.82) completed a clinical battery of symptom and personality measures (Sport Concussion

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Assessment Tool [SCAT-3] Symptom Severity Scale, Brief Symptom Inventory [BSI-18], Minnesota Multiphasic Personality Inventory-2-Restructured Form Somatic Complaints [MMPI-Som]) and provided blood samples for collection of serum. Inflammatory markers of interest included interleukin[IL]-6, IL-1 receptor antagonist[RA], and c-reactive protein [CRP]; KP metabolites included kynurenic acid (KynA), quinolinic acid (QuinA), 3-and hydroxykynurenine (3HK) to generate the neuroprotectice ratios of KynA/QuinA and KynA/3HK. Criteria for PCS+ were based on SCAT-3 symptoms (i.e., more than 2) and the subjective report of the percentage that participants felt they were recovered relative to before their injury (i.e., <90%). Differences between HC, PCS+ (*n*=22) and PCS- (*n*=41) were assessed using general linear models; interactions of sex (31.7% female), prior concussion (42.3%), and injury characteristics (e.g., posttraumatic amnesia and/or loss of consciousness; 19.2%) were assessed in separate models.
Results: PCS+ reported higher SCAT-3 scores and more BSI-18 and MMPI-Som symptoms (*p*s<0.05) compared to PCS- and HC groups. There were no significant differences in IL-6, IL-1RA, or CRP, and no significant interaction of sex, history of concussion, or acute injury characteristics. PCS+ had lower KynA/QuinA (p= 0.02, partial η^2= 0.08) than HC, driven by lower KynA (p= 0.01, partial η^2 = 0.08). Female participants had lower KynA, KynA/QuinA, and KynA/3HK (*ps*<0.01) than males, but no significant group-by-sex interactions were found. The effects of prior history and injury characteristics on KP metabolites were not significant.
Conclusions: To our knowledge, this is the first investigation of neuroactive KP metabolites in adolescents with and without PCS following mTBI. We observed no differences in peripheral inflammatory markers at the studied time point, consistent with previous reports in athletes that the effects of mTBI on the investigated markers are restricted to the acute phase. In contrast, adolescents with prolonged symptoms did have lower KynA/QuinA than healthy controls, driven by lower KynA, an antagonist of ionotropic glutamatergic receptors that is generally considered to be neuroprotective. Finally, we also observed significant differences in KP metabolites between male and female participants, again driven by decreased KynA in female participants, consistent with our prior work in adults. These results highlight a potential role of neuroactive KP metabolites in prolonged symptoms following adolescent mTBI that should be further explored.
Keywords: concussion/ mild traumatic brain injury**,** neurophysiology
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39 Psychometric Support for the Acute Concussion Evaluation in an Emergency Department Setting

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Objective: The Acute Concussion Evaluation (ACE) was developed to assist standardized diagnosis of mTBI in healthcare settings. Initial psychometrics were performed on the ACE symptom scale in a post-acute outpatient setting (Gioia et al, 2008). The ACE Symptom scale is frequently used at the initial point of contact with healthcare providers. The purpose of this study was to examine the measure's psychometrics in the early acute phase.
Participants and Methods: The current data is from the Predicting and Preventing Post-concussive Problems in Pediatrics (5P) study, with data from nine pediatric emergency departments within the Pediatric Emergency Research Canada (PERC) network (Zemek et al., 2016). Participants were parents of 2895 children and adolescents with suspected mTBI presenting to the ED completing the ACE via tablets or interview. Pre- and post-injury symptom ratings were collected to calculate the Retrospective-Adjusted Post-Injury Difference (RAPID) scores. Median interval between the

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injury and completion of the ACE was 2.9 hours compared to 6 days in the original 2008 sample. The age range of the patients was 5-17.99 years (mean age=11.65, SD=3.35); sex distribution was 60.7% male.
Results: Symptom frequency and severity revealed greater physical symptoms endorsed acutely compared to the post-acute sample. Gender differences in symptom severity were smaller in the acute sample (d=0.16) relative to the post-acute sample (d=0.45). Age had an overall significant though small effect on the Total symptom score (η2 = 0.012) with significantly higher physical symptoms in the 13-17 year old children relative to the 5-7 year old age group (p<0.001, d=0.54). Reported loss of consciousness (p<0.001, d=0.27) and retrograde (p<0.001, d=0.36) and anterograde amnesia (p<0.001, d=0.44) were associated with higher Total symptoms. Internal consistency reliability (Cronbach's α=0.84) was comparable to that reported in the 2008 post-acute sample (Cronbach's α=0.82). Concurrent examination of parent and child ED reports produced significant correlations ranging from 0.27-0.60 in the 8-12 year old group, and 0.45-0.71 in the 13-17 year old group. Discriminant relationships of the ACE Total RAPID score with pre- and post-ratings exhibited very low correlations with pre-injury ratings (r=0.060, p=0.001), relative to the post-injury ACE total score (r=0.935, p<0.001). Exploratory factor analysis examined the scale structure, producing a six factor model as most representative of the ACE Symptom scale, compared to the four factor model in the post-acute sample. The physical symptom factor separated into three factors, comprised of sensitivity (i.e., light and noise), vestibular, and headache items.
Conclusions: Our results provide support for the reliability and validity of the ACE in an acute setting. Multiple consistent psychometric findings were found between the acute and post-acute samples, with common cognitive, emotional, and sleep factors. In contrast, physical symptoms differed in scale structure and frequency. The ACE symptom Total scale demonstrated comparable appropriate internal consistency and differentiation from pre-injury status in favor of post-injury. This study demonstrates evidence of appropriate psychometric properties of the ACE Symptom scale in an acute setting.
Keywords: concussion/ mild traumatic brain injury**,** psychometrics

40 Clinical Variables and Neuropsychological Performance in Pediatric Concussion Recovery

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Objective: Many studies have sought to understand demographic and clinical variables that influence pediatric concussion recovery within weeks to months after injury. However, a unique subset of children continues to report cognitive and functional challenges far beyond the expected recovery time following a concussion, and this group is less understood. The current study aimed to examine clinical variables and neuropsychological performance in a subset of children and adolescents treated for concussion within a multidisciplinary specialty concussion care program.
Participants and Methods: Clinical and neuropsychological data were obtained within neuropsychology clinic visits within the Minds Matter Concussion Program at the Children's Hospital of Philadelphia (CHOP). Data from 250 children (Age range 6-22 years, Mage = 15.1 years, 62% female) seen by the program neuropsychologist within a 32-month timeframe were analyzed in a retrospective study.
Results: Of the 3,059 patients treated for concussion within the same 32-month timeframe in the Minds Matter Concussion Program at CHOP (Mage = 14.1 years, 57% female), 8% were referred for neuropsychological evaluation due to cognitive and/or functional concerns (N = 250). Average time from injury to referral to neuropsychology was 241 days (min = 2, max = 2,396), and average time from referral to the initial neuropsychology visit was 63 days (min = 2, max = 448). At the time of their initial neuropsychology visit, 51% of the patients reported pre-injury anxiety (n = 125), 30%

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reported pre-injury mood concerns (n = 73), 45% reported pre-injury attention concerns (n = 112), 45% had participated in behavioral health treatment (n = 112), and 14% had a pre-injury ADHD diagnosis (n = 35).
Approximately half of the patients participated in a consultation visit only (n = 117), while 133 patients participated in at least one neuropsychological testing visit. Of those who passed effort testing (n = 124), performance on neuropsychological screening measures were well within age expectations: Grooved Pegboard dominant hand (M_{SS} = 94.87, SD = 16.68), KTEA-3 Reading Fluency (M_{SS} = 102.53, SD = 12.30), KTEA-3 Math Fluency (M_{SS} = 97.78, SD = 12.55), WISC-V/WAIS-IV Digit Span Total (M_{ScS} = 10.06, SD = 2.32), D-KEFS Trail Making Number-Letter Switching (M_{ScS} = 9.38 SD = 2.48), D-KEFS Letter Fluency (M_{ScS} = 10.36, SD = 2.84), and D-KEFS Category Fluency (M_{ScS} =12.42, SD = 3.27).
Throughout the course of neuropsychological consultation and evaluation, 79% of patients were referred for behavioral health treatment (n =198). At concussion resolution after neuropsychological testing, 15% (n = 19) were given a new diagnosis of ADHD.
Conclusions: A unique subgroup of pediatric concussion patients continues to report cognitive and functional challenges months and years after injury. The present study revealed that a large percentage of these patients have pre-injury anxiety, mood, and attention concerns in the setting of intact neuropsychological functioning. Pediatric patients experiencing prolonged concussion recovery require unique interventions to address pre-injury factors. Neuropsychologists are uniquely positioned to evaluate these patients and facilitate resolution of symptoms by providing consultation, psychoeducation, and diagnostic clarity as models of intervention, in addition to screening cognitive functioning.
Keywords: concussion/ mild traumatic brain injury**,** pediatric neuropsychology

41 Changes in Cognitive Networks as a Result of Sport-Related Concussion

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Objective: Given the high prevalence of concussion in sports, assessment of cognition has become a standard part of athletics at the secondary, post-secondary, and professional levels. Assessment results are used to judge the severity of concussion and inform return to play decisions. Baseline and post-concussion cognitive performance is compared, with declines in performance providing evidence for concussive injury. However, recent research suggests that changes in the associations between test scores may provide important and unique information above and beyond what can be identified in the current protocols. Similar to studies examining the topology of concussion symptoms, a network framework may help characterize post-concussive cognitive changes and account for heterogeneity that is commonly seen following concussive injury. Longitudinally examining the structure and interconnectedness of cognitive abilities in athletes with sport-related concussion (SRC) will provide unique insights into this complex injury.
Participants and Methods: Participants were selected from a larger longitudinal database of high school athletes who were administered ImPACT between 2008 and 2020. The present sample (*n* = 1,553) consisted of athletes who had three assessment time points: a baseline assessment, an acute assessment (within 72 hours of suspected SRC), and a recovery assessment (final assessment before they returned to play). Cognitive variables were transformed prior to network estimation to address non-normality. The Gaussian graphical model was used to estimate the regularized partial correlation networks for each time point, and networks were regularized using the recommended GLASSO algorithm. In this network model, edges represent partial correlations between nodes (cognitive variables) after adjusting for the influence of all other nodes in the network. Centrality indices were calculated to determine relative importance of

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each cognitive variable in each network. Network Comparison Tests were conducted to examine differences in network structure, connectedness, and centrality over time. Network accuracy was examined with methods recommended by Epskamp et al. (2018).
Results: Edge weights, node strength, and expected influence were stable and interpretable for all three networks. Visual memory and processing speed nodes were highly central and influential within each network. Network connectivity was significantly higher in both the acute and recovery networks compared to the baseline network. Connectivity decreased slightly from acute to recovery, but the difference was not significant. Additionally, network structure changed significantly from baseline to recovery. Visual memory became more central and influential over time, and impulsivity became more central from acute to recovery.
Conclusions: Cognitive networks become more densely connected after SRC and remain densely connected at the recovery time point. This parallels findings from neuroimaging: functional networks become hyperconnected post-SRC, possibly reflecting recruitment of additional resources to enable communication and compensate for network disruption. Similarly, increased connectivity in cognitive networks could reflect increased effort to complete cognitive tasks. Given that visual memory and impulsivity played an increasingly central role in networks over time, it may be helpful to target these processes during treatment. Future research should examine whether certain pre-injury characteristics (e.g., neurodevelopmental history) moderate longitudinal changes in cognitive networks.
Keywords: concussion/ mild traumatic brain injury**,** computerized neuropsychological testing**,** cognitive functioning
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42 The Role of Suspect Performance Validity in Evaluation of Pediatric Concussion

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Objective: It is challenging to understand the degree to which suspect performance validity impacts interpretation of neuropsychological test performance, symptom rating, and emotional functioning in the context of mild traumatic brain injury (mTBI). While this issue has been examined in adult samples, relatively few studies have investigated pediatric mTBI samples. This research will investigate differences in neuropsychological performance and symptom rating between groups of pediatric mTBI patients before and after excluding patients who exhibited suspect performance validity.
Participants and Methods: Participants consisted of children and adolescents referred to a pediatric concussion clinic [n = 74, m_{age} = 14.22 (2.08), 56.8% female]. All participants completed a flexible neuropsychological battery, which included measures of working memory, processing speed, executive functioning, and verbal learning and memory, as well as ratings of concussion symptomatology and emotional functioning. Although specific measures varied as a function of participant age and presenting concerns, data were aggregated into composite scores to reflect theoretically similar measures. Data were considered both before and after excluding individuals who failed at least one embedded or standalone performance validity test (PVT).
Results: Less than 10% of the participants (n = 6) were identified as having suspect performance validity. When considering the full sample, rates of obtaining impaired scores (i.e., T-score < 37) ranged from 3.03% to 13.36% across cognitive domains. Significant, small-to-medium negative correlations were observed between initial concussion symptom rating and performance on measures of trail making, processing speed, working memory, and verbal memory. Additionally, participants who endorsed clinically significant symptoms of anxiety and/or depression (i.e., 23.2% of the sample) performed significantly worse on measures of

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processing speed (η_p^2 = 0.17), verbal fluency (η_p^2 = 0.13), and verbal memory recognition (η_p^2 = 0.10). After excluding participants with suspect performance validity, rates of impaired neuropsychological scores ranged from 0% to 8.2% across domains. Significant correlations were observed between initial concussion symptom rating and performance on only the trail making and working memory measures. The same pattern of between-group differences emerged on measures of processing speed (η_p^2 = 0.11), verbal fluency (η_p^2 = 0.12), and verbal memory recognition (η_p^2 = 0.08) when considering significant concerns for emotional functioning.
Conclusions: Despite the relatively small percentage of participants identified as putting forth suboptimal performance validity, excluding their data meaningfully impacted interpretation of broad neuropsychological findings and the relationship between neuropsychological data and symptom report. As such, the current study suggest that assessment of performance validity should be a routine component of pediatric mTBI research and clinical management.
Keywords: concussion/ mild traumatic brain injury**,** child brain injury

43 Response to Injury Following Adolescent Concussion: An Orthopedic Injury Control Design

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Objective: Concussion research has utilized orthopedic injury (OI) comparison groups to examine outcomes specific to concussion versus physical injury in general, due to the suggestion that preexisting, comorbid, and other injury-related factors influence post-concussion symptom reporting and recovery. The aim of this study was to compare adolescent concussion to orthopedic injury at initial presentation and 3-months post-injury to examine whether self-reported concussion symptomatology and recovery are unique to brain injury or more related to response to injury in general.
Participants and Methods: Participants age 12-18 who sustained a concussion (n = 50) were matched by sex, age, and days since injury to an OI group (n = 50). ANCOVAs were used to compare physical, cognitive, emotional, and sleep symptoms, as well as recovery outcomes, such as pain level and functional impairment, between injury groups at initial and 3 months post-injury. Binary logistic regression analyses were used to determine predictors of prolonged recovery separately in concussion and OI groups.
Results: Repeated measure ANCOVAs indicated that concussion participants reported more severe post-injury symptomatology and psychological symptoms within the first week of injury compared to OI subjects, but by 3 months, the groups showed no differences (p > .05). Within the concussion group, females reported more severe symptoms compared to males, but this pattern was not observed in the OI group. For the concussion group, previous concussion was the only significant predictor in our model for prolonged recovery. In the OI group, time since injury and functional impairment rating scores predicted prolonged recovery.
Conclusions: Findings suggest concussion results in a higher severity of symptoms initially, but by 3 months injury groups are comparable on post-injury symptoms. Furthermore, recovery following concussion is influenced by a specific set of concussion-related factors that are not commonly seen in OI despite similar time to recovery.
Keywords: child brain injury**,** concussion/ mild traumatic brain injury**,** pediatric neuropsychology

44 Self-Reported Symptoms are Associated with Neuropsychological Performance During Acute Recovery from mTBI in Adolescents but not School-Aged Children

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Objective: A range of symptoms occur during the acute recovery period of pediatric mild TBI (mTBI) and typically manifest as physical, cognitive, emotional, and sleep changes. Consistent with CDC guidelines, a combination of tools is used to assess recovery including symptom-rating scales (caregiver and child reports) and neuropsychological testing. Little is known about how strongly self-reported symptoms of mTBI are related to neurocognitive functioning during acute recovery from mTBI, particularly in younger children. We explored the relationship between self-reported mTBI symptoms and performance on neuropsychological measures across two different age groups: school-aged children (8-12 years) and adolescents (13-18 years). We hypothesized that greater symptoms would be associated with poorer neuropsychological performance in both age groups.
Participants and Methods: Participants included 152 youth with mTBI evaluated in an interdisciplinary, hospital-based clinic less than 28 days post injury. As part of routine clinical care, self-report versions of the Postconcussion Symptom Inventory (PCSI) and a brief battery of neuropsychological tests assessing cognitive response speed (KTEA-3 Math Fluency, D-KEFS Verbal Fluency), working memory (WISC-V/WAIS-IV Digit Span Backward), verbal memory (WRAML2 Verbal Learning), and fine motor speed (Grooved Pegboard) were administered. The older child self-report form (PCSI-SR8) was administered to 8-12 year olds (n = 47; 70% male) and the adolescent self-report form (PCSI-SR13) was administered to 13-18 year olds (n = 105; 66% male).
Results: Correlations between PCSI scores and performance on neuropsychological tests were independently examined for each age group. In the adolescent group, math fluency was moderately correlated with physical (r = -0.32), cognitive (r = -0.31), and emotional (r = -0.32) symptoms (all p < .01). Delayed verbal recognition memory was moderately correlated with physical (r = -0.44) and fatigue (r = -0.38) symptoms and strongly correlated with cognitive (r = -0.53) symptoms (all $p \leq .01$). In contrast, no significant correlations were observed in school-aged children (all p's > .05). However, there was a moderate relationship between delayed verbal recognition memory and emotional symptoms (r = -0.30, p = .191).
Conclusions: Stronger relationships between self-reported symptom ratings and performance on neuropsychological measures were observed in adolescents compared to school-aged children with mTBI. These findings suggest that caution should be used when relying solely on subjective symptom ratings of school-aged children to determine recovery from mTBI. Objective data obtained from neuropsychological measures may be better indicators of recovery in this age group. These findings also suggest that higher symptoms may impact cognitive functioning differently in adolescences with mTBI. Future research should consider age and/or developmental level to better understand when self-reported symptom ratings are reliable indicators of neuropsychological performance in pediatric mTBI and whether this relationship is mediated by socioemotional or other noninjury factors (e.g., anxiety, depression, education, family systems).
Keywords: concussion/ mild traumatic brain injury**,** self-report**,** neuropsychological assessment

45 Psychometric Examination of a Self-Efficacy Scale for Football Coaches

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Objective: To evaluate the initial psychometrics of a new scale tapping the self-efficacy of coaches for teaching/reinforcing head-protective behaviors in tackling and blocking. Changes behavior associated with the teaching of football must consider the coaches own self-perceptions. Social cognitive theory of Behavior

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Change (Bandura, 1989) would suggest that a player's ability to learn and master head-protective behaviors is fundamentally complex, involving player-personal factors, behavioral learning factors, and coaching-environmental factors. Identifying these factors are important to effectively teach and generalize head-protective behaviors during contact sports.
Participants and Methods: Participants were 68 high school football coaches from 16 states recruited as part of the Hawaiian Helmetless Tackling Technique (HuTT-808) research study. Sample characteristics: age-81% between ages 30-59, 97% varsity coaches (71% head coaches), 81% with 11-30+ years of experience. Racial distribution: 29.4% Asian/Pacific Islander, 63.2% White, 5.9% Black, 1.5% Other. Inventories were completed via a secure online system with questions designed to address coach self-efficacy in teaching tackling and blocking skills and their knowledge, attitudes and motivations related to football. The initial inventory was generated by the research team and subsequently given expert refinement by a separate group of experienced coaches, producing the final 51-item survey. Responses were given on a 0-100 point scale.
Results: The 51 questions were divided into 5 subscales based on the nature of the content and statistical fit. The subscales demonstrated good to excellent internal consistency reliability, defined as: (1) Individual Coaching Ability, 19 items, alpha=0.983 (M=95.9(SD=9.6) higher score reflecting greater confidence in coach performing the skill), (2) Team Tackling/Blocking Ability, 12 items, alpha=0.988 (M=85.3(20.5) higher score reflecting greater confidence in team performing the skill), (3) Negative Pressure on Coaching, 5 items, alpha=0.829 (M=25.8(23.5) (lower score reflecting disagreement with item), (4) Provides Proper Learning Environment, 7 items/ alpha=0.883 (M=91.8(11.2) higher score reflecting positive coaching actions), (5) Promoting Positive Sportsmanship, 8 items, alpha=0.798 (M=95.4(7.7) higher score reflecting positive coaching actions). Coaching perceived individual abilities were consistently very high with a restricted range, which may have affected the test-retest value (r=0.374, n=19) despite a small absolute mean difference between the two ratings (2.5). Similar retest finds were evident with the Team Tackle/Block Ability while the other 3 scores produced more moderate stability coefficients (Subscale 3=0.614, Subscale 4=0.561, Subscale 5=0.710). Guttman split-half reliabilities were also moderate to high for all 5 subscales, ranging from .53 to .99.
Conclusions: A group of highly experienced coaches piloted the Coaching Self-Efficacy scale, reporting very high levels of perceived ability to teach blocking and tackling with relatively lower team ability to perform these skills. The subscales exhibited very high internal consistency in item content by several different metrics as well as adequate stability on the 3 of 5 subscales. This measure demonstrates initial evidence of appropriate reliability of its scores and will be given to a broader range of coaches from early-career high school to youth coaches in a broader effort to understand coaching behavior in the teaching of head-safe methods of contact in football.
Keywords: psychometrics

46 Defining 12-Week Recovery Trajectories Among Children and Adolescents Presenting with Acute Concussion in the Emergency Department

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Objective: To characterize the recovery/ non-recovery trajectory in boys and girls who have sustained a concussion, over a 12-week period, to define the overall pattern of recovery in children and adolescents.
Participants and Methods: Secondary analysis of a subset of children ages 8-18 followed over 12 weeks in the prospective multicenter cohort study (Predicting Persistent Post-concussive Problems in Pediatrics [5P]) within the Pediatric Emergency Research Canada (PERC) network (Zemek et al., 2016). Children and adolescents aged 8-18 (n = 1,551; mean age = 12.78; 62% male) who presented at the Emergency

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Department (ED) within 48 hours of an acute head injury completed the age-specific Post-Concussion Symptom Inventory (PCSI) at six timepoints starting in the ED and again at 1, 2, 4, 8, and 12-weeks post-injury. Total Retrospective-Adjusted Post-Injury Difference (RAPID) scores derived from PCSI pre- and post-injury symptom ratings were tracked and classified as recovered or not recovered at 12 weeks based on a recovery threshold established by the PCSI-2 Reliable Change Index scores (Gioia et al., 2019) for the age groups of 8-12 years and 13-18 years.
Results: Changes in PCSI Total RAPID scores were examined across the six time points for boys and girls separately. Significant recovery curves were found for boys and girls with an overall effect of time ($P<.001$, partial $eta^2 =0.319$), significant but small effect of sex (partial $eta^2 =0.024$) and no effect of age group. Overall, girls' ratings were higher than boys. Examination of symptom change across each of the 6 timepoints indicates consistent positive change with each successive level with the greatest change between the ratings in the ED and first week (partial $eta^2 =0.176$). A very small significant interaction effects between time and sex was found with the partial $eta^2<.005$. Significantly fewer girls were classified as recovered at 12 weeks (78.3%) than boys (91.5%) (Chi-square = 65.3, $p<.001$).
Conclusions: Our findings reveal a strong effect between Time and Total symptom score regardless of an individual's sex or recovery status, and identify a similar general pattern of recovery for both male and female pediatric patients, and across patients who were deemed recovered and those deemed not recovered by the 12-week time point. Despite similar recovery trends, some sex differences were found in that girls ratings were higher than boys and fewer were deemed symptomatically recovered at 12 weeks. These findings serve to better define the trajectory of recovery within children and adolescents who have sustained a concussion, and provide valuable insight for possible use in the treatment of concussion.
Keywords: concussion/ mild traumatic brain injury**,** pediatric neuropsychology**,** child brain injury
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47 Parents' Perceptions and Experience After Their Young Child Sustains Mild Traumatic Brain Injury: A Qualitative Approach

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Objective: Mild traumatic brain injuries (mTBI) are prevalent, particularly during early childhood (i.e, before the age of 6 years). They can lead to physical, cognitive and emotional impairments in the short term, and in some cases can persist over several months and even years. MTBI are also known to impact family functioning and are associated with increased parental stress and mental health vulnerability. It is therefore essential to consider parents' perspectives and experience after their young child sustains mTBI to better understand the impact of this type of injury on families. The objective of this study was therefore to document parents' perceptions and experience regarding their child's early mTBI through a qualitative approach.
Participants and Methods: Parents of children (N = 28, aged 6 months to 6 years) participated in semi-structured interviews three months post-injury. Interviews consisted of up to seven questions related to their overall experience regarding their child's injury as well as their post-injury expectations. They were conducted in person or over the phone (due to COVID-19 restrictions). A thematic analysis qualitative approach was used based on the transcribed and coded interviews (NVivo).
Results: Analyzing parents' reflections following their child's mTBI made it possible to identify four main themes, each of which included sub-themes: 1) emotions experienced after the injury, 2) impacts of the injury, 3) experiences with the healthcare system, and 4) priorities for recovery. Emotions such as anxiety and guilt were the most frequently mentioned by parents. Moreover, a majority of parents (N = 18) reported feeling relieved after being provided healthcare services.

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Conclusions: The qualitative information gathered on the personal experience of parents whose children sustained mTBI paves the way to identifying their main impressions following their child's head injury. Documentation and consideration of the themes and subthemes evoked by parents could provide loci for intervention and for improving management and follow-up of young children and their families after early mTBI.
Keywords: child brain injury**,** concussion/ mild traumatic brain injury

48 Association between sleep and the quality of parent-child interaction after early mild traumatic brain injury (mTBI)

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Objective: There is emerging concern that the quality of parent-child interactions is diminished after early mild traumatic brain injury (mTBI), and that poor sleep quality may be at play. However, evidence of this association is based only on parents' subjective perception of child sleep quality. The main aim of this study was to assess the association between sleep and parent-child interaction, using both subjective indicators (questionnaires) and objective, direct assessment of outcomes (observational measures, actigraphy). We thus compared the contribution of objective and subjective sleep assessment methods in the prediction of parent-child interaction after early mTBI.
Participants and Methods: The sample was drawn from a longitudinal cohort study of children who sustained mTBI when they were between 18 and 60 months of age: children with accidental mTBI (n=25) and typically developing children (TDC) (n=25). The quality of parent-child interaction was measured directly 6-months post-injury with the Mutually Responsive Orientation scale (MRO), an observational standardized measure of the dyadic quality of the interactions between parent and child. In the MRO, two interaction contexts were analysed: a snack setting (MRO-S) and an interactive toy-centered setting (MRO-TC). Sleep quality was assessed through the following indicators: actigraphy data and parental ratings of sleep problems and fatigue. Children were asked to wear an Actiwatch 2 actigraph up to 5 consecutive days six months post-injury, and the data were analyzed with the Philips Respironics Actiware software version 5.70. The sleep efficiency variable was used to quantify sleep quality. Parental questionnaires included two sleep-related items from the Post-Concussive Symptoms Interview (PCS-I), the Child Behavior Checklist Sleep Problems subscale and the Pediatric Quality of Life Inventory Multidimensional Fatigue Scale (PedsQL-F).
Results: In the mTBI group, results indicated a positive association between actigraphy data and MRO score (MRO-S: $r = 0.54$, $p = 0.012$; MRO-TC: r= 0.33, $p = 0.151$). In the MRO-S, family SES and sleep efficiency explained a significant 38% amount of variance ($R^2 = .38$, $p = .016$). Sleep efficiency is an independent predictor of the MRO-TC score (b=.515, $p = .015$). As for the MRO-TC, the combination of sleep efficiency, cognitive fatigue (PedsQL-F), and family SES explained a significant 51% of the variance in MRO ($R^2 = .51$, $p = .011$).
In the control group, no significant associations for actigraphy were found (MRO-S: p=.953; MRO-TC: $p = .659$). Correlations were found between MRO-TC and PedsQL-Cognitive Fatigue score ($r = .315$, $p = .176$). As for the MRO-S, correlations were found with PedsQL-F total score ($r = .368$, $p = .101$), PedsQL-F sleep/rest score ($r = .387$, $p = .083$) and PedsQL-Cognitive Fatigue score ($r = .425$, $p = .055$). Regressions in the TDC group were not significant.
Conclusions: This study suggests that assessing sleep in an objective manner is useful in providing a more profound understanding of the issues surrounding the complex relationship between parents and their child following early mTBI.
Keywords: traumatic brain injury**,** pediatric neuropsychology**,** sleep

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49 The Association Between Self-Reported Psychiatric Symptoms and Performance Validity Test Failure across Brain Injury Severity Levels

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Objective: Performance validity testing is a routine procedure used in neuropsychological assessment to ensure an examinee is putting forth a performance that is an accurate representation of their abilities. There is increasing evidence that individuals reporting high levels of psychiatric symptoms, as well as those with mild traumatic brain injury (mTBI) may fail performance validity tests (PVTs) more often. This research sought to determine if high base rates of failure (BR_{Fail}) in the mTBI sample were related to an increase of self-reported psychiatric elevations.
Participants and Methods: An archival dataset of 480 individuals with an orthopedic injury, mTBI, or moderate-severe traumatic brain injury (msTBI) referred for neuropsychological testing was retrospectively analyzed. Of the sample, 70.4% were male and the average age was 39.3 years (*SD* = 11.9). Participants took part in routine neuropsychological assessments which included the Word Memory Test (WMT) and the Minnesota Multiphasic Personality Inventory-2 (MMPI-2).
Results: Those in the mTBI diagnosis group failed the WMT more often than those with msTBI. There was no interaction between diagnostic groups and failing PVTs on psychiatric symptom reporting. Results did show a relationship between diagnosis and PVT failure on some psychiatric symptom scales independently. Failing the WMT was related to poorer outcomes on neurocognitive tests.
Conclusions: Overall, no interaction between PVT outcome and diagnosis was found on self-reported psychiatric symptoms, but each factor independently explained a significant amount of variance. Results suggest clinicians should continue to be aware of factors that may contribute to PVT failure in their practice, such as elevated psychiatric symptom reporting and diagnostic group membership.
Keywords: traumatic brain injury, validity (performance or symptom), self-report

50 The Relationship of Psychopathic Traits to Engagement in Criminal Behavior and Performance on Tasks Assessing Impulsivity

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Objective: Individuals who admit to criminal acts report high psychopathic traits and are more likely to be impulsive on self-report and behavioral tasks. Psychopathy is comprised of two weakly correlated dimensions; one focused on impulsive antisociality traits and the other on fearlessness and dominance, which may be differentially related to engagement in criminal behavior. Neuroimaging studies also suggest different neuroimaging correlates of these two dimensions, but there is a noticeable lack of studies focusing on the relationship of these dimensions to behavioral tasks. In the current study, we hypothesized that engagement in criminal behavior would be related to higher report of both impulsive antisociality (IA) and fearless dominance (FD) components of psychopathy. We also hypothesized that engagement in criminal behavior would be related to performance on a behavioral measure of impulsivity (Stop Signal Reaction Time Task; SSRT). Finally, we hypothesized that IA, but not FD, would mediate the relationship of engagement in criminal behavior to performance on the SSRT.
Participants and Methods: Participants were taken from a deidentified dataset of a larger study on psychopathy in undergraduate males

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(N=79). Participants were on average 19 years old (*SD=1.5)* and were 92.5% White non-Hispanic/Latinx. To assess IA and FD psychopathic traits, the Psychopathic Personality Inventory-Short Form was used. To assess family conflict, we used the Family Conflict subscale of the Family Environment Scale. Alcohol use was assessed with the Alcohol Use Disorders Identification Test (AUDIT) and drug use with the Drug Abuse Screening Test (DAST) Short Form. To assess criminality and create study groups, the Adult Criminality Scale was used. Participants also completed the SSRT. After completing practice trials, participants completed 3 blocks of 64 trials each; 25% of trials were stop signal trials.
Results: The sample was divided by those who had engaged in criminal acts (N=31) and those who had not (N=48). The two groups were not different in age (*p=.31),* estimated SES (*p=.15),* or family conflict (*p=.19).* Those who reported criminal behavior scored higher on both FD (*p<.001)* and IA (*p<.001)* components of psychopathy and reported higher scores on the AUDIT (*p<.001)* and DAST (*p<.001).* On the SSRT, those who reported criminal behavior scored worse on several aspects, including mean probability of responses on Stop Signal trials, mean stop signal delay, and mean RT to both signal respond and no signal trials (*ps=.03 to .005)*. Mediation models showed that the relationship of criminal behavior to SSRT performance was mediated by IA, but not FD.
Conclusions: Undergraduate males reporting histories of criminal behavior scored higher on both FD and IA components of psychopathy and performed worse on a behavioral measure of impulsive behavior. As predicted, performance on the SSRT was mediated by IA, but not FD symptoms. Results are consistent with other research suggesting that certain features of psychopathy, especially FD, may be linked to more socially successful behavior while IA may be associated with psychological difficulties, negative outcomes, and neuroimaging findings suggestive of differential activation in reward and impulse control areas of the brain.
Keywords: forensic neuropsychology**,** psychopathy**,** inhibitory control

51 MMPI-2-RF Response Bias Scale Predicting Failure on the Victoria Symptom Validity Test in a Sample of Adults Referred for Psychoeducational Testing

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Objective: The MMPI-2-RF is a widely used measure of personality and psychological functioning that includes five symptom validity indicators to assess various response patterns. One of the validity indicators, the response bias scale (RBS), assesses exaggerated cognitive complaints on the MMPI-2-RF and is designed to identify self-reported symptoms associated with failure on performance validity tests (PVTs). Importantly, the RBS was primarily developed and studied in the context of forensic evaluations, though research has shown that increasing attention should also be paid to measures of symptom validity in psychoeducational evaluations. Therefore, we aimed to examine rates of concordance between the MMPI-2-RF RBS and a PVT designed to assess feigned memory complaints in a sample of adults referred for psychoeducational testing using liberal and conservative cutoffs. We also aimed to examine whether the MMPI-2-RF RBS predicted PVT failure.
Participants and Methods: Participants were 192 students and community members referred for a psychoeducational evaluation at a university clinic in the South. Participants were administered the Victoria Symptom Validity Test (VSVT) and the MMPI-2-RF as part of the psychoeducational evaluation. Cut-off scores were based on recommendations in the test manuals as well as available research. Cut-off scores for the VSVT easy condition were 20 (Slick et al., 1997) and 23 (Silk-Eglit et al., 2016). Cutoff scores for the VSVT difficult condition were 16 (Slick et al., 1997) and 21 (Grote et al., 2000). The cutoff score for the RBS was ≥ 80 Participants with a VRIN or TRIN ≥ 80 were excluded from analyses (n=5).

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Results: On the MMPI-2-RF RBS, 22.8% of participants had invalid test scores. Failure rates for the VSVT Easy with a cutoff of 20 and 23 were 2.1% and 11.1%, respectively. For the VSVT Difficult, cutoff scores of 16 and 21 resulted in failure rates of 8.5% and 25.9%, respectively. Concordance rates (i.e., valid RBS/valid VSVT or invalid RBS/ invalid VSVT) between the RBS and VSVT ranged from 66%-75%, with conservative cutoffs yielding a higher rate of concordance than liberal cutoffs. Logistic regression revealed that RBS was a significant predictor of VSVT Easy failure at a cutoff of 20 (OR = 1.07, p = .01). RBS did not significantly predict failure using any other cutoff. When the MMPI-2-RF Fp-r and FBS validity scales were entered at step 1 RBS was no longer a significant predictor of failure on the VSVT easy at a cutoff of 20.
Conclusions: More liberal cutoffs have a greater impact on rates of failure on the VSVT Difficult than the VSVT Easy. Further, concordance between symptom validity and performance validity varied as a function of cutoff type. In addition, the results demonstrated that RBS had a weaker relationship with PVT failure than previous research has shown in forensic settings. Moreover, the results of the present study generally support previous literature in that symptom and performance validity are dissociable and need to be evaluated independently.
Keywords: forensic neuropsychology**,** malingering**,** psychometrics
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52 The Comparative Utility of the Response Bias Scale (RBS) Among MMPI-2-RF Symptom Validity Scales in Predicting TOMM Performance

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Objective: The Response Bias Scale (RBS) was added to the MMPI-2 to assist with differentiating psychiatric malingering from other iterations of invalid performance on neurocognitive tests (Gervais et al., 2007). Several studies have since confirmed the correlation between the RBS on the MMPI-2-RF and performance validity with tests including the Test of Memory Malingering (TOMM; Tarescavage et al., 2013; Wygant et al., 2011). This study sought to extend existing literature on the utility of the RBS as an indicator of invalid neuropsychological test performance in a forensic sample. It was hypothesized that scores obtained on RBS would demonstrate adequate predictive accuracy in classifying pass/fail group membership on the TOMM.
Participants and Methods: Participants included 265 retired males aged 69 or younger: 17% (n = 45) Caucasian and 83% (n = 220) African-American, in a forensic sample. Participants were classified into “pass” and “fail” groups by scores on trial 2 of the TOMM, according to test manual instructions (Tombaugh, 1996). Correlations and independent t-tests were performed among several symptom validity scales on the MMPI-2-RF (Fr, FPr, FBSr, RBS). Regression analyses were conducted to distinguish cumulative validity of the RBS compared to additional MMPI-2-RF validity scales.
Results: Significant correlations were found between all included symptom validity scales (RBS, FBSr, Fr, FPr) and scores on both trials of the TOMM. Results of t-tests indicated statistically significant differences between TOMM “pass” and “fail” groups and scores on Fr, FPr, FBSr, and RBS with large effect sizes (Cohen’s d) of .794, .722, .795, and .823, respectively. As expected, lower scores on TOMM trial 2 were associated with higher scores on validity scales. Regression analyses indicate that RBS adds significant incremental predictive utility when compared to FBSr, FPr, and Fr (F change = 4.77 (p=.030), 11.01 (p=.001), 4.20 (p=.041), respectively) in classifying TOMM pass/fail group membership.
Conclusions: Findings from this study support the utility of RBS as a relatively superior MMPI-2-RF symptom validity index for detecting invalid performance in the context of a comprehensive neuropsychological test battery. These findings

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are particularly salient in similar forensic and medical-legal populations. Future studies should seek to further clarify the predictive power of RBS in the general population.
Keywords: validity (performance or symptom)
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53 Examination of Expanded COWAT Performance in Cognitively Normal or Impaired Older Adult Veterans

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Objective: The Expanded COWAT (xCOWAT) was developed as an embedded expressive language-based performance validity indicator in traumatic brain injury (TBI) with a control group consisting of undergraduate students. Its oral format and quick administration time make it attractive for use as a validity measure in telephone-based research studies and teleneuropsychological evaluations. However, at present, there is a lack of evidence for cross-validation in non-TBI clinical populations. This study examines the base rates of noncredible task engagement when a cut score of ≤30 on xCOWAT is utilized in an older adult veteran population among individuals with dementia, mild cognitive impairment (MCI), and normal cognitive functioning.
Participants and Methods: Overall study sample consisted of 76 veterans with a mean (SD) age of 72.8(9.6) and 13.9(2.2) years of education. The sample was 98.7% male, 75% White, and 22.4% Black. Participants were grouped as “normal cognition” (NC) [n = 34, aged 70.5(10.8), 14.2(2.3) education], “MCI” [n = 27, aged 74.5(7.8), 13.8(1.9) education], and “dementia” [n = 15, aged 74.7 (9.1), 13.3(2.5) education] based on pre-existing clinical diagnoses. Pearson chi-square analysis was used to examine group differences in pass/fail rates on xCOWAT. Descriptive statistics are also reported.
Results: Mean(SD) CFL/phonemic verbal fluency raw score for the overall sample was 22.2(12.2). Mean(SD) phonemic verbal fluency raw CFL scores for each group were as follows: NC = 23.5(13.2), MCI = 23.1(12.5), and dementia = 17.5(7.8). Mean(SD) raw xCOWAT score for the overall sample was 32.4(18.7). Mean(SD) raw xCOWAT scores by group were as follows: NC = 33.9(20.4), MCI = 34.1(19.0), and dementia = 25.9(12.9). Pearson chi-square analysis did not establish group differences in xCOWAT pass/fail rates between NC, MCI, and dementia groups [$X^2 = 1.497$, $p = 0.473$]. xCOWAT failure rates at a cut score of ≤ 30 for each group were as follows: NC = 50.0%, MCI = 48.1%, and dementia = 66.7%.
Conclusions: These results indicated that xCOWAT failure rates of individuals with either MCI or intact cognition may approach 50%, and about 67% for individuals with dementia. This strongly suggests that an xCOWAT cutoff score of ≤30 representing 2 standard deviations below healthy young controls and within a half of a standard deviation of scores typical of simulated or clinical malingerers may not be appropriate for use with older adults in traditional outpatient neuropsychology, telephone-based research, and/or teleneuropsychological contexts. Current xCOWAT verbal fluency normative data corrects for gender and education. However, the mean verbal fluency raw score for cognitively intact older adults in this study produces Z-scores in the impaired range using the current normative data. This study establishes a need for further refinement of xCOWAT verbal fluency and effort index normative data. Future studies should employ receiver operating characteristics analysis to establish a more appropriate cutoff score for valid performance in older adults with and without cognitive impairment.
Keywords: validity (performance or symptom), teleneuropsychology, fluency

54 Classification Accuracy of the Dot Counting Test Across Verbal and Visual Memory Impairment Severity in a Mixed Neuropsychiatric Sample

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Objective: Performance validity tests (PVTs) are crucial to assessing the accuracy of neuropsychological evaluations. However, it can be difficult to disentangle invalidity from true cognitive deficits in individuals with significant memory impairment. Given the prevalence of false positive classifications on performance validity testing among patients with memory impairment, it is important to examine the relative efficacy of PVTs within these populations. The Dot Counting Test (DCT) is a non-memory based PVT that relies on speed and accuracy rather than the more traditional forced-choice PVT paradigm. Despite the manual recommendation for a more conservative cut-score for patients with mild dementia, few studies have examined performance on the DCT in populations with frank memory impairment and the degree to which appropriate classification cut-scores may vary as a function of memory impairment. This study examined the DCT in the context of varying levels of material-specific verbal and visual memory impairment.
Participants and Methods: Data was examined from a mixed clinical sample of 247 adult outpatients, with a mean age of 46.58 (*SD*=16.14; range=18-78) and education of 13.92 years (*SD*=2.75; range=6-20). The sample was 57.1% female; 35.2% White, 41.7% Black, 16.6% Latinx, 4.5% Asian, 2.0% other race/ethnicity. Valid (*n*=199) and invalid (*n*=48) groups were established based on four freestanding independent criterion PVTs and current practice standards for performance validity assessment. Delayed memory T-scores on both verbal and visual memory (i.e., the Rey Auditory Verbal Learning Test and Brief Visuospatial Memory Test-Revised, respectively) were averaged and used to create composite memory impairment bands for the valid group. The memory impairment bands were classified as ≥37T (no impairment; *n*=117); 30T-36T (mild impairment; *n*=49); and ≤29T (severe impairment; *n*=33). Receiver operating characteristic (ROC) curve analyses were conducted for DCT E-scores to determine classification accuracy, identify optimal DCT cut-scores, and evaluate associated sensitivity/specificity across memory impairment bands.
Results: The DCT displayed excellent classification accuracy in the context of the no impairment band (area under the curve [AUC]=.847, *p*<.001), with an optimal cut-score ≥14 (65% sensitivity/88% specificity). It also demonstrated robust, albeit reduced, classification accuracy in the context of mild impairment (AUC=.707, *p*<.001), at an optimal cut-score ≥19 (35% sensitivity/90% specificity). However, the DCT was not able to reliably classify invalid performance when compared to the severe impairment band (AUC=.545; *p*=.495).
Conclusions: The current study indicated that DCT performance reliably classified validity groups in patient samples with no memory impairment at the cut-score dictated in the DCT manual (E-score ≥14). To maintain appropriate sensitivity/specificity in those with mild memory impairment, a higher optimal cut-score must be used (E-score ≥19). However, the DCT was unable to reliably classify validity group among adults with severe memory impairment. These findings indicate that the DCT does not appear to be fully independent of memory functioning and underscore the psychometric limitations of the DCT. More specifically, use of the DCT should be limited to patients with clinical profiles that do not indicate severe memory impairment. Future research should elucidate the potential differential effect of isolated memory impairment versus multidomain cognitive impairment on DCT performance.
Keywords: noncredible presentations**,** memory complaints**,** neuropsychological assessment

55 Detecting Global Over-Reporters and Defensive Responders with the Cognitive Bias Scale in the Personality Assessment Inventory

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Objective: Research suggests that there are two distinct symptom feigning styles apparent on personality testing in neuropsychological evaluations when external incentives are present. First, a “defensive” style that is characterized by minimization of psychological symptoms and exacerbation of cognitive deficits; and second, a global over-reporting style that is characterized by gross over-reporting of all symptoms, including cognitive, somatic, and psychological symptoms (Patrick & Horner, 2014; Gaasedelen et al., 2017). The present study examines, in a mixed clinical outpatient sample, the ability of the Personality Assessment Inventory (PAI) Cognitive Bias Scale (CBS) to detect both defensive and global symptom over-reporters.
Participants and Methods: The sample included 638 consecutive clinical referrals for neuropsychological evaluation (mean Age = 41.8, SD = 15.7; mean Education = 13.7, SD = 2.7; 53% female; 89% Caucasian). All participants completed a comprehensive examination that included at least one free-standing performance validity test (PVT), at least two embedded PVTs, and the PAI. Participants who failed a free-standing PVT and at least one additional PVT (either freestanding or embedded) were classified into the FAIL group (n=83), and all others were classified into the PASS group (n=555). Groups were further divided into global over-reporters and defensive responders, based on the Negative Impression Management scale (NIM; T >72 = global over-reporters, with all others considered defensive), as suggested by prior research. Receiver Operating Characteristic (ROC) analyses were performed and area under the curve (AUC) was calculated to evaluate overall classification accuracy.
Results: Most participants in the FAIL group were deemed defensive responders based on NIM responses (70%; n = 58). The ability of the CBS to correctly classify participants as defensive responder in the FAIL group from participants in the PASS group (via ROC analysis) was low, with an AUC = 0.62; however, the ability of the CBS to correctly classify participants as global over-reporters in the FAIL group from participants in the PASS group was very good (AUC = 0.92). No other PAI validity scale demonstrated an AUC > 0.55 in classifying defensive responders. The Malingering Index and the Negative Distortions Scale were the next highest in classifying participants as global over-reporters, with an AUC = 0.84. An exploratory analysis that included a summed subset of seven items from the CBS scale improved classification accuracy of participants as defensive responders to AUC = 0.66.
Conclusions: Results of the study suggest the CBS performs very well in detecting participants who fail PVTs and globally over-report symptoms, but its ability to detect the defensive response style in participants who fail PVTs is poorer. However, the CBS is superior to the other PAI validity scales in its ability to detect both the global and the defensive response style. Preliminary examination of a subset of items of the CBS shows promise in improving detection of defensive responders; however, additional research and item analysis are needed.
Keywords: validity (performance or symptom), forensic neuropsychology
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56 Validating a Shortened Version of the Structured Inventory of Malingered Symptomology Within a Veteran Based Epilepsy Monitoring Unit

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Objective: The Structured Inventory of Malingered Symptomatology (SIMS) is a measure of impression management that covers a range of symptomatology through 75 items and five scales, some of which are particularly relevant for cognitive evaluations. Recently, a subset of 19 items, known as the Neuropsychological Settings (SIMS-NS), was shown to be psychometrically equivalent to the original SIMS.

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Participants and Methods: The current study aimed to investigate the validity of this newly developed subscale in detecting invalid performance among 297 inpatient veterans on a long-term video electroencephalogram epilepsy monitoring unit (EMU). The Structured Inventory of Malingered Symptomatology (SIMS), Word Memory Test (WMT), Test of Memory Malingering (TOMM), and Weschler's Adult Intelligence Scale – 4th Edition Digit Span subtest (WAIS-IV) were completed as part of a larger test battery. Participants were characterized into "valid" and "invalid" groups based on results of performance validity tests. Group status was used as a criterion for validating the SIMS-NS with receiver operating characteristic (ROC) curves.
Results: A student's t test revealed significantly higher SIMS-NS scores ($t(295) = -4.1$; $p < .0001$) among the performance invalidity group ($M = 7.70$; $SD = 4.63$) compared to individuals with valid performance testing ($M = 5.54$; $SD = 4.28$). ROC curve analysis (AUC= 0.635; $p < .0001$) revealed an optimal SIMS-NS cut-score of ≥ 12 for identifying performance invalidity, emphasizing specificity of .90 and a sensitivity of 0.18. Separate ROC curve analyses examining the Neurological Injury (AUC= 0.613; $p = .0007$) and Amnestic Disorders subscales (AUC= 0.630; $p < .0001$) of the SIMS-NS revealed optimal cut-scores of ≥ 8 and ≥ 6 respectively, for identifying performance invalidity while maintaining specificity of .90.
Conclusions: The abbreviated SIMS-NS and its subscales, despite their brevity, were adequately able to identify veterans failing performance validity measures on an inpatient EMU. Optimal cut-scores for identifying invalid performance were higher (representing greater endorsement of invalid symptoms) than those reported in the original study, highlighting the importance of considering patient population when interpreting performance validity data.
Keywords: malingering, epilepsy / seizure disorders
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57 Creating Training Opportunities in Cross-Cultural Forensic Neuropsychology

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Objective: While around 5% of the US population has a serious mental illness (SMI), up to 15% of the incarcerated population has a SMI diagnosis (Kaeble, Glaze, Tsoutis, & Minton, 2016).
Forensic neuropsychologists are often tasked with evaluating defendants with SMI (Larrabee, 2012), including those with possible neurocognitive and neurodevelopmental issues. Some evaluations are literally life-or-death, such as in Atkins claims (where establishing intellectual disability blocks a defendant's execution due to the Eighth Amendment; Atkins v. Virginia, 2002). Making retrospective diagnoses of intellectual disability (ID) in adult forensic patients requires distinctive clinical and legal knowledge (Schalock, Luckasson, & Tasse, 2021) which can be difficult to obtain via our field's existing training models.
The linguistic and cultural barriers faced by foreign-born, non-English-speaking US defendants only increase the challenge. Between 1980 and 2019, the Latino share of the US population more than doubled, from 5% to 18% (Noe-Bustamante, Lopez, & Krogstad, 2020). Unfortunately, the number of Latino defendants sentenced to death in the US has increased sevenfold in the last two decades. Given the increasing number of Latinos entering the US legal system and the high prevalence of ID in the incarcerated population, the need for highly skilled and culturally-sensitive forensic neuropsychologists—particularly in the field of intellectual disability—is critical.
Participants and Methods: First, we review existing literature and examine training trends in forensic neuropsychology and the law. Second, we list important factors to consider when working with justice-involved individuals with SMI (including those who do not speak English). Third, we describe a training model to increase competence in addressing these issues and pilot its initial didactics with advanced law

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students (*n* = 11), experienced attorneys (*n* = 3), and neuropsychology doctoral students (*n* = 3).
Results: A limited number of forensic workshops for early-career and experienced neuropsychologists have been developed in the last decade (NAN, 2021). These workshops help neuropsychologists start or expand a forensic (mostly civil) consulting practice. Training opportunities for forensic criminal consulting appear to be much rarer.
To address this gap, we developed a didactic and experiential training model for teaching neuropsychology postdoctoral fellows to apply their skills in criminal forensic contexts. A parallel arm of the model will offer didactics and practicum consultation to advanced law students, to help them better address cognitive, developmental, and mental health issues that may complicate their work. The two components will work symbiotically, with neuropsychology and law student trainees each benefitting from access to advanced practitioners from both fields.
Examining the initial didactic pilot sample, though 85% of the law students reported training to be either a public defender or a prosecutor, most indicated that they had not received any prior training on cognitive, developmental, or mental health issues and felt unprepared to represent this population effectively. Similarly, doctoral students identified lacking familiarity with the legal system as a primary training need. The present authors' extensive psycholegal experience, and experience training culturally competent students or early-career practitioners in various settings, will be leveraged to build out both arms of the model.
Conclusions: Training models for increasing the cultural, legal, and mental health competence of forensic neuropsychologists and lawyers are sorely needed.
Keywords: intellectual disability**,** forensic neuropsychology**,** cross-cultural issues

58 Classification Accuracy of Two Memory-Based Embedded Performance Validity Tests for Detecting Performance Invalidity Among Adult Attention-Deficit/Hyperactivity Disorder Referrals

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Objective: The Rey Auditory Verbal Learning Test (RAVLT) and Brief Visuospatial Memory Test Revised (BVMT-R) both contain embedded performance validity tests (PVTs) that have been cross-validated and shown to accurately discriminate valid and invalid test performance across medicolegal and mixed clinical populations. However, the accuracy of these PVTs for detecting invalid performance has not previously been investigated in the context of Attention Deficit/Hyperactivity Disorder (ADHD), nor have previously reported optimal cut-scores for these PVTs been cross-validated in patients referred for ADHD evaluations. Considering the high base rate of invalidity among adults presenting for ADHD evaluation, this study examined the accuracy of the RAVLT and BVMT-R embedded PVTs among a large sample of adults referred for outpatient neuropsychological evaluation for ADHD.
Participants and Methods: This cross-sectional study included data from 305 consecutive adult clinical patients referred for neuropsychological evaluation at a Midwestern academic medical center for diagnostic clarification of suspected ADHD and assistance with treatment planning. All patients were administered the RAVLT and BVMT-R among a larger, standardized neurocognitive battery. Five independent criterion PVTs were used to establish valid (*n*=262) and invalid (*n*=43) groups. The sample was 61% female/39% male, 46% White, 23% Hispanic, 14% Black, 11% Asian, and 5% other. Mean age was 28 (*SD*=6.8) and mean education was 15.6 years (*SD*=2.1). Receiver operating characteristic (ROC) curve analyses were conducted for the RAVLT Recognition Effort Score (ES) and BVMT-R Recognition Discrimination (RD) to determine classification accuracy, optimal cut-scores, and associated sensitivity/specificity for each embedded PVT.
Results: RAVLT ES (F=36.56, p<.001) and BVMT-R RD (F=21.86, p<.001) scores were significantly higher (i.e., better) in the valid group

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relative to the invalid group, with medium effects (η_p^2=.07-.11). The RAVLT ES demonstrated acceptable classification accuracy (area under the curve [AUC]=.730, p<.001), with an optimal cut-score for invalid performance of ≤13 (43% sensitivity/90% specificity). The BVMT-R RD demonstrated poor classification accuracy (AUC=.617, p=.014) with an optimal cut-score of ≤5: (33% sensitivity/90% specificity).
Conclusions: RAVLT ES and BVMT-R RD were independently able to detect invalid test performance among adult ADHD referrals undergoing neuropsychological evaluation. The RAVLT ES generally evidenced greater accuracy and more robust psychometric properties than the BVMT-R RD. These results also indicated that slightly more conservative cut-scores (i.e., 1-point higher), compared to those previously reported in the literature, may be necessary when using these particular embedded PVTs in patients referred for ADHD evaluation.
Keywords: validity (performance or symptom), attention deficit hyperactivity disorder, neuropsychological assessment

59 Effects of Pre-Existing Stroke on Acute Hospital Outcomes for Older Adults Admitted with Traumatic Brain Injury and Orthopedic Injury

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Objective: While traumatic brain injury (TBI) has been demonstrated as a risk for stroke (Chen et al., 2011), there is little research examining the effects of pre-existing cerebrovascular accidents (CVA) on acute outcomes following TBI. Given the effects of neuroinflammatory processes following stroke (Buga et al., 2013) and the increased risk of suffering a subsequent stroke, we hypothesized that TBI patients with pre-existing CVA (CVA+TBI) would experience poorer outcomes and require longer hospital stays compared to TBI without CVA (TBIa), orthopedic injury (OI) with pre-existing CVA (CVA+OI), and OI without CVA (OIa).
Participants and Methods: Using data from the Pennsylvania Trauma Outcome Study, we identified trauma patients seen at hospitals in Pennsylvania between 1992-2019 for TBI or OI with and without an identified history of CVA with residual deficits, aged 50-99. We used propensity score matching to match our groups on age and injury year, applying 1:1 nearest neighbor matching without replacement. This yielded four groups of N=11,648 each: CVA+TBI, CVA+OI, TBIa, and OIa. Binary logistic regressions assessed mortality, craniotomy, and discharge to home based on injury type, stroke with residual deficits, and their interaction. Given that anticoagulant therapy is associated with these poorer hospital outcomes, we re-ran these analyses without the subset with known anticoagulant use. Kruskal-Wallis tests examined total hospital, ICU, step-down, and ventilator days, and functional status at discharge (FSD).
Results: Stroke history did not predict mortality, nor was there any significant interaction effect between TBI and stroke. However, stroke history was predictive of whether or not a patient received a craniotomy (OR=1.25, p=.008). These results remained consistent with the removal of the anticoagulant subset. There was a significant difference between the four groups for total hospital days, total step days, and total ventilator days for surviving patients, but these effect sizes were small. The CVA+TBI group remained in the ICU the longest, followed by TBIa, then CVA+OI, and finally OIa (η2=.10, p<.001). Although there was a significant difference across groups for FSD, these effect sizes were particularly small. Pre-existing stroke patients, regardless of injury, were less likely to be discharged to home (30.7%) compared to non-stroke (40.6%) (OR=.65, p<.001) with their most frequent discharge destination being to a skilled nursing facility (41.0% stroke compared to 32.1% non-stroke).
Conclusions: Patients with a history of CVA with residual deficits were more likely to have a craniotomy, spent comparatively more time in the ICU, and were less likely to be discharged to home, regardless of injury type. Surprisingly, there were no interaction effects for stroke and

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TBI for these acute outcomes. While it is possible that functional differences pre-injury influenced discharge destination, given these results, pre-existing stroke with residual deficits may serve as a risk factor for craniotomy following injury, and these patients may be more likely to require skilled care upon discharge.
Keywords: stroke recovery**,** traumatic brain injury
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60 Preoperative Cognition Predicts Clinical Stroke and Mortality After Cardiac Surgery

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Objective: Stroke and death remain a risk of cardiac surgery, with surgical aortic valve replacement (SAVR) being among the highest risk procedures commonly performed. Cognitive measures may help identify risk for negative surgical outcomes because they are objective, easy to administer at the bedside, and may be sensitive to current general health status in older adults preparing for surgery. While some prior research has identified preoperative cognition as a significant risk factor for negative surgical outcomes, these studies have included individuals undergoing a range of cardiac surgeries and procedures, and more importantly, have relied on brief cognitive evaluations. Thus, we aimed to determine whether preoperative cognitive function was independently associated with post-operative clinical stroke and mortality and to identify specific cognitive tests/abilities that were most strongly associated with poor surgical outcomes.
Participants and Methods: 165 older adult (65+) participants (M age=75.5, SD=5.9; 37% women; 94.5% White) with moderate-to-severe aortic stenosis were recruited for a prospective study on stroke and post-operative cognitive change following SAVR. Demographic, clinical, and cognitive data from a comprehensive cognitive battery were collected at baseline, and stroke and mortality outcomes were determined at 1 week, 1 month, and 1 year after surgery. Between-group analyses were conducted to identify demographic, clinical, and cognitive data associated with death and stroke. Hierarchical logistic regressions were then conducted to evaluate predictors of mortality within 1 year of surgery and predictors of clinical stroke within 1 week of surgery.
Results: A total of 13 participants (7.9%) died within a year following surgery, and a total of 29 participants (17.6%) suffered either an acute clinical stroke or TIA within the first seven days following surgery. The logistic regression model with greatest accuracy for predicting death demonstrated that a measure of medical comorbidities (Charlson Comorbidity Index; OR=2.86, 95%CI [1.27, 8.11]) and a measure of confrontation naming (Boston Naming Test; OR=0.77, 95%CI [0.61, 0.93]) were significant predictors of death within one year of surgery, $X^2(8) = 28.32$, $p<.001$. Additionally, only a single measure of visuospatial abilities (JOLO; OR=0.90, 95%CI [0.82, 0.99]) emerged as a significant predictor of clinical stroke within one week of surgery, $X^2(4) = 19.07$, $p<.001$.
Conclusions: Preoperative cognitive abilities, along with medical comorbidities, improve prediction of clinical stroke and mortality after SAVR in older adults. Cognitive tests are valuable because they may offer a sensitive measure of brain health predictive of negative outcomes following surgery, while also being objective, sensitive measures. Cognitive protocols that target language/semantic abilities and visuospatial functions (e.g., Digital Clock Drawing Test) may be best suited for the rapid and effective screening of older adults at risk for poor surgical outcomes.
Keywords: carotid artery disease**,** neuropsychological assessment**,** cognitive functioning

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61 Cerebral Small Vessel Disease Following Preeclampsia with Severe Features

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Objective: Preeclampsia with severe features is defined as new-onset or significantly worsened maternal hypertension after 20 weeks of gestation with organ dysfunction. Preeclampsia is associated with an increased risk of cerebrovascular disease (CVD) later in life, and some studies have shown increased risk of vascular dementia in this population. However, there are limited data regarding cerebral small vessel disease in young adults with a history of preeclampsia. Prior community-based studies showed that people who have progressed to dementia later in life had higher white matter hyperintensity (WMH) volume in parietal regions, compared with people who did not. We hypothesized that following delivery with a diagnosis of preeclampsia with severe features, magnetic resonance imaging (MRI) would reveal differences in regional WMH volume and pattern, compared to imaging in parous adults with no history of hypertension or preeclampsia.
Participants and Methods: Cases with preeclampsia with severe features were recruited at the time of preeclampsia diagnosis and followed prospectively for up to 24 months. Magnetic resonance imaging (MRI) was performed between 12-24 months (median = 22 months) after delivery. Controls were parous subjects with no history of preeclampsia and with available MRI from an ongoing community-based study of middle-aged adults with similar demographic characteristics. T2-weighted fluid attenuated inversion recovery (FLAIR) MRI sequences were used to quantitate regional WMH using in-house developed software. We compared regional WMH volumes between groups with a mixed-design general linear model.
Results: There were 11 cases (age=35.4±6.8 years, range=22-42, n=8 Hispanic, n=1 non-Hispanic Black, n=2 non-Hispanic White) and 18 controls (age=38.7±4.4, range=29-43, n=12 Hispanic/Latinx, n=3 non-Hispanic Black, n=3 non-Hispanic white) Overall, WMH volume did not differ between cases and controls. Cases had higher WMH volume in posterior regions, particularly the parietal and occipital lobes, compared to controls (Diagnostic Group x Region interaction, F=4.94, p=0.003). Controls had more WMH in the temporal lobes than cases.
Conclusions: These results provide preliminary evidence of regional differences in subclinical cerebral small vessel disease, among young adults 12-24 months after pregnancy with preeclampsia with severe features. The pattern of higher parietal region WMH seen in the preeclampsia group has been associated in prior studies with elevated dementia risk. More prospective studies are needed to investigate whether early regional differences in WMH are mechanistically related to higher risk for cognitive decline after preeclampsia with severe features.
Keywords: neuroimaging: structural**,** cerebrovascular disease**,** medical disorders/illness
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62 Neuropsychological Effects and Outcomes of Music Interventions Following Stroke

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Objective: This systematic review explores the neuropsychological effects and outcomes of music interventions following stroke. The purpose of this study is to synthesize, update, and expand the current knowledge of music-based therapies to directly inform treatment recommendations for clinicians.
Participants and Methods: In accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, a systematic review was conducted in April 2021 of PubMed and psycINFO. Eligibility criteria included randomized and clinical controlled trials and case studies with cross-over design published in English between 2000-2021. Participants included adults ages 18 and over with a history of acute, post-acute, or chronic stroke. Given the nature of evaluating arts-based interventions, a textual narrative evidence synthesis was utilized. Grouping the studies into homogeneous categories, this method is beneficial for synthesizing discrete forms of evidence, assessing the strength of evidence available, and identifying gaps in the literature. Included studies were coded and grouped by 1) intervention type 2) symptoms and outcomes (further grouped by psychological, cognitive, language, and motor functioning) and 3) acuity and chronicity of stroke. Patterns analyzed included the types of music interventions used to address neuropsychological symptom domains and reported outcomes on the effects of stroke.
Results: Two researchers collected 491 articles, with 91 duplicates identified. We reviewed 400 articles, eliminating 180 during title screening, 131 during abstract screening, with 89 remaining for full-text review and quality appraisal. During full-text screening, 40 studies were eliminated due to excluded methodology (n=28), stroke not isolated (n=7) or study unavailable (n=5). Forty-nine selected studies (1,561 patients) were included in the data synthesis. Interventions included both active and receptive modalities, including Music-Supported Therapy (14 studies and 387 patients), music listening (386 patients across 11 studies), Music Therapy (355 patients over eight studies), singing and music performance (74 patients in five studies), Rhythmic Auditory Stimulation (four studies with 143 patients), Melodic Intonation Therapy (three patients in one study), and other active music and movement interventions (six studies of 213 patients). Significant improvements were seen across fine and gross motor recovery, visual attention, spontaneous speech, verbal memory, gait, and functional connectivity across the affected hemisphere. Significant reductions in depression and negative affect were seen across psychological targets and outcomes through both active and receptive musical modalities. Notably, receptive music listening was most commonly applied in studies with acute stroke, each of which reported statistically significant improvements.
Conclusions: Though the incidence of spontaneous recovery makes it difficult to accurately weigh the promise of early interventions, our findings support several neurocognitive benefits of musical behavior suggesting interventions should begin as soon as feasible following stroke. Given the high incidence of post-stroke depression, its associated risk of morbidity and mortality, and cost-effectiveness of the intervention, the use of structured music listening may be highly indicated for targeting motivational elements, effects of isolation, and depression following stroke. Results indicate music interventions can provide noninvasive, equitable, and culturally congruent adjunctive treatment for neuropsychological sequelae of stroke. Findings surrounding the efficacy and ecological validity of these interventions as well as recommendations for research and practice are discussed.
Keywords: stroke recovery**,** cognitive rehabilitation**,** transdisciplinary research
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63 Auditory-Orthographic Lexical Processing in Aphasia using Voxel-based Lesion Symptom Mapping

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Objective: Spoken and written language recognition relies on our ability to integrate auditory and visual sensory input to an abstracted 'internal' representation of the same lexical item. Theoretical models posit a role for semantics in spoken word recognition, such that semantic knowledge is thought to provide contextual information useful for eliminating unlikely competitors. However, it is unclear whether semantic processes alone can support this process independently of 'sublexical' retrieval mechanisms. The aim of this study is to examine the critical region necessary for auditory-orthographic integration for words and pseudowords using Voxel-based Lesion-Symptom Mapping (VLSM). We hypothesized that lesions in the posterior perisylvian cortex would be associated with poorer performance on the spoken word recognition tasks.
Participants and Methods: Fifty patients with chronic left hemisphere stroke performed two spoken word recognition tasks (words and pseudowords). Patients were right-handed, native English speakers, and at least 6-months post-stroke. Patients heard a word or pseudoword and matched it from 4 written forms. There were 40 trials for each task. Foils were phonologically related to the target item and differed by 1, 2, or 3 phonemes. Lesion status at each voxel was used as a grouping variable to examine accuracy on the two tasks using VLSM. Voxels lesioned in less than 5 patients (10% of the sample) were excluded from the analysis. Lesion volume and response accuracy on the auditory-written matching task that was not used as the dependent variable were included as covariates. The resulting t-maps were thresholded at a voxel-wise $p < .005$ and cluster thresholded (minimal volume 3108µl) to correct for FWE at alpha < .05, as determined by randomization testing using 1,000 permutations.
Results: Accuracy of word recognition matching (91%) and pseudoword recognition matching (81%) were strongly correlated ($p < .001$). When no covariates were included in the model, auditory-written word matching was associated with damage to the left inferior frontal gyrus and posterior superior temporal gyrus (STG) and sulcus. Auditory-written pseudoword matching involved similar regions, with additional involvement of the ventral motor/somatosensory area and supramarginal gyrus (SMG). When the response accuracy of the word task and lesion volume were included as covariates in the auditory-written pseudoword matching task, VLSM revealed a region centered on the posterior perisylvian cortex, including the posterior STG, posterior planum temporale, and SMG. No significant voxels survived the VLSM result for auditory-written word matching after inclusion of either lesion volume or accuracy on the pseudoword auditory-written matching task as a covariate.
Conclusions: The results reveal a region in the posterior perisylvian cortex that is critically involved in mapping between auditory-to-written forms, a task made harder by using phonologically-related foils. Word recognition involved a similar region, but when pseudoword recognition was covaried out, no voxels survived correction, suggesting that word recognition depends on the 'sublexical' mapping involved in pseudoword recognition. While additional semantic regions may aid word recognition, the results suggest that they cannot support the process independently if this more critical region is damaged.
Keywords: cerebrevascular injury**,** language: aphasia

64 Improved Detection of Neurobehavioral Deficits Following Acute Stroke Screening

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Objective: Stroke affects approximately 795,000 people in the United States every year. Though follow-up with stroke patients is not uncommon, it is estimated that approximately 65% of patients receive no rehabilitation, which impacts patients' recovery and quality of life. Further, there are limited systemic processes to

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identify and follow-up with patients with cognitive and depressive impairments. Accurate identification of early cognitive deficits and depression following stroke integrated with routine inpatient care may help to guide follow-up evaluations and recommendations. Therefore, the objective of the current study was to confirm that rates of cognitive and mood disorders exceed 50% after stroke through comprehensive bedside assessment. We also wish to establish a neuropsychological care pathway for successful community transition.
Participants and Methods: From April to July 2021, 110 patients hospitalized for acute stroke care were evaluated at bedside. Patients completed a global cognitive screen (Montreal Cognitive Assessment; MoCA) as well as screening instruments for aphasia (Language Screen Test; LAST), spatial neglect (Catherine Bergego Scale; CBS), and depression (Patient Health Questionnaire; PHQ-8). Patients were aged 26 – 95 years, (Mage = 63.64, SD = 15.4). The sample included 40% women and the overall sample was primarily Black/African American (54.8%) and White (40.4%). The average level of education was some college (Medu= 13.77, SDedu= 3.3).
Results: We used standardized cut-off scores to identify patients with global cognitive impairment, aphasia, spatial neglect, and depression. Over 90% of patients met criteria for global cognitive impairment on the MoCA (MMoCA= 18.55, SDMoCA= 5.8). Of the group, 46.3% of patients met criteria for spatial neglect and 34.5% met criteria for aphasia. Importantly, many patients met criteria for impairment in more than one area assessed. Specifically, 19.3% of patients met criteria for both aphasia and spatial neglect; 42.5% of patients met criteria for both global cognitive impairment and spatial neglect; 34.5% of patients met criteria for both global cognitive impairment and aphasia; and, finally, 19.3% of patients met criteria for spatial neglect, aphasia, and global cognitive impairment. Further, 28.2% of patients met criteria for depression.
Conclusions: Our results confirm a high percentage of patients who meet criteria for cognitive deficits and depression immediately following stroke. Importantly, many of these patients experience more than one deficit which may impact the validity of assessments. For example, an individual experiencing aphasia may score lower on a measure of global cognitive function due to the reliance on language assessment: thus, patients with aphasia may appear more impaired globally than would be observed by their functional performance. Future studies must address validation of rates of cognitive impairment and depression and methods of assessing patients with multiple deficits as part of inpatient acute stroke care. This is an important first step toward developing a comprehensive evaluation and treatment plan for these patients that includes structured neuropsychological follow-up assessment. By identifying deficits immediately following stroke, neuropsychologists are better able to appreciate and monitor change throughout the recovery period, which will allow lead to more tailored recommendations for follow-up treatment.
Keywords: stroke recovery**,** neuropsychological assessment**,** aphasia
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65 Neuroplasticity and Neuropsychological Performance after Early Bilateral Occipital Hemorrhage

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Objective: After early childhood brain injury with consequent intraparenchymal damage, the central nervous system (CNS) typically responds by re-routing neuronal pathways to allow for better functional outcomes than observed following similar brain injury sustained in adulthood. The Kennard principle theorizes that neuroplasticity is maximal during early post-natal development because the neural organization of the brain of a neonate is not as functionally

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committed as that of an adult brain, allowing for more complete and functional neural network reorganization. Research has confirmed that younger children usually recover better from TBI than adults, thought to be due to protective physiological factors including greater flexibility of the child's skull, lower frequency of intracranial hematomas, and greater neuroplasticity of the child's brain relative to adult brain.
Participants and Methods: This case study is of a 7-year-old, left-handed female of Chinese origin who was in kindergarten at the time of assessment. She experienced a spontaneous, non-traumatic intra-parenchymal bleed at 4 months of age with consequent significant bilateral, posterior neuropathology. Months after the intracranial bleed, she experienced a series of seizures that were effectively pharmacologically controlled. She was adopted and moved to the USA at age 2. Subsequent visual assessment revealed a significant and dense left visual field cut. She was referred for neuropsychological assessment to assess reported difficulties with visual information processing, emotional/behavioral control, impulse control, sustained attention, and academic performance. A comprehensive neuropsychological evaluation assessing intelligence, academic achievement, attention, executive functioning, memory, phonological processing, motor skills, visual construction, visuomotor integration, and psychosocial functioning was completed.
Results: Test performance revealed general intellect to be 2 standard deviations below average for her age, with a relative strength in verbal abilities which were average range. Academics were variable but generally fell 1-2 standard deviations below average, though reading and written language as relative strengths. She demonstrated problems with grapheme-phoneme translation / processing was generally impaired. Deficits in mental flexibility and visual attention were observed. Visual perception and visuomotor skills fell within the moderately to severely impaired range, though visual construction performance was only mildly impaired. The presenting difficulties with visual-spatial processing are thought to be attributable underlying neuropathology in the occipital-parietal-temporal area (greater in the right than left hemisphere) at the time of her intracranial bleed at 4 months of age. Reassessment for evidence of progression in her recovery is pending and will be reviewed with the initial assessment as a baseline level of ability for contrast.
Conclusions: Neuroplasticity plays an essential role in determining the scope of impairment that might be present after a TBI. This case study highlights the significant resiliency of the brain through lateralization and neuroplasticity. Despite the significant damage to this child's brain that will result in permanent deficits in processing rapid and complex visual information, she has been able to maintain average processing of simple and moderately complex visual information and achieve a developmentally expected trajectory on verbal abilities -- excluding reading-based learning. She had learned to effectively use external supports to attain age-appropriate adaptive skills. Still, impairments in other domains were found, including for behavioral, emotional, and cognitive regulation. Significant intervention and support will be required to ensure maximal recovery.
Keywords: brain plasticity**,** visuospatial functions**,** occipital lobes

Live Program Open

9:55 - 10:00am
Friday, February 4, 2022

LIVE Plenary D: (Birch Memorial Lecture) Side-lining Bias: A Flexible Social Cognition Approach to Social Bias Reduction

Presenter: Lasana T. Harris

10:00 - 10:55am
Friday, February 4, 2022

Abstract & Learning Objectives:
Current approaches to reducing social biases focus on the individual, rather than social

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context that communicates and reinforces bias. This individual-level focus has resulted in the implicit bias training cottage industry hinged on making people aware of their biases in the hope that they can engage regulatory mechanisms to prevent such biases resulting discriminatory behavior. Social neuroscience research demonstrates that social biases result from social learning processes: brain regions governing social learning and emotion support social bias expression. This literature also hints at an alternate approach that targets stereotypes—cognitive constructs—rather that affect. I argue that social bias can be side-lined if alternate cognitive constructs can be triggered rather than stereotypes during social interactions. This shifting focus relies on the inherent flexibility of social cognition, as well as social roles and goals within the social context, keeping the focus on the individual, but empowering the social context to dictate whether the stereotype gets triggered or not. I conclude by discussing the implications of this novel approach for bias training and social bias reduction.

Upon conclusion of this course, learners will be able to:
- Explain why social biases occur
- Critique existing approaches to social bias training
- Utilize social neuroscience evidence to employ alternative approaches to social bias reduction

LIVE Plenary E: Neurological complications of COVID-19: exploring syndromes, mechanisms and management

Presenter: Mark Ellul

11:00am - 12:00pm
Friday, February 4, 2022

Abstract & Learning Objectives:
Pandemic viruses throughout history have been associated with neurological sequelae, including influenza viruses and flaviviruses such as Zika and West Nile virus. Other coronaviruses, including those associated with the severe acute respiratory syndrome and Middle East respiratory syndrome epidemics, were also associated with reports of central or peripheral nervous system syndromes. COVID-19 is a multisystem disorder with an extremely wide spectrum of symptomatology and severity. In the early stages of the pandemic, numerous reports emerged from around the World of diverse neurological manifestations of the virus, although without clarity of case definitions it was challenging to distinguish true manifestations of SARS-CoV-2 infection from the complications of critical illness or co-incident infection. To address these questions we developed a UK-wide surveillance study of neurological and psychiatric complications of COVID-19, which is providing insights into the risk factors, characteristics and outcome of patients who developed neurological complications, specifically identifying severe encephalopathy and cerebrovascular disease as the most frequent syndromes. Ongoing work is shedding light on possible pathogenic mechanisms underlying these manifestations, including the direct effects of viral infection, parainfectious or postinfectious immune-mediated disease. This session will reflect this rapidly evolving area of clinical research, discussing the current understanding of the acute neurological complications of COVID-19, reviewing the possible pathogenic mechanisms of these syndromes, their outcome and clinical management.

Upon conclusion of this course, learners will be able to:
- Recognize potential neurological complications of COVID-19
- Discuss the issues and challenges in establishing the role of viral infection in neurological syndromes
- Apply this knowledge in future interactions with patients and engagement with the scientific literature

Coffee Break

12:00 - 12:30pm
Friday, February 4, 2022

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Poster Session 09: Adult Assessment | Career

12:00 - 1:00pm
Friday, February 4, 2022

01 Stroop Color and Word Test Normative Update: What to Know to Administer and Interpret

Brian Syzdek
Stoelting, Wood Dale, IL, USA

Objective: The Stroop Color and Word Test is an efficient assessment of executive functions, particularly inhibition and attention, used extensively for clinical and research applications. The Normative Update contains new administration procedures to enhance validity and reproducibility and is updated to reflect the current population.
Participants and Methods: The Stroop was administered to a sample of over 300 adults and 100 children. Additional measures of attention, reading, and the Stroop effect were administered to examine the concurrent validity and construct of the Stroop effect. The structure of the Stroop was analyzed with factor analysis. Reliability and validity of the Stroop was examined. Normative scores tables were constructed.
Results: The Stroop demonstrated good test-retest reliability, good internal reliability, and correlated with other measures. Normative score tables demonstrated increased accuracy in predicting scores compared with previous models.
Conclusions: The Stroop demonstrated strong psychometric properties. The updated version reflects current population characteristics. The updated administration procedures contain clearer language for more consistent administration.
Keywords: assessment**,** attention deficit hyperactivity disorder**,** demographic effects on test performance
Correspondence: Brian Syzdek, Psy.D.; Stoelting; bsyzdek@stoeltingco.com

02 The Rey Auditory Verbal Learning Test: Cross Validation of Mayo Normative Studies (MNS) Demographically Corrected Norms

David W. Loring[1], Jessica L. Saurman[1], Samantha E. John[2], Stephen C. Bowden[3], James J. Lah[1], Felicia C. Goldstein[1]
[1]Emory University, Atlanta, Georgia, USA. [2]University of Nevada, Las Vegas, Las Vegas, Nevada, USA. [3]Univesity of Melbourne, Melbourne, Victoria, Australia

Objective: Although the origins of the Auditory Verbal Learning Test (AVLT) date back to the late 19th century with the Swiss psychologist Édouard Claparède (Boake, 2000), it remains a popular instrument for the clinical assessment of verbal learning and memory. Because it was created to investigate memory rather than developed as a clinical memory test, the AVLT has never been subjected to contemporary standardization practices and there are multiple options to choose from for normative comparisons, none of which control for gender ability differences. The Mayo Normative Studies (MNS) represent a robust dataset that provides demographically corrected norms. Here we report the generalizability to an independent sample from the Southeastern United States and evaluate whether MNS norms reliably compensate for established AVLT performance differences due to gender.
Participants and Methods: Participants from the Emory Healthy Brain Study (463 women, 200 men) who were administered the AVLT were analyzed to establish predicted performance differences as a function of gender and age across multiple AVLT scores, and then to characterize whether MNS normative correction successfully controlled for both demographic performance effects. Group differences for age and for gender were examined based upon one-way ANOVAs for each group separately or chi-squared analysis depending on the question of interest.
Results: Expected effects of gender and age were observed across all primary AVLT learning and memory scores. Applying MNS either eliminated or minimized all observed statistically significant raw score performance differences, effects that differed as a function of sample size,

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reducing differences to very small effect sizes as characterized by Eta Squared values. Estimated confidence intervals for raw scores were calculated demonstrating broad ranges exceeding the standard deviation for each measure. Significant gender differences were present for 10/15 words on recognition memory testing.

		Sample	Female	Male	Total	Eta Squared
Raw Scores	Trial 1-5 Sum	N=663	50.0 (9.0)	44.4 (9.5)	48.4 (9.5)	0.074
	Delayed Recall	N=646	10.1 (3.5)	8.1 (3.8)	9.5 (3.7)	0.060
		Sample	Female	Male	Total	Eta Squared
MNS T Scores	Trial 1-5 Sum	N=663	50.1 (11.0)	52.1 (11.6)	50.7 (11.2)	0.007
	Delayed Recall	N=646	49.7 (11.5)	51.0 (12.1)	50.1 (11.7)	0.002

Conclusions: These findings demonstrate the generalizability of the MNS regression norms to a sample of cognitively healthy volunteers from a different geographic region of the United States. Although AVLT gender differences have previously been described (Gale et al., 2007), common AVLT normative tables did not demographically correct for gender prior to MNS. Application of the full MNS demographic correction in the EHBS cohort adjusted for the gender differences across most measures, and the small statistically significant gender differences that remained were associated with effect sizes that are considered small. Further support for MNS use in performance characterization is illustrated by its ability to adjust age-related performance difference to overall performance levels near the expected value of *T*=50.

Keywords: learning**,** demographic effects on test performance**,** neuropsychological assessment

Correspondence: David W. Loring, Department of Neurology, Emory University, dloring@emory.edu

03 Determining Appropriate MoCA Scores for Black Patients

Lauren Ratcliffe[1], Taylor McDonald[1], John Sass[2,3]
[1]Mercer University, Atlanta, GA, USA. [2]Cognitive Rehabilitation of Georgia, Atlanta, GA, USA. [3]Restore Health Group, Rosewell, GA, USA

Objective: The Montreal Cognitive Assessment (MoCA) is the standard cognitive screener in detecting mild cognitive impairment (MCI). The recommended cutoff score of 26 has

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been indicated as being too high in Black populations. However, limited studies exist providing alternative cutoff scores for Black patients with MCI and dementia. The purpose of the present study is to determine the optimal cutoff points in the detection of cognitive impairment.
Participants and Methods: Data was obtained from the National Alzheimer's Coordinating Center Uniform Data Set between March 2015 and September 2019. This resulted in a sample of 818 total participants with a mean age of 69.19 (SD = 8.07). Sample demographics were predominately female (76.5%) with an average education of 15.33 years (SD = 2.66). Participants were then grouped into their respective diagnostic categories: normal aging n = 644 and MCI n = 174.
Results: Based on the recommended cutoff score for impairment of <26, the MoCA had poor sensitivity (40%) and adequate specificity (72%) in our normal aging group. However, the MCI group demonstrated extremely low sensitivity (9%) and specificity (16%). A cutoff score of 23 or less on the MoCA retained adequate sensitivity (76%) and good specificity (94%) for normal aging. In the MCI group, a score of 16 points or less yielded excellent sensitivity (92%) and specificity (97%).
Conclusions: These findings suggest that the cutoff of 26 is not generalizable across all contexts. These findings are consistent with those previously reported in the literature of recommending lower cutoff scores when accounting for racial identity. Race-specific cutoff scores can then promote clinician confidence, thus contributing to reduced misclassification at time of screening.
Keywords: assessment, cognitive functioning, cross-cultural issues

04 Is the MoCA Culturally Biased?

Taylor McDonald[1], Lauren Ratcliffe[1], John Sass[2,3]
[1]Mercer University, Atlanta, GA, USA. [2]Cognitive Rehabilitation of Georgia, Decatur, GA, USA. [3]Restore Health Group, Roswell, GA, USA

Objective: The Montreal Cognitive Assessment (MoCA) is a widely used cognitive screener for the detection of mild cognitive impairment (MCI). Research has demonstrated that Black older adults generally attain lower cognitive test scores throughout the U.S. However, this effect is largely observed in the South and in individuals born in the South who relocate to other states. Differences in test performance between White and Black individuals may suggest that specific items on the MoCA may be culturally biased or have poor psychometric properties that differ across studies, settings, and target populations.
Participants and Methods: Data was obtained from the National Alzheimer's Coordinating Center Uniform Data Set between March 2015 and September 2019. This resulted in a sample of 3,650 normal aging participants with a mean age of 68.19 (SD = 10.53). Sample demographics were predominately White (82.4%) and female (65%) with an average education of 16.36 years (SD = 2.49).
Results: Based on an independent t-test, there was a significant difference between test scores for White participants (M = 26.61, SD = 2.47) and Black participants (M = 24.31, SD = 3.21); $t(813.39) = 17.14$, $p < .001$, Cohen's d = .88. According to a series of t-tests, there was a significant difference between White and Black participant performance on all subtests, except the clock contour, delayed recall category cue, delayed recall recognition, date, month, year, day, city, and place, as well as the orientation domain ($p > .05$). Further examination using normal distribution revealed worse performance on the cube and delayed recall no cue for Black participants.
Conclusions: To the best of our knowledge, this is the first study using an item-analysis to detect culturally biased items on the MoCA. Although there were statistically significant results, the difference in scores for these groups were small, which is likely reflective of the large sample size and not considered to be clinically meaningful. Despite the literature suggesting culturally biased items on the MoCA, our findings did not support these claims. Rather, this discrepancy may be reflective of poor psychometric properties for this population. Future studies could examine the combination of screening measures, such as the MoCA and the Functional Activities

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Questionnaire, in reducing cultural bias in cognitive testing.
Keywords: assessment**,** cognitive functioning**,** cross-cultural issues

05 Concurrent Validity of Performance and Symptom Validity Groups is Impacted by Discordance of Criterion and Invalidity Operationalization

Jonathan P Fillauer, Troy A Webber, Nicholas J Pastorek, Brian I Miller
Michael E. DeBakey VA Medical Center, Houston, Texas, USA

Objective: Assessment of symptom and performance validity is a critical component of accurately interpreting neuropsychological test scores. Prior research has suggested that performance and symptom validity are distinct constructs based partly on differential relations of performance validity tests (PVTs) and symptom validity tests (SVTs) to cognitive test performances and self-reported symptoms, respectively. Although PVTs and SVTs likely provide non-redundant information regarding the validity of neuropsychological test interpretations, studies arguing that performance and symptom validity represent distinct constructs have reached this conclusion by showing differential relationships between criterion and validity indices using SVTs that are not specific to the overreporting of cognitive complaints, or compare the association of PVTs with self-report instruments that do not measure cognitive complaints. Further, most research on this topic has been conducted in mixed clinical or mild traumatic brain injury samples. Using an epilepsy monitoring unit sample, we hypothesize that PVTs and SVTs are both strongly associated with self-report instruments and performance on cognitive tests when there is concordance between what the PVTs and SVTs measure and what is measured by the self-report and cognitive test scores.
Participants and Methods: Two-hundred ninety-nine Veterans (mean age = 48.7; 22.1% female) completed neuropsychological test batteries during a four-day inpatient hospitalization on an epilepsy monitoring unit. Performance validity status was defined by failure on 2 out of 3 performance validity indicators, while symptom validity status for cognitive symptom invalidity was defined using above threshold scores on 2 out of 3 SVTs that specifically index noncredible cognitive symptom reporting. The PVT and SVT groups were then compared across a battery of neurocognitive and self-report measures using independent samples t-tests.
Results: As expected, results indicated large effect sizes (all significant at $p<.05$) for the association between PVT groups and cognitive tests (Cohen's d = 0.806-0.882). Additionally, small to large effect sizes (most of which were statistically significant at $p<.05$) were observed for the association between cognitive SVT groups and self-report measures (Cohen's d = 0.257-1.458), with the largest effect sizes observed for self-reported cognitive and depressive symptoms. However, results also demonstrated small to large effect sizes (most of which were statistically significant at $p<.05$) for associations between performance invalidity and self-report instruments (Cohen's d = 0.238-1.003), with the largest effect size observed for a measure of self-reported cognitive symptoms. Also, small to medium effect sizes (most of which were statistically significant at $p<.05$) were observed for the association of cognitive symptom invalidity with scores on neurocognitive tests (Cohen's d = 0.186-0.653).
Conclusions: Results highlight that symptom and performance invalidity may not be as discrete and dissociable as prior research has proposed, particularly when there is conceptual concordance between the SVT/PVT indices and what is measured by the neurocognitive/self-report measures. Although results support the notion that PVTs and SVTs provide non-redundant information regarding the validity of neuropsychological assessment measures, both neurocognitive test and cognitive symptom self-report measure scores should be interpreted cautiously when either performance or symptom invalidity for cognitive symptom reporting is identified by assessment instruments.
Keywords: validity (performance or symptom)**,** assessment

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06 Comparison of Test-Retest Reliability of Baseline Concussion Symptom Scores on the SCAT5 vs. SCAT3

Henri Y Lu, Rachel T Fouladi
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Objective: The Sport Concussion Assessment Tool (SCAT) Symptom Evaluation (SE) is widely used for assessing concussion symptoms in athletes. Instructions for baseline administration changed from the 3rd edition (S3SE: "how you feel now") to 5th edition (S5SE: "how he/she typically feels"). Few studies have investigated the effect of the change in instruction reporting time frame, so the present study aimed to compare test-retest reliability of baseline symptom scores on the S5SE versus S3SE over one week.
Participants and Methods: A total of 682 undergraduate psychology students (M = 19.51 years, SD = 3.12; 79% self-identified females and 21% self-identified males) were included in the analysis. At two timepoints about one week apart (M = 6.67 days, SD = 0.78), participants completed online versions of the S5SE and S3SE in immediate succession with counterbalanced order of administration. Two-way repeated measures ANOVAs were conducted to compare means, and chi-square tests were conducted to evaluate equality of corresponding test-retest reliability coefficients for number of symptoms and symptom severity score on the S5SE versus S3SE at the total symptom and symptom cluster levels. The Holm-Bonferroni correction method was used for pairwise comparisons at the symptom cluster level.
Results: At the total symptom level, there were no statistically significant differences between one-week test-retest reliability coefficients on the S5SE and S3SE for number of symptoms (S5SE r = .79 vs. S3SE r = .77), $\chi^2(1) = 1.49$, p = .222, or symptom severity score (S5SE r = .81 vs. S3SE r = .78), $\chi^2(1) = 2.15$, p = .142. At the symptom cluster level, omnibus chi-square tests showed statistically significant differences between corresponding test-retest reliability coefficients on the S5SE and S3SE for number of symptoms, $\chi^2(4) = 9.68$, p = .046, and symptom severity score, $\chi^2(4) = 18.10$, p = .001. Follow-up pairwise comparisons revealed significantly higher test-retest reliability coefficients on the S5SE than S3SE for number of physical symptoms (r = .72 vs. r = .64), severity of physical symptoms (r = .76 vs. r = .68), severity of cognitive symptoms (r = .78 vs. r = .71), severity of affective symptoms (r = .76 vs. r = .69), and severity of sleep symptoms (r = .76 vs. r = .69); no statistically significant differences were found for number of cognitive, affective, or sleep symptoms.
Conclusions: Comparisons of baseline one-week test-retest reliability coefficients of symptom scores between the S5SE and S3SE demonstrated mixed findings, but statistically significant results consistently showed small to medium improvements in test-retest reliability from the S3SE to S5SE. Overall, the new baseline instructions on the S5SE appeared to elicit more consistent reporting of baseline symptoms over a short test-retest interval. Reporting time frames are important to consider, as they can affect psychometric properties of scores, and thus, diagnostic decisions.
Keywords: concussion/ mild traumatic brain injury, psychometrics, sports-related neuropsychology
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07 Base Rates of Digit Span Forward ≤ 6 Performance Validity Failures in a Nationally Representative Mild, Moderate, and Severe Alzheimer's Dementia Sample

Scott Mooney[1], Trevor Durey[2], Sydney Skaggs[1], Deven Dyer[3], Ronald Okolichany[1], Haley Aaron[1], A'mie Preston[1], Prasad Padala[1]
[1]Central Arkansas VA, Little Rock, AR, USA. [2]Harding University, Little Rock, AR, USA. [3]University of Central Arkansas, Conway, AR, USA

Objective: Retrospective appreciation of credible performance validity in existing, large, nationally representative and publicly available Alzheimer's datasets can be challenging when standalone procedures were not included in the data collection plan. Prior research has provided some empirical support for Digit Span Forward

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(DSF) ≤ 6 as an embedded indicator of non-credible task engagement during performance based cognitive testing. The purpose of the present study was to examine the base rates of DSF total score performance validity failures in a Dementia of Alzheimer's Type (DAT) patient sample stratified by severity of cognitive dysfunction.
Participants and Methods: 1,844 primary English-speaking patients with probable DAT and an available collateral informant were assessed with MMSE and WAIS-III Digit Span Forward and identified from the National Alzheimer's Coordinating Center Uniform Dataset. Dementia was classified as "Mild", "Moderate" or "Severe" when MMSE total scores ranged from 20-24, 13-19, and ≤ 12, respectively.
Results: Overall study sample mean(*SD*) age, education, and MMSE scores were 74.7 (9.9), 14.4 (3.1) years, and 18.2 (5.1) respectively. The sample was 53% female, 83%Caucasian, and 17% African American. Stratified by dementia severity, mean(*SD*) age and MMSE total score for each of the groups was as follows: "Mild" dementia group (n = 917) was 75.1(9.2) and 22.1(1.4), "moderate" (n = 683) was 74.3(10.6) and 14.3(4.5), and "severe" (n = 244) was 71.9(11.1) and 7.9(3.4), respectively. The severe dementia group was younger, on average, relative to the other groups (all p's <.001). 567/917 (62%) of "mild", 312/683 (46%) of "moderate", and just 37/244 (15%) of "severe" dementia cases produced a digit span forward ≥ 7 (Chi-Square = 174.82; p <.001).
Conclusions: The base rates of dementia patients successfully demonstrating credible task engagement based on a DSF score of ≥ 7 was moderate to low with a greater frequency of failure as dementia severity increased. Low DSF scores (i.e., ≤ 6) may reflect the degree of cognitive dysfunction rather than non-credible task engagement in the elderly with known moderate to severe dementia. Similar conclusions have been found when examining and extending empirically validated performance validity tests in younger adult traumatic brain injury and/or heterogeneous neurological and dementia populations. Thus, DSF may have limited utility in retrospectively appreciating credibility of obtained cognitive test results in an existing, large, nationally representative and publicly available Alzheimer's dataset --- the National Alzheimer's Coordinating Center Uniform Dataset. Study limitations and future directions discussed.
Keywords: validity (performance or symptom), dementia - Alzheimer's disease

08 The Clinical Utility of the OPIE-3 as a Measure of FSIQ Across the Psychosis Spectrum

Danielle Kaplan[1,2], Joanna M. Fiszdon[3], Godfrey D. Pearlson[1,3], Jimmy Choi[1]
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Objective: The Oklahoma Pre-Morbid Intelligence Estimate (OPIE-3) is a method of estimating premorbid FSIQ using WAIS-III subtests and demographic characteristics. It has been widely used in research and utilized with many populations including schizophrenia spectrum disorders. While using cognitive measures to estimate FSIQ is an expected method, symptoms associated with schizophrenia, such as thought-blocking and alogia, can make this assessment challenging. To date, no studies have specifically examined the relationship between individual subtests and the overall OPIE-3 FSIQ estimate across the spectrum of schizophrenia disorders.
Participants and Methods: Participants included 42 young adults experiencing their first psychotic episode (15-18yo) and 47 who experienced their first psychotic episode less than 3 years ago (18-24yo). The Four Subtest OPIE-3 was administered including Vocabulary, Information, Matrix Reasoning, and Picture Completion. To characterize the expression of psychosis, symptom severity at onset was gauged by either the Scale of Psychosis-risk Symptoms (SOPS) for those under 18yo or the Positive and Negative Symptom Scale (PANSS) for those over 18yo. Age of illness onset was collected via self and family report during clinical interview.
Results: Positive correlations existed between FSIQ and Information (r = .36, p = 0.00), Picture

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Completion (r = .27, p = 0.03) and Matrix Reasoning (r = 0.65, p = 0.00). Overall OPIE-3 FSIQ was not correlated with the Vocabulary subtest. While the non-verbal subtests were positively correlated with each other (e.g., Matrix Reasoning and Picture Completion) (r = .27, p = 0.04), the verbal subtests (e.g., Vocabulary and Information) were not inter-correlated. Vocabulary was not correlated with any of the other OPIE-3 subtests or with the aggregate variable. Symptom severity was negatively correlated with Matrix Reasoning (r = -.39, p = 0.00) and positively correlated with age of illness onset for both self -report (r = .30, p = 0.00) and family report (r = .23, p = 0.04).
Conclusions: Analyses revealed strong correlations between the overall FSIQ estimate and the majority of stand-alone subtests with the exception of Vocabulary. Findings suggest that vocabulary or verbal tests requiring expressive language may not be viable in estimating FSIQ in schizophrenia spectrum disorders. Psychotic symptoms that impede verbal communication are prominent in many patients with schizophrenia, and non-verbal measures may be more suitable to capturing cognitive reserve in this population. Verbal subtests were not intercorrelated potentially due to differences in task demand. Specifically, while Vocabulary requires access to a diverse set of linguistic abilities, the Information subtest prefers a simple and straightforward response. Future research will focus on determining the most appropriate measure of FSIQ for different subsets of psychotic disorders (i.e. WASI, WAIS).
Keywords: assessment**,** psychosis

09 Confirmatory Factor Analysis of the Somatic Complaints Scale on the Personality Assessment Inventory

Mary U Simons[1], Brooke Magnus[2], Morgan Nitta[1], James Hoelzle[1]
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Objective: Somatization, the propensity to experience emotional distress as physical symptoms, is associated with poor health outcomes (Barksy, Orav, & Bates, 2005). The construct of somatization has received increased attention recently as its placement in hierarchical models of psychopathology is debated. The Personality Assessment Inventory (PAI) Somatic Complaints (SOM) scale quantifies degree of preoccupation with and/or psychological reactions to physical health matters. The current study will utilize confirmatory factor analysis to investigate the factor structure of SOM.
Participants and Methods: Participants seeking therapy or assessment services completed the PAI as part of the intake process at a university-based clinic. Data was obtained from 391 adults, 240 of which were female (61.2%). Multiple confirmatory factor analyses (CFA) were conducted (SOM scale unidimensional; unidimensional within each SOM subscale: conversion, health concerns, and somatization; and bifactor) utilizing the diagonally weighted least squares (DWLS) approach, which is specifically designed for ordinal data (Li, 2015). Solutions were evaluated by considering fit statistics: chi-square estimates, the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993), the comparative fit index (CFI; Bentler, 1990), and the Tucker-Lewis Index (TLI; Bentler, 1990).
Results: CFA for a unidimensional SOM model suggested marginal fit, $X^2(252)= 679.24$, $p<$ .001, CFI=.90, TLI=.89, RMSEA=.08, and SRMR=.09. Further investigation of each subscale reveal adequate fit for a single dimension underlying Health Concerns ($X^2(20)=$ 12.50, p=.90, CFI= .99, TLI= .99, RMSEA= .03, SRMR= .04) and Somatization ($X^2(20)=36.84$, p=.01, CFI= .96, TLI=.94, RMSEA=.07, SRMR=.06). However, there was marginal fit for a single dimension underlying Conversion, $X^2(20)= 48.78$, CFI= .95, TLI= .93, RMSEA=.09, SRMR= .08. A bifactor model, consisting of a general SOM dimension and specific factors reflecting Health Concerns, Somatization, and Conversion, exhibited best fit, $X^2(228)= 337.18$, $p<$ .001, CFI=.95, TLI=.94, RMSEA=.05, and SRMR= .07.
Conclusions: SOM is best conceptualized as a bifactor structure with a general somatoform dimension and specific factors reflecting health concerns, somatization, and conversion. With regards to SOM subscale unidimensionality,

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Health Concerns and Somatization were adequately unidimensional, however, Conversion did not demonstrate unidimensionality. No prior research has investigated the SOM factor structure, therefore the current findings are novel and elucidate the complex nature of somatization as measured by the PAI. Future research is encouraged to evaluate the predictive validity of general and specific SOM factors in predicting health outcomes.

Keywords: psychometrics**,** medical disorders/illness**,** neuropsychological assessment

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10 Item Response Analysis of the Somatic Complaints Scale on the Personality Assessment Inventory

Mary Simons[1], Brooke Magnus[2], Morgan Nitta[1], James Hoelzle[1]
[1]Marquette University, Milwaukee, WI, USA. [2]Boston College, Boston, MA, USA

Objective: Somatization, the propensity to experience emotional distress as physical symptoms, is associated with poor outcomes (Barksy, Orav, & Bates, 2005). The Personality Assessment Inventory (PAI) Somatic Complaints (SOM) scale quantifies an individual's preoccupation with and/or psychological reactions to physical health matters. However, little is known about how specific SOM items are associated with the construct somatization. Therefore, the current study will utilize item response analysis to investigate how specific SOM items are related to the latent trait of somatic complaints.
Participants and Methods: Participants seeking therapy or assessment services completed the PAI as part of the standard intake process at a university-based clinic. Data was obtained from 391 adults, 240 of which were female (61.2%). Given that a bifactor SOM solution optimally explained SOM variance, bifactor item response analysis (IRT) was conducted to document items discrimination (*a*) and difficulty (*b*) parameters. A graded response model (GRM) was utilized to conduct a polytomous IRT.
Results: To facilitate interpretation of results, this research will focus on a dichotomy that differentiates "*False, Not at all True"* and *"Slightly True"* vs. *"Mainly True"* and "*Very True"*. Item discrimination parameters on the general factor ranged from 0.32-2.48 and averaged 1.51, indicating that SOM best discriminates at levels of the latent trait 1.5 standard deviations above the mean. Item difficulty ranged from -0.09- 4.38 and average difficulty across all items is 2.05. When levels on the specific traits are fixed at 0, the SOM scale functions most efficiently at trait levels .5 to 2 standard deviations above the mean. Item discrimination related to the specific trait of Health Concerns ranged from -0.27 to 1.04 and averaged 0.54. Item discrimination related to the specific trait of Conversion ranged from -0.13 to 1.24 and averaged 0.89. Lastly, item discrimination related to the specific trait of Somatization ranged from 0.18 to 0.91 and averaged 0.53.
Conclusions: This research was conducted to better understand the psychometric properties of the PAI SOM scale. SOM most efficiently identifies somatic complaints at trait levels 0.5 to 2 standard deviations above the mean (corresponding with T scores of 55-70). At the item level, psychometric investigations shed light on how efficiently each SOM item functions, specifically how well each item measures the latent trait of somatic complaints. Items with high discrimination and moderate difficulty reflect more general comments about health status and are adequate measures of somatic complaints. In contrast, items with significantly high or low difficulty and low discrimination reflected uncommon and unusual somatic symptoms. This investigation sheds light on a poorly understood construct, somatization, which could aid in better detecting and understanding somatic symptoms in clients.

Keywords: neuropsychological assessment**,** psychometrics

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11 The Impact of Visual Memory Impairment on Victoria Symptom Validity

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Test Performance: A Known-Groups Analysis

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Objective: A psychometrically sound PVT should accurately identify invalid performance while remaining robust against the effects of bona fide cognitive impairment. We assessed the effect of visual memory impairment on performance on the Victoria Symptom Validity Test (VSVT) for both easy (VSVT-E) and difficult (VSVT-D) items to determine the effect of genuine memory deficits on a commonly administered performance validity test (PVT).
Participants and Methods: Cross-sectional data from 156 patients who were administered the VSVT and Brief Visuospatial Memory Test-Revised (BVMT-R) were examined. All participants were administered at least four independent criterion PVTs, which resulted in 114/156 (73%) classified as having valid test performance and 42/156 (27%) as demonstrating invalid test performance. The sample was 47% female/53% male, 44% White, 26% Black, 19% Hispanic, 7% Asian American, and 3% other race/ethnicity, with a mean age of 39.2 (*SD* = 13.5) and education of 14.5 years (*SD* = 2.8). BVMT-R Delayed Recall (DR) memory bands were defined as ≥40 T (unimpaired; *n* = 77) and <=39 T (impaired; *n* = 37). Receiver operator characteristic (ROC) curve analyses tested the VSVT-E and VSVT-D's classification accuracy for the overall sample, and then separately for subgroups based on visual memory functioning (i.e., unimpaired/invalid; impaired/invalid).
Results: ROC curve analysis for the overall sample revealed that the VSVT-E and VSVT-D yielded acceptable classification accuracies (areas under the curve [AUCs] = 77.2 and 76.4, respectively), with respective sensitivities of 47.6% and 52.4%, and respective specificities of 92.1% and 88.6% at optimal cut-scores of ≤22 and ≤16. When stratified by memory bands, comparable classification accuracies were found for both the unimpaired (AUCs = 77.6 and 76.7) and impaired (AUCs = 76.4 and 76.0) subsamples. Optimal cut-scores were invariant regardless of the presence/absence of memory impairment (i.e., VAVT-E ≤22; VSVT-D ≤16). At optimal cut-scores, the memory unimpaired sample showed VSVT-E and VSVT-D sensitivities of 47.6% and 52.4%, and specificities of 92.2% and 88.3%, respectively. Similarly, the memory impaired sample showed VSVT-E and VSVT-D sensitivities of 47.6% and 52.4%, and specificities of 91.9% and 89.2%, respectively.
Conclusions: The present study sought to examine the discriminability of the VSVT-E and VSVT-D overall and in the presence and absence of visual memory impairment. Current results demonstrate that both the VSVT-E and VSVT-D yielded acceptable classification accuracies in the overall sample, and this effect was maintained in those with and without visual memory impairment. Findings indicate that the VSVT is a robust PVT capable of maintaining its psychometric properties with stable cut-scores despite the presence of bona fide visual memory impairment.
Keywords: psychometrics**,** validity (performance or symptom)**,** memory disorders

12 Rasch Analysis of the Toronto Alexithymia Scale–20 in Healthy Adults and Adults with Acquired Brain Injury

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Objective: Alexithymia refers to difficulties in experiencing, identifying, and describing emotions. It is a prevalent and important problem after acquired brain injury (ABI) that can adversely affect quality of life for individuals with ABI and their loved ones. Accurate measurement of alexithymia is critical for the development of effective rehabilitation strategies. The Toronto Alexithymia Scale-20 (TAS-20) is the most commonly used self-report measure of alexithymia. The TAS-20 provides a Total score and three subscales: difficulty identifying feelings (TAS-DIF), difficulty describing feelings (TAS-DDF), and externally

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oriented thinking (TAS-EOT). This study evaluated the TAS-20 in individuals with ABI and neurologically healthy comparisons using Rasch analysis. Rasch analysis facilitates detailed psychometric evaluation of a scale, as well as how the items function specific to the people who complete the scale.
Participants and Methods: Participants were 121 neurologically healthy adults (NH) and 132 adults with ABI due to traumatic brain injury or stroke. TAS-20 items use a 5-point scale, with response alternatives ranging from Strongly Disagree to Strongly Agree. High TAS-20 scores indicate high levels of alexithymia (i.e., worse emotional functioning). Rasch analyses included dimension analysis, item and person reliabilities, targeting, and mean-square fit to examine reliability and capacity of the scale to measure the participants' ability.
Results: Dimension analysis indicated that TAS-20 is multidimensional (Eigenvalue > 3). Each subscale was composed of a single dimension; however, because the TAS-20 Total is typically interpreted, it was assessed as well. For both groups, targeting for the Total, TAS-DIF, and TAS-DDF was well accomplished for individuals with moderate to moderate-high alexithymia traits; however, individuals with very high or low alexithymia were not captured by the TAS-20. Targeting for TAS-EOT was good for moderate through high levels of alexithymia, but like the other subscales, participants with low levels were not captured adequately. Model fit statistics INFIT and OUTFIT were adequate for both groups for the Total and all subscales. Fit statistics at the person level were variable, with > 10% of the sample having extreme INFIT or OUTFIT values. Reliabilities for the Total and TAS-DIF were adequate for both groups (alpha > .80, person reliability > 70.), whereas TAS-DDF and TAS-EOT showed inadequate reliability, particularly for the ABI group.
Conclusions: Surprisingly, psychometric properties of the TAS-20 differed little between NH and ABI samples, with the exception of reliability for the TAS-EOT subscale. The TAS-20 showed clear signs that it comprised multiple dimensions, which suggests that clinicians should consider the subscales instead of relying solely on the total; however, the reliabilities of the TAS-DDF and particularly the TAS-EOT scales were inadequate. TAS-EOT includes reverse-keyed items, which may be especially difficult for individuals with ABI and may underlie the very low reliability of the subscale for that group. Limitations in TAS-20 targeting suggest that it might be complemented on the low end by items or measures of emotion approach coping, which would reflect the continuum of emotional functioning to be leveraged as a strength in rehabilitation following ABI.
Keywords: brain injury**,** assessment**,** psychometrics
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13 Category Switching: Not the Perfect Pear

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Objective: Verbal fluency tests are commonly used in neuropsychology batteries as measures of language productivity and executive functioning in the assessment of several disorders (Strauss et al., 2006). These tasks can involve letter and category fluency tasks. Letter fluency tasks require examinees to verbally produce words that begin with a specific letter, whereas category fluency tasks require examinees to produce words that belong to a designated semantic category within a particular time limit. A popular way to formally assess mental flexibility and the ability to shift between concepts is a category switching task, where examinees are required to fluently switch between producing words from two categories. Two categories that are often used in such a task are fruits and furniture. However, anecdotal clinical observations suggest that these categories are not comparable in terms of the number of correct items produced. Semantic neighbourhood density (SND) is a measure of semantic richness used to study semantic effects in psycholinguistic tasks (Durda & Buchanan, 2008). SND has been shown to have facilitatory effects in both memory and psycholinguistic tasks (Buchanan et al., 2001; Wong Gonzalez, 2018). It was hypothesized that the categories that are more semantically rich

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would produce more correct items. The purpose of the present study was to investigate the underlying semantic structure of each of these two categories using SND (Durda & Buchanan, 2008).
Participants and Methods: One-hundred University of Windsor undergraduate students completed two trials of a category fluency task (i.e., one trial for fruits and one trial for pieces of furniture). Each participants' responses were scored according to standardized rules provided by the Delis-Kaplan Executive Functioning System (DKEFS; Delis et al., 2001). SND values were computed from the Semantic Neighbourhood App (Lutfallah et al., 2018), which is derived from an existing database (WINDSORS; Durda & Buchanan, 2008).
Results: Overall, participants generated more correct items in the fruits category, and they made significantly more set-loss errors in the furniture category. Further, on average, items from the fruit category have denser semantic neighbourhoods compared to items from the furniture category.
Conclusions: These results support our observation that these two categories are not equal and therefore should not be included in a single category switching task. Examinees are likely better able to produce items from the fruit category than they are the furniture category because of the constraints associated with the smaller set size for furniture. As such, their scores may be misinterpreted as deficits in retrieval or cognitive flexibility.
Keywords: assessment**,** semantic processing**,** test development

14 Examining the Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF) Symptom Validity Indicators and Performance Validity in a Neuropsychiatric Sample

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Objective: The Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF) is commonly utilized in neuropsychological evaluations for the assessment of underlying psychopathology and personality in clinical examinations. The pattern of responses across the MMPI-2-RF symptom validity scales are an important component of neuropsychological and psychological evaluations regarding the accuracy and credibility of the examinee's performance and reporting style. Several studies have examined the relationship between MMPI-2-RF symptom validity indictors and performance validity tests (PVTs) in the context of medicolegal cases and evaluations of traumatic brain injury; however, these relationships remain understudied in mixed clinical samples with broader diagnostic and etiological compositions. The purpose of the current study was to extend current research and examine the relationship between MMPI-2-RF symptom validity scales and PVT performance in a general neuropsychiatric sample.
Participants and Methods: This cross-sectional study included data from 163 clinical patients who completed the MMPI-2-RF and four independent criterion PVTs used to establish validity group membership (i.e., Medical Symptom Validity Test; Test of Memory Malingering-Trial 1; Word Choice Test; Dot Counting Test) during outpatient neuropsychological evaluation. Based on performance on the criterion PVTs and current practice standards, 134 patients were assigned to the valid group, whereas 29 were classified as demonstrating invalid performance. The sample was 59% female/41% male, 42% White, 32% Black, 18% Hispanic, 6% Asian American, and 2% other race/ethnicity. Mean age was 42.0 (SD=14.6) and mean education was 14.4 years (SD=2.4). Receiver operating characteristic (ROC) curve analyses were conducted for the five over-reporting symptom validity indicators on the MMPI-2-RF (F-r, Fp-r, Fs, FBS-r, and RBS), to examine classification accuracy for detecting performance validity, as well as to determine optimal cut-scores and associated

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sensitivity/specificity values.
Results: F-r (area under the curve [AUC]=.67, *p*<.01; cut-score ≥90T: 45% sensitivity/88% specificity), Fs (AUC=.63, *p*<.05; cut-score: ≥87T; 38% sensitivity/90% specificity), FBS-r (AUC=.66, *p*<.01; cut-score: ≥82T; 35% sensitivity/89% specificity), and RBS (AUC=.69, *p*<.01; cut-score: ≥86T; 52% sensitivity/87% specificity) were able to significantly discriminate between those with valid and invalid neuropsychological test performance. By contrast, classification accuracy for Fp-r was nonsignificant (AUC=.60, p=.10), suggesting poor discriminability.
Conclusions: Results demonstrated four of the five MMPI-2-RF over-reporting scales (F-r, Fs, FBS-r, and RBS) accurately detected invalid neuropsychological test performance, with RBS showing the most robust classification accuracy and associated psychometric properties. Therefore, these symptom validity indicators are not fully dissociable from PVT performance and should be interpreted in conjunction with PVT performance. This study emphasizes the importance of exploring whether the combined effect of performance and symptom validity test failures increase accuracy for detection of invalidity in mixed clinical populations.
Keywords: assessment**,** validity (performance or symptom)
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15 Factor Structure of the Memory for Intentions Test in Samples of Older Adults and People with HIV Disease

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Objective: The Memory for Intentions Test (MIsT) is a clinical measure of prospective memory that requires participants to complete 8 intentions in response to specific cues, which vary based on cue type (time-based or event-based), delay interval (2 or 15 min), and response modality (verbal or action). This study evaluates the latent structure of the MIsT among two samples who may experience prospective memory deficits: older adults and people living with HIV disease.
Participants and Methods: Study participants included 303 people with HIV disease (ages 18-67) and 267 community-dwelling older adults (ages 50-91). Confirmatory factor analyses of the MIsT were conducted separately in each sample. In addition to a one-factor model, 3 two-factor models were conducted, with the MIsT items loading onto each factor based on cue type, delay interval, or response modality. A Bonferroni correction was used to correct for multiple comparisons (critical alpha = .017).
Results: Findings indicated that the one-factor model provided the best (and most parsimonious) fit to the data for the participants with HIV disease, $\chi^2(20) = 20.837$, $p = .407$, RMSEA = .012, CFI = .998, SRMR = .040, and the sample of older adults, $\chi^2(20) = 23.169$, $p = .281$, RMSEA = .024, CFI = .968, SRMR = .056. All two-factor models also demonstrated good fit statistics (RMSEAs < .02, CFIs > .98, SRMRs < .06), although correlations between the two factors in each model were high (*r*s = .67–.95). After correcting for multiple comparisons, none of the two-factor models provided a significantly better fit than the one-factor model (*p*s > .03) in either sample.
Conclusions: Results provide support for the factor structure of the MIsT in older adults and people with HIV disease. A total score for the MIsT provides the most parsimonious solution, although available evidence and theory also support the use of subscales based on cue type or delay interval. Future psychometric studies of the MIsT, including measurement invariance, would be useful to determine the performance of this measure among a variety of clinical populations.
Keywords: memory: prospective**,** aging (normal)**,** HIV/AIDS
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16 The Visuospatial Dot Learning and Memory Task: Validation Pilot Study of Visual Memory Screening Items Added to the MoCA for Patients with Stroke.

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Objective: The Montreal Cognitive Assessment (MoCA) is well-validated for use with patients with stroke (e.g., Cumming et al., 2011; Toglia et al., 2011; Wu et al., 2019; Chan et al., 2019) but is limited because of high verbal requirements and lack of visual memory items (Chan et al., 2017; 2019). This study examined the feasibility and validity of a novel visual memory screening test to be used as an adjunct to the MoCA in patients with stroke.
Participants and Methods: The Visuospatial Dot Learning and Memory (VDLM) task is a novel task designed to be added to the MOCA to measure visual memory. Examinees are briefly shown an array of circles and required to learn the placement of shaded circles (dots) on the page. Paralleling the MoCA verbal learning and memory items, there are two learning trials assessing immediate recall, a delayed free recall trial, and a multiple-choice recognition discrimination item. Participants in the study were consecutive patients with a history of supratentorial stroke who completed the task as part of their routine interdisciplinary stroke care at a VA hospital.
Results: Participants included 39 patients with left-sided stroke, 29 with right-sided stroke, and 12 with bilateral strokes. Participants were older adults (M = 69.4), mostly male (95%), mostly White (67.4%) or African American (30%), and high school educated (M = 12.7). All patients completed the VDLM, even those with significant dominant hand hemiparesis, and the task took < 5 minutes. Psychometrically, learning and delayed recall scores were skewed but showed adequate variance within the sample. On recognition testing, 82.5% of the sample correctly identified the target dot array. Spearman correlations revealed strong relationships between the two learning trials and delayed recall on the VDLM (r_s = 0.56 – .0.73, p < .01). Relationships were moderate between free recall trials and recognition testing (r_s = 0.38 – 0.46, p < .05). Correlations were modest between dot learning recall trials and total MoCA scores (r_s = 0.32-.0.39, p <.01). Providing evidence for convergent and discriminant validity, VDLM recall scores were moderately positively correlated with attention, visual, executive, and memory items from the MoCA (r_s = 0.22 – .0.38, p < .05) and not significantly correlated with orientation, naming, verbal abstraction, and sentence repetition items. Comparing those with left and right-sided strokes, there were significant differences on the MoCA initial learning trial (p = .009) and on delayed recall (p = .006). No statistically significant differences between left and right supratentorial stroke groups were evident for the VDLM subtask scores (p's > 0.10.).
Conclusions: Pilot data indicate the VDLM is feasible for use in those with stroke, as limited motor abilities are required to perform the task. Unlike the memory items of the MoCA, the VDLM does not bias against left versus right sided stroke patients perhaps because it is less dependent on language. The VDLM, used in conjunction with the MoCA, offers a unique contribution to the field of assessment, as many cognitive screeners neglect to include the cognitive domain of visuospatial memory. Further validation is needed to compare the VDLM to gold-standard visuospatial memory tests.
Keywords: visuospatial functions, assessment, stroke recovery

17 A Comparison of the Stroop Color and Word Test Scores for Detecting Invalid Neuropsychological Test Performance Among Adult ADHD Referrals

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Objective: Few studies have compared the relative accuracy of the Stroop Color and Word Test (SCWT) embedded performance validity indicators (Color Naming, Word Reading, Color-Word [CW]) for detecting invalid performance. Previous research has found that SCWT has high classification accuracy for validity group membership in mixed clinical and clinical/medicolegal samples; however, this research has not been conducted within patients referred for an ADHD evaluation.
Participants and Methods: This cross-sectional study included 311 consecutive adult patients who completed the SCWT during outpatient neuropsychological evaluation for ADHD. The sample was 61.3% female, 46.6% non-Hispanic White, 23.3% non-Hispanic Black, 14.4% Hispanic, 10.5% Asian American, and 5.2% other, with a mean age of 27.7 years (*SD* = 6.8) and a mean education of 15.7 years (*SD* = 2.1). Six patients (2%) had missing data, resulting in a final sample size of 305. 263 patients (85%) were classified as having valid neurocognitive performance and 42 (13%) as having invalid neurocognitive performance as established by performance across seven previously-validated independent criterion PVTs (i.e., Brief Visuospatial Memory Test-Revised Recognition Discrimination, Rey Auditory Verbal Learning Test Effort Score, Dot Counting Test, Rey 15-Item Test Recall/Recognition, Reliable Digit Span, FAS T-score, Trails A T-score) and objective diagnostic criteria for identifying invalid performance. Of those with valid neurocognitive performances, 219 patients were diagnosed with ADHD.
Results: When performance on SCWT's Color, Word, and C-W were independently compared, receiver operating characteristic curve analyses yielded significant areas under the curve of .75-.81 for the SCWT validity indices (*p*'s < .001). They demonstrated acceptable specificity (89% - 90%) and acceptable yet varied sensitivities across trials (40% - 60%). In the current sample, Color Naming (raw and T-scores) had the lowest sensitivities, with 43% and 41% sensitivity/90% specificity at optimal cut-scores of ≤57 and ≤30, respectively. At optimal cut-scores of ≤75 and ≤25, Word (raw and T-scores) showed 55% and 43% sensitivity/ 91% specificity, respectively. Of the three validity indicators, C-W had the most robust sensitivity in this sample, with C-W (Raw and T-scores) yielding 55% and 60% sensitivity/90% and 89% specificity at optimal cutoff scores of ≤34 and ≤37, respectively.
Conclusions: Of the SCWT validity scales, C-W consistently had the highest sensitivity for detecting invalid performance while maintaining acceptable specificity, whereas Color Naming consistently performed the worst. The benefit of using embedded validity measures, such as SCWT C-W, is that they provide additional data regarding performance validity without extending test battery length, allowing for appropriate conclusions to be made without additional time and effort for the patient.
Keywords: validity (performance or symptom)**,** neuropsychological assessment**,** attention deficit hyperactivity disorder

18 Validating the V-8: An Initial Validation of the Eight-Variable Psychiatric Screener (V-8)

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Objective: This study was designed to provide initial empirical validation for the Eight-Variable Psychiatric Screener (V-8), an eight-variable (energy, depression, anxiety, pain, fatigue, happiness, stress, and motivation) psychiatric screener based on the visual analog scaling method.
Participants and Methods: Participants were 278 healthy undergraduate students (35% male; 61% Caucasian, 14% Middle Eastern, 11% Asian; M_{age} = 21.8, SD_{age}=5.0; M_{edu}=14.3, SD_{edu} = 1.9) from a mid-sized Canadian University. Data were collected through an online survey whereby the V-8 was administered twice to each student participant in conjunction

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with established self-reported symptom inventories to serve as criterion variables. Each individual was asked to move a slider along a 10 cm line, indicating the point that best captures how they are feeling in the moment at both the beginning and end of the survey.
Results: Two-tailed bivariate correlations were conducted to determine the relationship between V-8 scores on each variable at the beginning and the end of each online survey. There was a strong relationship ($r \geq .70$) between the pre- and post-questionnaire scores for depression, happiness, stress, and pain. There was a moderate relationship ($r \geq .50$) between the pre- and post-questionnaire scores for energy, anxiety, motivation, and fatigue. There were also a number of moderate correlations between different items, such as between energy and happiness at time 1, and motivation at time 1 and energy at time 2. The V-8 depression and anxiety items were found to correlate moderately with the total, depression, anxiety, and stress scales of The Depression Anxiety Stress Scales (DASS), and weakly with the Difficulties in Emotion Regulation Scale (DERS). The V-8 anxiety, stress, fatigue, depression, and pain scores were found to correlate weakly with the Patient Health Questionnaire-15 (PHQ-15).
Conclusions: The current study provides an initial validation of the V-8, an eight-variable psychiatric screener. These data demonstrate convergent validity to other established self-report inventories, particularly with regard to the anxiety and depression items. Given its quick and easy administration and scoring (<1 minute), low cost, and minimal demands on the examinee (i.e., reading level, cognitive ability, motivation), the V-8 has the potential to become a cost-effective and empirically validated rapid assessment instrument in clinical and research settings requiring large-scale repeated testing.
Keywords: psychometrics
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19 Examining the Clinical Utility of the Controlled Oral Word Association Test (COWAT)

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Objective: The Controlled Oral Word Association Test (COWAT) is a staple of most neuropsychological batteries. It is relatively easy to administer and one of the few assessments that does not have a ceiling effect, thus allowing for natural variability in performance. At the same time, there are several issues that remain unresolved. Firstly, there is debate over which cognitive functions underlie performance. Additionally, there have been various reports about how performance is impacted by demographic variables and test version. Furthermore, previous findings suggest it may lack sensitivity to cognitive impairment, especially compared to the category fluency test. Recent studies recommend using item-level analyses, such as lexical frequency of each word produced, over the traditional total score as a more sensitive marker of decline. Specifically, healthy individuals are more likely to produce low frequency words (i.e., words that are less common such as 'fastidious') while those who may be showing signs of decline are less likely to retrieve low frequency words. Thus, we were interested in examining which variables predict performance on two COWAT measures (total words and lexical frequency) as well as examining whether the COWAT is an important predictor of diagnostic category compared to other widely utilized tests of cognition.
Participants and Methods: Sixty-seven healthy aging adults (aged 45-82) and thirty-seven adults with Mild Cognitive Impairment (MCI; aged 55-82) completed the COWAT, tests of memory: (California Verbal Learning Test, Brief Visuospatial Memory Test), vocabulary (Wechsler Test of Adult Reading), and executive function (Trail Making Tests A & B, Stroop Color-Word, and Digit Span). Mann-Whitney U tests were used to determine if healthy individuals and adults with MCI differed in COWAT performance. Elastic net regression models were used to examine whether age, sex, education, test version, vocabulary, or diagnosis were associated with performance on total scores or lexical frequencies. We then examined if adding other cognitive measures improved the

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models and which factors emerged as important predictors. Finally, we built a classification model predicting diagnostic status (healthy/MCI) including all previous predictors as well as the total words and lexical frequencies. The goal of this model was to determine the relative variable importance of lexical frequency and total correct words as compared to other cognitive tests.
Results: There was a significant difference in both total words produced (U=1730, p<0.001) and lexical frequencies (U=892, p=0.018) between the two groups. Individuals with MCI were producing fewer words and their words were overall higher frequency. The variance in either total score or lexical frequency was not explained by demographics, vocabulary, test version, or diagnosis. Additionally, the variance in total words produced but not lexical frequency was mostly explained by measures of executive function when controlling for all other measures. The important factors in predicting overall diagnosis were short-delay free recall on the CVLT followed by total correct words on the COWAT and the BVMT total immediate recall.
Conclusions: Thus, while it appears that the COWAT is an important predictor of cognitive impairment, our findings suggest the traditional total score, not lexical frequency, has better diagnostic utility.
Keywords: neuropsychological assessment**,** mild cognitive impairment
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20 Accuracy of the Rey-15 Item Test Recall and Recognition Trials for Detecting Performance Invalidity in Adult Attention-Deficit/Hyperactivity Disorder Referrals

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Objective: Studies that have attempted to cross-validate the Rey-15 Item Test (RFIT) Recall and Recognition Trials as performance validity tests (PVTs) and to confirm their ability to accurately discriminate valid and invalid test performance across diverse clinical samples have shown mixed results, including limited utility in some populations. Further, the accuracy of these PVTs for detecting invalid performance among individuals with suspected Attention Deficit/Hyperactivity Disorder (ADHD) has not been particularly well studied, nor have established optimal cut-scores for these PVTs been cross-validated in patients referred for ADHD evaluations. Extant literature demonstrates a high base rate of invalidity among adults presenting for ADHD evaluations. Therefore, the current investigation aimed to evaluate the accuracy of the RFIT Recall Trial and the RFIT Recall/Recognition Trial PVTs among a large sample of adult outpatients referred for neuropsychological evaluation for ADHD.
Participants and Methods: This cross-sectional study incorporated data from 305 consecutive adult clinical outpatients at a Midwestern academic medical center referred for neuropsychological evaluation to obtain diagnostic clarity for suspected ADHD and support for treatment planning. All patients were administered the RFIT Recall and Recognition Trials as a part of a larger, standardized neurocognitive battery. Seven independent criterion PVTs were used to establish valid (n=254) and invalid (n=51) groups. The sample composition was 61% female and 39% male, with a mean age of 28 (SD=6.8) and a mean education level of 15.7 years (SD=2.1). Racially, the sample was 46% White, 23% Hispanic, 14% Black, 11% Asian, and 5% other. Independent receiver operating characteristic (ROC) curve analyses were conducted for the RFIT Recall Trial and the RFIT Recall/Recognition Trial to determine classification accuracy, optimal cut-scores, and associated sensitivity/specificity for each PVT.
Results: The RFIT Recall (F=28.58, p<.001) and RFIT Recall/Recognition (F=45.07, p<.001) scores were significantly higher (i.e., better performance) in the valid group compared to the invalid group, with medium effect sizes (η_p^2=.09-13). The RFIT Recall Trial demonstrated

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statistically significant, but low classification accuracy (area under the curve [AUC]=.620, p<.01), with an optimal invalidity cut-score of ≤14 (31% sensitivity/92% specificity). The RFIT Recall/Recognition Trial also evidenced significant, albeit low classification accuracy (AUC=.687, p<.001), with an optimal cut-score of ≤26 (35% sensitivity/92% specificity).
Conclusions: The RFIT Recall Trial and the RFIT Recall/Recognition Trial were independently able to successfully detect invalid test performance among adult, outpatient ADHD referrals undergoing neuropsychological evaluation. Although the RFIT Recall/Recognition Trial showed slightly higher accuracy and more robust psychometric properties relative to the RFIT Recall Trial alone, this study demonstrated weaker accuracy and psychometric properties of the RFIT as a PVT in adult ADHD referrals relative to those previously reported in other settings and sample types. Results may be due, in part, to the memory-based nature of the RFIT as a PVT among individuals with suspected ADHD, which is not a disorder of memory.
Keywords: neuropsychological assessment, attention deficit hyperactivity disorder

21 MMSE Scores, Neuropsychological Test Battery Scores and Level of Effort in a Non-Compensation-Seeking Outpatient Clinical Sample

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Objective: The MMSE is widely used as a screening tool for dementia. We investigated the extent to which MMSE-Total Score (0-30) and Memory scores (0-3) might be influenced by incomplete effort in persons who were examined in a memory disorders clinic.
Participants and Methods: Participants were 436 outpatient referrals to a memory disorders clinic. Sample was 60% women, 84% white non-Hispanic, average age 65.6 ± 13 and education 14.2 ± 3 years. They were administered the Halstead-Russell Neuropsychological Test Battery-Revised (HRNES-R). Participants were initially screened for ongoing or anticipated litigation or other forms of material compensation.
Age/education-corrected scale scores on the HRNES-R were factor analyzed to obtain three composite scores representing measures of Verbal, Spatial, and Memory performance. The global HRNES-R score (Average Impairment Rating; AIR), was also examined in relation to effort. Effort/performance validity was assessed using popular embedded measures, Reliable Digit Span (RDS), Enhanced Reliable Digit Span (ERDS), and Digit Span scaled score (DSSS). Cutoffs for invalidity were 6, 10, and 5, respectively.
Group 1 (n = 322) consisted of examinees who passed all three performance measures. Group 2 (n = 107) consisted of individuals who failed to meet validity criteria on one or more of the three measures. Minor intergroup differences in age and education were found; these variables were used as covariates in score comparisons.
The MMPI-2 was used to investigate psychological characteristics that might distinguish low from high-effort examinees. Profiles were screened for invalidity due to symptom over-reporting (F > 90T). K-corrected T-scores on the standard clinical profile were contrasted between the groups.
Results: Effort level distinguished the two groups across the MMSE and four neuropsychological composite scores. Group 2 (Incomplete Effort) scored lower than Group 1 on MMSE-T (MN = 25.9 vs. 27.7), $F(3,112) = 19.1$, $p < .001$. Group 2 also scored slightly lower than Group 1 on the 3-item memory test (MN = 1.98 vs. 2.07), $F(3,1.18) = 1.37$, $p = .01$. Effort strongly impacted global scores on the HRNES-R Average Impairment Rating (MNs = 91.8 vs. 97.5), $F(3,690) = 28.5$, $p < .001$, 22.7% of the variance. Similar findings emerged in the intergroup comparisons of mean scores on the Memory, Spatial, and Verbal components of the neuropsychological test battery, with respective effect sizes of 9%, 16.9%, and 20.9%, all ps < .001.
In the analysis of psychological variables on the MMPI-2, minor intergroup differences emerged on Scales L and F. Incomplete effort was associated with greater openness in symptom disclosure combined with more frequent

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assertions of rare moral virtue. Although about half of the participants in both groups expressed significant psychological problems, no intergroup differences were found on any of the standard clinical scales.
Conclusions: In a clinical setting with no identifiable incentives for malingering, incomplete effort played an important role in suppressing scores on the MMSE and neuropsychological tests. Level of effort was not associated with differences in psychological symptom reporting on the MMPI-2.
Keywords: assessment**,** cognitive screening**,** validity (performance or symptom)
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22 Predictive Utility of the MMSE in Screening for Neuropsychological Testing

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Objective: The MMSE is widely used as a screening tool for dementia. Scores less than 25 have been recommended as a basis for referring individuals for a more detailed neuropsychological examination. We investigated the power of MMSE Total score (0-30) and Memory (0-3) in predicting performance on a comprehensive neuropsychological battery.
Participants and Methods: Participants were 436 outpatient referrals to a memory disorders clinic. Sample was 60% women, 84% white non-Hispanic, 13% African-American, average age 65.6 ± 13 and education 14.2 ± 3 years. They were administered the Halstead-Russell Neuropsychological Test Battery-Revised (HRNES-R). Age/education-corrected scale scores on the HRNES-R were factor analyzed to obtain three composite scores representing measures of Verbal, Spatial, and Memory function. The Average Impairment Rating (AIR) was included as a predictor variable. Partial correlations between MMSE scores and the four HRNES-R composite scores were obtained controlling for the time gap separating the MMSE and HRNES-R administrations. Predictive utility of MMSE-Total was examined by classifying participants into five groups by scores (29-30, 27-28, etc.) and examining their performance on the four neuropsychological test domains. The predictive utility of MMSE Memory (MMSE-M) scores was examined by classifying participants into four groups based their memory score levels (0, 1, 2, or 3) and examining their performance on WMS-4 Logical Memory (LM-II), Visual Reproduction (VR-II) and on delayed recall of a 12-item word list (Miami Selective Learning Test - MSLT).
Results: MMSE-T predicted HRNES-R performance on the global neuropsychological rating (AIR, r = .399), Memory (.438), Spatial (.386), and Verbal Domains (.346), ps < .001. MMSE-M predicted scores on VR-II (.276), MSLT-Delayed (.263) and LM-II (.259), ps < .001.
High MMSE-T scores (29-30) predicted normal-range performance on the HRNES-R in 76% of cases, Verbal, 76%, Spatial, 82%, and Memory 60%. MMSE-T scores (27-28) were associated with normal-range performances on the AIR in 45% of cases, Spatial 62%, Verbal 62%, and Memory 46%. The largest drop off in test performance involved MMSE-T of 25-26, with 55% impaired on Memory, 33% AIR, 29% Spatial, and 14% on Verbal.
Recall of 3/3 words predicted normal-range memory performance in: list learning-delayed recall (51%), Logical Memory-Delayed (LM-II) (55%), and Delayed Visual Reproduction (VR-II) (65%). Memory was significantly impaired in 30% of the sample across all three measures. Recall of 2/3 items yielded only a slight drop off in memory test performance. Significant LM-II impairment occurred in 53% of the 1/3 recall group. List learning was normal in 40%, and only 14% had severe impairment in delayed recall of the list. Recall of 0/3 on MMSE-M predicted marked impairment across all memory tests in 62% to 71% of cases.
Conclusions: The MMSE demonstrated modest predictive utility with frequent underestimates of wide-ranging impairments on comprehensive neuropsychological testing. Although a MMSE-T of 24 or below is widely cited as a guide for

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referring for further testing, about half of participants with scores at 27-28 were impaired across all measured cognitive domains. The largest drop off occurred in referrals who scored 25-26.

Keywords: cognitive screening, neuropsychological assessment, dementia - Alzheimer's disease

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23 Is Speed a Confounding Factor in NIH Toolbox Dimensional Change Card Sort Performance?

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Objective: The NIH Cognitive Toolbox Dimensional Card Sort Change (DCSS) is a computerized task to assess set shifting aspects of Executive Function (EF). The task involves sorting a bivalent test stimulus on each trial by either color or shape as indicated by the computer, which is similar to other computerized EF tasks such as with Wisconsin Card Sorting Test (WCST). Unlike the WCST, however, DCSS uses a two vector scoring method combining response accuracy and reaction time (RT). This new scoring method was normed in healthy, non-neurologic populations, allowing for the possibility that processing speed (PS) inefficacies commonly associated with neurologic disease may be decreasing its specificity as an EF measure. In this report, we evaluate the relationship of DCSS to independent neuropsychological measures of EF and PS.

Participants and Methods: Subjects were 91 epilepsy patients who were administered the DCSS and computer version of the WCST during their preoperative evaluation as epilepsy surgery candidates. DCSS age-adjusted performance correlations were made across EF measures including WCST Total Errors (T score), and Controlled Oral Word Association (COWA) using Heaton demographic correction. PS measures included WAIS-IV Coding and NIH Toolbox Pattern Comparison (age-adjusted scaled score). Animal fluency was also examined using Heaton demographic correction.

Results: Pearson correlations were performed to characterize the relationships across measure. The two highest DCSS correlations were with PS measures of Coding and Pattern Comparison. DCSS was not correlated with WCST Total Errors, selected rather than number of categories due to its restricted range and distribution skew. DCSS was correlated with COWA but not Animal Fluency.

	WCST Errors (T score)	COWA (T score)	Animals (T score)	Coding (scaled score)	Pattern Comparison (scaled score)
DCSS (scaled score)	.09	.35**	.14	.55**	.51**

*** Statistically significant at at least the p=.001 level*

Conclusions: Although designed as a primary measure of EF, these data suggest a stronger relationship to PS in patients with neurologic disease (e.g., epilepsy) which may contribute to slower PS and efficiency in the absence of impaired EF. Although there is a statistically significant correlation with COWA, which is often interpreted as a measure of EF, it accounts for only ~ 12% of shared variance compared to Pattern Comparison (~ 26%) or Coding (~ 30%). In addition, COWA is also a timed task so some of effect of decreased processing efficiency would be expected to be reflected in performance. However, the correlation with another timed measured, Animal Fluency, was not statistically significant, which is considered

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to be less sensitive to impaired EF suggesting some convergent task validity.
If this observation indicating a strong influence of PS to DCCS normative performance levels in clinical populations is replicated in independent clinical samples, then interpreting poor DCCS as reflecting poor EF should be made cautiously. These data also suggest that accuracy and response speed for DCSS, and perhaps other NIH Cognitive Toolbox measures, should be uncoupled and presented separately so that non-specific disease effects decreasing processing efficiency do not have undue influence on domain specific cognitive characterization.
Keywords: executive functions**,** reaction time
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24 Embedded Measures of Attention: CVLT-II List A Trial 1 and List B Predict Performance on WAIS-IV Digit Span Forward in a Sample of U.S. Veterans

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Objective: Digit span forward (DSF) has long been used to measure auditory attention clinically and in research settings (Lezak et al., 2012). Similarly, the California Verbal Learning Test, Second Edition (CVLT-II) is frequently used to measure verbal learning and memory, though Donders et al. (2008) demonstrated that scores on List A Trial 1 and List B were more associated with an individual's attention span. Previous literature has reported a moderate association between performance on Digit Span and CVLT List A Recall and List B (Curtiss et al., 2001; Vanderploeg et al., 1994). The present study predicted that better performance on both CVLT-II List A Trial 1 and List B would predict higher scores on DSF when controlling for relevant demographic and cognitive covariates.
Participants and Methods: The present study included a diverse sample of 919 U.S. veterans (mean age=57.26, mean education=13.8, 11% female). Participants completed comprehensive neuropsychological evaluations, including the CVLT-II and DSF from the Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV). Two scores from DSF were used: total correct and longest digit sequence forward (LDSF). Structural equation modeling was used to determine if CVLT-II List A Trial 1 and List B predicted performance on DSF total correct and LDSF when controlling for age, education, current intellectual functioning (WAIS-IV Full-Scale Intelligence Quotient), processing speed (WAIS-IV Processing Speed Index), working memory (WAIS-IV DS Backward), and verbal generativity (Delis-Kaplan Executive Function System Verbal Fluency Conditions 1 and 2).
Results: The model converged with adequate model fit indices (CFI=.977, TLI=.938, RMSEA=.055, SRMR=.035). When accounting for relevant demographic and cognitive covariates, higher scores on CVLT-II List A Trial 1 predicted better performance on DSF total correct (β=.237, p<.001) and LDSF (β=.198, p<.001). In addition, higher scores on CVLT-II List B predicted better performance on DSF total correct (β=.101, p<.05) and LDSF (β=.116, p<.05). CVLT-II List A Trial and List B predicted LDSF and DSF total correct with small effect sizes (R^2=.07, p<.001; R^2=.09, p<.001).
Conclusions: The present study aimed to determine the utility of two scores on the CVLT-II as measures of auditory attention using structural equation modeling. When accounting for relevant demographic and cognitive covariates, both CVLT-II List A Trial 1 and List B significantly predicted performance on the DSF total correct and LDSF. With increasing demands for managed care and hospital administrations to be more efficient with fewer tests, neuropsychologists must find more creative ways to use and interpret test results. By using embedded measures of attention on the CVLT-II, neuropsychologists can make judgments about an individual's attention without needing to give a separate test, or these scores can be aggregated with other attention measures like DSF to make a more robust conclusion. Future research should evaluate other measures of learning and memory for embedded measures of attention as well as determine if the present results are also observed within pediatric populations.

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Keywords: attention**,** learning**,** working memory

25 Daily Assessment of Independent Living and Executive Skills (DAILIES) Protocol: Preliminary Validation

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Objective: Executive functioning (EF) is necessary for performance of instrumental activities of daily living (IADLs; Boyle et al., 2003; Jefferson, Paul, Ozonoff, & Cogen, 2006). Traditionally, past research has assessed IADL performance in two ways: (1) a controlled laboratory setting which allows for optimal performance (Schmitter-Edgecombe et al., 2020; Suchy et al., 2019), or (2) using self-reports, which represent participants' perception, but are likely inaccurate for many older adults (e.g., Suchy, Kraybill, & Franchow, 2011). Consequently, research examining the relationship between EF and IADLs has been limited by a lack of ecologically valid IADL assessment measures. The Daily Assessment of Independent Living and Executive Skills (DAILIES) protocol was developed to ecologically evaluate real-world IADL task performance. The DAILIES protocol requires participants to complete tasks (e.g., rescheduling appointments, completing reimbursement forms) in their home at predetermined times, much like actual IADLs. Previous research found the DAILIES total score related to both EF assessed in the lab and EF assessed at home (Brothers & Suchy, under review). However, participants complete various categories of tasks (e.g., financial, shopping, planning) as part of the protocol and it is unclear whether certain categories are more related to EF than others. Understanding which tasks relate best to EF performance is crucial for developing an ecologically valid measure of IADLs.
Participants and Methods: Participants were 52 community-dwelling older adults (*M age* = 69.5; 65.4% female). Their EF performance accuracy was assessed *in the lab at baseline* using the Delis Kaplan Executive Function System (D-KEFS) (*Baseline-EF*) and *at home once daily for 3 weeks* using the backward Digit Span and Stroop tasks (*Daily-EF*). They also completed IADL tasks at home for 3 weeks as part of the DAILIES protocol. Participants completed 3 each of online information-gathering, online account/password management, email communication, planning/problem-solving, errands/shopping, and finances/bill-paying tasks.
Results: Zero-order correlations were significant between scores on online information-gathering and email communication tasks with *Baseline-EF* (r = .287, p = .043; r = .352, p = .012) and *Daily-EF* (r = .387, p = .005; r = .383, p = .006), as well as between planning/problem-solving and *Daily-EF* (r = .307, p = .029). Online information-gathering and email communication tasks had the most variance relative to their range (*Range* = 4, *SD* = 1.29; *Range* = 3, *SD* = .927) when compared to other tasks (e.g., planning tasks; *Range* = 8, *SD* = 1.82).
Conclusions: These results suggest that EF at home and in the lab is most predictive of participants' performance on online information-gathering and email communication tasks. This may be due to greater variance on these tasks compared to others, suggesting these tasks were more difficult for some participants in this sample. Understanding which types of tasks are sufficiently difficult for community-dwelling older adults to capture IADL lapses is important for understanding how best to measure IADLs at home and can improve research on daily functioning in older adults. Future research with a larger sample could use a confirmatory factor analysis to evaluate the loadings of each specific task on different IADL categories.
Keywords: activities of daily living**,** executive functions**,** assessment

26 Measurement Invariance of the Neurobehavioral Symptom Inventory (NSI) in Military Veterans with a History of Traumatic Brain Injury (TBI): An Examination of Biological Sex and Race/Ethnicity

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Objective: Military Veterans with a history of traumatic brain injury (TBI) often endorse a wide range of neurobehavioral symptoms both acutely and chronically following injury. One of the most widely used tools to assess neurobehavioral symptom reporting is the Neurobehavioral Symptom Inventory (NSI). Although prior studies have evaluated the factor structure of the NSI, research examining its measurement invariance across study groups (i.e., establishing that the same construct is being measured across subgroups of individuals) is scarce. Therefore, we investigated NSI measurement invariance across biological sex and race/ethnicity using a large national sample of military Veterans with a history of remote TBI.
Participants and Methods: Participants (N=10,673) included military Veterans who (1) enrolled in the VA's Million Veteran Program, (2) were administered the Comprehensive Traumatic Brain Injury Evaluation and confirmed to have a TBI history, and (3) completed the NSI. Multiple-group confirmatory factor analyses were used to investigate the degree to which previously derived NSI symptom domains (i.e., vestibular, somatic/sensory, cognitive, and affective symptoms) are invariant across (1) sex (males: n=9,763; females: n=910) and (2) race/ethnicity (non-Hispanic White: n=5,768; non-Hispanic Black: n=1,420; Hispanic: n=1,362; Another Race/Ethnicity: n=1,039). Likelihood ratio chi-square tests were used to evaluate the different levels of measurement invariance and the comparative fit index (CFI) was used to assess the degree of invariance.
Results: The configural (factor structure) invariance model showed acceptable fit for both sex (CFI = .948, RMSEA = .059) and race/ethnicity (CFI = .947, RMSEA = .059). For sex, likelihood ratio chi-square tests demonstrated metric (loading) invariance ($\Delta\chi^2$ = 26.1, p = .053) but showed violations of scalar (intercept) invariance ($\Delta\chi^2$ = 233.5, p < .001); however, the degree of noninvariance was mild (ΔCFI = -.002). For race/ethnicity, likelihood ratio chi-square tests showed violations of both metric invariance ($\Delta\chi^2$ = 72.7, p = .012) and scalar invariance ($\Delta\chi^2$ = 374.6, p < .001); again, the degree of noninvariance was mild (ΔCFI = -.001 for metric and ΔCFI = -.003 for scalar).
Conclusions: Examining measurement invariance allows for meaningful assessment and interpretation of group differences on the NSI. Our results showed support for configural invariance for both sex and race/ethnicity, suggesting that the NSI four-factor model is meaningful for all subgroups studied. However, scalar invariance was violated for both sex and race/ethnicity, indicating that adjustment may be needed before comparing NSI scores *across* subgroups. Findings underscore the importance of examining the factor structure of the NSI for each subgroup of interest before making group comparisons. They also highlight the importance of considering validity of measurement across study groups, or whether a given measure is interpreted in a conceptually similar manner by respondents from different sexes or cultural backgrounds. Finally, results underscore the importance of examining the measurement properties of commonly used assessment tools, and they suggest a need for ongoing research to evaluate measurement invariance of the NSI and other related assessment tools commonly used in TBI populations.
Keywords: assessment**,** traumatic brain injury**,** psychometrics
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27 A Case Study Demonstrating the Use of Trails-X, a Novel Executive Functioning Measure, in a Patient with Imaging-Confirmed Frontal Lobe Atrophy.

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Objective: To compare the performance of a novel executive functioning measure, Trails-X, with standard neuropsychological measures of executive functioning on a patient with progressive atrophy of the right temporal and frontal lobes.
Participants and Methods: A 71-year-old Caucasian man was referred for neuropsychological evaluation by neurology due to concerns for a frontotemporal neurodegenerative disorder. The patient's history includes right frontoparietal infarct in 2014 with mild right frontal lobe atrophy found incidentally. MRI of the brain in 2019 demonstrated subacute infarcts of the right cerebral hemisphere, moderate generalized atrophy, mild cerebellar atrophy, and severe right temporal atrophy. PET imaging obtained in 2021 demonstrated bilateral hypometabolism of the prefrontal cortices with bitemporal hypometabolism, right greater than left, consistent with frontotemporal dementia (FTD). CSF and Alzheimer's disease biomarkers were within normal limits. At the time of evaluation, the patient lived independently without any cognitive or safety concerns expressed by him or his family.

Neuropsychological interview, records review, and administration of a standard neuropsychological assessment battery. The Trails-X is a relatively new measure of executive functioning, consisting of nine trials of progressive difficulty. Users are asked to complete each trail by alternating between yellow and blue circles while following multiple rules within a time frame. The authors report the task requires adaptive planning, psychomotor speed, and impulse control to successfully complete.
Results: Testing results revealed many areas of preserved cognitive functioning, with mild cognitive deficits in the domains of working and visual memory, semantic fluency, and executive functioning. Executive deficits included impaired inhibition, planning, set switching, and construction. Qualitative observations were notable for mildly impulsive speech, contextually inappropriate humor, and inappropriate humor content.
Executive functioning results varied by task. The Wisconsin Card Sorting Test (64) was within normal limits. Phonemic fluency (FAS) was in the low average range (18%ile), and Trailmaking Test B was in the mild impairment range (4%ile, 3 errors). The Rey-Osterrieth Complex Figure copy trial demonstrated poor planning and a piecemeal approach. Trails-X performances were notable for average range on completion times, in the context of mildly impaired total connected circles (3%ile). The total matrix score (combinatory score of speed and accuracy) was in the mild impairment range (5%ile). His performance on Trails-X demonstrated impulsivity, which did not improve with successive trials.
Conclusions: Accurate assessment of executive functioning is important in a number of disease processes that are highly prevalent in neuropsychological practice. Given the range of functions the frontal lobe possesses, new ways of assessing and refining understanding of executive functions is a valuable contribution to the functional assessment of dementia and other syndromes. In the current case report, Trails-X provided additional qualitative and quantitative data to the evaluation that corresponded with behavioral observations. Additionally, Trails-X was noted to be more sensitive to impulsivity than other measures of executive function and provided unique evidence that justified its inclusion in the battery.
Keywords: frontal lobes**,** executive functions**,** neuropsychological assessment

28 A Comparison of the Factor Structure of the Personality Assessment Inventory Full and Short Forms in a Neurological Population

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Objective: The Personality Assessment Inventory (PAI; Morey, 1991; 2007) has been validated in various populations (Slavin-Mulford et al., 2012). The short-form of the PAI (PAI-SF) has received less research attention across different populations. The PAI-SF may have

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clinical utility when respondent burden or fatigue is a concern or for screening purposes. As such, more research examining the psychometric properties of the PAI-SF in various populations is needed. The psychometric properties of the PAI-SF range from adequate to strong in psychiatric (Sinclair et al., 2009), forensic (Sinclair et al., 2010), outpatient and nonclinical (Ward et al., 2018), and neurological samples (Udala et al., 2020). For neurological populations, research has revealed a two-factor solution for the PAI clinical scales (Busse et al., 2014), in contrast to Morey's (1991) original three-factor solution, but the factor structure of the PAI-SF has yet to be explored. The present study examined the factor structure of the PAI and PAI-SF in a stroke sample.

Participants and Methods: Participants were patients from a tertiary hospital in Western Canada who had suffered a stroke (hemorrhagic *n* = 35, ischemic *n* = 117, undefined *n* = 19). Following transfer to the rehabilitation department (*N* = 171), patients completed a neuropsychological evaluation including the full form of the PAI. The same patient PAI protocols were utilized to score both the full and short forms.

Results: A Confirmatory Factor Analysis (CFA) compared Morey's (1991) original three-factor structure of the clinical scales to the current stroke sample. Goodness of fit parameters did not meet acceptable levels for the PAI full-form (RMSEA = 0.09, CFI = 0.75, and TLI = 0.71) or the PAI-SF (RMSEA = 0.09, CFI = 0.94, and TLI = 0.92). Principle Components Analyses (PCA) revealed a two-component solution for the clinical scales for both full and short-forms. Component 1 comprised 47.89% of the variance for the full-form and 49.73% of the PAI-SF. Both components consisted of positive loadings from the SOM, ANX, ARD, DEP, MAN, PAR, SCZ, BOR, ANT, ALC, and DRG scales. Component 2 comprised 13.83% of the variance for the full-form and 12.71% of the PAI-SF. Both components consisted of positive loadings from the MAN, PAR, BOR, ANT, ALC, and DRG scales.

Conclusions: CFA results suggested Morey's (1991) original three-factor model evaluating the clinical scales did not fit the stroke sample data. PCA demonstrated both the PAI and PAI-SF had similar two-component solutions for clinical scales, consistent with previous examinations of the PAI in neurological populations (Busse et al., 2014). The two-component solution represented "internalizing" and "externalizing" behaviors. Although CFA results did not support Morey's factor model, PCA results varied only slightly from the original factors. Practically, this lends support for the psychometric properties of the PAI-SF in a neurological population, as results were nearly identical to the PAI full form. However, caution is warranted if making clinical decisions with the PAI-SF as the factor structure did not completely align with Morey (1991) and more research is needed to evaluate the reliability of the clinical scales.

Keywords: neuropsychological assessment**,** personality**,** psychometrics

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29 The role of education and spontaneous speech on cognition in middle-aged adults

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Objective: Although clinical neuropsychological measures exist to track the onset of cognitive impairment, they can be time-consuming and inaccessible to portions of the population. Cognitive decline affects speech production - in recent years, analysis of speech has shown promise as an indicator of subtle cognitive decline, particularly in early stages before other neuropsychological tests can detect it. Additionally, education may moderate the relationship between linguistic features and cognition. This study investigated the relationship between lexical-semantic properties of spontaneous speech production and cognition, and tested whether educational level

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moderates this association in community-dwelling middle-aged adults.

Participants and Methods: One hundred nine participants were included from the Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease, comprising 48 non-Hispanic White, 17 non-Hispanic Black, 43 Hispanic, and 1 "other" race/ethnicity, and were stratified into college educated (n = 88, mean education = 16.3 years) and non-college educated groups (n = 21, mean education = 11.7 years). The adults responded to speech prompts that asked them a series of autobiographical questions (i.e., What accomplishment are you most proud of and why? If you could live your life over, what would you do differently? etc.) to generate spontaneous speech. In the first analysis, to investigate the relationship between education level and computed properties of spontaneous speech, separate linear regressions were run with education level (college educated, not college educated) as the predictor variable, and each individual linguistic feature (n = 14) as an outcome variable. In the second analysis, to investigate whether characteristics of speech are differentially predictive of episodic memory based on education level, the main effects of linguistic features, education level, and the interaction of each individual linguistic feature were included as predictors in separate linear regressions, with SRT delayed recall score as the outcome variable. Correction for multiple comparisons was conducted using the Benjamini-Hochberg method.
Results: Education was positively related to Honoré's statistic (β = 1.11, 95% CI = [0.24, 1.98], p = .009), a measure of lexical diversity, indicating that participants with more education produced richer speech. Additionally, education was negatively related to lexical frequency (β = -.291, 95% CI = [-.48, -0.09], p <.001), indicating that participants with more education produced lower frequency (i.e., less common or "harder") words. When predicting SRT delayed recall score, education interacted with two linguistic features: indefinite articles and total words, indicating a stronger positive relationship between indefinite articles and SRT scores (β = 1.07, 95% CI = [-0.939, 3.083]), and total words and SRT scores (β = .002, 95% CI =[-.0002, .005]), for the higher-education compared to the lower-education group.
Conclusions: The role of education in the preservation of cognitive resources is well established. However, the relationships between education and spontaneous speech and their relationship with cognition are less clear. This preliminary study provides a broad overview of the relationship between individual linguistic features and education, and how education and spontaneous speech are related to cognition. Future work will focus on achieving a broader range of educational attainment.
Keywords: aging disorders**,** speech**,** assessment
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30 Lexical-Semantic Properties of Spontaneous Speech Production are Predictive of Memory in a Multi-Ethnic Cohort

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Objective: Existing neuropsychological assessment tools for mild cognitive impairment (MCI) and dementia are often insensitive to subtle cognitive changes, making early diagnosis difficult. Additionally, they may involve procedures which can be time- and cost-intensive, require substantial training to administer, and/or induce high participant burden, and are therefore difficult to perform regularly for disease monitoring. Spontaneous speech production – when participants speak naturally and continuously in response to a prompt – shows promise as a measure which could be sensitive to cognitive decline before behavioral symptoms appear. We investigated whether lexical-semantic features derived from automatic analysis of spontaneous speech are associated with neuropsychological measures of cognition and memory, and thus whether speech

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could be a feasible diagnostic marker for cognitive decline.
Participants and Methods: Participants were 113 adults (age range: 32-89; mean: 56 years) from the Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease, a community-based study of middle-aged adults in upper Manhattan which is diverse racially/ethnically (Black: 17; non-Hispanic white: 50; Hispanic: 44; more than one race: 2), linguistically (first language English: 79; Spanish: 31; other: 3), and by sex and gender (male: 51; female: 62). We administered a neuropsychological battery and a spontaneous speech task: a structured interview, in which the experimenter asked a series of questions about the participant's life, conducted in English. We investigated three neuropsychological outcome measures: the Selective Reminding Test (SRT) delayed recall score; the SRT total recall score; and semantic fluency as measured by animal naming. For spontaneous speech, 14 lexical-semantic features known to be affected in MCI and dementia, covering word count, filled pauses, parts of speech, lexical diversity, and lexical frequency, were calculated automatically on the transcriptions of the spontaneous speech task. The 14 spontaneous speech features and 6 demographic variables (age, sex, race, ethnicity, education, and first language) were jointly entered as predictors in several multiple regressions to predict each of the neuropsychological outcome variables. We used model comparison to investigate whether adding linguistic features provided explanatory power over and above that of demographics alone.
Results: The addition of linguistic features significantly predicted **SRT delayed recall** scores, explaining 24.0% of the variance and providing a significantly better fit than the demographic features alone ($F = 2.825$, $p < .001$, Adjusted $R = 0.490$). The linguistic features and demographic variables were also correlated with participants' **semantic fluency** scores, explaining 38.6% of the variance, significantly more than was explained by demographics alone ($F = 3.764$, $p < .0001$, Adjusted $R = 0.621$). In fact, the linguistic features alone, even without the moderating demographic variables, significantly predicted semantic fluency score (Adjusted $R = 0.470$, $p < .0002$). In contrast, the linguistic features were not associated with participants' **SRT total recall** scores, explaining just 11.8% of the variance in the outcome measure ($F = 1.145$, $p < .332$, Adjusted $R = 0.344$).
Conclusions: Spontaneous speech, particularly lexical-semantic features, is strongly associated with performance on neuropsychological tests that capture episodic memory and semantic fluency in middle-aged adults. These results suggest that spontaneous speech, which can be collected with relatively low participant burden, cost, and clinical training, could provide important metrics to track the onset and progression of cognitive decline.
Keywords: aging disorders**,** speech**,** assessment
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32 Level of Creativity Within Occupation May Be More Strongly Related to Crystalized Intelligence Skills Than Fluid Ones.

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Objective: The scientific study of creativity is becoming increasingly popular, though the construct's measurement is heavily debated (Park et al., 2016). The most common approach has focused on understanding the cognitive skills involved in creativity (Said-Metalwy et al., 2017), primarily through divergent thinking tests. Such tests, however, may not accurately reflect daily creativity use throughout the lifespan. Occupation may provide a pathway to understanding daily engagement of creative faculties. The present study explores how occupational creativity level may be related to performance on four cognitive domains (fluid reasoning, memory, vocabulary, and processing speed) in order to determine which cognitive abilities may be associated with daily creativity use.
Participants and Methods: 512 participants aged 20-80 completed a neuropsychological battery and reported their longest held

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occupation. Occupation was quantified through the O*NET database, which has assigned numerical values to 246 attributes of 969 occupations. A principal component analysis was performed and identified nine common factors that were weighted in combinations with all 246 attributes. One of these factors was used to approximate occupational creativity, characterized by high (>0.3) positive loadings on attributes such as Fine Arts, Artistic, Thinking Creatively, History and Archeology, Innovation, Originality, Communications and Media, and Philosophy and Theology, and negative loadings (<-0.3) on attributes such as Support, Degree of Automation, Conventional, and Importance of Repeating Same Tasks. Cognitive domain scores were derived as described in Habeck et al. (2020). Pearson correlations were run to examine the relationship between the creativity factor and its attributes and the four cognitive domains.
Results: Occupational creativity had a low positive correlation with reasoning, $r(502) = .16$, $p = <.001$, memory, $r(499) = .14$, $p = .001$, and vocabulary, $r(496) = .27$, $p = <.001$, and was not related to processing speed, $r(500) = .07$, $p = .15$. Though the creativity factor's correlation with vocabulary was low, when separately analyzed by its attributes, Originality emerged as having the strongest relationship to vocabulary, $r(496) = .37$, $p = <.001$, followed closely by Thinking Creatively, $r(496) = .36$, $p = <.001$. Philosophy and Theology, $r(496) = .19$, $p = <.001$, and Fine Arts, $r(496) = .26$, $p = <.001$, were the least related to the vocabulary domain.
Conclusions: Cognitive theories on creativity posit that the construct is most closely associated with fluid intelligence (Horn & Cattell, 1966; Carroll, 1993). Although the present data confirms this association, it has found that creativity level in occupation, particularly the use of creative thinking and originality, is more strongly correlated with vocabulary ability, a crystallized intelligence measure, than fluid abilities. This finding is consistent with literature on creative occupations (Colombo et al., 2018), and creativity as predicting the use of vocabulary learning strategies (Seddigh, 2013). Though conceptually creativity may relate to fluid abilities, in practice it may be more involved in honing crystallized abilities. Future studies should explore the directionality of this relationship as well as possible links to aging research, given that crystallized intelligence is better maintained with age (Gazes et al., 2020).
Keywords: creativity**,** cognitive functioning**,** verbal abilities
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33 Reliable change scores of the Multicultural Neuropsychological Scale

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Objective: To determine whether a person has shown significant change in its cognitive status over a period of time, it is necessary to consider the influence of bias and error in the measurements. Empirically based statistical methods such as standardized regression-based (SRB) methodology provide an approach directed to clarify the magnitude and degree of change across time. Thus, SRB values were calculated for the Multicultural Neuropsychological Scale (MUNS), a short neuropsychological scale devised with a cross-cultural approach.
Participants and Methods: The MUNS is composed of seven subtests that evaluate five cognitive domains; namely, memory, attention, executive functioning, constructional praxis, and language (Fernández et al., 2018). This scale was administered twice to a sample of 74 participants of both sexes ranging in age from 15 to 75 years (28.26 ± 14.87). The educational level was estimated through a short test of reading fluency (correct words per minute), which ranged between 113.16 and 189.09 (147.49 ± 17.85). Years of schooling ranged between 4 and 20 (14.73 ± 2.95). The test-retest time interval was 32.18 ± 3.88 days. The MUNS total score (Y) was composed of the scores of five subtests; namely, executive functioning, verbal memory (2), visual memory, and semantic verbal fluency. SRB equation for the

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predicted MUNS retest scores (Y') was determined based on the procedure described by Chelune & Duff (2019). The percentage of participants with meaningful reliable change was calculated. A retest z score above or below ±1.64 (i.e., a 90% confidence interval) was considered a significant change. A multiple regression analysis was performed to predict subjects' MUNS retest total scores based on MUNS pretest total scores, age, years of schooling, and reading fluency.
Results: The predictors contributing significantly were MUNS pretest total score (B = .49, *p* = .000) and age (B = -1.54, *p* = .000). The results of the regression indicated that the model explained 59% of the variance. *F*(2, 71)= 53.43, *p* = .000. The final predictive model was: Y'' = 235.78 + (-1.54 * Age) + (0.49 * Y). Nine percent of the total sample showed a significant change in the MUNS retest total score. Five percent of participants showed a meaningful reliable decrease, whereas four percent showed a meaningful reliable improvement.
Conclusions: Results suggest that the MUNS has clinical utility. Only a low percentage (<10%) of participants showed a meaningful reliable change. Years of schooling and reading fluency may not have been predictive variables due to the sample characteristics (predominantly young and highly educated participants).
Keywords: cross-cultural issues**,** test reliability**,** assessment

34 The Mnemonic Similarity Task (MST) and Traditional Memory Measures: How Similar are They?

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Objective: The Mnemonic Similarity Task (MST) is a visual object recognition task designed to be sensitive to hippocampal function. The MST places strong demands on pattern separation processes, particularly the ability to group similar inputs into distinct memory representations. In the current study, we sought to examine the degree to which the MST correlated with traditional memory measures (i.e., list learning and story tasks) in a sample of older adults. Given that (a) both the MST and story memory tasks were designed to assess medial temporal lobe memory system integrity and (b) the unstructured format of list learning tasks places greater demands on "executive" processes, we hypothesized MST performance would be more strongly associated with delayed recall of stories rather than a word list.
Participants and Methods: Participants included a sample of non-demented, healthy older adults (*n* = 38) from two ongoing studies at the University of Florida. As a group, participants were between 65 and 80 years old (mean age = 71.0±4.8), well-educated (mean years = 17.1±2.1), predominantly female (60.5%), and mostly White (92.1%). Traditional measures of recent memory included WMS-III Logical Memory (LM) I and II and the Rey Auditory Verbal Learning Test (AVLT) Immediate Recall (sum of trials 1-5) and Delayed Recall. Participants also completed the computer-based MST. Two indices from the MST were derived: corrected recognition memory (REC) which measures ability to identify previously presented items and the lure discrimination index (LDI) which measures ability to identify items that are perceptually similar to those previously presented. The relationship between MST indices and LM/AVLT performance was assessed using partial Pearson's correlation coefficients, controlling for demographic factors.
Results: Performance on the MST was not associated with AVLT Immediate Recall (MST REC *r* = .184, *p* >.05; LDI *r* = .130, *p* >.05) nor Delayed Recall (MST REC *r* = .004, *p* >.05; LDI *r* = -.016, *p* >.05). However, there were medium to strong correlations between the MST and LM. Both MST REC (*r* = .347, *p* = .048) and LDI (*r* = .624, *p* <.001) were positively correlated with LM Immediate Recall. Additionally, MST REC (*r* = .346, *p* = .048) and LDI (*r* = .576, *p* <.001) were positively correlated with LM Delayed Recall. As such, there appears to be a stronger relationship with the MST and LM stories than with the AVLT.
Conclusions: Our results provide further evidence that the pattern separation paradigm of the MST is a sensitive marker of episodic memory. The correlations between the MST and LM, but not AVLT, suggest that the MST may be

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less susceptible to the “executive” demands of word list tasks which require more intrinsic organization and structuring. Indeed, by presenting semantically meaningful categories during target encoding, the MST has a similar structured format to LM. Overall, our findings highlight the use of the MST as a visually based measure of recent memory that correlates with traditional story tasks.
Keywords: memory disorders**,** hippocampus**,** neuropsychological assessment

35 Modeling Item Bias Removes Racial Group Differences on Word List Learning

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Objective: Unadjusted neuropsychological test scores often differ by race but the sociopolitical and systemic inequities underlying these differences are not as thoroughly investigated. Score inequities may in part be a result of test item bias. Differential item functioning (DIF) in item response theory (IRT) can be used to study item-level bias. We examined whether DIF explained racial group differences on the CERAD List Learning Test.
Participants and Methods: Participants were from the Health and Retirement Study Harmonized Cognitive Assessment Protocol (n=1219; 64.4% female, 78.4% White, M_{age} = 74.41 [7.13], M_{edu} = 13.30 [2.72]), had no informant-reported functional impairment or objective cognitive impairment, and completed the CERAD word list test in English as part of a larger test battery. Race was dichotomized as White or Not White to ensure adequate sample sizes of each group for IRT. IRT analyses using Bayesian generalized non-linear mixed models were conducted to model performance on the test. Models assuming no DIF, including DIF, and estimating DIF on item features were fit. Based on previous analyses, tested item features included age of acquisition, word frequency, body-object integration, and concreteness. Latent trait estimates were extracted and compared by race using Bayesian *t*-tests. Skeptical, weakly informative priors were used for all models. Significance of results are operationalized through the Bayes factor (BF; <1=no support, 1-3=weak support, 3-20= positive support, 20-150=strong support, and >150=very strong support.
Results: Racial groups differed significantly by age ($BF_{White\neq NotWhite}=4x10^{15}$) and education ($BF_{White\neq NotWhite}=37.41$) but not sex ($BF_{White\neq NotWhite}=0.22$). Without DIF, there were significant differences between racial groups on IRT-based memory scores, M_{White}-$M_{NotWhite}$=0.17 [95% CI: 0.09, 0.25], Cohen’s *D*=0.22 [95% CI: 0.11, 0.33], controlling for age and education. Of the 10 CERAD words, 5 evidenced uniform DIF and 2 non-uniform DIF on at least one trial. Across the 10 items over the three trials, there were 12 occasions (40% of the test) in which recall for words was easier for White-identifying participants ($3.49 < BF_{White>NotWhite} < 189.48$). After modeling DIF, racial differences in the latent trait were removed, M_{White}-$M_{NotWhite}$= -0.01 [95% CI: -0.09, 0.07], Cohen’s *D*= -0.01 [95% CI: -0.11, 0.10], controlling for age and education. Including explanatory item covariates, causes of DIF were average age of word acquisition and frequency of the word in English. Age of acquisition ([95% CI_{White}: -0.62, -0.07] vs [95% $CI_{NotWhite}$: -0.57, 0.16]) and word frequency ([95% CI_{White}: -0.77, -0.24] vs [95% $CI_{NotWhite}$: -0.59, 0.03]) were significant for White-identifying persons only. Including item covariates reduced evidence of DIF ($4.52 < BF_{White>NotWhite} < 15.43$).
Conclusions: Sociodemographic differences in CERAD word list trials were attributable to item-level bias, primarily explained by differences in age of word acquisition and word frequency between White and non-White participants. These differences may reflect factors such as early education quality and social advantage. IRT methods that estimate ability while modeling bias could help in understanding sociodemographic effects on neuropsychological tests, reduce risk of misdiagnosis of cognitive impairment in diverse samples, and aid in the design of more culturally equitable tests of cognitive ability.
Keywords: minority issues**,** psychometrics**,** memory: normal

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36 Clustering and Switching Predicts Executive Function not Memory Scores

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Objective: Psychometrics is increasingly turning to item level analyses as a more sensitive marker of cognitive impairment. One example of this is examining clustering and switching from the Controlled Oral Word Association Test (COWA), a test of verbal fluency. Clustering (listing groups of phonetically similar words) and switching (the ability to shift between these groups) have shown to be useful in delineating between impairments in executive function and memory. Lower switching values have been associated with decreased executive functioning, whereas decreased clustering has been associated with declining semantic stores. In our study, we examined whether clustering and switching could predict memory and executive function scores. If so, the COWA is one accessible test that could assess two different cognitive domains and could serve as a valuable diagnostic tool.
Participants and Methods: Sixty-seven healthy adults (age= 62.3, edu= 17.4) and thirty-seven adults (age= 69.6 edu= 17.4) with mild cognitive impairment (MCI) completed tests of memory (California Verbal Learning Test, Brief Visuospatial Memory Test), executive function (Trail Making Test A and B, Digit Span Total, Stroop Color Word Total) and either version FAS or CFL of the COWA test. Average sample Z-scores were calculated for each group to create a healthy and MCI memory score and a healthy and MCI executive function score. Clustering and switching were analyzed for the letter F on the COWAT as it is used in both forms. The mean cluster size and max switch count were extracted for each participant using the automated system VFClust. VFClust calculates the similarity between words by applying the Levenshtein Distance, the number of edit operations necessary to transform one word into the next word. A Mann Whitney U test was performed to determine whether there was a difference in average clustering and amount of switching between individuals with MCI and healthy adults. A linear regression analysis was conducted to examine whether clustering and switching can predict memory or executive function performance separately for healthy individuals and individuals with MCI. Each model included: average cluster size, switching count, controlled for age, sex and education.
Results: Memory performance was predicted by age (t=-4.248, p=0.0002) only in the MCI, not the healthy, group. For healthy adults, executive function performance was predicted by age (t= -3.357, p=0.001), clustering (t= 2.357 , p=0.022), and switching (t=3.034, p=0.004). However, for adults with MCI, only age (t=- 2.483, p=0.019) and clustering scores (t= 2.500, p=0.018) predicted executive function performance.
Conclusions: These findings suggest that clustering abilities, as measured by the COWA, are related to other measures of executive function but not memory in adults with and without cognitive impairment. Instead, clustering strategies in COWA appear to be a greater determinant of EF and do not discriminate between the two cognitive domains.
Keywords: cognitive functioning**,** mild cognitive impairment

37 Symptom Under-Reporting on the Beck Anxiety Inventory in an Outpatient Memory Disorders Clinic

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Objective: The Beck Anxiety Inventory (BAI) is widely used as a measure of anxiety. It is composed of 21 face-valid items that tap panic, fear, and physical symptoms of anxiety (e.g., jitteriness). The BAI does not include any measure of test-taking attitude or self-report validity. We used validity scales from the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) to investigate evidence of symptom under-reporting on the BAI in persons referred for neuropsychological evaluation in a Memory Disorders Clinic.
Participants and Methods: Participants were 165 outpatient neuropsychological referrals, 64% women, 75% white non-Hispanic, average

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age 58 ± 16.8 and education 14.6 ± 3 years. Referrals were made by board-certified neurologists (87%) as part of a more comprehensive work up of complaints of forgetfulness, distractibility, and/or word finding difficulties. Participants were administered the BAI, MMPI-2, and Test of Premorbid Functioning (TOPF) in addition to the Halstead-Russell Neuropsychological Test Battery (HRNES-R). Protocols were screened for self-report invalidity due to random- or content-independent responding (MMPI-2 VRIN and TRIN < 80T). Defensiveness/under-reporting of anxiety symptoms was assessed using MMPI-2 validity scales (L ³ 65*T*, K ³ 60*T*, or F < 45*T*). BAI scores and demographic variables were contrasted in the defensive (n = 67) and non-defensive participant groups (n = 98). Intergroup frequencies by BAI severity level (minimal, mild, moderate, severe) were contrasted.
Results: In contrast to the non-defensive group, defensive participants had a mean age that was seven years older (62 vs. 55). Age was therefore used as a covariate in the ANCOVA comparison of mean BAI scores. The two groups did not significantly differ in level of education, estimated premorbid intelligence (TOPF), or Average Impairment Rating on the HRNES-R. On the BAI, non-defensive participants had a mean raw score of 17.2 ± 11.1; defensive participants averaged 9.4 ± 9.4, $F(2,162) = 15.5$, $p < .001$, 16% of the variance). In the non-defensive and defensive groups, respective BAI scoring levels were: Minimal (40.8% vs. 77.6%), Mild (21.4% vs. 6%), Moderate (23.5% vs. 10.4%), and Severe (14.3% vs. 6%). Overall, BAI scores appeared to reflect underestimates of anxiety in 36.8% of the entire sample. In the defensive group, 21.4% of the cases involving moderate to severe levels of anxiety were misclassified as being less anxious.
Conclusions: Self-report of anxiety symptoms on the Beck Anxiety Inventory was influenced by a defensive response style in approximately one-third of neuropsychological referrals to an outpatient Memory Disorders Clinic. In this setting, false negative findings are likely to occur in a significant number of referrals who have moderate to severe levels of anxiety. The generalizability of these results to other settings warrants investigation. These findings underscore the importance of measuring symptom validity on self-report measures of psychological functioning and emotional status.
Keywords: validity (performance or symptom), anxiety, mood disorders
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38 Cognitive Practice Effects within a Spanish-Speaking Sample; Results from SOL-INCA.

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Objective: Practice effects (PEs) on neuropsychological assessments mask cognitive decline, which interferes with and delays diagnosis of mild cognitive impairment. Cognitive PEs have been demonstrated even after 5-7 years. Studies of PEs have been completed almost exclusively in predominately white samples that completed tests in English. Moreover, PE calculations typically do not consider detailed demographics beyond age, education, and race. We sought to calculate PEs within a Hispanic/Latino sample (Study of Latinos-Investigation of Neurocognitive Aging; SOL-INCA) and determine how PEs altered diagnosis of impairment at follow-up.
Participants and Methods: 6030 participants in SOL-INCA, a sub study of the Hispanic Community Health Study/Study of Latinos, completed tests in Spanish at baseline and at their follow-up, approximately 7 years later. The sample utilized by this project was 65% female and the average age at baseline was 55.4 (7.4 SD). Neuropsychological tests included the 6-item screener, Brief-Spanish English Verbal Learning Test (delayed recall and total of

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learning trials), Word Fluency Test, and the Digit Symbol Substitution test. Implementing a variant of the replacement method of PE-adjustment, we matched returnees to participants who were completing the test for the first time. Matching variables included age, education, income, Framingham cardiovascular risk score, number of years in the US, and heritage group. A comparison of scores between returnees and matched participants, adjusting for attrition, provided a group-level PE for each test.
Results: PEs were observed for both memory measures and the Digit Symbol Substitution test. PE effect sizes (Cohen's d) ranged from .05 to .11. PEs appeared to vary by study site and/or heritage group, potentially due to differing attrition effects and the impact of other demographic factors.
Conclusions: PEs existed across an interval of 7 years; to our knowledge, this is the first demonstration of PEs in a Hispanic/Latino sample. Notably, PEs were calculated while considering typical test-correction variables (i.e., age, education) as well as biological (i.e., cardiovascular risk), socioeconomic, and culture-related variables. Though small, the PEs are still meaningful as prior work has shown that adjusting for PEs of similar magnitude resulted in significantly increased incident MCI at follow-up in non- Hispanic/Latino samples. Moreover, PE-adjusted diagnoses were more accurate based on greater concordance with Alzheimer's disease biomarkers. Moving forward, we will examine the impact of PE-adjustment on follow-up cognitive diagnoses in SOL-INCA. Their use in SOL-INCA may help uncover the relationship between sociocultural risk and protective factors that are contributing to differences in dementia prevalence among adults of varied Hispanic/Latino heritage
Keywords: aging (normal), assessment

39 Evaluating the Efficacy of the Test de Vocabulario en Imagenes Peabody (TVIP) in Estimating Premorbid Intellectual Functioning in Monolingual Spanish Speaking Adults

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Objective: The estimation of premorbid intellectual functioning is an essential component of comprehensive neuropsychological evaluations to approximate the examinee's level of intellectual functioning before onset of cognitive difficulty. As such, so called "hold measures," including the word reading subtests of the Wide Range Achievement Test (WRAT) and Test of Premorbid Functioning (TOPF), have been employed as proxy measures for premorbid intellectual functioning in English speaking populations. However, due to the phonetically regular nature of word reading abilities in the Spanish language, these tests are a questionable proxy for intellectual functioning in monolingual Spanish speaking patients. Currently, there are no validated measures of premorbid intellectual functioning available to Spanish speaking individuals. The *Test de Vocabulario en Imagenes Peabody* (TVIP) has the potential to enable accurate estimation of premorbid intellectual functioning and achievement performance in clinical evaluations, despite normative limitation to ≤18 years old. This study evaluated the concordance of the TVIP with the *Woodcock-Muñoz- IV Batería* (WM-IV) Passage Comprehension and Letter-Word Identification subtests to determine the clinical utility of the TVIP in rapidly estimating premorbid intellectual functioning.
Participants and Methods: This cross-sectional study included data from 58 monolingual Spanish-speaking clinical patients of Mexican descent who completed the TVIP and WM-IV as part of a comprehensive neuropsychological evaluation. Mean age was 61.09 (*SD*=16.83; range=18-87) and mean education was 6.10 years (*SD*=3.99; range=0-17). The sample was 55.2% female. Linear regression analyses were conducted to evaluate the predictive value of the TVIP on WM-IV Passage Comprehension and Letter-Word Identification.

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Results: Both WM-IV Passage Comprehension *(r*=.755, *p*<.001) and Letter-Word Identification (*r*=.564, *p*<.001) had significant positive correlations with TVIP raw score. The TVIP significantly predicted WM-IV Passage Comprehension performance, *F*(1,56=74.237, *p*<.001, and accounted for 57.0% of the variance, with a large effect (η^2=.570). TVIP raw score also significantly predicted WM-IV Letter-Word Identification, *F*(1,56=26.099, *p*<.001, and accounted for 31.8% of the variance, with a medium effect (η^2=.318).
Conclusions: This study examined the utility of the TVIP as a predictor for WM-IV Letter-Word Identification and Passage Comprehension performance. Results of this study support that the TVIP raw score is a useful and rapid estimate of WM-IV Letter-Word Identification and Passage Comprehension performance, and thus, may serve as a valid and reliable estimate of premorbid intellectual and achievement abilities in monolingual Spanish speaking patients of Mexican descent. It would be beneficial to further validate these findings in samples from other ethnolinguistic samples (e.g., other Latin American countries) in future research.
Keywords: bilingualism/multilingualism**,** cognitive neuroscience**,** neuropsychological assessment

40 Exploratory Association of a Novel English-Spanish Fluency Ratio Score and Neuropsychological Assessment Administered in Spanish

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Objective: Previous research has shown a meaningful effect of Spanish-English bilingualism on neuropsychological test performance such that bilingual examinees exhibit greater cognitive control attributable to better “code switching” abilities. This bilingual advantage is associated with increased inhibitory control, but reduced performance on tasks of novel phonemic/semantic word generativity. However, few studies have evaluated how the relative degree of bilingualism is associated with neuropsychological performance. This study evaluated the association of cognitive performance and a novel quantitative metric of relative English-Spanish fluency in a mixed clinical sample evaluated in Spanish.
Participants and Methods: This cross-sectional study included data from 27 bilingual Spanish and English-speaking clinically referred patients who completed a comprehensive neuropsychological assessment in Spanish. The sample was 51.9% female, with mean age of 47.81 (*SD*=19.07; range=22-83) and mean education of 12.59 years (*SD*=3.04; range=6-18). Standard scores of the *Test de Vocabulario en Imagenes Peabody* (TVIP) and the *Woodcock-Muñoz- IV Batería* (WM-IV) Passage Comprehension subtest were averaged to compute a Spanish fluency composite, while standard scores of the Peaboody Picture Vocabulary Test- 5th Edition (PPVT-5) and Woodcock-Johnson- 4th Edition Tests of Achievement (WJ-IV) Passage Comprehension were averaged to create an English fluency composite. These composites were used to create an English/Spanish ratio score, wherein scores >1 indicate greater relative English fluency, while scores <1 indicate greater relative Spanish fluency. Two linear regressions were conducted using the English/Spanish ratio score to predict Verbal Fluency (P/M/R) and Stroop Color-Word performance.
Results: Neither Verbal Fluency *(r*=-.277, *p*>.05) nor Stroop Color-Word (*r*=.390, *p*>.05) were correlated with the English/Spanish ratio. The English/Spanish ratio did not significantly predict Verbal Fluency performance (*F*(1,15=.610, *p*>.05)) nor Stroop Color-Word performance (*F*(1,16=2.875, *p*>.05)).
Conclusions: This exploratory study examined relative English-Spanish fluency as a predictor for cognitive performance in aspects of language-mediated inhibitory control and novel verbal generativity. Results of this study suggest that degree of relative English-Spanish fluency does not appear to impact performance on measures mediated by semantic access. This novel approach to quantifying relative language fluency in bilingual patients may serve as a

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unique clinical tool in evaluating the influence of bilingualism on neuropsychological test performance.
Keywords: bilingualism/multilingualism**,** cognitive neuroscience**,** neuropsychological assessment

41 Computerized Cerebral Assessment: An Effective Cognitive Screening Device

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Objective: The use of cognitive screening devices is popular however debates continue on both sensitivity and specificity of these devices. The use of cognitive screening devices recently has become more common among many healthcare professionals. In general screening measures are useful in identifying severe cognitive impairment, but are often insensitive to mild/subtle forms of cognitive impairment. Sensitive screening measures of cognitive functioning are needed to determine the presence/absence of subtle cognitive impairment in various diagnostic groups. A sensitive screening method can be useful in identifying patients who will need more thorough neuropsychological evaluation or other clinical services (e.g. imaging). Recently, an automated cerebral assessment technique was developed (Cognivue) for the detection of cognitive impairment in people above the age of 55. It is described as a measure of cognitive functioning that is also predictive of future functional decline. Cognivue was created to provide healthcare practitioners with rapid and sensitive quantitative assessment of an individual's cerebral function. Cognivue is related to psychophysics in that it engages an individual in continuous stimulus-response paradigms that demand intervening cerebrocortical processes. This study hypothesized that Cognivue is a sensitive screening measure in people diagnosed with mTBI and adult ADHD as well as older patients who self-identify as experiencing cognitive decline (CD) and these patients would perform significantly worse on Cognivue than normal controls (NC). It was also hypothesized that psychiatric patients (PP) would not demonstrate impairment on Cognivue, since Cognivue is an early detection system for the presence of cerebrally based impairment only.
Participants and Methods: Participants were referred to a neuropsychology practice for assessment. All participants were administered the Cognivue task prior to neuropsychological assessment. Cognivue technology is a non-invasive computerized assessment device. The viability of Cognivue in detection of cognitive difficulty related to dementia has been supported by a number of recent investigations. The data generated was entered into a spreadsheet and mean scores on the Cognivue test (11 measures) were compared using ANOVA and Bonferroni follow-up tests. The subject samples were as follows: NC (N=24), mTBI (N=55), ADHD (N=46), CD (N=59) and PP (N=37).
Results: ANOVA results indicated Cognivue performance in mTBI, ADHD, CD and PP patients was significantly worse than normal controls on all measures. Psychiatric patients performed worse than normal controls only. They were significantly better than all clinical groups.
Conclusions: This investigation demonstrates that Cognivue not only identifies the presence of impairment in pre-dementia patients (as previously reported) but also in patients with mild TBI, adult ADHD and recently self-identified cognitive decline. Cognivue is a quick (20 minutes), sensitive and useful screening tool in determining the presence of cognitive impairment. Future research will focus on determining whether, in addition to sensitivity, Cognivue profiles have specificity related to diagnostic groups (e.g. mTBI, dementia, ADHD) and also whether failure on Cognivue also predicts declining function over time in the diagnostic groups evaluated for this study.
Keywords: cognitive screening**,** computerized neuropsychological testing**,** neuropsychological assessment

42 Rasch Analysis of the Affect Intensity Measure in Acquired Brain Injury and Neurologically-Healthy Adults

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Objective: Affective disorders and emotion dysregulation are common sequelae following acquired brain injury (ABI). The Affect Intensity Measure (AIM) is a self-report scale that assesses intensity and reactivity of emotional experiences. Initially created as a unitary scale, multiple studies with neurologically-healthy adults have shown four factors that demonstrate differential predictive validity: positive affectivity (AIM-PA), negative reactivity (AIM-NR), negative intensity (AIM-NI), and positive intensity (AIM-PI). The AIM has been used successfully in ABI research, although weaknesses of the scale have been noted. For example, the subscales perform variably and anecdotal evidence suggests that individuals with ABI have particular difficulty with the reverse-coded items. The present study investigated the psychometric properties of the AIM with ABI and neurologically-healthy adults using Rasch modeling, which evaluates latent traits and functioning of a scale specific to the sample.
Participants and Methods: 129 neurologically-healthy (NH) adults and 124 adults with stroke or moderate or severe traumatic brain injury completed the AIM. The AIM contains 40 items rated on a 6-point scale from *Never* to *Always*, including 11 reverse-coded items. Polytomous Rasch models were applied to the total scale and each factor. Analyses included item fit statistics, person reliabilities, and targeting to examine degree of the scale to measure affect intensity.
Results: Flesch-Kincaid Grade Level and Flesch Reading Ease were within appropriate ranges for all subscales except AIM-PI (8.4, 62.1%), which contains all reverse-coded items. Internal consistency reliability for subscales ranged .60 (AIM-NI) to .93 (AIM-PA) for ABI and .68 (AIM-NR) to .92 (AIM-PA) for NH. Tests for unidimensionality indicated the AIM-Total is multidimensional (Eigenvalue > 7) for both groups. Visual inspection of first component loadings showed reverse-coded items hung together and were separate from other items. For ABI, eigenvalues for AIM-PA and AIM-NI also suggested the presence of an additional dimension (> 2) and clustering for reverse-coded items was observed for AIM-NI subscale. Person and item reliability were acceptable for all subscales except person reliability for AIM-NI and item reliability for AIM-PI, which were poor (< .70). Several items across subscales demonstrated evidence of misfit based on OUTFIT and INFIT model fit statistics. For both groups, targeting was poor for people at the tails of subscales, indicating that adults with very low or high scores were not accurately represented.
Conclusions: Overall, the AIM showed sound properties as well as some psychometric concerns that appear special to people with ABI. The traditional total score showed evidence of multidimensionality, which suggests practitioners should refrain from interpreting this score in isolation. The four subscales developed among neurologically-healthy samples were partly replicated; however, an important cautionary finding suggests that reverse-coded items do not likely measure the intended construct, particularly for ABI. Thus, AIM subscales should be interpreted with caution, particularly the AIM-NI and AIM-PA subscales for adults with ABI.
Keywords: psychometrics**,** brain injury**,** affective processing (normal)
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43 Verbal fluency tests as embedded measures of cognitive performance validity in a veteran sample.

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Objective:
Objective: This study attempted to replicate and extend previous findings regarding the utility of verbal fluency tests (FAS, CFL, and Animal Naming) as embedded performance validity tests (PVTs) in a mixed clinical sample of veterans referred for neuropsychological evaluation.
Participants and Methods: Participants and Methods: Participants included clinically referred patients who underwent a comprehensive neuropsychological evaluation at a Veterans Affairs Medical Center in south Texas from 2011 to 2019. The final sample

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included a total of 486 participants. The sample was predominantly male (87.0%; *N* = 423) with an average age of 58.49 years (SD = 13.40; range = 20-88 years) and average education of 13.61 years (SD = 2.73; range = 4-20 years). The sample was 50.0% Caucasian (*N* = 243), 32.9% Hispanic/Latinx (*N* = 160), 14.0% Black or African American (*N* = 68), 1.4% multiracial (*N* = 7), 0.8% Native American (*N* = 4), 0.4% Asian American (*N* = 2), 0.4% unknown/not reported (*N* = 2). Participants' performance on empirically established stand-alone (Test of Memory Malingering and Word Choice Test) and embedded (Reliable Digit Span) PVTs were used as criteria for valid performance. Logistic regression and receiver operating characteristic (ROC) curve analyses were used to examine the sensitivities and specificities associated with all obtained scores for each verbal fluency measure. These scores were examined in both the overall sample and separately for groups with and without genuine cognitive impairment. Specific cut-off scores were selected for raw and demographically adjusted scores for each variable based on general guidelines of at least 90% specificity with approximately 50% sensitivity. Additionally, the overall sample was divided by language status (i.e., monolingual English-speaking and bilingual English/Spanish-speaking) to explore possible differences in classification accuracy and/or sensitivity/specificity based on self-reported language proficiency.
Results: Results: Logistic regression and ROC curves were used to determine cut scores which maximized the sensitivity and specificity of the measures. Overall, examination of phonemic (CFL/FAS) and semantic fluency measures revealed unacceptably poor classification accuracy, with a notable proneness to false positive indication of invalid performance among individuals with genuine cognitive impairment. For example, a CFL raw score of <21 could distinguish between valid and invalid PVT performance in our patients without cognitive impairment, with 90.2% specificity and 55.0% sensitivity. However, among patients with genuine cognitive impairment, a CFL raw score of <11 only provided 93.2% specificity and 20.0% sensitivity. This relationship remained regardless of language history; i.e., presence of cognitive impairment weakened classification accuracy of all three verbal fluency measures for both monolingual and bilingual patients.
Conclusions: Conclusion: While early research into verbal fluency measures as embedded PVTs indicated some promise, the current study adds to a growing literature which indicates these measures are not robust to cognitive impairment and therefore are not appropriate for assessment of performance validity.
Keywords: neuropsychological assessment**,** validity (performance or symptom)**,** bilingualism/multilingualism

44 Pre-Surgical Memory Performance Predicts BMI Change in Adults with Severe Obesity Following Roux-Y Gastric Bypass

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Objective: Within the last few decades, worldwide obesity has more than tripled, representing an increasingly serious public health concern. While obesity is a risk factor for many physical health morbidities, mounting evidence suggests that chronic obesity is associated with selective impairments in cognition, particularly in the domains of attention, executive function, and memory. Moreover, recent research has demonstrated a strong association between cognitive performance and adherence to postoperative guidelines after weight loss surgery. The goal of the present study was to investigate which domains of cognition are the most robust predictors of successful weight loss following Roux-Y gastric bypass compared to a community-control sample of adults with severe and chronic obesity who did not undergo surgery.

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Participants and Methods: The final sample included 96 adults with obesity (BMI > 35kg/m2) aged 20-75 years (n = 50 bariatric surgery, and n = 46 community-recruited non-surgery peers). Exclusion criteria were as follows: a total score of < 20 on the Montreal Cognitive Assessment (MoCA), history of neurological disorder or injury, severe psychiatric or unstable medical condition, and history of substance abuse. Participants completed neuropsychological testing at baseline and 12 weeks follow-up, using the following measures: California Verbal Learning Test, Second Edition (CVLT-II), Paced Auditory Serial Addition Test (PASAT), Stroop Color Word Test, Trail Making Tests Parts A and B, letter and categorical fluency, Boston Naming Test, Second Edition (BNT-2), and the cognitive component of the NIH Toolbox. Neuropsychological measures were chosen based on their respective content involvement in each cognitive domain of interest. For each cognitive domain, raw scores were converted to z-scores and averaged to create composites. Six neuropsychological composites were created: executive functioning, processing speed, attention, learning, memory, and semantics. Age, years of education, and gender were added to the model as covariates.
Results: Least Absolute Shrinkage and Selection Operator (LASSO) regression model selected learning, memory, age, and years of education as important predictors of BMI change. Memory was positively and significantly associated with weight loss ($p < 0.01$), while age was significantly and negatively predictive of BMI change ($p < 0.05$). Executive functioning, processing speed, attention, learning, and semantics did not significantly predict change in BMI.
Conclusions: Our findings suggest that in adults with severe obesity, memory performance at baseline is selectively predictive of greater reduction in BMI at 12-week follow-up. As memory involves the retention of information over time, superior memory at baseline may facilitate adherence to post-operative guidelines and lifestyle changes that support and maintain weight loss over time. Overall, these findings suggest that pre-operative assessment of memory functions may be a useful tool in predicting weight loss outcome. Future research should investigate the development and implementation of interventions targeting memory of treatment recommendations to facilitate weight loss in severely obese populations.
Keywords: cognitive functioning, neuropsychological assessment, treatment outcome
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45 Much ado About Norming: Trail Making Test Performance Outcome for African Americans Differs Between Normative Systems

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Objective: The Trail Making Test (TMT) is a popular test of executive functioning. We compared TMT performance between African Americans and Caucasians using Heaton norms (Heaton et al., 2004), Mitrushina meta-norms (Mitrushina et al., 1999), and the Calibrated Neuropsychological Normative System (CNNS; Schretlen et al., 2010).
Participants and Methods: TMT parts A and B raw scores for 325 African Americans (56% female, mean age 50 years, mean education 13 years) and a matched sample of 330 Caucasians (54% female, mean age 47, mean education 13.5 years) were converted to normed T-scores using Heaton, Mitrushina, and CNNS norming systems. ANOVA with racial group as the independent variable and TMT T-score as the dependent variable was used. T-score differences between normative systems were compared for the overall sample as well as for education level (less than 12, 12, 13-15, and 16 or more years) and age range (18-35, 36-50, 51-65, and greater than 65 years old).
Results: Mitrushina meta-norms and CNNS norms were significantly different between African American and Caucasian participants for both TMT-A [$F(1,587) = 10.39$, $p=.001$; $F(1,575) = 10.35$, $p=.001$] and TMT-B [$F(1,585) = 34.12$, $p=<.01$; $F(1,572) = 54.68$, $p=<.01$] while Heaton norms did not differ by race. For

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education, Mitrushina meta-norms were significantly different for race on TMT-B for all education levels [F (1,95) = 9.26, p=.003; F (1,195) = 5.00, p=.026; F (1,58) = 19.70, p=<.01; F (1,72) = 29.76, p=<.01] and for TMT-A for the less than 12 years [F (1,103) = 8.30, p=.005], 13-15 years [F (1,62) = 9.66, p=.003], and 16 plus years of education [F (1,48) = 15.402, p < .01]. CNNS norms were significantly different for race on TMT-B for the less than 12 years [F (1,99) = 4.24, p=.042], 13-15 years [F (1,58) = 26.75, p<.01], and 16 plus years of education [F (1,95) = 30.37, p <.01]. CNNS norms were significantly different for race on TMT-A only for 13-15 years of education [F (1,59) = 8.50, p=.005].
Examining age range, Heaton norms were significantly different between African American and Caucasian participants only for TMT-A in 18-35 years old [F (1,459) = 5.26, p=.002]. Both Mitrushina and CNNS norms were significantly different by race for 18-35 years old for both TMT-B [F (1,418) = 21.86, p< .01; F (1,427) = 31.35, p < .01] and TMT-A [F (1,441) = 4.57, p= .033; F (1,432) = 4.28, p = .039]. Mitrushina and CNNS norms were significantly different by race for TMT-B for the 36–50-year range [F (1,256) = 22.47, p < .01; F (1,262) = 21.03, p < .01]. None of the norming systems were significantly different for either 51-65 years old or over age 65 years.
Conclusions: The interpretation of TMT performance for African Americans differed by the normative system utilized and this may be more pronounced for younger age ranges. Normative implications for minority groups in clinical interpretation and legal settings requires further research examining validity and differential impact.
Keywords: psychometrics**,** multiculturalism

46 Association of Memory Scores to Word Choice Performance

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Objective: Performance validity tests (PVT) are commonly used in neuropsychological evaluations to determine test engagement and validity of results, often utilizing a forced-choice recognition memory paradigm. While designed to detect suboptimal performance in individuals without genuine cognitive deficits, memory impairment, rather than poor effort, may possibly negatively impact PVT performance in some cases, yet little research exists comparing associations between cognitive domains and PVT scores. This study investigated the strength of the relationship between memory performance and a commonly used forced-choice PVT paradigm [Word Choice (WC) from the Advanced Clinical Solutions] in a diverse clinical sample to aid in interpretation of performance validity scores.
Participants and Methods: Data were obtained from 111 patients evaluated in an outpatient neuropsychology clinic within an academic medical center, who were at least 18 years old [(M_{age}=51.36 (13.62), range=18-69; $M_{education}$=15.1 (2.4)] and completed the California Verbal Learning Test-II (CVLT-II) and Rey-Osterrieth Complex Figure Test (RCFT) as part of a routine neuropsychological evaluation. To reduce the probability that participants obtained low WC scores because of poor test engagement, participants were required to obtain a Wechsler Adult Intelligence Scale-IV (WAIS-IV) Reliable Digit Span (RDS) score of =>7. Composite scores were created for the CVLT-II (total learning and delayed recall Z-scores) and RCFT (immediate and delayed recall Z-scores). Hierarchical linear and logistic regression analyses were conducted to assess the relative contribution of memory performance on WC scores, controlling for age, education, and RDS performance.
Results: Approximately 30% (n=33) and 37% (n=41) of participants performed at least 1 SD below the mean on CVLT-II and on RCFT composites, respectively, and 12% of participants (n=13) scored below a WC cutoff score of 45. WC [M=47.54 (4.24)] had a moderate positive correlation with CVLT-II (r=.38, p<.001) and RCFT (r=.49, p<.001) composites. The hierarchical linear regression was significant, [F(5,110)=7.564, p<.001, R^2=0.230,], with CVLT-II being the strongest predictor of WC score (β=.390, t=3.80, p<.001)

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compared to RCFT. Demographic factors and composite scores together explained 27% of the variance in WC scores, with CVLT-II performance alone accounting for 23% and minimal contribution from RCFT. Binary logistical regression was conducted to determine predictors that increase the probability of failure rates (defined as ≤ 44) on WC, given inherently non-linear distribution of the forced-choice paradigm data. Results revealed that 1 SD lower performance on CVLT-II scores increased the probability of failure on WC by 63.6%, while age, education, RDS, and RCFT did not significantly increase the probability of WC failure (all *p's*>.05).

Conclusions: Ideally, PVTs should not correlate strongly with neurocognitive domains targeted for assessment in a neuropsychological evaluation. However, these data suggest that verbal memory, but not visual memory, was significantly associated with WC performance even after controlling for demographic factors and an embedded PVT performance. Clinically, these data suggest using caution in interpreting low or failed WC performance and the need to use multiple (including non-memory) PVTs in patients with low memory scores. Future research assessing associations between other cognitive domains and commonly used PVTs is warranted.

Keywords: assessment**,** validity (performance or symptom)**,** memory disorders

47 Profiles of Neurocognitive Functioning in Adults with a History of Depression

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Objective: Cognitive impairment associated with Major Depressive Disorder (MDD) has been well-documented, particularly in the domains of executive functioning, attention, memory and psychomotor speed (Snyder, 2013). However, relatively little research has examined possible idiographic patterns of cognitive functioning that may reflect subgroups characterized by specific deficits in functioning across domains (Tran et al., 2021). It may be that cognitive functioning in individuals with histories of MDD varies across domains for subgroups of individuals with differential risk for adverse long-term outcomes. As an initial step to address this gap, we used an intra-individual approach to identify latent profiles of performance on a multi-domain assessment of neurocognitive functioning in a sample of 267 adults with a history of depression.

Participants and Methods: Participants were 267 adults (87% female; *M* age = 42.78±6.49 years) with a history of MDD who completed a baseline neurocognitive assessment as part of a study testing the efficacy of a family depression preventive intervention. Participants self-reported race (65.5% White; 12.9% Black/African American) and ethnicity (16.1% Hispanic or Latino). Five subtests from the NIH Toolbox Cognition Battery were administered to assess domains of neurocognitive functioning: shifting, inhibitory control/attention, working memory, episodic memory, and processing speed. Models were fit using the mixture package in R; predictors were age-adjusted standard scores on each subtest. We used a data-driven approach to identify the best-fitting multivariate mixture model based on Bayes' Information Criterion (BIC) using a start point identified from *k*-means clustering.

Results: The best fitting model selected by applying the BIC criteria was a 3-class mixture model with proportional variances over classes and a diagonal covariance matrix. However, a likelihood ratio test comparing the 3-component solution with a diagonal covariance matrix (i.e., traditional latent profile analysis structure) to an unstructured covariance matrix favored the less restricted model (*p*<.001). Three latent profiles emerged using this final model. The largest group (*n*=153; 57%) demonstrated above-average performance across domains, with relative strengths in shifting (*M*=116.86) and processing speed (*M*=114.24). A second group (*n*=93; 35%) demonstrated low-average performance across domains, with relative weaknesses in inhibitory control/attention (*M*=82.83) and processing speed (*M*=89.81). The third group (*n*=21; 8%) also performed in the low-average range on inhibitory control/attention (*M*=86.59) and processing

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speed (*M*=91.07) but exhibited clear strengths in both working (*M*=114.23) and episodic (*M*=137.36) memory.
Conclusions: Results from our final mixture model indicate that patterns of performance clustered into three profiles. The largest group displayed no evidence of deficits and functioned broadly average and above in all areas. A second group, comprising a third of the sample, was broadly low-average in functioning. A third more heterogeneous pattern emerged, including above-average to superior memory. Importantly, both the second and third groups displayed deficits in inhibitory control/attention and processing speed. Episodic memory was unaffected across all profiles. These findings suggest important differences in profiles of neurocognitive functioning that may be meaningful for predicting long-term outcomes. A next step for this research is to investigate correlates of and outcomes predicted by class membership.
Keywords: depression**,** executive functions**,** neuropsychological assessment

48 Examination of a Single-Item Prospective Memory Task in the Cognitive Assessment of Older Adults

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Objective: Prospective memory (PM), or "remembering to remember," is a cognitive function essential to supporting the independence of older adults. However, PM is not often assessed objectively through inclusion in neuropsychological batteries due to time constraints, financial limitations, and the small number of validated tests specific to PM. The present study sought to evaluate the utility of a single-item PM task incorporated into an existing clinical battery in understanding the everyday prospective memory of older adults. Because the PM task involved both remembering to carry out a future event and to recall the nature of the event, we hypothesized that the PM Hidden Object score would correlate with objective measures of memory and executive functioning as well as with self-reported memory and everyday executive functioning abilities.
Participants and Methods: Eighty-five community-dwelling older adults completed a battery that included the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and Delis-Kaplan Executive Functioning System (DKEFS) Design Fluency and Letter Fluency subtests. Participants engaged in a PM Hidden Object task, in which the examiner hid a personal item at the beginning of session, and participants were required to ask for the item to be returned at the end of session and tell the examiner where the hidden item was located. Additionally, participants completed the Prospective Retrospective Memory Questionnaire (PRMQ) and the Dysexecutive Questionnaire (DEX).
Results: After controlling for education, performance on the PM Hidden Object task was positively correlated with the RBANS Immediate Memory Index scores (r = .22. p = .04) and RBANS Delayed Memory Index scores (r = .27, p = .01). The PM Hidden Object task did not display a relationship to either the Design Fluency (r = .07, p > .05) or Letter Fluency (r = .08, p > .05) scores. Also contradictory to hypotheses, performance on the PM Hidden Object task exhibited no relationship to self-reported PRMQ and DEX responses.
Conclusions: Older adults' performance on an objective measure of PM did not exhibit a consistent relationship to measures of executive functioning or self-reported everyday memory and executive functioning abilities in the present study. While simple assessments of PM are attractive due to ease of administration, they might fail to fully capture examinees' true abilities or typical behavior in daily life. Future studies should involve the development of tasks to evaluate PM that are more representative of real-world activities and that allow for the use of compensatory strategies in task completion.
Keywords: memory: prospective**,** neuropsychological assessment**,** aging (normal)
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49 How Easily can Adults Evade Detection when Feigning Symptoms During Teleneuropsychological Evaluations?

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Objective: The COVID-19 crisis highlighted the need for Neuropsychologists to provide certain services virtually using teleneuropsychology (TNP). While previous research has suggested that TPN and face-to-face assessments are equivalent, the vast majority of these studies took place at satellite clinics, where a technician configured equipment and test stimuli. Additionally, most studies conducted on the validity and reliability of TNP have focused on small samples of adult or geriatric patients and research is generally lacking on the application of TNP assessments to populations who may be motivated to perform noncredibly. Thus, the primary aim of this study was to determine how easily adults could evade detection when performing noncredibly during TNP assessments.
Participants and Methods: Participants were 33 staff (mean age 39.76; 29 female, 22 white) working in postsecondary Disability Services Offices in Ontario, Canada. All volunteered to participate in a study evaluating the equivalence of in-person versus virtual testing. In part one of this study, two trained psychometrists delivered the virtual testing and made subjective evaluations of the participant's level of engagement and credibility of performance. Unbeknownst to the psychometrists, eight participants had agreed to exaggerate their performance in a manner that would suggest a need for academic accommodations (the Instructed to Feign Group; ITF), but were warned not to answer in ways that would arouse suspicions.
Participants completed tests at home on their computers, with psychometrists working from their homes. Cognitive and academic tests adapted for virtual use were employed, including most subtests of the Wechsler Adult Intelligence Scale-fourth edition (WAIS-IV), the Conner's Adult Attention Rating Scale (CAARS), the oral version of the Memory Complaints Inventory (Green, 2018), and various other measures adapted for use in TNP.
Results: Psychometrists were unable to identify ITF participants. Mean ratings for observed effort and credibility were equivalent between groups, with all ITF participants receiving ratings of good or excellent effort. The ITF group performed significantly lower on the Digit Span subtest (Cohen's d=.80), of the WAIS-IV, but were not identified by Reliable Digit Span. The ITF group reported significantly more hyperactive symptoms than the honest performers (d=.98), and had an overall higher ADHD total on the CAARS than the honest group (d=.81), but were not identified by embedded symptom validity scales. Honest and ITF participants had equivalent MCI scores. The ITF group reported significantly more problems on functional impairment ratings than did the honest group (ranging from d=.75 to d=1.31 depending on domains evaluated).
Conclusions: While TNP may offer promise in some situations, results from this preliminary study demonstrate the ease with which individuals instructed to feign or exaggerate symptoms could remain undetected by clinicians during virtual assessments. Trained psychometrics were unaware of any attempt to deceive on the part of the ITF participants. The ITF group reported more symptoms of ADHD overall, particularly hyperactivity, and report experiencing more functional impairment across settings. They also demonstrated some impairment on tests like Digit Span. Neither the embedded nor the stand-alone validity measures available for virtual use identified the ITF individuals. These results highlight concerns regarding noncredible presentation during TNP assessments.
Keywords: assessment**,** teleneuropsychology**,** malingering

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50 A Pilot Study of Remote App-Based Assessment of Cognition in Aging and Pre-Clinical Alzheimer's Disease

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Objective: Mobile, valid, and engaging cognitive assessments are essential for detecting and tracking change in research participants and patients at risk for Alzheimer's Disease and Related Dementias (ADRDs). This pilot study aims to determine the feasibility and performance of app-based memory and executive functioning tasks, included in the mobile cognitive app performance platform (mCAPP), to remotely detect cognitive changes associated with aging and preclinical Alzheimer's Disease (AD).
Participants and Methods: The mCAPP includes three gamified tasks: (1) a memory task that includes learning and matching hidden card pairs and incorporates increasing memory load, pattern separation features (lure vs. non-lure), and spatial memory (2) a stroop-like task ("brick drop") with speeded word and color identification and response inhibition components and (3) a digit-symbol coding-like task ("space imposters") with increasing pairs and incidental learning components. The cohort is also assessed with the NACC UDS3 or T-Cog neuropsychological battery within six months of the mCAPP testing. Participants included seven older adults (43% female; age=73.6±5.8, years of education=15.3±3.1; 71% Caucasian) with normal cognition who are enrolled in the Penn ADRC cohort. Participants completed two weeks of at-home testing, with eight scheduled sessions, four in the morning and four in the afternoon. Participants also wore activity trackers to collect daily step and sleep data and answered questions about mood, anxiety, and fatigue throughout the two weeks of data collection.
Results: The participants completed an average of 9 at-home sessions and most participants (6 of 7) completed 9-11 sessions. On the memory task, participants required more guesses to succeed on the lure levels and there was stability in performance over sessions. Task performance shows greater variability between participants on the more cognitively demanding blocks of the tasks, including blocks with a higher memory load on the memory task, the inhibition block of the "brick drop" task, and blocks with a higher number of pairs on the "space imposters" task. Participants' report of their emotional and fatigue states prior to gameplay was 2.8±2.4 for fatigue (0-10 range; 0=no fatigue), 7.5±2.1 for mood (0-10 range; 0=sad; 10=happy) and 1.7±1.3 for anxiety (0-10 range; 0=no anxiety).
Conclusions: Participants were willing and able to complete at-home cognitive testing and most chose to complete more than the assigned sessions. This pilot study shows preliminary feasibility and validity of remote app-based tests of cognition for detection of subtle cognitive differences in older adults with intact cognition. This work will help to advance remote detection and monitoring of early cognitive changes associated with preclinical AD. Future directions will include evaluation of the relationships between at-home burst testing, daily activity and behavioral states, traditional neuropsychological measures, and neuroimaging biomarkers in a larger cohort of participants.
Keywords: computerized neuropsychological testing**,** aging disorders**,** dementia - Alzheimer's disease
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51 Visuospatial Memory Eye-Tracking Test (VisMET): Demographic Predictors and Cognitive Correlates

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Objective: Accurate, fast, and widely available detection of cognitive decline is critical to the development and implementation of effective interventions for Alzheimer's Disease (AD). Current methods of detecting early cognitive decline are limited in that they can be racially biased and burdensome for patients and health care providers. Passive digital indicators, such as the Visuospatial Memory Eye-Tracking Test (VisMET) stand to mitigate these limitations. The

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present study aims to evaluate demographic predictors and cognitive correlates of VisMET, which is a brief task that uses a tablet to display naturalistic images and capture eye movements to monitor patient viewing.
Participants and Methods: Participants were 161 older adults (M_{Age}= 68.8 years, SD_{Age}= 8.0 years; M_{MOCA} = 25.7, SD_{MOCA} = 3.9) who completed VisMET testing as part of a standard neuropsychological battery during their annual clinic visit or for a research visit at Emory University. Included participants were 80.7% White, 14.9% Black, 64.6% Female, and had an average of 16.2 years of education ($SD_{education}$= 2.2 years). VisMET requires participants to view 40 images over the course of 5 minutes. Half of the images are novel and the other half are repeated images with a visual component added or removed. Two outcome variables are produced: average view time of critical regions for added images (VisMET-Added) and average view time for critical regions for removed images (VisMET-Removed). In addition to VisMET, participants completed measures of attention (Digit Span Forward), processing speed (Trails A), language (Animal Fluency), memory (Benson Figure Delay), visuospatial function (Benson Figure Copy), and executive function (Trails B, Digit Span Backward).
Results: Linear regression analyses revealed age was a significant predictor of both VisMET-Added, b = -.002, SEb= .001, t= -3.4, p< .01, and VisMET-Removed scores, b = -.002, SEb= .001, t= -3.0, p< .01. Education, race and sex were not significant predictors of either score. Bivariate Pearson Correlations revealed VisMET-Added scores were correlated with global cognition (r= .20, p< .05), processing speed(r= -.23, p< .01), visuospatial function (r= -.30, p< .05), and visual memory (r= -.34, p< .01). VisMET-Removed scores were significantly correlated with visuospatial function (r= -.38, p< .01), and visual memory (r= -.30, p< .01).
Conclusions: VisMET performance was impacted by age (small effect) but does not appear to be influenced by other demographic factors. Performance on VisMET items with added components was related to many aspects of cognitive function whereas performance on items with removed components related more selectively to visuospatial memory. Limitations include the restricted range of education of our sample. Future directions include formal psychometric validation of VisMET-Added and VisMET-Removed scores with further exploration of education, race, and sex in a sample with greater demographic diversity.
Keywords: neuropsychological assessment**,** aging disorders**,** memory disorders

52 Eye-tracking based Attention Inflexibility Indices to Valence-Neutral and Hedonic Stimuli Predict Executive Functioning Deficits.

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Objective: Attention flexibility, or goal-directed attention redeployment as appropriate to context, is integral to adaptive functioning in human beings. Indeed, deficits in attention flexibility are a transdiagnostic risk factor for psychiatric problems, and are evident among those neurocognitively impaired. Further, a growing literature suggests that attentional flexibility is state-dependent, as evidenced by distinct patterns in attention shifting in response to valanced and neutral stimuli. However, the preponderance of studies that examined the construct relied on self-report measures or behavioral paradigms that are confounded by response biases and limited self-knowledge, as well as construct-irrelevant variance (e.g., motor speed). Eye-tracking paradigms surmount some limitations observed in self-report and behavioral tests of attention flexibility, but most measure attention bias towards valenced information rather than its motivated disengagement. We examine the convergent validity of a novel eye-tracking paradigm that quantifies attention flexibility under neutral, positive, and negative valence conditions in relation to self-reported behavioral inhibition and flexibility deficits within a sample of Hungarian adults with depression histories.

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Participants and Methods: Fifty-three Hungarian adults with depression histories (36% female, *M*= 25.93, SD = 2.69, n=8 in episode) completed self-reported a measure of executive functioning (Behavior Rating Inventory of Executive Function-Adult, Brief-A) and a visual attention disengagement task (disengagement task) via E-prime 3.0 and the Tobii x2-60 eye-tracking system. During the disengagement task, participants were presented with frontal-view same-actor face-pairs (angry-neutral, sad-neutral, happy-neutral, neutral-neutral) that were drawn from KDEF database. Participants freely viewed the face pairs and shifted their attention in response to a visual prompt. Attention disengagement indices reflect the speed with which participants shifted visual attention away from a valenced face towards a neutral face (Dangry, Dhappy, & Dsad) and across neutral faces (Dneutral) in response to a visual prompt (i.e., a shape framing the target face). The t-score converted Brief-A Shifting and Inhibition indexes that reflect flexible problem-solving and impulse control, respectively, served as the primary disengagement task validators.
Results: Spearman bivariate correlations revealed robust associations among the four disengagement task indices (rs = .45-.73, ps £.001), and between Dneutral and the Brief-A Shifting subscale (r=.32, p = .02). Partialling the effect of demographic characteristics and depression status sharpened the association between Dneutral and Brief-A shift subscale (r= .39, p= .004). Controlling for the effects of Dneutral increased the Dhappy-Brief-A Shifting subscale correlation to a level of significance (r=-.32, p = .02).
Conclusions: Our findings provide some support for the convergent validity of the disengagement task, as evidenced by the robust association between valence-neutral attention disengagement scores and behavioral rigidity, as well as in the inverse association between attention disengagement from happy valenced faces when valence-neutral disengagement scores were statistically controlled. The results also highlight a need to consider valence when measuring attention flexibility, and clinical implications will be discussed.
Keywords: attention**,** affective processing disorders**,** assessment

53 Validation of The Mobile Toolbox: A Remote Assessment for Measuring Cognitive Change Across the Lifespan

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Objective: The ability to easily detect early indicators of and/or risk factors for brain disease AND differentiate these from typical cognitive aging is crucial to supporting healthy aging. However, there are currently only a few sensitive assessment tools to address this need. The “Mobile Toolbox” (MTB) is an assessment library and technology platform enabling clinical researchers to deploy smartphone-based measures and remotely assess cognitive and emotional functioning across the adult lifespan. We describe the validation of eight MTB cognitive measures, the first suite of measures available through MTB, which are adapted versions of NIH Toolbox (NIHTB) measures for remote assessment.
Participants and Methods: Participants and Method: Ninety-four English-speaking participants between the ages of 18-85 were recruited by a market research company. Our sample skewed predominately female (n = 61, 65%). Participant age (Mage= 51; SD = 17) was distributed across six age brackets: 18-30 (n = 16), 31-40 (n = 12), 41-50 (n = 14), 51-60 (n = 22), 61-70 (n = 18), 71 and over (n = 12). More details about participants will be available in full at the time of the conference. All participants completed the NIHTB Cognition battery, “gold standard” measures, and the MTB (pre-loaded on a study device), in that order. Completion time for MTB averaged around 57 minutes (+/-9). See table for list of all measures and associated domains.

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MTB	Domain	NIHTB	Gold Standard
Flanker Inhibitory Control and Attention Test	Attention/ Executive Function	Flanker	Delis Kaplan Executive Function System (D-KEFS) Color-Word Interference Test
			Wisconsin Card Sorting Test (WCST-64)
Dimensional Change Card Sort (DCCS)	Executive Functioning	DCCS	WCST-64
			D-KEFS Color-Word Interference Test
Picture Sequence Memory (PSM)	Episodic Memory	PSM	Wechsler Memory Scale (WMS-IV) Verbal Paired Associates I and II
Vocabulary	Language	Vocabulary	Peabody Picture Vocabulary Test (PPVT)
Spelling	Language	Oral Reading	Wechsler Individual Achievement Test (WIAT-4) Spelling
Number Match	Processing Speed	Pattern Comparison, Oral Symbol Digit	Wechsler Adult Intelligence Scale (WAIS-IV) Symbol Search and Coding/Processing Speed Index
Memory for Sequences (MFS)	Working Memory	List Sorting Working Memory (LSWM)	WAIS-IV Digit Span, Letter Number Sequencing
Face Name Associative Memory Exam (FNAME)	Memory	FNAME	WMS-IV Verbal Paired Associates I and II

Results: We measure reliability via internal consistency and validity through correlations between MTB, NIHTB, and gold standard measures. To evaluate internal consistency, measure appropriate statistical indices will be used. For Spelling and Vocabulary (the two MTB measures that are CAT-administered), empirical reliability derived from the respective IRT model will be evaluated. For DCCS, PSM, Flanker, and FNAME (the measures in which all participants receive identical item sets), Cronbach's alpha will be calculated. For MFS and Number Match (tasks in which items are administered based on participant ability), even-odd split half reliability with Spearman Brown correction will be calculated. These calculations are currently underway and will be available in full by the time of the conference.

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Conclusions: This validation effort reflects an essential step in the development and dissemination of the MTB app, paving the way for its potential use in cognition research. Available for both iOS and Android devices, we envision the MTB being used in fully remote or follow-up remote studies. With our validation data, researchers will have the evidence needed to make an informed decision on using MTB as part of their measure selection when studying cognition.
Keywords: technology**,** assessment**,** cognitive functioning
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54 Dialectical Tensions in Clinical Neuropsychology Supervision – A Narrative Review and Adapted Model

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Objective: High quality supervision is essential in the training of new neuropsychologists, and is a professional activity in which many neuropsychologists participate. Formal training in supervision is also a requirement for program accreditation in many jurisdictions. Despite the importance of supervision, clinical neuropsychology lags behind other areas of psychology with regards to formal training of supervision, empirical research on current practices, and published literature on theoretical models. The objective of this narrative review is to describe the adaptation of a dialectical supervision model to neuropsychology supervision.
Participants and Methods: We conducted a narrative review of the published literature in the areas of neuropsychological supervision, and dialectical tension in clinical supervision more broadly. A supervision model that emphasizes mindfulness of dialectical tensions was adapted for neuropsychological supervision. Case illustrations are employed to demonstrate how this approach could help supervisors navigate challenging situations that could arise in real world practice.
Results: Several studies have investigated supervision practices in clinical neuropsychology, but few have discussed formal approaches. A hybrid model of supervision proposed by Stucky et al. (2010) described the need to integrate three major approaches of supervision: developmental (consideration of supervisee's level of professional development), process oriented (modeling, usage of time, content of supervision sessions), and psychological (supervisee's individual characteristics). These three approaches, and the goals they represent, can come into conflict with one another. Supervisor flexibility and awareness of these conflicts allow one to navigate the tension that can exist between these three approaches, and therefore improve client care and supervisory outcomes. In an article written for counselling and clinical psychology supervisors, Veilleux et al. (2014) proposed four dialectical tensions for the supervisor to be aware of and flexibly balance. These four dialectics are: promoting change and providing support; providing feedback and maintaining the relationship; supervisee directed and supervisor directed; and client-focus and supervisee development focus. In our discussion of an adapted model, we describe how insights from the dialectical approach can be adapted to Stucky's hybrid model of neuropsychological supervision, so that supervisors may more mindfully navigate the competing roles and needs that arise in neuropsychological supervision. Through six case illustrations drawn from real-world experience, we describe how the application of dialectical thinking allows a supervisor to skilfully navigate situations where these tensions are in conflict.
Conclusions: This narrative review describes the existing literature on supervision in clinical neuropsychology, and a novel approach to supervision that formally includes dialectical thinking. Mindful awareness of dialectical tensions is expected to help supervisors more effectively manoeuvre through these challenges, and contribute to improved supervision outcomes.
Keywords: neuropsychological assessment

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55 Digital Methods of Delivering Education and Training in Neuropsychology

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Objective: The future of neuropsychology depends to a great extent on the quality of current educational practices in the profession. Ongoing advancements include developing a taxonomy of education and training, outlining competencies, and updating the Houston Conference Guidelines. Meanwhile, there is room for growth in the "how" of education in neuropsychology. That is, how can we most effectively deliver brain-behavior knowledge and skills? This is particularly relevant to neuropsychology learners who are disadvantaged with respect to income, geographic location, and access to large academic medical centers.
There is a large pedagogical literature supporting the use of digital approaches to education, where careful implementation of electronic technologies is shown to enhance learning outcomes. The objective of the current study is to outline and describe three empirically supported digital methods to advance education in neuropsychology across the training spectrum.
Participants and Methods: We review the literature and report on data from on podcasts, webinars, and social media platforms as educational tools to improve learning of brain-behavior concepts and clinical skills.
Results: Limitations of the three digital methods of education, revealed in our literature review, include the requirement for internet connectivity, fewer in-person interactions, and the increased potential for distractibility during learning. Shared benefits include cost savings of remote learning, increased availability of advanced educational content for people of disadvantaged circumstances, and general convenience. Descriptive data from one podcast and one webinar series are reported. The podcast *Navigating Neuropsychology* currently has 75 episodes and over 275,000 total downloads (>3,600 downloads per episode) by people from 107 different countries. The webinar series *KnowNeuropsychology* has over 2,500 subscribers and attendees from over 85 countries. Two surveys of *KnowNeuropsychology* viewers suggested that over 95% believe that these webinars have benefits to clinical and research training, as well as sensitivity to issues of culture/diversity.
One recommendation for implementation uses an evidence-based flipped learning paradigm, where a course instructor assigns podcast episodes and/or webinars on foundational neuropsychological concepts as homework to be completed outside of class. Next, in-class quizzes confirm that students attended to the material, followed by group discussions about more complex aspects of the content. For example, students could learn core concepts related to neuroanatomy or assessment feedback via podcasts and/or webinars, and then participate in in-class group discussions about differential diagnosis of neurological syndromes and clinical vignettes/role plays for the delivery of patient feedback.
A second example uses widely available social media platforms such as Twitter to share recent scientific advancements (e.g., publications), announcements about class assignments, and specific professional opportunities such as upcoming conferences, committee openings, and academic webinars. A third example encourages the use of both podcasts and webinars for exam preparation and clinical/professional development. This could apply to board certification, CE requirements, and literature reviews to inform patient care.
Conclusions: On balance, we believe that podcasts, webinars, and social media platforms could be carefully and thoughtfully implemented to improve learning outcomes across the continuum of neuropsychology training programs, from graduate school through postdoctoral fellowship and continuing education.
Keywords: technology**,** academic skills**,** inclusion

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56 Where are the International Psychology Graduates in Neuropsychology?

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Objective: About 45 million individuals in the US are born in another country (Budiman, 2020). The current data also indicates that the nation is diversifying faster than previously predicted (US Census Bureau, 2021). However, neuropsychologists from diverse ethnoracial and linguistic backgrounds continue to remain scarce (Cory, 2020). The 2008 Multicultural Problem-Solving Summit recommended an early and individualized mentoring system for successful recruitment and retention of ethnic minorities in neuropsychology (Byrd et al., 2010). However, the neuropsychology workforce remains insufficiently diversified. In this paper, I propose following the medical model and creating a commission for international psychology graduates. It can assess international graduates' readiness to enter training programs in neuropsychology. The pathway to a career in neuropsychology for international graduates is also in the national interest of the US because providers from diverse backgrounds are needed now more than ever.
Participants and Methods: Immigrants often include professionals who hold advanced academic degrees in their countries of origin. For example, foreign-born professionals have played an instrumental role in alleviating shortages in areas like medicine. It is estimated that about one in six health care professionals are foreign-born (National Conference of State Legislators [NCSL], 2018). However, the neuropsychology workforce is rarely foreign-born. There are no clear guidelines on pursuing a career in neuropsychology with international academic and training credentials. The lack of a clear pathway becomes the sole reason for many migrants never to re-enter the profession unless they are willing to repeat the entire course of their study in the US. The development of a workforce that reflects the communities it serves is of paramount value in reducing health disparities and creating a sustainable neuropsychological care system that produces positive health outcomes.
Results: Neuropsychology does not have to develop a novel system. The field can learn from the medical model that has successfully created an entry system for international medical graduates (IMGs). The Educational Commission for Foreign Medical Graduates (ECFMG) provides IMGs comprehensive information and resources on US licensure, evaluates their credentials, and assesses if they are ready to enter a residency or fellowship program (Educational Commission for Foreign Medical Graduates [ECFMG], 2011). There is empirical evidence that patient outcomes are at least equivalent, if not better, for individuals treated by IMGs (Norcini et al., 2010). Following a similar model, neuropsychology can establish a commission for international psychology graduates. Individuals will have a clear roadmap on becoming a part of the US training system with the eventual goal of practicing as a neuropsychologist. These foreign-educated-US-trained professionals can provide care to an increasingly diverse patient population. They can also play an instrumental role in diversifying clinical research, recruiting minority patients to develop an appropriate normative sample, and bringing unique perspectives into the field.
Conclusions: There is empirical evidence that culture and language influence an individual's perception of health, disease, and treatment-seeking behavior. Therefore, it is imperative to develop systems that train, recruit, and retain neuropsychologists who understand and appreciate individuals from varying backgrounds. In addition, the development of diverse executive leadership and governance bodies is essential for implementing effective reforms to fulfill the needs of a diverse provider and patient population.
Keywords: inclusion**,** language: second/foreign**,** academic skills

57 Was the COVID-19 Pandemic Associated with Gender Disparities in Authorship of Manuscripts Submitted to Clinical Neuropsychology Journals?

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Objective: The COVID-19 pandemic has exacerbated gender disparities in scientific output in some academic disciplines. Clinical neuropsychology has a history of gender disparities in multiple professional domains, including authorship on peer-reviewed manuscripts. This study examined the association of the COVID-19 pandemic with gender authorship disparities in clinical neuropsychology journals.
Participants and Methods: The author bylines of 1,018 initial manuscript submissions to four major clinical neuropsychology journals from March 15 through September 15 of both 2019 and 2020 were coded for binary gender using estimates from national databases. In addition, authorship of 40 articles published on pandemic-related topics (e.g., COVID-19, teleneuropsychology) across nine clinical neuropsychology journals were also coded for binary gender.
Results: Initial submissions to clinical neuropsychology journals increased by 27.2% during the pandemic, with comparable increases in the total number of authors coded as either women (+23.0%) or men (+25.4%). Neither the average percentage of women on manuscript bylines nor the proportion of women who were lead and/or corresponding authors differed significantly across time. Moreover, the representation of women as authors of pandemic-related articles did not differ from expected frequencies in the field.
Conclusions: These encouraging findings suggest that representation of women as authors of peer-reviewed manuscript submissions to clinical neuropsychology journals did not change during the initial months of the COVID-19 pandemic as compared to the prior year. Future studies might examine the roles of risk (e.g., caretaking responsibilities) and protective (e.g., sponsorship, resilience) factors that might influence individual differences in scientific productivity during the pandemic.
Keywords: diversity
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58 Barriers to Ordering Neuropsychological Services, According to Medical Residents

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Objective: Neuropsychologists receive most of their patient referrals from neurologists, psychiatrists, and primary care physicians (Sweet et al., 2015). It is consequently important to understand how to facilitate future providers' continued engagement with the field of neuropsychology. The current study explores barriers medical residents perceive to ordering neuropsychological services. By understanding obstacles to referring patients, neuropsychologists will be better equipped to provide education and training that reduce these barriers and thereby increase the likelihood of future referrals.
Participants and Methods: Participants consisted of 240 residents in accredited family medicine (36%), internal medicine (25%), psychiatry (24%), neurology (13%), and combined specialty (3%) training programs across the United States who completed a survey about their education and attitudes surrounding neuropsychological practice. The survey included an open-ended question in which residents were asked to list perceived barriers to ordering neuropsychological services. All of the included residents provided at least

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one barrier. Residents' responses were coded line by line and collapsed into themes. Frequencies of each code were calculated to determine the most commonly reported barriers.
Results: Two primary themes emerged. One theme consisted of barriers related to residents' education and training surrounding neuropsychological practice. Approximately one third of residents (34% of participants) cited lack of knowledge about the field as an obstacle; they indicated that they do not understand what neuropsychologists do, how neuropsychological services can be helpful, or how to make a referral. Other residents (12%) stated that they are not aware of who provides neuropsychological services in their local area. The second theme revolved around logistics. Half of the residents (50%) reported limited availability of neuropsychological services as a barrier, either due to lack of neuropsychologists locally or not having access to neuropsychologists in their work setting (e.g., in an inpatient context). Other barriers in the logistics category included the perceived cost of neuropsychological evaluations (23%) and long wait times before patients are seen (15%). Additional barriers were reported by less than 5% of participants.
Conclusions: The current study suggests several ways in which medical residents' education about neuropsychology can be tailored to reduce barriers to making referrals. Results indicate that useful targets for training might include sharing information about local providers of neuropsychological services and instructing residents about the field of neuropsychology, including what neuropsychologists do, when neuropsychological services are indicated, potential benefits, and the referral process. This study also shows that there is an unmet need for neuropsychological services; limited availability of neuropsychologists and long wait times for appointments were commonly reported barriers. While the long-term solution to these problems might be training more neuropsychologists, especially ones willing to work in remote or rural areas, short-term stopgaps might include disseminating a national list of neuropsychologists organized by geographic area and a list of neuropsychologists who are willing to travel, as suggested by Temple et al. (2006). Implementing these informational and educational strategies might increase the likelihood of future referrals.
Keywords: transdisciplinary research, self-report
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59 Implementing Evidence-Based Treatment for Neurocognitive Conditions: A Model for Training, Supervision, and Maintenance

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Objective: Children and adolescents with acquired brain injuries and other neurological conditions experience a range of cognitive, behavioral, and social consequences that impair everyday functioning. Extant evidence suggests that these problems often go unrecognized and untreated, in part because few behavioral health care providers understand the complex interplay among neurological, behavioral, and social contributing factors. Neuropsychologists are uniquely equipped to understand and manage these neurobehavioral sequelae, yet relatively few deliver clinical care. Online family problem solving treatment (OFPST) has been established as a standard of care for traumatic brain injuries and can be delivered by neuropsychologists-in-training, thereby expanding capacity and access for these vulnerable populations. We describe our process for virtual training and support and provide two case examples regarding how it is being successfully integrated into neuropsychological training.
Participants and Methods: OFPST is a 10-14 session problem-solving treatment for adolescents and emerging adults with TBI and their families integrating online learning modules with synchronous sessions with a therapist to review online content and problem-solve around adolescent or family-identified aims. In addition

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to problem-solving, the program provides training in metacognitive strategies, emotion regulation, and communication skills to both the adolescent and their family. Training consists of 2 half-day virtual sessions involving didactics, role play and discussion. A companion therapist training website provides more detailed information regarding specific content, strategies for managing challenging situations, and webinars around working with specific population. After completing training, each site developed implementation plans based on their infrastructure and available clinical resources.
Results: 50 neuropsychologists and 20 neuropsychology trainees have been trained across 15 implementation sites across the United States and Canada through an implementation award from the Patient Centered Outcomes Research Institute (PCORI). Two of these sites, Nationwide Children's Hospital (NCH) and Holland Bloorview Kids Rehabilitation Hospital, have integrated program implementation into their neuropsychology training rotations and supervision. At NCH, neuropsychology interns and post-doctoral fellows are trained to deliver the intervention through attending an 8-hour virtual training seminar, shadowing supervisors engaging in treatment delivery, and starting with co-treatment cases alongside previously trained therapists. Clinical supervision is primarily provided in a bi-weekly group supervision meeting with individual training support as needed. Neuropsychologists and psychology interns at Holland Bloorview attend the same virtual training learning about treatment delivery and review the training materials as a group shortly after. OFPST is offered as a clinical rotation. Psychology interns are under direct supervision from neuropsychologists for their first client and are provided supervision for additional clients as needed. Supervision meetings among trained personnel are held on a bi-weekly basis.
Conclusions: Implementing OFPST or other evidence-based treatments as part of neuropsychology training programs offers a viable approach for maintaining implementation over time while building the capacity for neuropsychologically-informed behavioral health care. However, this approach raises questions about neuropsychologist's role in tertiary care children's hospitals and overall capacity.
Keywords: transdisciplinary research**,** brain injury**,** teleneuropsychology

60 What Do Medical Residents See as the Benefits of Neuropsychological Services?

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Objective: Research on factors that influence physicians' use of and satisfaction with neuropsychological services is currently limited. While the few existing studies show that the majority of physicians are satisfied with the neuropsychological evaluations that their patients receive (Temple et al., 2006; Tremont et al., 2002), Bishop and colleagues (2003) point out that more research is needed on which aspects of neuropsychological services are perceived as the most valuable. The current study contributes to this body of work by exploring what medical residents see as the benefits to patients of neuropsychological services. Understanding which aspects of neuropsychological practice are perceived as beneficial will enable neuropsychologists to focus on these factors in their interactions with medical providers, with the goal of promoting physician satisfaction and, in turn, future referrals.
Participants and Methods: Participants included 198 residents in accredited family medicine (34%), psychiatry (26%), internal medicine (22%), neurology (15%), and combined specialty (3%) training programs across the United States. Residents completed a survey assessing their education and attitudes surrounding neuropsychological practice. In an open-ended question, they were asked to identify how neuropsychological services benefit patients. All of the included residents provided at least one benefit. Their responses were coded

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line by line and collapsed into themes. Frequencies of each code were calculated to determine the most commonly reported benefits.
Results: Three themes emerged. First, residents appear to appreciate neuropsychology as a specialty; this theme consisted of benefits related to neuropsychologists' expert knowledge about cognition, their ability to conduct comprehensive evaluations, and the objective nature of neuropsychological test results. A second theme revolved around diagnostics. Benefits in this category included identifying a patient's current level of functioning, establishing a diagnosis, and understanding the prognosis. The third theme centered on patient care. This included informing treatment planning, therapeutic benefits such as psychoeducation and emotional support, and assisting patients in accessing relevant community resources. The most commonly reported benefits were establishing a diagnosis (reported by 43% of residents), informing treatment (32%), understanding current level of functioning (15%), and therapeutic benefits (11%). Other benefits were endorsed by less than 10% of respondents.
Conclusions: Diagnoses and treatment recommendations seem to be the most appreciated aspects of neuropsychological evaluations, followed by understanding current functioning and therapeutic benefits. Given that these are all core components of neuropsychological practice, it is encouraging that residents recognize their value. However, the relatively low percentages of endorsement suggest room for improvement in residents' awareness of the benefits of neuropsychological services. Educators might consequently make this an area of focus. In the meantime, neuropsychologists interacting with medical providers might emphasize their skills in diagnosis, treatment planning, therapeutic interventions (e.g., psychoeducation), and identifying current levels of functioning. By highlighting their ability to provide services physicians see as important, neuropsychologists might not only promote physician satisfaction but also increase the likelihood of future referrals.
Keywords: transdisciplinary research**,** self-report
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61 The Impact of the COVID-19 Pandemic on Training Expectations at Internship Programs Offering Specialization in Neuropsychology

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Objective: Previous studies have examined training directors' and supervisors' expectations of competitive applicants looking to specialize in neuropsychology during internship. Periodic updating of training directors' and supervisors' expectations benefits both training programs and applicants by helping optimize fit between the two. However, given the decreased clinical training opportunities during the COVID-19 pandemic, the present study aimed to provide insights into how expectations of competitive applicants may have been adjusted for the 2021 internship application cycle.
Participants and Methods: Respondents (*n* = 46) from internship programs offering at least an "exposure" in neuropsychology (i.e., 5–10% maximum time spent training; Sperling et al., 2017) completed questions about how training expectations of competitive applicants have changed because of the COVID-19 pandemic. Chi-square tests of independence and Wilcoxon-signed rank tests were conducted to analyze the data.
Results: Clinical experience in assessment, personal interview, and personal statement were the three most prioritized criteria across the majority of respondents. More than 85% of respondents stated that telehealth experience was at least somewhat important, though less so compared to more traditional criteria. Additionally, respondents reported slightly reduced expectations for clinical experience in assessment and intervention/psychotherapy, minimum and average number of clinical hours in assessment and intervention/psychotherapy, minimum and average number of integrated reports, and minimum and average number of first- and co-authored publications and professional presentations (*p*s < .05).

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Conclusions: Most respondents reported stable expectations of competitive applicants, with isolated changes. Specifically, trainees may be expected to have greater competency with telehealth intervention and assessment. Further, expectations for clinical hours and research experience are only slightly reduced relative to previous application cycles. Therefore, the importance of fit between applicants and internship programs remains critically important for trainees pursuing neuropsychology careers.
Keywords: assessment**,** teleneuropsychology

31 If A Then X, If B Then Y: DKEFS Color-Word Interference Condition 4 and WAIS-IV Symbol Search as Measures of Conditional Reasoning in a Sample of U.S. Veterans

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Objective: Conditional reasoning (CR; i.e., "if A then X, if B then Y") is often considered one of the most important high-level reasoning abilities and is essential for our understanding of cause and effect. Previous literature has demonstrated that CR is associated with verbal working memory, (Handley et al., 2002), inhibitory control, and processing speed (Forgues & Markovits, 2010); however, few studies have used standardized neuropsychological measures to test CR. The present study aimed to assess the association between two commonly used neuropsychological tasks requiring the use of CR, including Symbol Search (SS) from the Wechsler Adult Intelligence Scale, Fourth Edition and Color-Word Interference Condition 4 (CW4) from the Delis-Kaplan Executive Function System (DKEFS). Additionally, the study aimed to assess the role of inhibitory control (i.e., DKEFS CW Condition 3; CW3) as a possible moderator and mediator.
Participants and Methods: The present study includes a sample of U.S. veterans (*n*=438, mean age=55.0 years, mean education=13.9 years, 11% female) who underwent comprehensive neuropsychological evaluations, including tests of current intellectual functioning, processing speed, attention, executive function, memory, language, and visual skills. Structural equation modeling was used to evaluate the ability of SS to predict performance on CW4 while controlling for the effects of current intellectual functioning, processing speed, working memory, and set-shifting. DKEFS CW Condition 3 (CW3) was evaluated as a possible moderator (i.e., influencing the relationship between CW4 and SS) and mediator (i.e., explaining the relationship between CW4 and SS).
Results: The first model converged with good model fit indices (CFI=.967, TLI=.938, RMSEA=.049, SRMR=.033), and higher scores on CW4 predicted better performance on SS (*B***=**.551, *p*<.001). When CW3 was introduced, the model converged with adequate fit indices (CFI=.974, TLI=.951, RMSEA=.046, SRMR=.034), and the relationship between CW4 and SS weakened but remained significant (*B*=.239, *p*<.001) with a small effect size (R^2=.310, *p*<.001). Additionally, higher scores on CW4 predicted better performance on CW3 (*B*=.742, *p*<.001), and CW3 predicted better performance on SS (*B*=.236, *p*<.001). Overall, the indirect relationship between CW4, CW3, and SS was significant (*B*=.287*, p*<.001); however, the direct effects between CW4 and SS remained significant, suggesting partial mediation. Regarding moderation, the interaction between CW3 and CW4 was tested dichotomously and continuously but ultimately did not significantly predict SS performance.
Conclusions: The present study showed that SS performance predicted CW4 performance, even when controlling for other cognitively relevant covariates. CR is often an essential component of psychotherapy and various cognition remediation approaches that patients utilize to understand how to manage stressors, triggers, and symptoms that they experience in their daily life; therefore, neuropsychologists may consider evaluating CR to assess the effectiveness of such techniques and strategies employed within psychotherapy and/or cognitive remediation with specific patients. Additionally, although CW3 did not moderate the relationship between SS and CW4, it partially mediated it,

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suggesting that inhibitory control is in part related to performance on these two tasks requiring CR. These results highlight two neuropsychological tasks as potential measures of CR; however, future research is needed to demonstrate convergent and discriminant validity between SS and CW4 with other tasks requiring CR.

Keywords: neuropsychological assessment**,** executive functions**,** cognitive functioning

LIVE Invited Symposium 3: Environmental Pollution and the Brain

Chair: Beate Ritz
Presenters: Zeyan Liew, Marc G. Weisskopf, Jennifer Weuve

12:30 - 1:55pm
Friday, February 4, 2022

Abstract & Learning Objectives:
The role of air pollution exposures in brain development and autism. - Studies linked pre- and peri-natal air pollution exposures to child brain development particularly autism. Here, Dr. Ritz will briefly review different sources of air pollution and exposure assessment methods, and then introduce novel metabolomic approaches to assess biologic mechanisms related to brain health. She will discuss novel efforts at identifying biologic mechanisms for autism and air pollution effects related to metabolic perturbations in the blood of pregnant women and their neonates. These insights may contribute to a better understanding of how environmental risk factor affect neurodevelopment – particularly autism - and encourage public health efforts to reduce air pollution worldwide.
Human exposure to per- and polyfluoroalkyl substances (PFAS) and the effects on neurodevelopment. - Per-and polyfluoroalkyl substances (PFAS) are a group of chemicals used to make fluoropolymer coatings and products that resist heat, oil, stains, grease, and water. PFAS are also known as the “forever chemicals” because they do not break down in the environment and can remain in our bodies for years. In this seminar, Dr. Liew will introduce human exposures to PFAS and present a series of studies that investigated whether in-utero exposures to PFAS affected multiple neurological disorders and brain function in childhood.
The role of metal exposures in cognitive decline and dementia in old age. - Metals can have neurotoxic properties and there are several lines of evidence suggesting such exposure adversely affects cognitive function, in particular of lead. While there is suspicion that such exposure could also contribute to clinical dementia, there is less evidence for this. Dr. Weisskopf will discuss the role of metal exposures in later life cognitive function and dementia, and the state of the evidence.
Exposure to air pollution and dementia risk: the evidence we have and the evidence we need - Exposure to air pollution has been hypothesized to increase dementia risk through two major compelling mechanisms, a direct neurotoxic mechanism and a mechanism grounded in air pollution’s vascular effects. If air pollution is such a cause, then policy and technology levers could be used to reduce the risks of a large swath of the population. Over the past decade, published evidence has rapidly amassed on air pollution’s relation to dementia. The usefulness of much of this research is limited by common challenges in measuring dementia. Dr. Weuve’s presentation will address the findings that have amassed, characterize the challenges this line of research faces, and propose lines of research that will clarify and extend this research to be more inferentially compelling and relevant to policy interventions.

Upon conclusion of this course, learners will be able to:
- Introduce what are per-and polyfluoroalkyl substances (PFAS), air pollution and metals
- Introduce how populations are exposed to PFAS, air pollution and metals
- Learn about the developmental toxicity of fetal exposure to PFAS and air pollution and links to neurodevelopmental outcomes in childhood as well as the role of air pollution and metals on neurodegeneration leading to dementia

Symposium 11: Mentoring and Sponsorship from an Equity and Anti-

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Racist Framework: An Educational Paradigm Shift Employed by HNS Mentoring Program in 2020-2021

12:30 - 1:55pm
Friday, February 4, 2022

29 Mentoring and Sponsorship from an Equity and Anti-Racist Framework: An Educational Paradigm Shift Employed by HNS Mentoring Program in 2020-2021

Chair

Mirella Diaz-Santos
University of California, Los Angeles (UCLA Health), Los Angeles, USA

Discussant

Beatriz MacDonald Wer
Baylor College of Medicine, Houston, USA

Objective: This symposium will describe efforts by the Hispanic Neuropsychological Society's (HNS) Mentoring Program to discuss and thoroughly understand the influence of social inequities and structural racism in academia. In the wake of the disparities highlighted by the onset of the COVID-19 pandemic as well as the murders of George Floyd and Breonna Taylor in the hands of non-Hispanic white law enforcement agents, the United States (US) and the world are facing a social reckoning. In response to the current socio-political climate in the US, the Hispanic Neuropsychological Society's (HNS) Mentoring Program intentionally integrated the work of Black and Brown scholars from other disciplines (education, sociology, anthropology, social work, policy, law, public health, journalism, art sciences) to develop an Equity and Anti-racist curriculum for the 2020-2021 mentoring program year.
Methods: Using critical pedagogy as the theoretical foundation and critical self-reflection as the methodology, our two-part webinars on professional development (abstract #1), mentorship (abstract #2), and sponsorship (abstract #3) were designed to unpack systemic strategies of oppression in academic settings impacting under-represented minority (URM) trainees, and professionals. Our overarching objective was to discuss how structural racism in academic medicine, sites where many of our neuropsychology programs are housed, uphold predictable practices that "push out" persons from historically minoritized groups via isolation, retaliation, forced assimilation, dehumanization, devaluation of their scholarly work focused on equity and justice denoting it as "activism" rather than scholarship.
Results: Our 2020-2021 mentoring program members (n = 90) are 85% trainees (undergrad, post-bac, grad and beyond) and early career professionals, and 95% are cis-women and LGBTQIA+. Attendance to the live webinars ranged from 13 to 24% (4th Wednesday of the month). Similar number of participants engaged in the post-webinar dialogues. Initial themes on pain, trauma, and hopelessness in attaining an equitable academic career authentic to individual identities and values emerged from the dialogues. Generative themes arose with the progression of the webinars ranging from belonging and reckoning with individual complicity with the oppressive systems governing neuropsychology.
Conclusions: Following the work of Paulo Freire in Pedagogy of the Oppressed (1970), praxis (reflection - word - action) was the overall foundation of HNS Mentoring Program's Equity and Anti-Racist Educational Series for the 2020-2021 academic year. We created a vulnerable and safe space for honest and radical dialogue to identify oppressive structures, and understand how they affect us. Self-exploration in a non-judgmental space was key in these didactic and experiential meetings to understand how we internalize oppressive strategies, which potentially contributes to many individuals from historically minoritized groups leaving academia with a sense of betrayal. By engaging in praxis, trainees and professionals have been equitably co-creating generative themes based on their unique lived experiences with the intention of igniting a paradigm shift in our current models of professional development, mentorship and sponsorship governing neuropsychology.
Keywords: praxis**,** ethnicity*,* quality of life

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953 Professional Development from an Equity and Anti-Racist Framework

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Objective: The objectives for the first webinar on professional development were two-fold: (1) to define the role of equity and anti-racism in professional development and (2) to engage in dialogue revealing the hidden factors rooted in structural racism in academic medicine culture impacting career trajectories within (multi)cultural neuropsychology. Current models of mentorship and sponsorship often leads to implicit and explicit messages of professional behaviors that often invalidates the identities of mentees from historically minoritized groups thus forcing them to make inauthentic decisions regarding who they should be (how to look, how to speak, how to present oneself, what to study and who to collaborate with) in order to succeed as a neuropsychologist. Academic professionalization, therefore, often asks for forced assimilation (Motha & Varghese, 2018) and internal colonization (Asadi, 2011) with traits, beliefs, and values incongruent with who we are.
Participants and Methods: Within the framework of antiracist pedagogy, we implemented the methodologies of counter-story (Solorzano & Yosso, 2002), and community cultural wealth (Yosso, 2005) to professional development as a neuropsychologist. Counterstory is a tool for exposing, analyzing and challenging the majoritarian stories of racial privilege, whereas community cultural wealth is the cultural knowledge, skills, abilities and contacts serving as sources of support to cope with the dominant academic culture that remain largely unacknowledged by academic systems. The author initially used first-hand lived experiences throughout her academic career, with poetry and visual arts as part of the counterstory methodology, later moving into dialogues of community cultural health focused on, “why are we not making it?”
Results: Generative themes ranged from feeling silenced and invisible, isolated and alienated, dealing with constant microaggressions and macro-insults towards our racial, ethnic, and nationality identities, the new onset of medical conditions, psychological distress, moral injuries, and hopelessness. Towards the end of the dialogue, themes of feeling seen and heard, and having a supportive community through shared common lived experiences in the dominant academic culture of neuropsychology surfaced.
Conclusions: New models of professional development in neuropsychology are urgently needed. By implementing the methodologies of counter-story and community cultural wealth, we began to unveil a potential blueprint on scholarly identities aligned with our values, and traditions anchored in our unique cultural and historical authenticities.
Keywords: praxis**,** ethnicity**,** quality of life

959 Mentorship from an Equity and Anti-Racist Framework

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Objective: A mentor is an individual with expertise who provides guidance on career development, psychological support, and other forms of professional growth (APA, 2006). Latinx/a/o graduate students and academics remain underrepresented constituting only 7.2% of all doctorate degrees obtained (Kamimura-Jimenez & Gonzalez, 2018) and often reporting not positive mentoring relationships or fewer mentors in their career (Santa-Ramirez, 2021). As the field of neuropsychology strives to repair the broken student pipeline by increasing diversity, it is imperative for mentoring relationships to be centered on the practice of equity and anti-racism to foster inclusion and engagement.
Participants and Methods: We provided the mentors and mentees who attended the webinar (n=22) an anti-racism mentoring framework (Vargas et al., 2020) that integrates ecological systems theory, critical race theory, and the NIH-funded program, Building Infrastructure Leading to Diversity: Promoting Opportunities for Diversity in Education and Research. This model

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situates the mentor-protégé relationship within a macrosystem (i.e., institutional systems and socio-political system, and chronosystem that maintains structural racism) to contextualize the interpersonal discourse within the mentoring relationship.
Results: Mentors and mentees (n=22) who participated in the webinar were polled (n=14 respondents) and shared that the majority of them had more than one mentor in their professional career (83%). Participants reported experiencing racism in mentorship relationships (58%), which mainly occurred as a mentee (83%). To address and cope with mentor and mentee challenges, participants often consulted with other colleagues (17%), consulted with others and addressed it directly with their mentor (50%), or did something else (33%). When describing the meaning of equitable and anti-racist mentoring, participants highlighted belonginess, inclusion, empowerment, genuineness, holisticness, transparency, openness, and vulnerability.
Conclusions: To intentionally integrate a framework of anti-racist mentoring, academic and training programs in neuropsychology need to consider educational activities to increase race consciousness and anti-racist practices. As a standard of inclusion, we need to dismantle system-justifying mechanisms that enable inequities in the provision of mentoring to Black, Indigenous, and People of Color.
Keywords: praxis**,** ethnicity**,** quality of life

967 Sponsorship from an Equity and Anti-Racist Framework

Franchesca Arias[1], Luis Efren Aguilar[2]
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Objective: Sponsorship, or a professional relationship where a senior-level person leverages their network to propel the career of their proteges, has emerged as a predictor of professional success in business and academia. While backing by a sponsor is critical for career advancement in academic medicine, its application in Clinical Neuropsychology has been understudied. Its role in influencing the professional advancement and career satisfaction of professionals from minoritized groups is poorly understood.
Participants and Methods: Mentors and mentees (n= 12) enrolled in the HNS Mentoring Program for the 2020-2021 year participated in our webinar entitled “Equity and Anti-racist Sponsorship”. Participants varied in race, ethnicity, years in academic practice, and cultural background. We examined trends in sponsorship practices relevant to professionals from minoritized groups. Incorporating didactic and experiential learning, we deconstructed the term “sponsorship” and engaged in a radical discussion about underlying structures in sponsorship that may be incongruent with the values of professionals from diverse groups.
Results: Overall, 25% of our sample reported having limited exposure to the term “sponsorship” in the context of academic settings. Our literature review revealed that persons from minoritized groups face unique challenges in sponsor-protege relationships. The “Critical Mentoring & Sponsoring Model” and the “Identity-base Model”, which describe social, economic, and political ideologies embedded in academia and positioned personal identity at the center of professional relationships, respectively, were presented.
Conclusions: Sponsorship is still unknown to professionals in Clinical Neuropsychology. Future research in sponsorship should elucidate its role in the career advancement of professionals from minoritized groups. Efforts to dismantle its oppressive underpinnings are needed to ensure that proteges from diverse backgrounds equitably benefit from sponsorship. Implications for professionals in Clinical Neuropsychology will be provided.
Keywords: praxis**,** ethnicity**,** quality of life

Paper Session 14: mTBI

12:30 - 1:55pm
Friday, February 4, 2022

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1 Longitudinal White Matter Microstructural Changes in Pediatric Mild Traumatic Brain Injury

Ashley L Ware[1], Keith Owen Yeates[1], Ayushi Shukla[2], Adrian Onicas[3], Sunny Guo[2], Naomi Goodrich-Hunsaker[4], Nishard Abdeen[5], Miriam Beauchamp[6], Christian Beaulieu[7], Bruce Bjornson[8], William Craig[7], Mathieu Dehaes[6], Sylvain Deschenes[6], Quynh Doan[8], Stephen B Freedman[2], Bradley G Goodyea[1], Jocelyn Gravel[6], Andrée-Anne Ledoux[9], Roger Zemek[9], Catherine Lebel[1]
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Objective: Diffusion tensor imaging (DTI) can characterize brain tissue alterations following pediatric mild traumatic brain injury (mTBI), but prior results have been inconclusive. This prospective, longitudinal, concurrent cohort study examined trajectories of brain microstructure changes after mTBI relative to mild orthopedic injury (OI) in the largest pediatric sample studied to date.
Participants and Methods: Children aged 8-16.99 years with mTBI (per the World Health Organization diagnostic criteria) or mild OI (per the Abbreviated Injury Scale) were recruited from 5 pediatric emergency departments belonging to the Pediatric Emergency Research Canada (PERC) network and completed DTI at post-acute (2-33 days) and chronic (randomly assigned to 3 or 6 months) post-injury assessments. DTI metrics for 18 white matter tracts were derived using automated deterministic tractography from 892 scans in 560 children (362 mTBI/198 OI), of which 407 (73%) had longitudinal data. Linear mixed models were computed on DTI metrics with injury group, time (days) post-injury, age, sex, hemisphere and site as fixed effects, and participant as a random effect, correcting for multiple comparisons.
Results: Superior longitudinal fasciculus fractional anisotropy was higher in mTBI relative to OI across time and hemispheres (d=-0.32). Group differences in mean diffusivity (MD) were moderated by time post-injury. MD was higher post-acutely (d=-0.22) and 3 months post-injury (d=-0.37) in the anteriorthalamic radiation, but lower 6 months post-injury in the anterior thalamic radiation (d=0.24) and arcuate fasciculus (d=0.57) in mTBI relative to OI.
Conclusions: Subtle white matter microstructural alterations, suggesting neuroinflammation and axonal swelling, continue up to 6 months post-injury after pediatric mTBI. This signals neurophysiological changes that persist after most children with mTBI are no longer symptomatic. Chronic DTI may provide a biomarker for mTBI, whereas early post-injury DTI may not aid clinical detection in individual patients.
Funding: Canadian Institutes of Health Research (FDN143304), Ronald and Irene Ward Chair in Pediatric Brain Injury (KOY); Canada Research Chair (CL); Harley N. Hotchkiss-Samuel Weiss and Killam Postdoctoral Fellowship (ALW); Alberta Children's Hospital Foundation Professorship in Child Health and Wellness (SBF).
Keywords: neuroimaging: structural**,** traumatic brain injury**,** child brain injury

2 Sex Differences in Postconcussive Symptom Reporting in Those with History of Concussion: Findings From the Federal Interagency Traumatic Brain Injury Research (FITBIR) Database.

Amy J Jak[1], Victoria Merritt[1], Michael Thomas[2], Cody Witten[3], Amma Agyemang[4], Mary Jo Pugh[5]
[1]UC San Diego, San Diego, CA, USA. [2]Colorado State University, Ft. Collins, CO, USA. [3]Veterans Medical Research Foundation, San Diego, CA, USA. [4]Virginia Commonwealth University, Richmond, VA, USA. [5]University of Utah, Salt Lake City, UT, USA

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Objective: Females have been severely understudied in concussion outcomes and existing research has been plagued by small female samples. Current understanding of concussion outcomes is largely based on research conducted on predominately male samples, meaning that clinical care for concussed females is far less evidenced-based and often extrapolated from male-dominated studies. While prior research has identified several risk factors for poor outcome following concussion, examining the extent to which biological sex contributes to outcome and recovery following mTBI has received comparatively less attention. Thus, there is a significant gap in our knowledge with respect to the female experience of concussion. Therefore, we sought to investigate the influence of biological sex on postconcussive symptoms (PCS) following concussion in the large sample afforded by the Federal Interagency Traumatic Brain Injury Research database (FITBIR).
Participants and Methods: We utilized the FITBIR database to identify all studies with publicly released data as of April 7th, 2021 that included both males and females, enough information to determine severity of injury consistent with concussion, a measure of PCS, and objective measures of neurocognitive functioning. This resulted in 6 studies with a total of 9960 participants (3210 females, 6750 males). Of the studies meeting criteria for inclusion, 815 participants completed the Neurobehavioral Symptom Inventory (NSI), 473 participants completed the Rivermead Post-Concussion Symptoms Questionnaire (RPSQ), and 8672 completed the Sport Concussion Assessment Tool – 3rd Edition (SCAT 3). The questionnaires were harmonized and the following symptom domains emerged: Somatic, Cognitive, and Affective.
Results: Regression analyses were used to examine the effects of sex and scale on symptom endorsement. No significant interactions were observed. We found a small to medium sized significant effect of sex, with females reporting higher symptoms overall (beta = 0.21, $CI_{95\%}$ = [-0.39, -0.03], p = 0.0243). Mean symptom endorsement scores were higher overall on the NSI in comparison to the RPSQ and SCAT (*p*s < .001). Follow-up analyses revealed sex differences were largest for cognitive symptoms (beta = -0.24; $CI_{95\%}$ = [-0.43, -0.06]), followed by somatic symptoms (beta = -0.19; $CI_{95\%}$ = [-0.38, -0.01]), and finally affective symptoms (beta = -0.17; $CI_{95\%}$ = [-0.34, 0.01]).
Conclusions: In this study, one of the largest known samples of females with history of concussion, females endorsed significantly higher PCS than males, particularly cognitive symptoms. However, findings were somewhat dependent on the method of self-reported symptom assessment. Those responding via the RPSQ and SCAT 3 reported significantly lower symptoms as compared to the NSI. Further understanding sex differences in postconcussive symptom reporting is key to informing the most appropriate treatment options. Future work will need to examine whether any sex differences in symptom reporting is due to sex differences in endorsement styles or genuine differences in symptom presentation as well as the relationship between subjective and objective cognitive functioning.
Keywords: concussion/ mild traumatic brain injury

3 Predictors of Recovery in Adolescents with Preexisting Mental Health Problems following Sports-Related Concussion

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Objective: For most individuals who sustain a sports-related concussion (SRC), symptom resolution occurs within 7-10 days. However, preinjury factors such as preexisting mental health problems (PMHP) appear to increase the risk of prolonged recovery following SRC, though research in this area is limited. The aims of the current study were to: (1) examine if PMHP result in longer recovery following SRC, and (2) examine the predictors of recovery for adolescents with (+) and without (-) PMHP following SRC.

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Participants and Methods: Participants were retrospectively sampled from the Concussion-Texas (ConTex) study (Cullum et al. 2020), a multi-institutional concussion study in North Texas. Adolescents age 12-18 who were evaluated within 14 days of injury and self-reported a history of anxiety, depression, or anxiety+depression were included in the PMHP+ group (n = 51). These individuals were case matched to PMHP- (n = 96) by age, sex, race, and time to clinic within 1 day. Recovery was assessed using "days until symptoms resolved" on a 4-point scale (1-7 days, 8-14 days, 15-30 days, >30 days). Chi-Square or t-tests were used to assess group differences across demographics, injury characteristics, and categorical outcomes. Ordinal regressions with statistical model selection were utilized to explore predictors of recovery from 27 covariates.
Results: There were no demographic differences between groups. The PMHP+ group reported 3.5 times more frequent comorbid-ADHD, and higher rates of family history of depression and anxiety. Recovery differed significantly between groups, as a majority of the PMHP+ group recovered in >30 days (41.7%) while most PMHP- recovered within 1-7 days (30.1%). In the regression analyses, there was not a significant effect for PMHP type or post-concussive symptoms after including sex [male: 95% CI: (-1.03, -0.09)], Generalized Anxiety Disorder-7 item scale (GAD-7) score [95% CI: (0.23, 0.85)], and whether the participant was taken to the emergency department after the injury [yes: 95% CI: (0.09, 1.08)]. No other variables were significant predictors or improved model predictions. The final model is expected to account for approximately 21% of the variance for future prediction of time-to-recovery (Bayesian R^2 = 0.208, 95% CI: [0.118, 0.292]).
Conclusions: Results indicate that adolescents with a self-reported history of PMHP take longer to recover following SRC. Risk factors for prolonged recovery include higher initial post-injury GAD-7 scores, female sex, and visiting the emergency department after injury. Higher levels of anxiety were more strongly associated with longer recovery than overall concussion symptoms. Post-concussive anxiety may play a role in length of recovery regardless of the presence of PMHP. Further research is warranted to examine the mechanisms underlying the intersection of both preexisting and post-concussive anxiety with SRC recovery.
Keywords: adolescence**,** concussion/ mild traumatic brain injury**,** mood disorders

4 Trajectory of depression symptom severity and the influence of concussion history, health, and demographics over a 19-year period among former National Football League (NFL) players

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Objective: To investigate the longitudinal course of depressive symptom severity over 19-years in former American football players and the influence of concussion history, years of football participation, cardiovascular disease/risk factors (CVD/RF), physical function, and demographics on observed trajectories.
Participants and Methods: Former American football players completed a general health questionnaire at three time points (2001, 2010, and 2019). Parallel process latent growth curve modeling tested associations between concussion history, years of football participation, demographic factors (age, education, race), overall and longitudinal change in physical function, and CVD/RF on the overall level and trajectory of depressive symptoms.
Results: Among the 333 participants (mean[SD] age, 48.95[9.37] at enrollment), there was a statistically significant, but small increase in depressive symptom severity from 2001 (48.34[7.75]) to 2019 (49.77[9.52]), slope =.079(SE=.11), p=.007. Within the model, a

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positive association between concussion history and overall depressive symptom severity was observed, B=1.38(SE=1.78), *p*<.001. Concussion history, B<.001(SE=.02), *p*=.997, was not associated with rate of change in depression over the 19-year period. Demographic factors, years of football participation, and CVD/RF were not associated with overall or change in depression symptom severity, ps >.05. Greater decline in physical function, B=-.71(SE=.16),*p*<.001, was predictive of a faster growth rate of depression symptom endorsement over time.
Conclusions: Depressive symptom severity increases do not appear to be inherently progressive over a 19-year period in this sample of former NFL players. Decline in physical function, not concussion history or other relevant factors, was a significant predictor of a steeper trajectory of increased depressive symptoms. This represents one viable target for preventative intervention to mitigate long-term neuropsychiatric difficulties associated with concussion across subsequent decades of life.
Keywords: concussion/ mild traumatic brain injury**,** depression**,** aging (normal)

5 Sport-by-Sport Recovery Trajectories for NCAA Civilian Collegiate Athletes Following Concussion

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Objective: The clinical management of collegiate athletes with sport-related concussion (SRC) involves a complex, multimethod assessment, yet the clinical decision of when an athlete begins the return-to-play (RTP) process is largely informed by the athlete's self-reported symptoms. Although significant work has been done to understand clinical recovery among some contact/collision sport athletes (e.g., American football), little is known about the recovery profiles of athletes participating in other contact/collision sports and limited- and non-contact sports. This dearth of information limits the ability of clinicians to effectively manage the RTP process among these athletes. The current study was designed to elucidate the time to asymptomatic and unrestricted RTP across a broad range of male and female collegiate sports. Days from injury until asymptomatic and unrestricted RTP were then used to develop recovery categories.
Participants and Methods: Data were obtained from the National Collegiate Athletic Association (NCAA) and Department of Defense (DoD) Concussion Assessment, Research, and Education (CARE) Consortium. Following enrollment, a baseline assessment captured demographic data and medical history, including concussion history and sport information. Data from athletes sustaining a SRC while participating in their primary sport (game or practice) included the injury setting, timing, and subsequent clinical presentation. A total of 2035 concussed participants were included in the final dataset after excluding United States military academy cadets, cheerleading athletes, and sports with fewer than 30 SRCs. Time to asymptomatic was defined as the time when the athlete was cleared by their clinician to begin the RTP process.
Survival analysis using the Kaplan-Meier model estimated the median recovery times (asymptomatic and RTP) for each sport. For athletes with missing data on time to asymptomatic or time until RTP, SRC were censored at 30 days for asymptomatic (*n*=151) and 60 days for RTP (*n*=235), consistent with prior research. Injury setting, sport season, and sport contact level were used as covariates. Optimal univariate K-means clustering grouped sports into recovery groups. All analyses were conducted using R (version 4.0.3). Alpha was set at 0.05 for all statistical tests.
Results: Across all sports, median time to asymptomatic following SRC ranged from 5.30 (male ice hockey) to 9.75 days (female field hockey). Median RTP days ranged from 9.70 days (male ice hockey) to 16.95 days (male wrestling). Injury setting and sport season (*e.g.,*

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fall, winter, or spring) did not have a consistent effect on time to asymptomatic and RTP across sports; however, sport contact level was significantly associated with time to asymptomatic, with contact sports (median 6.9 days) requiring fewer days than non-contact sports (median 9.1 days; p=0.034). No statistically significant recovery differences between sports based on time to asymptomatic or unrestricted RTP were identified.
Conclusions: There are within- and between-sport differences for post-SRC time to asymptomatic and RTP, including in limited and non-contact sports. Our findings suggest that there is likely not a typical or universal SRC recovery trajectory across sports.
Keywords: concussion/ mild traumatic brain injury**,** sports-related neuropsychology

6 Cognitive profiles following sport-related concussion in high school athletes: Relationship to symptom reporting, complicated recovery, and change from baseline

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Objective: Heterogeneity is common following traumatic brain injury (TBI) with important implications for clinical outcome. Research in moderate to severe TBI identifies clusters that are differentiated by cognitive profiles and clinical outcomes. There is little research, however, investigating potential clusters following sport concussion. Understanding common neurocognitive profiles that occur following concussion may inform the development and implementation of interventions that are tailored for each cognitive cluster. The aim of the current paper was to 1) determine whether different clusters can be identified in athletes based on post-concussion cognitive ImPACT scores at three different post-concussion assessment time points (72 hours, 4-7 days, and 8-30 days following injury), 2) investigate whether the clusters identified were associated with outcomes such as complicated recovery.
Participants and Methods: Participants included 1,817 high-school athletes who completed ImPACT following concussion who were selected from a larger longitudinal database assessed between 2008-2016. ImPACT cognitive factors identified in recent literature (Maietta et al., 2021) were used and cluster analysis was conducted to determine patterns of cognitive post-concussion test performance at 72 hours, 4-7 days, and 8-30 days following injury. Once the optimal number of clusters was identified, external validity was assessed using PCSS symptom data, demographic variables, magnitude of change from baseline, and complicated recovery status.
Results: Separate cluster analyses of cognitive scores were conducted at each post-concussion assessment time-point. Results indicated three-cluster solutions of cognitive performance within one-week of injury, while a two-cluster solution was identified at longer intervals (8-to-30-days). Clusters differed primarily by level of performance and also exhibited stratified differences in symptom severity and magnitude of change in cognitive function and symptom reporting from pre- to post-concussion. The clusters did not vary on demographic characteristics (e.g., age, gender, psychiatric history, neurodevelopmental history), which suggests that the subgroups identified here only differed on aspects of performance, symptom reporting, and clinical outcome related to concussion rather than to demographic characteristics alone. The lowest performing cluster at each time point was Mildly-to-Moderately Impaired and exhibited the highest proportion of athletes with complicated recovery, suggesting utility of the clusters for predicting protracted recovery. Furthermore, raw original post-concussion scores were used to predict athletes into each cluster, with high levels of classification accuracy. A supplemental excel calculator based on discriminant scores is provided for classifying athletes into clusters for clinical and/or research purposes.
Conclusions: Overall, results provide preliminary evidence that ImPACT can identify

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clusters of athletes based on cognitive performance post-concussion that differ in clinically meaningful ways, including symptoms, magnitude of change from baseline, and concussion recovery outcomes. Predicting complicated recovery trajectories has been of paramount interest in the literature. The current study provides evidence for such prediction as well as a clinical tool that may be useful for further research. Understanding the neurocognitive and symptom differences identified post-concussion may be beneficial in predicting outcomes for athletes and identifying those who may be at risk for more complicated recovery. Future work should investigate whether these clusters may assist in return-to-play decision-making by identifying at-risk athletes who may benefit from targeted intervention.

Keywords: concussion/ mild traumatic brain injury**,** computerized neuropsychological testing**,** sports-related neuropsychology

Paper Session 15: Movement

12:30 - 1:55pm
Friday, February 4, 2022

1 Depressive symptoms predict memory decline in Essential Tremor

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Objective: Essential tremor (ET), a common movement disorder, is characterized by motor, cognitive and psychiatric symptoms. Depressed mood, a symptom of ET, has historically been viewed as a psychological response to disability. However, depressive symptoms are emerging as a predictor of cognitive decline across several clinical populations such as Parkinson's disease, Huntington's disease, and Alzheimer's disease. We examined whether baseline depressive symptoms predict decline in global cognition, memory, and executive functioning (EF), among cognitively normal older adults with ET.
Participants and Methods: 125 cognitively normal older adults with ET completed three in-person assessments of cognition, mood, and motor symptoms at baseline, 18 months, and 36 months. Depressive symptoms were measured with the Geriatric Depression Scale (GDS). EF was measured as a composite z-score of performance on the Wechsler Adult Intelligence Scale IV (WAIS-IV) Digit Span Backward subtest, and subtests of the Delis–Kaplan Executive Function System (DKEFS): Verbal Fluency, Color-Word Interference, Sorting, and 20-Questions. Memory was measured as a composite z-score of the Wechsler Memory Scale Revised (WMS-R): Logical Memory immediate and delayed scores, the WMS-IV: Verbal Paired Associates immediate and delay scores, and the California Verbal Learning Test II (CVLT-II) total recall, long delay, and discriminability scores. The discriminability score, which measures memory storage by eliminating demands on retrieval, is derived from the recognition portion of the test and reflects the number of true- versus false-positive responses. Generalized linear regression models examined depressive symptoms as a predictor of decline in global cognition, EF, and memory. Adjusted models included age, education, sex, total tremor score, and total medications as covariates. "Cognitive cluster" score, an empirically derived categorical score reflecting cognitive strengths and weaknesses, was also included as a covariate to account for

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the possibility that baseline differences in cognitive domains, despite being within the normal range, could have relevance for decline.
Results: Participants were grouped as having low versus high depressive symptoms according to a median split (GDS <5 versus >=5). Depressive symptoms did not predict change in global cognition (*b* = -.002, *p* = .588) or EF (*b* = .001, *p* = .757); however, individuals in the high depressive symptoms group demonstrated faster memory decline (*b* = -.009, *p* = .013). Secondary analyses examined the extent to which depressive symptoms predicted changes in the two primary components of memory, retrieval and storage. Depressive symptoms did not predict retrieval (*b* = -.008, *p* = .207), but did predict storage (*b* = -.018, *p* = .001).
Conclusions: Baseline depressive symptoms predicted faster memory decline in cognitively normal older adults with ET, particularly in memory storage. In contrast, depressive symptoms did not predict decline in EF or global cognition. Various mechanisms may link depressive symptoms and memory decline including psychosocial and/or neurodegenerative processes. Determining who is at greatest risk for cognitive decline has implications for clinical management, prognosis, and early intervention. Moreover, emerging work raises the intriguing possibility that treatment of depressed mood and related psychosocial factors may slow future cognitive decline.
Keywords: cognitive functioning**,** depression**,** memory disorders

2 Examining the Relationship Between the Multiple Sclerosis Neuropsychological Screening Questionnaire (MSNQ) and Objective Neurocognitive Performance

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Objective: Self-and informant reports may be used to evaluate perceived neurocognitive functioning, such as with the Multiple Sclerosis Neuropsychological Screening Questionnaire (MSNQ). However, the degree to which such measures may be influenced by mood and fatigue is unclear. Further, research literature surrounding the utility and sensitivity of the MSNQ in predicting objective neurocognitive impairment has presented mixed findings. Thus, this study aims to further examine the relationship between the MSNQ and mood and fatigue, as well as objective neurocognitive performance.
Participants and Methods: 87 persons with Multiple Sclerosis (PwMS) (F=65,M=22) completed a comprehensive neuropsychological battery that included self-report measures of anxiety, depression, fatigue, and self-reported neurocognitive function with the MSNQ-Self-Report (MSNQ-S), and MSNQ-Informant-Report (MSNQ-I). The objective neurocognitive measures were based on the Minimal Assessment of Cognitive Function in MS and were converted to sex-normed z-scores for analyses; Principal component analyses (PCA) revealed five separate objective factors (Simple Attention, Processing Speed, Executive Function, Visual Memory, and Verbal Memory) which were used to create composite scores. Linear regressions were first conducted with MSNQ-S and MSNQ-I as outcome variables and with depression, anxiety, physical fatigue, and cognitive fatigue as predictors. Next, we conducted linear regressions with each of the five objective neurocognitive composites as outcome variables and the MSNQ-S and MSNQ-I separately as predictors. Demographic variables (age, education, sex, disease course, and predicted full-scale IQ) were examined as potential covariates and were included if they significantly predicted any of the five outcome measures.
Results: Results revealed a positive prediction of the MSNQ-S by cognitive fatigue, $t(79)=4.65$, $p<.001$ and anxiety, $t(79)=2.12$, $p=.037$, but not by depression or physical fatigue. The MSNQ-I was not significantly associated with any mood or fatigue variables.
There were significant negative relationships between the MSNQ-S and measures of Executive Function, $t(82)=-2.85$, $p=.005$, Visual

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Memory, *t*(81)=-2.10, *p*=.04, and Verbal Memory, *t*(83)=-2.86, *p*=.007, such that higher MSNQ-S scores predicted poorer neurocognitive performance. The MSNQ-S was not associated with measures of Simple Attention or Processing Speed.
Similarly, there were significant negative relationships between the MSNQ-I and measures of Executive Function, *t*(82)=-3.05, *p*=.003, and Visual Memory, *t*(81)=-3.07, *p*=.003, such that higher MSNQ-I scores predicted poorer neurocognitive performance. There was also a marginal negative relationship with Verbal Memory, *t*(83)=-1.83, *p*=.07, but not Simple Attention or Processing Speed.
Conclusions: Findings suggest that cognitive fatigue and anxiety impact self-report of neurocognitive impairment in MS, though informant reports were not significantly influenced by mood or fatigue. Notably in this analysis, depression was not significantly associated with the neurocognitive self-report, which highlights the importance of fully assessing mood and fatigue. Our results also demonstrate that the MSNQ-S and MSNQ-I show similar sensitivity and demonstrate utility in predicting objective neuropsychological deficits in several domains. Further, results suggest that memory and/or executive function deficits may be more salient for individuals and explain high correlations between subjective and objective results. These findings indicate that the MSNQ may be a good neurocognitive screener, though formal neuropsychological testing, including mood and fatigue screeners, is likely still warranted.
Keywords: cognitive functioning**,** mood disorders**,** multiple sclerosis

3 Cognitive Enrichment Moderates the Relationship Between Cognitive Dysfunction and Education Quality in Multiple Sclerosis

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Objective: Individual differences in cognitive reserve may explain why some people with multiple sclerosis (MS) show intact cognition despite advanced disease progression. Years of formal education is the most common proxy of cognitive reserve; however, this quantitative measure has limitations. *Quality* of education, as indexed by word recognition, appears to be a better proxy of cognitive reserve than the *quantity* of education. Furthermore, few studies consider informal reserve-building activities, which reflect participation in cognitively-enriching activities *outside* of formal education, such as learning languages, playing musical instruments, or participating in workshops. This study examined the extent to which two proxies of cognitive reserve—education quality and informal cognitive enrichment—relate to cognitive dysfunction in MS.
Participants and Methods: Participants were 82 adults (74% women) with MS (77.2% relapsing-remitting), who averaged 12 years since diagnosis. Average age was 50 years, with an average of 15 years of education. Participants were evaluated at the time of a routine neurological follow-up visit. Global cognitive functioning was assessed with the Symbol Digit Modalities Test (SDMT). Education quality was estimated via the Wechsler Test of Adult Reading (WTAR). Participants reported their participation in various cognitively enriching activities during young adulthood using the Cognitive Reserve Scale (CRS).
Results: Bivariate scatterplots revealed nonlinear relationships between the proxies of cognitive reserve and SDMT performance. To illustrate these relationships, CRS scores were dichotomized into High CRS (*n* = 42) and Low CRS (*n* = 40) groups. WTAR scores were dichotomized using the normative mean, yielding 50 participants with high WTAR (SS ≥ 100) and 30 participants with low WTAR (SS < 100). Factorial ANOVA examined the effects of WTAR group and CRS group on SDMT performance. There was a significant WTAR x

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CRS interaction, $F(1, 78) = 5.76$, $p = .019$, partial $\eta^2 = .07$. Post-hoc tests indicated that the Low CRS–Low WTAR group scored significantly lower on SDMT than the other three groups (Low CRS-High WTAR, High CRS-Low WTAR, High CRS-High WTAR; all $p < .016$, Cohen's d -0.81 to -1.10), which were not significantly different from each other (all $p > .375$, d -0.12 to 0.29). Moderation analysis revealed a significant WTAR x CRS interaction, $\beta = -0.59$, $t(78) = -2.78$, $p = .007$. WTAR was significantly related to SDMT among participants with Low CRS scores ($r = .51$) but not among those with High CRS scores ($r = .07$).

Conclusions: Cognitive reserve can be built through multiple routes, including formal education and participation in informal cognitively enriching activities. The findings suggest a threshold effect among people with MS, such that cognitive enrichment may not provide additional reserve beyond formal education among individuals with high education quality. However, among individuals with low education quality, cognitive enrichment can be a vital source of reserve, capable of providing a similar level of protection as observed among individuals with high education quality. Treatment plans for MS should incorporate participation in cognitively enriching activities to buffer against the adverse effects of neurodegeneration in MS, particularly among individuals who are most vulnerable to cognitive decline.

Keywords: cognitive reserve**,** multiple sclerosis**,** demographic effects on test performance

4 Parkinson's Disease Side of Onset Predicts Sustained Attention Deficits and Motor Improvements After Attention Training

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Objective: Side of motor symptom onset in Parkinson's disease (PD) has been associated with distinct patterns of cognitive deficits; individuals with left-side onset PD (LPD) show more visuospatial impairments and those with right-side onset PD (RPD) show more verbal impairments. Non-spatial attention, predominantly a right-hemisphere capacity, has been associated with motor function and gait in healthy older adults, but these relations have not been examined in PD in general or in LPD vs. RPD specifically. We examined LPD/RPD differences in non-spatial attention; related non-spatial attention to PD motor functioning; and investigated whether LPD and RPD showed differential responses to a cognitive training program targeting deficits in non-spatial attention.

Participants and Methods: Participants included 9 LPD and 12 RPD (12 males, 9 females) with an average age of 65.6 (SD=7.1), disease duration of 5.0 years (SD=4.5), and mild-moderate disease as indexed by total score on the Unified Parkinson's Disease Rating Scale (UPDRS; mean 24.8, SD=9.0) and median Hoehn & Yahr stage 2 (range 1-3). To assess sustained attention, participants performed 4 minutes of the Gradual Onset Continuous Performance Test (GradCPT) and a more prolonged 36 min (3 x 12-min) slower-paced Go/No-Go Continuous Performance Test (CPT). Selective attention was assessed with the Attentional Blink task. Following baseline assessments, participants performed an adaptive sustained attention training program, Tonic and Phasic Alertness Training (TAPAT), for 4 weeks at home (36 min/day, 4 days/week). We assessed cognitive status and motor symptom severity before and after training, as well as after a 4-week no-contact period.

Results: Prior to attentional training, there were no LPD-RPD differences on Attentional Blink or GradCPT, but LPD performed significantly more poorly on the 36-min Go/No-Go CPT (commission errors: LPD=30%; RPD=17%), indicating specific LPD deficits with *sustaining* attention. We also found significant associations between UPDRS motor scores and both Attentional Blink accuracy (r=-0.72, p<0.001)

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and Go/No-Go commission errors (r=0.45, p<0.05) in the entire PD group, suggesting that poorer non-spatial attention may exacerbate PD motor symptoms. Throughout TAPAT training, LPD remained significantly more impaired at sustaining attention, failing to reach the same difficulty levels as RPD. We investigated whether training generalized to UPDRS motor function improvements and found an effect of side of onset, with LPD exhibiting significantly greater improvements in motor symptoms than RPD after training: On UPDRS-motor, LPD improved an average of 1.9 points, whereas RPD did not improve. Notably, four of the nine LPD experienced clinically meaningful improvements (≥ 2.3 points) in their UPDRS motor scores.
Conclusions: LPD were significantly more impaired than RPD in the domain of sustained attention, and performance was associated with motor symptom severity on the UPDRS. LPD were also more likely to improve on motor function with attentional training. These results indicate a potential mechanistic link between sustained attention and motor symptoms, particularly in individuals with compromised right-hemisphere function. Our findings suggest that attentional training may preferentially benefit motor function in those with underlying right-hemisphere pathology (LPD), providing support for differential treatment plans based on PD motor subtype.
Keywords: attention**,** motor function**,** Parkinson's disease

5 Early Rapid Eye Movement Sleep Behavior Disorder Predicts Incident Cognitive Impairment in Individuals with De Novo Parkinson's Disease

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Objective: Most individuals with Parkinson's disease (PD) will develop dementia after 15-20 years, but the rate of cognitive decline drastically varies between individuals. While age serves as the strongest risk factor for cognitive impairment and dementia in PD, rapid eye movement sleep behavior disorder (RBD) is another known risk factor. However, few longitudinal studies examine RBD as a covariate of cognitive impairment (Chahine et al., 2016; van Patten et al., 2021). Within a sample of de novo PD participants, this study used survival analyses to evaluate the predictive value of possible RBD (pRBD) at baseline for incident cognitive impairment over a five year period. We also examined whether age moderated this relationship.
Participants and Methods: Participants included 328 individuals (m=60.95, SD=9.74 years old; education m=15.68, SD=3.02; 93% non-Hispanic white) from the Parkinson's Progression Markers Initiative (PPMI), a prospective study of newly diagnosed, untreated, and non-demented individuals with PD. As part of the PPMI, participants were evaluated annually for five years after baseline. To be included in this study, participants had to obtain baseline scores ≥26 on the Montreal Cognitive Assessment (MoCA) and complete the RBD Sleep Questionnaire, where possible RBD (pRBD; n=86) was defined as a baseline score of ≥6. During follow-up evaluations, participants were designated as cognitively impaired if MoCA scores were ≤25. Life tables and hazard/survival functions were produced. Within the life table, to examine a potential interaction with age, participants with and without pRBD (pRBD+/-) were split into younger (n=152) and older (n=176) groups based on the sample's mean age at baseline. To assess the independent effects of predictors (pRBD, Aiken & West centered age) and the interaction term (pRBD*centered age), a binary logistic regression produced a fitted model.
Results: Approximately 42% (n=138) of participants developed cognitive impairment over five years. The hazard was greatest at the first follow-up evaluation followed by a sharp then gradual monotonic decline in risk. The pRBD+ group had greater relative hazard at all follow-ups (except follow-up #2). Overall, a significantly greater proportion of the pRBD+ group developed cognitive impairment relative to the pRBD- group (cumulative survival=39%, 59%; median lifetime=3.998 years, >6 years, respectively; W(1)=5.66, p=0.02). In both

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younger and older groups, the pRBD+ group had slightly steeper declines in cumulative survival curves relative to the pRBD- group. In the fitted model, both age (b=0.56, SE=0.13, p<0.001, OR=1.75, 95% CI=1.37-2.24) and pRBD (b=0.62, SE=0.22, p=0.003) were independent, significant predictors of cognitive impairment. Those with pRBD were significantly more likely to develop cognitive impairment over the study period (OR=1.90, 95% CI =1.25-2.88). The interaction between age and pRBD status was non-significant (b=0.13, SE=0.23, p=0.57, OR=1.14, 95% CI=0.73-1.76).
Conclusions: Taken together, these findings suggest that de novo PD participants with RBD have a greater risk of impending cognitive impairment across a five year period. Importantly, RBD contributed additional predictive value above and beyond age, and this relationship was not moderated by age. This work must be replicated in more racially and educationally diverse samples over longer time periods.
Keywords: Parkinson's disease**,** sleep disorders**,** cognitive course

6 Mild Cognitive Impairment in Presurgical Deep Brain Stimulation for Parkinson's Disease

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Objective: Although clinically characterized by motor impairments, Parkinson's disease (PD) often affects cognition early in the disease course. Cognitive changes common in PD include visuospatial abnormalities and prominent executive function (EF) deficits, with 30% of individuals at risk of developing Parkinson's disease dementia (PDD). Mild cognitive impairment (MCI) has been identified as a transitional state between normal cognition and PDD. Deep brain stimulation (DBS), an effective treatment for motor symptoms in PD, is independently associated with cognitive changes. However, the presence of MCI in those seeking DBS is not well characterized. The current study aimed to calculate prevalence of MCI in those seeking DBS and identify those cognitive domains most capable of differentiating cognitive status in these individuals.
Participants and Methods: A large cohort of individuals with PD at the Kentucky Neuroscience Institute have undergone pre-surgical evaluations for DBS. Baseline cognitive performance of this cohort from 2017-2020 was examined to characterize their pattern of cognitive functioning. Data from 136 patients were available for inclusion, and 110 were available for MCI analyses. ANOVA and Welch's ANOVA were used to examine performance differences between cognitive classification groups. Cohen's kappa was calculated to examine concordance between clinician diagnostic impression and MCI determination based on Movement Disorder Society (MDS) Level II (two cognitive tests in each of five cognitive domains) assessment criteria for PD-MCI. Receiver operating characteristic (ROC) curves were constructed and areas under the curves (AUCs) calculated to examine tests' ability to differentiate patients in the five cognitive domains based on MCI classification at 1.5 standard deviations (SD) below age and education adjusted norms.
Results: Cognitive performance in those with clinician-diagnosed MCI differed from those with normal cognition and PD-consistent mild changes across attention/working memory, EF, and memory domains. Application of MDS Level I (cognitive screeners) criteria yielded an MCI prevalence rate of 20.5%. Prevalence ranged from 33.6% to 87.3% using Level II criteria with varying cut points. Highest agreement (κ = 0.513) between Level II diagnosis and clinician diagnosis was demonstrated using a cut point of 1.5 SD below population norms. The memory domain was most often impaired for those with PD-MCI (65.5%), whereas the language domain was least often impaired (20.9%). AUCs were accordingly smaller for language domain measures (e.g., Boston Naming Test, AUC=.695) relative to domains such as visual memory (e.g., BVMT-R Delay, AUC=.883) and EF (e.g., D-KEFS Trails Switching, AUC=.829).
Conclusions: Results support the use of 1.5 SD below normative values as a cut point for

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identifying MCI in PD. The result that the memory domain was most frequently impaired aligns with recent findings, wherein both verbal and visual delayed memory strongly differentiate normal cognition from MCI in PD. This result highlights the need for visual memory measures being included more consistently in PD cognitive evaluations and for the creation of PD-specific norms for these measures given motor demands. Results also highlight that MCI should be expected in pre-DBS evaluations for PD. Further longitudinal investigation is needed to elucidate the impact of pre-DBS PD-MCI on post-surgical cognitive outcomes.
Keywords: Parkinson's disease**,** mild cognitive impairment**,** deep brain stimulation

Paper Session 16: CVA

12:30 - 1:55pm Friday, 4th February, 2022

1 Social Cognition and Social-Emotional Outcomes Following Pediatric Stroke

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Objective: Following pediatric stroke, children frequently experience cognitive sequelae, which may have an impact on functional outcomes and quality of life. An underappreciated element of pediatric stroke is its effect on social cognition and, in turn, social-emotional outcomes. Stroke characteristics such as lesion location and volume have been associated with social cognitive ability and aspects of social functioning. However, the impact of other factors - including stroke mechanism (ischemic or hemorrhagic), affected hemisphere (right or left), or brain regions affected on - social cognition remains unclear. The objectives of the present research are to assess the impact of these stroke characteristics on social-emotional outcomes and evaluate social cognition as a potential mediator of this association.
Participants and Methods: Cross-sectional study in a cohort of children and adolescents with a past history of arterial ischemic stroke or cerebral hemorrhage. A total of 42 youth (age 6-16) participated in the current study at the Hospital for Sick Children in Toronto, Canada. Cranial MRIs were evaluated to determine lesion location, hemisphere affected, and stroke mechanism. Participants underwent neuropsychological testing which assessed social cognitive ability through use of the Developmental NEuroPSYchological Assessment – Second Edition (NEPSY-II) and the Reading the Mind in the Eyes (RME) task, and parents completed the Social Responsivity Scale – Second Edition (SRS-2). Social-emotional outcomes were evaluated using parent responses on the internalizing, social problems, and total problems subscales of the Achenbach Child Behaviour Checklist (CBCL). Multiple linear regressions were used to determine which stroke characteristics predict social-emotional outcomes, and a mediation analysis was conducted to evaluate whether social cognition mediates the association between stroke characteristics and social-emotional outcomes.
Results: Having a left hemisphere stroke significantly predicts the likelihood of a child experiencing poorer social-emotional functioning following stroke (b= -11.819, p=0.002), and this association is fully mediated through social cognition as indexed by the parent responses on the SRS (z=-2.25, p=0.027). Ischemic stroke is predictive of worse social-emotional outcomes compared to hemorrhagic stroke (b= -8.321, p=0.022), however, it is not mediated by social cognition. Neither experimental measure (NEPSY-II or RME) significantly predicts social-emotional outcomes nor do they mediate the association between stroke characteristics and social-emotional outcomes.
Conclusions: Distinct predictive stroke characteristics emerged; for example, lesion laterality influenced social-emotional outcomes and this relationship was mediated by social cognition. Evidence from this work signals the importance of evaluating social cognition following pediatric stroke, to help identify those who may be at risk of poorer social-emotional outcomes. Extant measures provide a starting point for future research exploring social

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cognition in more detail, with a focus on validation of new measures to assess this important cognitive function.
Keywords: social cognition**,** stroke recovery**,** social processes

2 Neuropsychological Outcomes and Predictors in Young Children with Presumed vs. Acute Perinatal Stroke

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Objective: Perinatal stroke is the most common type of all childhood strokes, occurring between 20 weeks gestation and 28 days postnatal life, the majority due to ischemic injury. A distinction is made between infants with acute perinatal stroke (presenting at birth) and presumed perinatal stroke (delayed diagnosis during first couple years of life). Long-term morbidities can be high, including cerebral palsy, epilepsy, language, cognitive and behavioral deficits, however, very few studies distinguish between acute and presumed conditions, and often include a wide age ranges. While some research points to poorer global, motor and adaptive outcomes in presumed perinatal compared to acute perinatal stroke, few have studied specific cognitive functions in a developmentally homogenous sample. We aimed to assess cognitive outcomes in a homogenous sample regarding age, time since injury, and development to determine if children with perinatal stroke overall perform more poorly on neuropsychological assessment, and if preschoolers with *presumed* perinatal stroke demonstrate poorer cognitive function than those with *acute* neonatal stroke. We predicted that delay in diagnosis and hence intervention may have an impact on long-term cognitive outcome. In addition, we evaluate predictive factors of outcome including those related to injury, intervention, family and cultural environment.
Participants and Methods: Children age 4;0-5;11 years [n=63, Acute Perinatal (APS) =39, Presumed Perinatal (PPS) =24) underwent comprehensive neuropsychological assessment as part of standard care. Cognitive function was assessed with age-appropriate standardized tests of general cognitive ability, language, visual-spatial, memory, and motor functions. Parents/teachers completed ratings of executive and behavioral function. Data from initial evaluations at a single time point were analyzed retrospectively. Cognitive and behavioral function of the overall sample were compared to population means, as well as between acute and presumed perinatal subgroups. Potential predictors of outcome were analyzed via regression models.
Results: Compared to population means, the perinatal group as a whole demonstrated poorer processing speed, auditory memory, visual-spatial and visual-motor skills (p_{FDR}<.01-.05), as well as increased problems with executive functions (p_{FDR}<.01; flexibility, emerging metacognition) and adaptive skills reported by parents/teachers. APS patients had higher rates of neonatal seizures, whereas PPS patients had higher rates of hemiparesis, older age, and lesser parental education. Further, the PPS group showed reduced verbal ability (knowledge, reasoning, naming), and processing speed than the APS subgroup (p_s<.01-.05). Predictor analyses found stroke location, history of seizures, parental education, and ethnicity to be significant contributors.
Conclusions: Perinatal stroke causes widespread diminished cognitive and behavioral function in young children. We found cognitive differences (verbal, processing speed) in children with presumed versus acute perinatal stroke, underscoring the importance of early diagnosis and intervention to improve long-term cognitive and psychosocial function. In addition to injury factors, findings were also predicted by parental, socioeconomic and cultural factors, as an important target for intervention.
Keywords: cognitive functioning**,** perinatal factors**,** stroke recovery

3 Post-Stroke Cognitive and Motor Outcomes Predicted from Lesion Location and Lesion Network Mapping

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Objective: Clinicians and scientists alike have long sought to predict the course and severity of chronic post-stroke cognitive and motor outcomes, as the ability to do so would inform treatment and rehabilitation strategies. However, it remains difficult to make accurate predictions about chronic post-stroke outcomes due, in large part, to a reliance on clinical heuristics rather than empirical data. Because the neuroanatomical location of a stroke can be derived from routinely collected acute clinical neuroimaging data, there is an opportunity to use lesion location to predict chronic post-stroke deficits. Lesion-behavior mapping (LBM), and structural (sLNM) and functional (fLNM) lesion-network mapping are research tools for linking cognitive-behavioral abilities to the brain regions that, when damaged, are associated with deficits in those abilities. Few studies have explicitly evaluated the clinical and translation potential of these techniques. Here, our goal was to evaluate whether we can leverage LBMs, sLNMs, and fLNMs based on data from two large cohorts of individuals with focal brain lesions to make predictions about 12-month outcomes in an independent sample of stroke patients. Further, we evaluated whether sLNM and fLNM could add predictive value beyond LBM alone.
Participants and Methods: Using data from the Iowa Neurological Patient Registry, we derived LBMs for expressive language (Boston Naming Test; n = 437), receptive language (Token Test; n = 210), and anterograde verbal memory (Rey Auditory-Verbal Learning Test; n = 477). We also derived an LBM for motor outcomes using data from the NICHE clinical trial for hemiparesis (Fugl-Meyer Test; n = 103). The local maxima of these LBMs were then used as seed regions-of-interest for sLNM and fLNM analyses based on data from the Human Connectome Project, an approach that offers potentially greater precision compared to previously used single-lesion approaches LNM. Next, using data from an independent cohort of stroke patients, we quantified the overlap of each lesion location with the LBMs, sLNMs, and fLNMs, and examined how much variance each could explain in 12-month cognitive-behavioral outcomes and recovery rates using a latent growth curve statistical model. We compared the predictors using nested and non-nested model comparisons and model fit indices.
Results: We found that each lesion-deficit mapping modality was able to predict a statistically significant amount of variance in cognitive and motor outcomes. Both fLNM and sLNM were able to predict variance in 12-month outcomes and/or recovery rates beyond LBM. fLNM performed best for the prediction of language deficits, whereas sLNM performed best for the prediction of motor deficits. Each domain was best predicted from the combination of LBM, sLNM, and fLNM.
Conclusions: We demonstrate that LBM, sLNM, and fLNM can be used to predict post-stroke deficits. The best individual lesion-deficit mapping modality for predicting post-stroke deficits depends upon the functional domain in question. All deficits were best predicted from the combination of the three modalities. Our work provides some of the largest lesion-behavior mapping analyses of cognitive abilities to date, adds to a growing body of evidence regarding brain network-behavior relationships, and represents a step toward clinical translation of basic tools in cognitive neuroscience.
Keywords: focal lesion**,** neuroimaging: structural connectivity**,** neuroimaging: functional connectivity

4 Asymptomatic Carotid Stenosis in the CREST-2 Trial – Baseline Cognitive Performance

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Objective: To determine the distribution and extent of cognitive performance in stroke-free patients with asymptomatic carotid stenosis (ACS) from a clinical trial, compared with a demographically-matched population-based cohort.
Participants and Methods: Cognitive performance was measured in the first 1,000 consecutive CREST-2 patients, a pair of treatment trials for ACS. A cognitive battery was administered after randomization but before assigned treatment. The cognitive battery, involving Word-List Learning (WLL-Sum), Word-List Recall (WL-Delay), and verbal fluency for animal names and the letter "F," was developed in the general population REasons for Geographic And Racial Differences in Stroke (REGARDS) Study. The ACS patients were ≥ 45 years old with ACS and no history of stroke. Mean age was 70 years, 58% men, and 52% right-sided stenosis. The distribution of cognitive performance for the patients was standardized, accounting for age, race and education using performance from REGARDS, and after further adjustment for hypertension, diabetes, dyslipidemia and smoking. Using the Wald Test, we tabulated the proportion of Z-scores less than the anticipated deviate for the population-based cohort for the 95th, 75th, 50th, 25th and 5th percentiles, respectively, and used the binomial test to see if any of the differences between CREST-2 participants and the REGARDS norms was statistically significant.
Results: After controlling for previous stroke, missing data and race other than black or white, there were 786 baseline assessments included in the analysis. The overall Z-score for patients was significantly below expected for higher percentiles ($p < 0.0001$ for 50th, 75th and 95th percentiles) and marginally below expected for the 25th percentile ($p = 0.015$). Lower performance was attributed largely to WL-Delay ($p<0.0001$ for all percentiles) and for WLL-Sum (50th, 75th, and 95th percentiles below expected, $p\leq0.01$). Of note, however, the baseline performance of CREST-2 participants at the lowest (5th) percentile, was significantly better in 3 of 4 domains (Animal Naming, Letter F, WLL-Sum) than those in REGARDS ($p<0.006$, respectively).
Conclusions: Although the CREST-2 population exhibited lower scores overall, these data reveal a higher-than-expected cognitive performance at the lowest percentile, possibly due to sampling bias. Lower performing individuals are excluded in randomized trials for many diseases if there is a perception of cognitive impairment that would preclude successful treatment compliance and follow-up. Furthermore, individuals who are having cognitive difficulties are less likely to agree to participate in trials, contributing to sampling bias . Thus, the generalizability of cognitive findings at the lower levels of function to the broader disease population may be limited in these studies.
Keywords: carotid artery disease**,** cognitive functioning**,** clinical trials

6 Regional Vulnerability of the Corpus Callosum in the Context of Cardiovascular Risk Factors

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Objective: Age-related declines in white matter integrity are often attributed to "cerebrovascular health", however, many other factors can impact the structure of white matter. White matter integrity has demonstrated some regional specificity in postmortem studies, specifically with greater frontal vulnerability related to occurrence of cerebrovascular disease and white matter injury in posterior regions tracking with Alzheimer's disease proteinopathy.

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Identification of reliable and clinically meaningful biomarkers of cerebrovascular health are needed to help differentiate etiologic contributions to white matter markers. The corpus callosum is an easily detected bundle of white matter and often considered a reliable signal of white matter integrity. We aimed to examine whether specific regions of the corpus callosum are vulnerable to cardiovascular risk.
Participants and Methods: 405 functionally normal older adults (CDR = 0; 56% female; M_{age} = 69.38; $M_{education}$ = 17.24 years) completed diffusion tensor imaging, and a neurologic exam including vitals and clinical labs. A subset (n = 130) also completed a blood draw with plasma analyzed for IL-6 and TNFa. Cross-sectional multivariable regression models evaluated the associations between fractional anisotropy (FA) of the genu versus splenium (simultaneously entered) and cardiovascular risk factors of interest (i.e., systolic blood pressure, resting heart rate, hemoglobin A1C, TNF-alpha, and IL-6).
Results: Controlling for age, sex, and years of education, lower FA of the genu but not splenium was associated with greater cardiovascular risk, including higher systolic blood pressure (β = -0.18, p < 0.01) and hemoglobin A1C (β = -0.18 p < 0.05). Resting heart rate was not significantly associated with either the genu or splenium (β range = -0.09-0.07, ps > 0.20). Similarly, lower FA of the genu but not the splenium was associated with higher IL-6 (β = -0.34, p < 0.01); TNF-alpha was not statistically associated with either the genu or splenium (β = -0.06, p = 0.51). Sex did not significantly moderate the observed relationships.
Conclusions: Our results demonstrated differential vulnerability of the corpus callosum, such that frontal regions of the corpus callosum (genu) showed a stronger association with biomarkers of cardiovascular health in comparison to posterior portions (splenium). Our results suggest frontal white matter changes in older adults may reflect cerebrovascular health, while posterior white matter integrity may not. These findings are clinically relevant as they point to the importance of not necessarily equating white matter integrity with cerebrovascular disease. Future studies should continue to examine the neuropathological processes underlying white matter integrity to inform more precise diagnosis and intervention.
Keywords: cerebrovascular disease, cardiovascular disease, vascular dementia

Poster Session 12: Medical | Anoxia | Infectious Diseases

1:00 - 1:55pm Friday, 4th February, 2022

1 Neuropsychological Outcomes of Children with HIE Who Received Targeted Temperature Management

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Objective: Worldwide, hypoxic-ischemic encephalopathy (HIE) is the fifth leading cause of death among children under five years old. HIE is associated with long-term neurodevelopmental impairments, including cognitive and motor deficits, behavioral difficulties, epilepsy, and vision or hearing difficulties. However, limited research is available on the extent of these deficits in early and middle childhood, especially among children with a diagnosis of HIE but without cerebral palsy (CP). Targeted temperature management (TTM) is currently the only empirically validated treatment for neonatal HIE. Recent studies have shown higher rates of survival and less severe motor impairments in children diagnosed with HIE who received TTM. However, long-term follow-up of cognitive function among children with neonatal HIE who received TTM is limited. The present study aims to examine long-term neuropsychological outcomes in children between the ages of 7 and 9 who received TTM for HIE and who did not develop CP. We predicted that our sample would show less pronounced motor and cognitive deficits while

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still exhibiting subtle differences from the general population.
Participants and Methods: We enrolled 8 children diagnosed with HIE at birth (Mage = 8.56, SD = 0.94; Male = 5, 62.5%) who received TTM. Exclusion criteria included severe vision or hearing impairments, severe motor impairments, and genetic abnormalities known to affect cognition. Children completed measures of global cognitive ability, using the WASI-II and NIH Toolbox, motor and visual motor function with the Movement ABC-2, and semantic fluency using the NEPSY-II and CELF-5. Caregivers completed two questionnaires about their child's behavior, one focusing on broad-spectrum behavior problems (CBCL) and the other on executive dysfunction (BRIEF-2). Children's scores were compared to normative standards using one-sample t-tests.
Results: Participants scored below normative standards on tests of visual-motor ability, processing speed, executive functioning, and semantic reasoning and fluency (ps < .05), but not on measures of global cognitive ability or working memory. They also had elevated ratings of executive function problems on the BRIEF-2 and of social, attention, affective, and anxiety problems on the CBCL (ps < .05).
Conclusions: These preliminary findings suggest that children with HIE who received TTM for HIE at birth, but were not diagnosed with CP, may have persisting motor and executive functioning deficits as well as behavior problems suggestive of elevated levels of anxiety and weaknesses in executive control, attention, and socialization. Outcomes will be subject to further study as more children are recruited, but findings suggest that even those children without CP sustain adverse developmental consequences of HIE despite TTM.
Keywords: hypoxia**,** cognitive functioning**,** motor function
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2 Medical Outcomes Study HIV Health Survey (MOS-HIV) Subscales and Neurocognition Among Latinx People with HIV

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Objective: Health-related quality of life (HRQoL) is the perceived impact a disease or illness has on both mental and physical health. Importantly, better HRQoL has a positive effect on neurocognition among people with HIV (PWH). Non-Latinx Black PWH have reported worse HRQoL compared to non-Latinx white (NLW) PWH, however Latinx HRQoL remains poorly understood. Additionally, Latinx PWH demonstrate more advanced HIV disease progression and greater rates of neurocognitive impairment compared to NLW PWH. The Medical Outcomes Study HIV Health Survey (MOS-HIV) is a well-validated measure examining HRQoL in numerous domains (e.g., cognitive functioning, mental health) among PWH. Research suggests that the MOS-HIV's Mental Health Summary Score is associated with neurocognition, especially among Latinx PWH. However, MOS-HIV subscales and their relation to neurocognition are vastly understudied among ethnoculturally diverse PWH. Therefore, this study aimed to examine the relationship between MOS-HIV subscales and neurocognition among a group of primarily Latinx PWH.
Participants and Methods: This study included 105 PWH (74% Latinx, 26% NLW; 30% female; *M* age=46.9, *SD*=8.72) who completed the 35-item MOS-HIV. The MOS-HIV includes 10 subscales: 4 subscales contribute to the MOS-HIV Mental Health Summary Score (i.e., mental health, health distress, cognitive functioning, quality of life), 3 contribute to the MOS-HIV Physical Health Summary Score (i.e., physical functioning, pain, role functioning [e.g., activities of daily living]), and 3 contribute to both (i.e., energy, general health, social functioning). The MOS-HIV and its subscales are scored from 0-100 (higher scores indicate better perceived

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health). Neurocognition was assessed using a comprehensive neurocognitive battery evaluating 7 neurocognitive domains: Attention/Working Memory (WM), Processing Speed, Learning, Memory, Executive Function, Verbal Fluency, and Motor Function. Demographically-adjusted T-scores were used to compute average Global Neurocognitive T-scores and domain T-scores.
Results: Mann-Whitney U-tests showed the Latinx group had significantly better role functioning, cognitive functioning, and energy and lower pain scores compared to the NLW group (*p*s<.05). Spearman's rho correlations showed that in the Latinx group, mental health was positively correlated with Global Neurocognition, Attention/WM, Processing Speed, Learning, Memory, and Executive Function (*r*s=.24-.36, *p*s<.05). Energy was positively correlated with Global Neurocognition, Processing Speed, and Learning (*r*s=.27-.32, *p*s<.05). Social functioning was positively correlated with Global Neurocognition, Processing Speed, and Learning (*r*s=.25-.28, *p*s<.05). Lower pain was positively correlated with Global Neurocognition and Learning (*r*s=.25, *p*s<.05). General health was correlated with better Learning (*r*=.32, *p*<.01). In the NLW group, lower health distress was correlated with Learning and Memory (*r*s=.40-.48, *p*s<.05). Better general health was correlated with Attention/WM (*r*=.41, *p*<.05); lower pain was correlated with Processing Speed (*r*=.40, *p*<.05).
Conclusions: Overall, the findings suggest a positive relationship between mental health, energy, and social functioning and neurocognition among Latinx PWH. This work extends prior research highlighting that neurocognition among Latinx PWH is uniquely related to psychosocial factors (e.g., acculturation, healthcare access, health behaviors). Given this study's limitations of small sample size and cross-sectional design, future studies should investigate biopsychosociocultural factors that influence Latinx neurocognition to provide more sensitive and effective culturally tailored treatments for ethnoculturally diverse PWH.
Keywords: quality of life**,** HIV/AIDS**,** ethnicity

3 Psychological Functioning in Post-Acute Sequelae SARS-CoV-2 (PASC) or "Long COVID" Outpatients

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Objective: Research has implicated COVID-19 in a variety of neurological and psychiatric issues including depression/anxiety, and stroke. However, very limited research exists that directly investigates the long term psychological and emotional correlates of COVID-19 infection. Taquet et al. (2021) conducted a retrospective study utilizing electronic medical record (EMR) data on 236,379 COVID-19 patients in the United States and found a high prevalence of psychiatric diagnoses, primarily depression and anxiety. The current study aims to begin to address this limitation in patients experiencing long-term COVID-19 symptoms, commonly called "Long Covid" or Post-Acute Sequelae SARS-CoV-2 (PASC) and was designed to provide clinical neuropsychologists with data pertaining to typical post-COVID cases that may been referred for evaluation.
Participants and Methods: Participants were 43 consecutive outpatients diagnosed with Long COVID who were referred for outpatient neuropsychological evaluation and completed the Personality Assessment Inventory (PAI). Patients were referred as part of a post-COVID clinic. The sample was predominantly white (N=32) and female (N=36). No transgender or gender nonconforming individuals were referred. Effect sizes compared to the normative mean T scores (Morey, 2007) and base rates of elevated (T>69) scores were calculated.
Results: Personality Assessment Inventory (PAI) scales associated with psychological distress had the highest effect sizes and base rates of elevations overall. SOM and associated subscales, SOM-C, SOM-S, and SOM-H, had the largest effect sizes and highest base rates of scale elevations with the mean T score at approximately the normative cutoff for clinical significance (T=70). DEP also had a large effect

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size compared to the normative sample, although not to the extent of SOM. ANX and ARD had medium effect sizes. For DEP subscales, physiological symptoms (DEP-P) and affective symptoms (DEP-A) had large effect sizes, while cognitive (DEP-C) symptoms had a medium effect size. The Schizophrenia Thought Disorder subscale (SCZ-T) also had a large effect size and high base rate of elevation, likely reflecting cognitive concerns. The other PAI scales generally had small to negligible effect sizes.

Conclusions: Scales measuring psychological distress, particularly somatic preoccupation and depression were elevated most frequently in Long COVID patients. The specific reasons for somatic preoccupation could not be determined in this study. However, possible explanations include a vulnerability to Long Covid symptoms in patients with long standing somatic preoccupation or somatization-type disorders. An alternative explanation is that socioenvironmental factors have contributed to some Covid patients being acutely aware of changes in their bodies and to attributing those changes to Covid-19. One limitation is that the sample was comprised of patients who were seen in a post-COVID clinic, and there is likely a selection bias, particularly for those from higher SES backgrounds. Further research on psychological issues in PASC is indicated.

Keywords: infectious disease**,** depression**,** assessment

4 Cognitive Diversity and Personal Experience of the COVID-19 Pandemic

Brittany M Lang[1], Nora Mattek[2], Sarah Gothard[2], Sam Lee[3,1], Adriana Hughes[3,1]
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Objective: Emotional and behavioral responses to the COVID-19 pandemic, as well as adherence to COVID-related safety measures, likely vary greatly depending on individual, demographic, and clinical characteristics. Literature supports that cognitive ability can impact how an individual interprets and reacts to stressful events. This study explored differences in how typical aging (TA) older adults (OA) and OA classified with mild cognitive impairment (MCI) differentially experienced the COVID-19 pandemic.

Participants and Methods: The sample contained 242 OA from five longitudinal aging cohort studies across Florida, Illinois, Minnesota, and Oregon, ranging in age from 57 to 97 (M = 75.54; SD = 8.13). Participants were 50% male and mostly White (n = 223; 91.7%), non-Hispanic (n = 238; 97.9%), well-educated (M = 15.43 years; SD = 2.37 years), and classified as TA (n = 178; 73.6%). All participants completed the COVID-19 Experience Survey developed by the Oregon Center for Aging and Technology (ORCATECH) and a validated neuropsychological test battery. Data from the emotional impact, behavioral change, and adherence to safety protocols subscales of the COVID-19 Experience Survey was quantified for the entire sample. Comparisons between TA and MCI OA on subscale items were calculated with ANOVAs, Kruskal-Wallis, or Chi-squares. Relationships between subscale items and cognitive domains were examined via Pearson or Spearman correlations.

Results: In the entire sample, 94.6% of OA worried about the impact the pandemic would have, changing their behavior accordingly. Most OA practiced good safety protocol adherence. Compared to those with MCI, TA OA endorsed taking on more responsibility ($t(167.87) = 2.48$, $p = .014$) and more frequently avoiding significant other's homes ($K = -1.97$, $p = .049$). In the entire sample, better attention was related to more perceived behavior change ($r = .167$, $p = .016$), more public space avoidance ($r = .140$, $p = .045$), and shorter bouts of time spent in the house ($r = -.142$, $p = .042$). Better verbal fluency and confrontation naming were related to more COVID-related worry ($r = .162$, $p = .015$; $r = .360$, $p = .021$) and perceived behavior change ($r = .166$, $p = .013$; $r = .345$, $p = .031$). Better verbal memory was correlated with taking on more responsibility ($r = .178$, $p = .016$) and visiting more with others ($r = .176$, $p = .017$). Better executive functioning was associated with more optimism about managing the pandemic ($r = .152$, $p = .030$).

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Conclusions: Overall, OA with better cognitive functioning were more worried about the pandemic but more optimistic about being able to manage it, undertook more behavioral change, and maintained better contact with others. Understanding these differences may help tailor intervention targets for cognitively diverse older adults to aid in reducing their negative experiences with the COVID-19 pandemic, as well as give us a starting point to better manage the impact of pandemics that may arise in the future.
Keywords: cognitive functioning**,** aging (normal)**,** mild cognitive impairment

5 Language Fluency Difficulties are Distinct Deficits in Post Treatment Lyme Disease Syndrome

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Objective: Previous studies suggest slowed processing speed and memory difficulties are the most prevalent neurocognitive deficits in post treatment Lyme disease syndrome (PTLDS). However, patients consistently report difficulties with word retrieval and language fluency. It is unclear if these language problems are independent deficits or a function of reduced processing speed and memory retrieval.
Participants and Methods: We compared 40 patients with PTLDS to 83 healthy controls and 114 patients with Major Depressive Disorder (MDD) on a set of neuropsychological measures including WAIS-IV Vocabulary (an estimate of premorbid verbal ability), WAIS-IV Coding (processing speed), Buschke Selective Reminding Task (memory retrieval), and letter (FAS) and category (animals) fluency. All outcome measures were converted to normatively adjusted z-scores and compared among the groups. Fluency tasks were then compared adjusting for the other administered tests to determine if group differences in fluency performance could be explained by these other aspects of cognitive performance.
Results: PTLDS and MDD groups performed poorer than healthy controls on all measures, and PTLDS patients had significantly poorer performance on both fluency tasks relative to the other groups. Controlling for verbal ability, processing speed and verbal recall eliminated fluency differences between healthy controls and MDD patients. Yet, PTLDS patients continued to exhibit poorer performance relative to the other two groups on both letter ($p = .01$) and category ($p = .03$) fluency measures. Depression severity was not associated with verbal fluency performance: PTLDS patients had significantly lower depression inventory scores than MDD patients (13.7 +/- 8.2 versus 32.4 +/- 11.0), and the correlations between depression inventory scores and fluency measures in the PTLDS group were not significant ($r = .13$, $p = .40$ for letter fluency, and $r = -.06$, $p = .72$ for category fluency).
Conclusions: Language fluency deficits in MDD appear secondary to cognitive slowing and memory problems. In contrast, language fluency and word retrieval deficits in PTLDS are not explained by these other common difficulties and appear to be an independent neurocognitive deficit of unknown pathophysiology.
Keywords: lyme disease**,** verbal abilities**,** depression
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6 Emotional and Behavioral Functioning of Children in Tanzania with and without HIV

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Objective: HIV infection can result in central nervous system damage, placing children with HIV at increased risk for developmental delays. These may impair cognitive, emotional, and behavioral functioning. Even without HIV

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infection or exposure, the understanding of emotional and behavioral problems in Sub-Saharan African youth is limited. The current study examined caregiver ratings of emotional and behavioral problems of children living in Tanzania with and without HIV.
Participants and Methods: Participants were part of a longitudinal study in Dar es Salaam, Tanzania. Emotional and behavioral functioning was assessed using the ASEBA Child Behavior Checklist-Parent Form (CBCL), translated into Tanzanian Kiswahili. Participants (n = 446) were divided into groups based on the two distinct age-based CBCL forms. The younger cohort included 92 HIV+ and 114 HIV- children between the ages of 3.00-5.92 years (m=4.53 years; 51% female). The older cohort included 112 HIV+ and 121 HIV- children between the ages of 6-9 years (m=7.46; 47% female). Independent sample t-tests were run to determine differences between HIV groups for age, gender, and socioeconomic status (SES). As the samples were not normally distributed, Mann-Whitney U Tests examined HIV group differences on the CBCL syndrome and higher order factor scales.
Results: The HIV+ and HIV- children in both age groups did not differ significantly on age, gender, or SES. For the younger group, HIV+ children had significantly higher ratings than HIV- controls on the internalizing (U=4330.0, p=.040, d=.29) and total problems factor scales (U=4221.5, p=.021, d=.33), as well as on the somatic complaints (U=3622.0, p=<.001, d=0.54) and attention problems (U=4386.0, p=.049, d=.27) syndrome scales. For the older group, HIV+ children were rated to have more problems than HIV- controls on the internalizing (U=5104.5, p=.001, d=.44) and total problems factor scales (U=5612.0, p=.023, d=.30). For the syndrome scales, the withdrawn/depressed (U=4656.00, p=<.001, d=.56), somatic complaints (U=4817.0, p<.001, d=.52), and thought problems (U=5733.0, p=.038, d=.27) scales were significantly higher for HIV+ children compared to HIV- controls.
Conclusions: Caregiver ratings yielded significantly more internalizing and overall problems in HIV+ children than HIV- controls. The somatic complaints scale was significantly worse for children with HIV than controls across both age groups. Problems with attention were found in the younger group and depression and thinking problems only in the older group. All comparisons yielded small to medium effect sizes. These findings likely relate to the differences in how emotional-behavioral symptoms manifest developmentally. Regardless of age or HIV status, the average ratings did not exceed clinically significant thresholds. This may reflect the positive influence of antiretroviral therapies upon the central nervous system in HIV+ children. The CBCL has been used previously in Sub-Saharan Africa, but this is the first study to our knowledge exploring these ratings in Tanzania, so the usual clinical norms may not be applicable. Nevertheless, significant differences were seen between the HIV+ and HIV- groups.
Keywords: HIV/AIDS**,** assessment**,** cross-cultural issues
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7 Cognitive and Functional Abilities in an Older Adult Veteran Before and After Contracting COVID-19

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Objective: To present a case study highlighting potential cognitive and emotional changes after contracting COVID-19.
Participants and Methods: The subject is a 76-year-old, Caucasian, male, Veteran, with 16 years of education for whom cognitive and self-report assessments were obtained at baseline and follow-up as part of ongoing research studies. He was diagnosed with COVID-19 during the interim between cognitive assessments.

The New York University Paragraph Recall Test (NYU Paragraphs), Mini Mental Status Examination (MMSE), and The Conners Continuous Performance Test (CPT-3) were first administered in January 2020. The subject tested positive for COVID-19 in March 2020.

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Follow up cognitive testing encompassing CPT-3, NYU Paragraphs, and MMSE was conducted in July 2020. For procedures for which test-retest reliability data were available, reliable changes were appreciated for pre-COVID-19 and post-COVID-19. All other data were obtained in March 2021 after medical chart review and a study investigating the effects of COVID-19 restrictions on older adults with cognitive impairment following his diagnosis of COVID-19, including: Expanded COWAT (CFLJW); Telephone Montreal Cognitive Assessment (T-MoCA); Animal Naming; Brief Resilient Coping Scale (BRCS); International Physical Activity Questionnaire (IPAQ); Three-Item Loneliness Scale (LS-3); Lubben Social Network Scale (LSNS); Functional Activities Questionnaire (FAQ); Neuropsychiatric Inventory Questionnaire (NPI-Q); and Perceived Stress Scale 4 (PSS-4).
Results: The following MMSE, CPT-3, and NYU Paragraph results were obtained in January 2020: MMSE Total Score (28/30); NYU Paragraphs Immediate (7/19); NYU Paragraphs Delayed (9/19); CPT [Omissions (T=43), Commissions (T=54), Detectability (T=51)]. The following results were obtained at follow up in July 2020: MMSE Total Score (27/30); NYU Paragraphs Immediate (9/21); NYU Paragraphs Delayed (11/21); CPT [Omissions (T=43), Commissions (T=45); Detectability (T=43)]. The following measures were obtained in March 2021: CFLJW (Z = -0.2); CFL (Z = -0.4); Animals (T=44); T-MoCA (20/22); BRSC (20/20); IPAQ (2 hrs of walking/day, 7 days/week); LS-3 (3/9); LSNS (30/30); FAQ (0/30); NPI-Q (Total COVID Increased: 4/12); PSS-4 (0/16).
MMSE Total Scores were intact at both initial assessment and follow up. Attentional measures were also intact at follow up and scores did not differ significantly based on reliable change index. Delayed recall on NYU Paragraphs was above 100% for initially encoded information for both evaluations. At the time of third measurement, the subject demonstrated credible task engagement with intact verbal fluency and T-MoCA total score, high levels of resilience, exercise, social engagement, and low levels of loneliness, stress, and functional impairment. Mild increases in neuropsychiatric symptoms including agitation, depression, appetite, and irritability were noted on the NPI-Q.
Conclusions: Overall, no significant cognitive changes between pre-COVID and post-COVID assessments were found. Mild increases neuropsychiatric symptoms including agitation, depression, appetite, and irritability were reported. Of note, this particular subject has relatively ideal psychosocial circumstances in comparison to the typical older adult veteran male. It is hypothesized that improved psychosocial conditions will result in less negative cognitive and functional outcomes for older adults diagnosed with COVID-19. High levels of resilience, social support, and exercise, coupled with lower levels of perceived stress and loneliness may serve as protective factors against cognitive and functional decline in older adults who contract COVID-19.
Keywords: cognitive functioning**,** infectious disease**,** cognitive screening

8 Literacy Mediates the Relationship Between Socioeconomic Status and Change in Intra-Individual Variability in a Sample of Older Adults with HIV

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Objective: It has been well documented that socioeconomic status (SES) impacts neurocognitive functioning in healthy adults. Populations who are vulnerable to low SES and cognitive compromise (e.g., HIV) may be particularly vulnerable to the effects of SES on cognition. For example, our group found that while downward changes in SES status (i.e., going from moderate SES to low SES) was associated with psychological well-being for both HIV+ and HIV- adults, the cognitive effects were observed among those with HIV (Weissberger, Nunez, Tureson, Gold, & Thames, 2021). The mechanisms by which SES influences neurocognitive functioning remain to be fully elucidated particularly in populations with chronic health conditions.
Intra-individual variability (IIV) is a within-person measure of variance in cognitive performance. In aging populations, increases in IIV have been shown to better predict cognitive decline than mean-level performance. Within HIV populations, IIV has been associated with declines in daily functioning and medication adherence (Thaler Sayegh, Arentoft, Thames,

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Castellon, & Hinkin, 2015). To date, few studies have explored the role of SES and its association with IIV in individuals with HIV. Additionally, it is not known whether literacy, a byproduct of SES, may mediate this relationship.
This project extends the literature by examining the association between SES and IIV, and the mediating role of literacy.
Participants and Methods: This project was a secondary data analysis of older adults (i.e., 50+; N = 72) recruited from a larger study that included 160 HIV+ participants recruited from local HIV clinics in the Greater Los Angeles area. All participants underwent clinical interviews, neuropsychological assessment, and completed surveys.
Intra-individual variability was computed as the standard deviation across cognitive domains (fluency, executive function, processing speed, learning, memory, motor), derived from the neuropsychological assessment battery. Change in IIV (∆IIV) was calculated as the IIV at study baseline subtracted from IIV at study's 2-year follow-up. Socioeconomic status was measured using the Hollingshead Four-Factor Index of Social Status with higher composite scores indicating higher socioeconomic status (*M* = 41.4, *SD* = 12.4). The Wide Range Achievement Test 4 (WRAT-4) is a measure of reading recognition, which has been commonly used as a proxy for literacy (*M* = 98.1, *SD* = 16.2).
Utilizing a mediation model, the Hollingshead Four-Factor Index score was entered as the predictor, ∆IIV as the outcome, and WRAT-4 as the mediator.
Results: There was a significant indirect effect of SES on ∆IIV through the WRAT-4, ab= .07, CI [.0065, .1796]. The mediator, WRAT-4, could account for up to half of the total effect P_m=.41.
Conclusions: Literacy accounted for 41% of the variance contributed by SES. These results identify literacy as an important mechanism by which SES impacts cognitive outcomes in adulthood. Individuals with lower income and fewer educational opportunities, resulting in lower literacy, may be less likely to engage in cognition-preserving activities independently. Measures that are a proxy for literacy may help identify people at risk for cognitive change and help direct interventions to enhance engaging in cognitively stimulating activities.
Keywords: cognitive functioning**,** aging (normal)**,** HIV/AIDS
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9 Alexithymia is Associated with Different Patterns of Pro-Inflammatory and Vascular Biomarkers in People with HIV and/or Methamphetamine Dependence

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Objective: Alexithymia is a neuropsychiatric condition characterized by difficulty identifying and communicating feelings, which has been linked to chronic immune activation, inflammation, and cardiovascular disease (CVD). Alexithymia is elevated among people with HIV and people with methamphetamine dependence (MD), but the biological factors underlying alexithymia in these populations are not well understood. This study sought to examine associations between alexithymia and pro-inflammatory and vascular injury biomarkers that relate to CVD in people with HIV and/or MD.
Participants and Methods: Participants were 147 community-dwelling adults (M_{age} = 46.0, SD_{age} = 14.7) with or without HIV and/or a lifetime history of MD (HIV–MD– n = 57; HIV–MD+ n = 21; HIV+MD– n = 41; HIV+MD+ n = 28). On average, the overall sample had 15 years of education (*SD* = 2.5), were predominantly White (61%) and male (74%), and 21% were neurocognitively impaired. All people with HIV were on suppressive antiretroviral therapy. Participants completed the Toronto Alexithymia Scale (TAS-20). Pro-inflammatory biomarkers (IL-6, CRP) and vascular adhesion molecules (VCAM-1, ICAM-1) in plasma were measured by commercially available immunoassays. Backwards AIC regression models examined the effects of

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alexithymia and its two-way interactions with HIV and MD on each individual biomarker.
Results: An additive effect of HIV status and MD was observed such that alexithymia was highest among the HIV+MD+ group (p < 0.001). Among people with HIV, worse alexithymia was associated with higher VCAM-1 levels (HIV x alexithymia interaction p = 0.020), controlling for demographics, vascular risk factors, neurocognitive impairment. Among people with MD, worse alexithymia was associated with higher IL-6 and CRP (MD x alexithymia interaction ps = 0.010 and 0.003, respectively). Post-hoc analyses showed that these effects were strongest within the dual risk group (HIV+MD+, n = 28) for alexithymia and VCAM-1 (r = 0.38, p = 0.049), IL-6 (r = 0.45, p = 0.016), and CRP (r = 0.47, p = 0.011).
Conclusions: Alexithymia has been linked to worse disease outcomes across medical populations, and the present study suggests that the biological factors underlying those outcomes may differ based on HIV status and MD. In the context of HIV, alexithymia is linked to a marker of vascular injury (VCAM-1), whereas among people with MD, it is linked to markers of inflammation (IL-6, CRP). Furthermore, the magnitude of these relationships is strongest among people with comorbid HIV and MD. Clinical screening and treatment for alexithymia (e.g. targeted emotion-focused therapy) in these vulnerable populations may have downstream benefits for inflammation, vascular health, and disease outcomes.
Keywords: social cognition**,** emotional processes**,** addiction or dependence
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10 An Exploration of Neuropsychological Impairment in Patients with Subjective Cognitive Complaints Post COVID-19

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Objective: Subjective cognitive complaints are being reported by patients across the spectrum of disease severities, with recent studies beginning to corroborate patients' perceived deficits. In response to this, the aims of this study were (1) to explore the frequency of impaired performance across cognitive domains in post-COVID-19 patients with subjective complaints, and (2) to investigate to what degree impairment existed within a single cognitive domain or across multiple.
Participants and Methods: 84 patients with subjective cognitive complaints post COVID-19 were assessed with a comprehensive protocol consisting of various neuropsychological tests and mood measures at Hospital de la Santa Creu i Sant Pau in Barcelona, Spain. Cognitive test performance was transformed into t-scores and classified based on ranges proposed by the American Academy of Clinical Neuropsychology. After performing a principal component analysis to define cognitive domain factors, test scores were analyzed within and across domains. Effects of hospitalization, disease duration, biomarkers and affective measures on cognitive performance were also explored.
Results: After excluding suspected COVID-19 cases (negative results when tested for SARS-CoV-2 or not tested at all during illness), a final sample of 63 patient were included in analysis. All patients demonstrated impaired performance in at least one cognitive domain, providing objective evidence to support perceived cognitive impairment. Results revealed a pervasive impact on attention abilities, with 61.9% of the total sample showing attentional difficulties (19% with single-domain impairment in attention and 42.9% with multi-domain impairment of attention and at least one other cognitive domain). Executive functioning was also frequently impaired (43% of the total sample), but largely co-occurred with deficits in other cognitive areas (38.2% multi-domain impairment). These salient attentional and executive deficits significantly correlated with

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each other, but were largely unrelated to clinical factors such as disease duration, biomarkers, or affective measures. Interestingly, hospitalization during COVID-19 infection did not seem to have a significant impact on cognitive outcomes in these patients, with scores on only one test of processing speed showing a significant group effect.
Conclusions: These findings stress the importance of comprehensive cognitive evaluation and intervention to address cognitive sequelae in post-COVID-19 patients of varying disease courses, not just those who were hospitalized or experienced severe symptoms. Future studies should investigate to what extent these cognitive abilities are recuperated over time as well as employ neuroimaging techniques to explore the underlying mechanisms of neural damage associated with this widespread cognitive impairment.
Keywords: infectious disease**,** cognitive functioning
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11 Objectively-Measured Balance is Associated with Cognition in Older Adults Living with HIV

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Objective: Cognitive and sensorimotor changes are early indicators of neurodegenerative disease onset. There is evidence of accelerated aging in persons with HIV (PWH), yet little is known about the association between balance and cognition in this aging population. This project investigated the relationship between objectively-measured balance and objective and subjective cognition in older PWH.
Participants and Methods: Participants included 46 PWH between the ages of 50 and 80 years (Mean age = 62.6, SD = 6.8), of whom 83% were male, 59% non-Hispanic white, 13% Hispanic, and 28% Black, with 97% on ART and 96% with an undetectable viral load. Participants were enrolled at UC San Diego's HIV Neurobehavioral Research Program and at the Emory University Center for AIDS Research (CFAR) clinical core. Demographically-corrected and practice effect-corrected continuous, T-scores from a comprehensive neuropsychological test battery were used to assess global- and domain-level cognition (i.e., verbal fluency, executive function, speed of information processing, learning, delayed recall, working memory, and complex motor). A subsample (n=31) completed the Patient's Assessment of Own Functioning Inventory (PAOFI) to assess subjective cognitive functioning, where a higher total score (scored 1-6 per item) indicates worse subjective cognitive function. The Unipedal Stance Test, an in-lab postural balance evaluation using force plates, was administered, with higher scores indicating worse balance performance. Pearson correlations were used to examine the relationship between balance and objective cognition, and Spearman Rank-Order correlations were used to examine the relationship between balance and subjective cognition.
Results: Better performance on the Unipedal Stance Test was significantly related to better global objective cognitive functioning *(r*=-.41, *p*=.004); this relationship was driven by executive function *(r*= -.41, *p*=.005) and speed of information processing (*r*=-.31, *p*=.034). Balance was not significantly associated with other cognitive domains (*p*'s>.050). Better performance on the Unipedal Stance Test was significantly related to better subjective global cognitive functioning (=.49, *p*=.005).
Conclusions: These findings, indicating that worse balance performance is associated with worse performance on objective

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neuropsychological tests and worse subjective cognitive functioning, are aligned with a growing body of neuroscience literature on the relationship between movement and cognition. Specifically, these findings suggest that worse balance is associated with worse executive function and speed of information processing compared to other cognitive domains, and that work is needed to further examine these higher-order cortical functions in relation to balance in older PWH. These preliminary findings suggest that neuropsychological evaluations should incorporate assessment of sensorimotor functions, including balance, when attempting to identify PWH who are at risk for cognitive and functional decline.

Keywords: HIV/AIDS**,** cognitive functioning**,** aging disorders

12 The Impact of COVID-19 and Depressive Symptoms on Subjective Cognition Among COVID-19+ Participants with Neurological Symptoms

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Objective: Individuals infected with SARS-CoV-2 commonly report both acute and longer-term neurological (e.g., headache, loss of smell) and depressive symptoms, and both may contribute to cognitive difficulties. To explore the independent and combined effects of COVID-19 infection and depressive symptoms on subjective cognitive status, we asked COVID-19+ participants and uninfected participants to rate their cognition before and following the onset of the COVID-19 pandemic.
Participants and Methods: Fifty-two mostly male (75.0%) participants (mean age= 55.3 years, SD= 12.7) were considered for cross-sectional analyses. Four subjective cognitive complaints (forgetfulness, easier to have people show things than tell things, difficulty naming, distractedness) were measured using an abbreviated Patient's Assessment of Own Functioning Inventory. Participants rated their cognitive status (worse, same, better) from before to after the COVID-19 pandemic started and were dichotomized into 1) worse self-reported cognitive complaints on any item or 2) same/better self-reported cognitive complaints across all items.
Depressive symptoms were measured using the Patient Health Questionnaire-2. Clinical questionnaires were administered to obtain COVID-19 status, HIV status, and neurological symptoms during COVID-19 infection. Independent samples t-tests and Fisher's exact tests were conducted to characterize the sample. Binary logistic regressions were used to predict odds of worse cognitive complaints since COVID-19.
Results: 30.8% (16) of participants reported being diagnosed with COVID-19. COVID-19+ participants were younger than COVID-19- participants (47.13 v. 58.94; t= -3.39, p= 0.001), but did not differ by sex (p= 0.302). All COVID-19+ participants reported at least one neurological symptom during infection with a median of 5 weeks since their positive COVID-19 test (IQR= 2-12). A greater proportion of COVID-19+ participants reported worse cognition than COVID-19- participants (68.8% v. 33.3%, p= 0.033); specifically, worse forgetfulness (50.0% v. 16.7%, p= 0.016) and distractedness (50.0% v. 25.0%, p= 0.048). 78.0% (39) of participants were HIV+, but HIV status did not differ significantly by COVID status (64.3% HIV+/COVID-19+ v. 83.3% HIV+/COVID-19-, p= 0.252) and HIV status was unrelated to change in cognitive complaints since COVID-19 (41.0% HIV+/worse v. 54.6% HIV-/worse, p= 0.503).
Unadjusted logistic regressions showed that COVID-19+ status and higher depressive symptoms independently increased odds of worse cognitive complaints since COVID-19 by 4.40 (p= 0.022) and 2.07 (p= 0.003), respectively. In an adjusted model with age, sex, COVID-19 status, and depressive symptoms, COVID-19 status became non-significant (p= 0.070), while depressive symptoms increased odds of worse cognition by 2.06 for each point

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increase in score (p= 0.006). There was no significant COVID-19 x depressive symptoms interaction in unadjusted (p= 0.094) or adjusted (p= 0.084) models.
Conclusions: Participants who became COVID-19+ reported worsening distractedness and forgetfulness than uninfected participants. Becoming COVID-19+ and depressive symptoms independently predicted greater odds of worse cognition. Though there was no statistically significant COVID-19 x depressive symptoms interaction, small sample size may have affected power to detect an effect, which future studies should address. These findings suggest that COVID-19, like depression, significantly influences subjective cognition. Further work is needed to explore the relation between COVID-19 and depression and their impact on cognition measured via objective measures.
Keywords: infectious disease**,** cognitive functioning**,** activities of daily living
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13 Increased Cognitive Intra-Individual Variability in Adults with HIV-Associated Neurocognitive Disorder is not Reduced Following Targeted Cognitive Training

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Objective: Elevated cognitive intra-individual variability (IIV) has been observed in many clinical populations, including those with HIV-Associated Neurocognitive Disorder (HAND). Increased cognitive IIV is thought to reflect the deterioration of cognitive control and attention processes primarily due to underlying illnesses or pathological conditions. In this study, we first hypothesized that cognitive IIV would be increased in participants with HAND compared to those without HAND (non-HAND). Further, there is preliminary evidence that cognitive training can reduce cognitive IIV in an aging population. We hypothesized an individualized targeted cognitive training intervention could reduce IIV in participants with HAND.
Participants and Methods: Our study sample was comprised of participants with HAND (*n* = 107) and those without HAND (*n* = 26), aged 40 and older. The coefficient of variation (*CoV*; CoV = individual standard deviation/individual mean) was used as our cognitive IIV measure across nine neuropsychological test scores covering a broad range of cognitive domains. An unadjusted one-way analysis of variance (ANOVA) was first used to evaluate group cognitive IIV differences at baseline (HAND versus non-HAND). Then, participants with HAND were randomized to either a cognitive training group (*n* = 48) or a no-contact control group (*n* = 39). Those in the cognitive training group completed a 20-hour individualized targeted cognitive training protocol focused on two cognitive domains where they demonstrated deficiencies on the baseline neuropsychological testing. Attention and processing speed training took priority when deficits in these domains were identified. Post-training neuropsychological assessment was completed 12-weeks after their baseline visit. Pre- and post-training cognitive IIV in the treatment and no-contact control groups were compared with a repeated-measures ANOVA.
Results: The CoV was greater in the HAND (*M* = 0.29, *SD* = 0.08) than the non-HAND group (*M* = 0.17, *SD* = 0.06), $F(1,132) = 43.75$, $p < .001$. Of the HAND group who completed their cognitive training intervention, there was no significant effect on cognitive IIV, $F(1,85) = 4.31$, $p = 0.07$, or evidence of a significant cognitive IIV x training interaction, $F(1,85) = 0.44$, $p = 0.51$. Mean baseline CoV of the training group (*M* = 0.29, *SD* = 0.09) did not differ from post-training CoV scores (*M* = 0.27, *SD* = 0.07). Similar scores were observed in the no-contact control group at baseline (*M* = 0.28, *SD* = 0.07) and 12-weeks from baseline (*M* = 0.27, *SD* = 0.09).
Conclusions: At baseline, cognitive IIV was greater in the HAND than non-HAND group, which is consistent with prior cognitive IIV research in the HIV population. Increased cognitive IIV reflects the greater cognitive burden observed in people living with HAND. In

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this study, cognitive training did not reduce cognitive IIV among adults with HAND. Results suggest the need for further developing and testing of cognitive training protocols specifically designed to treat cognitive IIV, such as Targeted-Impairment Training, whereby the most compromised cognitive domains that contribute the most to the cognitive IIV formula are used as a guide to target for cognitive training.
Keywords: HIV/AIDS**,** cognitive functioning**,** neuropsychological assessment

14 Utility of the HIV Dementia Scale (HDS) among Black and White Persons Living with HIV

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Objective: Although the incidence of HIV-associated dementia (HAD) and central nervous system opportunistic infections have declined in the cART era, milder forms of HIV-associated neurocognitive impairment (HAND) persist in nearly 50% of persons living with HIV (PLWH). Thus, several major challenges in the screening of HAND remain. Instruments adapted specifically for HIV, such as the HIV Dementia Scale (HDS) and its international counterpart (i.e., iHDS), generally demonstrate adequate criterion validity for mild neurocognitive disorder and HAD. However, HAND diagnosis in culturally diverse populations poses unique challenges. These challenges in conjunction with limitations of cognitive screening tools may pose particular difficulties in the screening of diverse PLWH. This study examined the utility of the HDS among Black and White PLWH and investigated whether any observed race group differences were attenuated by literacy/quality of education.
Participants and Methods: Participants included 39 Black and 84 White PLWH who underwent baseline evaluations as part of a NIMH-funded study on memory at the University of California San Diego HIV Neurobehavioral Research Program. All participants completed the HDS and Wechsler Test of Adult Reading (WTAR) in addition to a comprehensive neuropsychological battery examining attention, executive function, processing speed, episodic memory, and motor functions.
Results: A nonparametric Wilcoxon analysis indicated Black PLWH had significantly lower raw HDS scores than white PLWH, p<.001, d=.61. A subsequent mediation analysis indicated that indeed WTAR was a significant mediator explaining race group differences on raw HDS scores (b =-1.04, 95% CI [-1.84, -.43]). Lastly, raw HDS scores emerged as a significant predictor of global neurocognitive performance, as measured by a comprehensive neuropsychological battery (X^2= 5.49, p=.02, odds ratio=.83, CIs [.72, .97]). Race (X^2= .91, p=.34, odds ratio=.59, CIs [.20, 1.73]), WTAR (X^2= 1.09, p=.30, odds ratio=.98, CIs [.94, 1.02]), and their interaction (X^2= .45, p=.50) were not predictors of global neurocognitive performance.
Conclusions: Consistent with prior literature on race and cognition, findings suggest that Black PLWH may score lower than white PLWH on a commonly used screening measure for HAND and that such score differences may be at least partly explained by literacy. Nevertheless, those differences did not affect the classification accuracy of the HDS in detecting HAND, although overall diagnostic validity was weak in both groups. Future work is needed to determine the optimal cognitive screening methods for Black PLWH and other under-represented groups.
Keywords: HIV/AIDS**,** demographic effects on test performance**,** cognitive screening

15 Neurocognitive Sequelae of COVID-19 in African American Adults

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Objective: The impact of COVID-19 persists beyond the acute infection period, and ‘long

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haulers' (i.e., persons more than 4 weeks post-acute infection) experience symptoms that negatively affect their activities of daily living and quality of life. Of these symptoms, the post-acute neurocognitive sequelae of the SARS-CoV-2 Infection (PASC) have not been systematically investigated, especially in groups identified as most vulnerable to poor outcomes from COVID-19 including African American adults. Towards this end, we examined the frequency and correlates of subjective complaints and objective neurocognitive symptoms of patients referred to the PASC Clinic established at Grady Memorial Hospital, a large inner city teaching hospital in Atlanta, Georgia.

Participants and Methods: Forty one African American patients (mean age=54.0, range=22-74) were evaluated between January 14-April 22, 2021 in the Grady PASC clinic. They ranged from 1-10 months post positive SARS-COV-2 antigen testing. Patients were administered a subjective cognitive complaint questionnaire (PROMIS Cognitive Function Scale) as well as cognitive screening measures including the Mini-Cog (3 item recall, clock) and the Digit Symbol Substitution Test (DSST; timed visuomotor sequencing). Mood was assessed via the Patient Health Questionnaire-9 (PHQ-9).

Results: Twenty-seven (66%) of 41 patients reported experiencing clinically elevated symptoms of cognitive impairment on the Promis Cognitive Function Scale. Using a cutoff of $\geq$ –1.5 SDs based on published norms, 19 (46%) of the 41 patients demonstrated age-adjusted impairment on one or both cognitive screening measures, with processing speed being impacted for more patients (83%) than memory/executive function (26%). Eight (53%) of 15 patients without subjective complaints had objective impairments. There were no significant ($p>.05$) differences in age or severity of initial COVID-19 symptoms (i.e., requiring vs. not requiring hospitalization) in either those with subjective complaints or objective cognitive findings. However, patients with subjective complaints were significantly less depressed (PHQ-9 m=6.7; SD=5.4) than patients without subjective complaints (PHQ-9 m=13.9; SD=6.3). Depression scores did not significantly differ between those with vs. without objective findings.

Conclusions: Findings indicate a high frequency of subjective complaints and objective cognitive impairments in African American COVID-19 "long-haulers', and the data suggest that depression is not solely responsible for this elevated frequency. Cognitive screening should be routinely performed in African Americans in order to increase detection of neurocognitive PASC. Patients should be subsequently referred for detailed neuropsychological testing to fully characterize the specific domains that are impacted. Our ongoing prospective registry of African Americans and persons of other races/ethnicities will allow us to identify and to compare risk factors and mechanisms responsible for neurocognitive sequelae of PASC in a diverse sample.

Keywords: cognitive screening**,** cognitive functioning

16 Seeing Through the Brain Fog: The Heterogeneous Presentation of Post-Covid Encephalopathy

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Objective: The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was declared a global pandemic in March 2020. This single-strand RNA virus causes acute clinical concerns which appear to be predominantly respiratory, and the varying degree of initial symptom presentation is used to classify acute disease course severity. However, lingering cognitive symptom profiles are emerging well beyond the acute infectious stage; literature suggests that encephalopathy is the most common post-infectious complication. Presentation of concerns can range from exacerbation of preexisting conditions, to long-term dysexecutive syndrome, pronounced deficits in learning and memory, psychosis, and even encephalitis. No clear correlation between severity of acute disease course/length and severity/classification of long-term cognitive symptoms appears present. The presentation of post-Covid encephalopathy and complications appear to vary widely, but for a

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portion of individuals who were diagnosed with SARS-CoV-2, appear to lead to chronic, complex, and occasionally debilitating symptom profiles. The purpose of this paper is to elucidate the heterogeneity of post-infectious profiles and raise awareness of gaps in care provision for evaluation and rehabilitation of these patients.
Participants and Methods: Herein, a series of patient cases will be presented representing various symptom profiles of individuals previously diagnosed with SARS-CoV-2. For each case, a brief history of their SARS-CoV-2 acute infectious period will be discussed (including length of infection, symptom profile, severity of disease course, and requirement for hospitalization), followed by an examination of any/all reported psychiatric complications, neurologic manifestations, and performance on a standardized neurocognitive battery. Similarities in neurocognitive findings will be discussed, as well as hypotheses for how the post-infectious profile impacts various pre-existing diagnoses, including neurologic (e.g., epilepsy s/p temporal lobectomy), cerebrovascular (e.g., prior CVA), and developmental (e.g., Autism Spectrum Disorder). There will also be review of longitudinal monitoring for a post-Covid autoimmune encephalitis patient, heretofore not elucidated in contemporary literature. The presence of these concerns as they are estimated in the global population (as identified by literature review) will also be discussed. Finally, recommendations for evaluation and rehabilitation from a multidisciplinary perspective will be discussed.
Results: Significant acquired deficits across multiple cognitive domains have been observed. In these cases, changes following SARS-CoV-2 infection include learning and memory, attention, vigilance, working memory, executive functioning, processing speed, language abilities, visuospatial skill, affective/emotional, and even psychiatric domains. The case reports will aim to demonstrate that the reliable degree of change in these domains is beyond what would simply be attributable to physical fatigue and emotional exhaustion secondary to the acute period of infection, and instead represent a true, longitudinal, post-infections profile.
Conclusions: The SARS-CoV-2/Coronavirus infection is acutely associated with respiratory symptoms and complications. However, the evidence is clear that multiple neurologic and neurocognitive symptoms may become downstream complications following the acute infectious window. The deficits seen in several case presentations do not appear pronounced on initial mental status screening, but emerge on a more integrated, in-depth analysis of neurocognitive abilities. A suspicion and monitoring protocol for various neurocognitive concerns must be a component of a comprehensive medical evaluation for individuals reporting SARS-CoV-2 infection for the foreseeable future. Likewise, SARS-CoV-2 infection history/status must be queried as a component of a comprehensive neurocognitive clinical evaluation.
Keywords: infectious disease**,** cognitive functioning

17 Validity, Reliability, and Acceptability of a Computerized Neurocognitive Battery for Youth Affected by Human Immunodeficiency Virus in Botswana

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Objective: Children born to mothers infected with human immunodeficiency virus (HIV) during pregnancy experience increased risk of neurocognitive impairment. In Botswana, HIV infection is common among youth, but standardized cognitive screening is limited. The Penn Computerized Neurocognitive Battery (PennCNB) is a widely used test battery that streamlines evaluation of neurocognitive functioning. Our group culturally adapted the PennCNB for use among youth in this high-burden, low-resource setting. The current study examined the structural validity, test-retest

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reliability, and acceptability of the culturally adapted PennCNB among a cohort of HIV-affected young people in Gaborone, Botswana.
Participants and Methods: 209 school-aged children aged 7-17 years (*n*=173 HIV+; *n*=36 HIV exposed, uninfected [HEU]) completed the PennCNB. Confirmatory and exploratory factor analyses were performed on speed, accuracy, and efficiency measures for 13 PennCNB tests. Following completion of the PennCNB, 155 participants completed a three-point Likert scale survey eliciting perspectives of acceptability of the overall PennCNB and its 13 individual tests, along with open-ended responses to elaborate on acceptability ratings. In 65 HIV+ participants, the PennCNB was administered at baseline and repeated after 8-12 weeks, and test-retest reliability was examined with intra-class correlation coefficients (ICCs) corrected for age and practice effects.
Results: Confirmatory factor analysis supported four hypothesized neurocognitive domains: executive functioning, episodic memory, complex cognition, and sensorimotor/processing speed. However, exploratory factor analysis suggested that tests assessing executive functioning and sensorimotor/processing speed clustered together rather than forming differentiable factors. Test-retest reliability for individual tests were predominantly above ICC=0.6 and ranged from ICC=0.50 (Penn Face Memory Test) to ICC=0.82 (Penn Line Orientation Test). Participants reported high acceptability of the overall PennCNB (98%), but the acceptability of the individual PennCNB tests varied. Tests measuring sensorimotor speed, executive functioning, and complex cognition were perceived as most acceptable, while those measuring memory had lower acceptability. Themes about the content of the cognitive assessment (e.g., stimulation), features of the modules (e.g., aesthetics), and participant characteristics (e.g., confusion) were articulated as reasons for reporting the PennCNB tests as acceptable or unacceptable.
Conclusions: Overall, results support the validity and test-retest reliability of a neurocognitive battery adapted for use in Botswana, a non-Western, resource-limited setting. Results indicated that the adapted battery applied to youth in a non-Western setting with limited computer familiarity had a similar factor structure as in Western settings, indicating that the PennCNB measured the hypothesized neurocognitive domains. In addition, the battery showed marginal to high test-retest reliabilities. Importantly, the PennCNB was highly acceptable among young people in Botswana, which offers promise for successful implementation of the tool for use among pediatric populations in this setting. Together, these results provide evidence that the PennCNB could serve as a useful tool for the assessment of neurocognitive functioning in Botswana and, potentially, other resource-limited settings.
Keywords: HIV/AIDS**,** cross-cultural issues**,** adolescence

18 Knowledge About COVID-19 in Cognitively Impaired or Intact Older Adults

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Objective: The Coronavirus Disease-2019 pandemic has wreaked havoc on the health and emotional well-being of millions of individuals. Older adults have been especially impacted, as evidenced by their greater morbidity and mortality than younger persons. Increased age is a risk factor for cognitive impairment, including Alzheimer's disease, and therefore it is possible that poor knowledge about transmission and preventative strategies to mitigate susceptibility to COVID-19 contribute to the vulnerability of the older age group. To this end, we administered a COVID-19 Questionnaire to older adults with and without cognitive impairment to evaluate their knowledge about the virus.
Participants and Methods: Sixty nine patients (Mean/SD: Age=74.3/7.4; Education=16.1/2.4; MoCA=19.6/3.4) with mild cognitive impairment or in the early stage of dementia who were enrolled in the Cognitive Empowerment Program, a comprehensive lifestyle intervention, completed an 11-item questionnaire about symptoms, risks for acquiring the SARS CoV-2 infection, and behavioral techniques to reduce

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such risks. Sixty eight of their care partners (Mean/SD: Age=68.6/10.4; Education=16.4/2.0; MoCA=26.9/2.0) without cognitive impairment independently completed the same questionnaire. Questions were administered in a true-false format.
Results: As a group, patients (Mean/SD Correct=9.9/0.9) obtained significantly (p<.01) lower correct total scores than their care partners (Mean/SD Correct=10.3/0.8). A significantly lower percentage of correct responses for patients was obtained on an item asking about the Centers for Disease Control and Prevention 6-foot social distancing recommendation (Correct: 81% patients; 97% care partners). Both groups exhibited a low frequency of correct responses about the main clinical symptoms of the infection (Correct: 61% patients; 66% care partners) and the importance of using other strategies besides wearing a face mask (Correct: 72% patients; 81% care partners).
Conclusions: Although overall knowledge about COVID-19 was relatively good for both groups, inspection of individual items highlighted some gaps. Our sample included persons who were well-educated, and it is thus possible that knowledge would be more compromised in persons with less education or health literacy. Given the rapid transmission rate of the SARS CoV-2 infection, any lapse in knowledge could have deleterious repercussions. Public health messages should be tailored to ensure that older adults, including those with cognitive impairment, are effectively informed.
Keywords: assessment**,** cognitive screening

19 Psychological Impact of Pandemic-Related Social Isolation: Exploring Psychiatric Risk and Resilience

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Objective: The COVID-19-pandemic related social-distancing has become a necessary public health measure, though with potentially detrimental effects that can disproportionately impact at risk individuals' mental health. In this study, we examined how individuals' current symptoms of depression, anxiety, and loneliness are linked to various behavioral aspects of prolonged social isolation (SI). Our aim was to investigate whether individuals with depression and/or anxiety history are more heavily impacted by SI. We additionally explored the role of cognitive flexibility (CF) as a resilience factor that may buffer the strain on mental health. Hypothesis1: Greater perceived adverse effect of SI on mood and increased avoidance of outdoor activities will be associated with elevated loneliness, depression, and anxiety particularly in individuals with history of depression and anxiety. Hypothesis2: Higher CF will moderate the magnitude of such adverse effects.
Participants and Methods: Between June, 2020 – February, 2021, we recruited neurologically normal adults who are actively physically distancing and socially isolating (n=304, Mean Age=57.3, 81% female). Individuals with history or current symptoms of depression and/or anxiety were included. Participants completed a series of questionnaires about their social isolation-related behavior (SIQ), current symptoms of depression (CES-D), anxiety (GAD-7), loneliness (UCLA-Loneliness), and a measure of trait CF (CFS). Factor analysis performed on the SIQ using orthogonal rotation (varimax) resulted in a 7-factor solution. Of the 7 factors, we focused on the top two latent factors of the SIQ that explained the highest amount of variance in the factor analytic model: *Perceived adverse impact of SI (Appraisal)* and *Infrequency of outdoor activities (Avoidance)*. A series of multiple linear regression analyses were run with loneliness, depression, and anxiety symptoms as outcome variables and the two aforementioned social isolation factors – Appraisal and Avoidance – as predictors with CF and household size as covariates.
Results: Loneliness, depression and anxiety were all significantly predicted by Appraisal (β=0.31; β=0.56; and β=0.46, respectively) as well as Avoidance (β=0.2; β=0.24; and β=0.22, respectively) – all p<.001. Furthermore, higher CF significantly moderated the impact of

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Appraisal on individuals' anxiety symptoms (β=-0.1, p<.05) such that individuals with greater CF tended to be less adversely impacted by having a high Appraisal score. As predicted, smaller household size (i.e., fewer people living with the participant) predicted greater loneliness (β=-0.16, p<.005) but not worse depression or anxiety. Subsequent analysis also indicated that greater Avoidance score strongly predicted anxiety only for individuals with history of both depression and anxiety (β=0.22, p<.05) but not for those who denied having any history of depression and anxiety or those who had history of either one but not both.
Conclusions: In socially isolating individuals, greater outdoor-activity avoidance and appraising higher degree of adverse effects of SI on mood predicted elevated loneliness, depression, and anxiety during the COVID-19-pandemic. Importantly, prior depression and anxiety history appear to be a major risk factor for having disproportionately more adverse outcomes. However, CF was identified as a buffer that protects individuals against such adverse effects of SI. Future studies should further examine how CF acts as a buffer against SI, with an eye toward developing novel interventions.
Keywords: depression**,** anxiety
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20 Blood Biomarkers and Cognition in People with HIV

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Objective: People with HIV (PWH) are at high risk for HIV-associated neurocognitive disorders (HAND) and may also be at risk for other incident age-related neurodegenerative disorders, such as Alzheimer's disease (AD) and Alzheimer's disease related dementias (ADRDs) with advancing age. We examined the relationship between plasma-derived biomarkers of AD and neurodegeneration with HIV clinical variables and neurocognitive performance in a racially/ethnically diverse cohort of PWH residing in New York City.
Participants and Methods: Eighty five HIV+ adults (mean age= 59.8+/-6.1 years; 48% male; 66% Black) completed a demographic survey, underwent comprehensive neuropsychological assessment and blood draws for biomarker analysis. Summary scores for neurocognitive domains (verbal learning memory, episodic verbal memory, executive attention, language fluency, motor processing speed) were derived. Plasma Aβ40, Aβ42, total tau (t-Tau), hyperphosphorylated tau (p-Tau), neurofilament light (NFL), CD4 count, and HIV viral loads were measured using Simoa Quanterix. Bivariate correlations between biomarkers were examined. Multivariate analyses were performed to evaluate associations between plasma biomarker concentrations and neurocognitive performance in PWH. Summary scores for each neurocognitive domain served as the dependent variables and plasma Aβ40, Aβ42, t-tau, p-tau, and NFL concentrations as predictors. Non-significant predictors (p > .10) were removed from the bivariate models and models were re-run without these terms. General linear models were then performed with high-scoring biomarkers associated with neurocognitive domain scores with and without adjustments for age, sex, race/ethnicity, education, CD4 counts <200, and HIV viral suppression.
Results: Approximately, 9% of the cohort had a CD4 count <200 and 20% exhibited unsuppressed viral load (>400 copies/ML). Plasma biomarkers of AD and neurodegeneration were not associated with CD4 count or HIV viral load. In both unadjusted and adjusted models, only p-tau and NFL were associated with verbal learning memory performance. Specifically, mean NFL concentrations were negatively associated with verbal learning memory performance (β = -.25, p < .01). In contrast, elevated p-tau was associated with better verbal learning memory performance (β = .20, p < .05). There were no significant associations between plasma biomarkers of AD and neurodegeneration with episodic verbal memory, executive attention, language fluency, and motor processing speed. Of the covariates, verbal learning memory

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performance was negatively associated with age (β = -.04, p < .05) and male sex (β = -.38, p < .05) but positively associated with years of education (β = .13, p < .05).
Conclusions: These preliminary findings suggest plasma biomarkers of unspecified neurodegeneration, but not of AD, are associated with poorer neurocognitive performance in PWH. The positive association between p-tau and verbal learning memory performance was unexpected. Prior studies have reported both elevated and decreased cerebral spinal fluid and plasma tau concentrations in cognitively impaired PWH. Given our small sample, these observations may underestimate the predictive utility of plasma biomarkers of AD and neurodegeneration in PWH and warrant further investigation.
Keywords: HIV/AIDS**,** cognitive functioning

21 Effects of Loneliness and Wisdom on Physical and Mental Well-Being among People with and without HIV

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Objective: Loneliness is prevalent among people with HIV (PWH), and is an established risk factor for poorer physical and mental well-being. Conversely, wisdom, which is negatively correlated with loneliness, is associated with better quality of life among PWH. Although loneliness and wisdom's effects on well-being have been studied separately, research has yet to examine their combined effects in PWH. We investigated the independent relationship between loneliness and well-being, while simultaneously accounting for potentially protective effects of wisdom and its subcomponents. We hypothesized that loneliness would exacerbate HIV's effect on physical and mental well-being, and wisdom would attenuate the negative impact of loneliness on physical and mental well-being, irrespective of HIV status.
Participants and Methods: The cross-sectional study included 202 adults (mean age [SD]=52.82 [7.89]); PWH (n=87) and HIV- (n=82). By design, PWH and HIV- individuals were age-comparable. However, PWH had higher proportion of males and fewer years of formal education. Participants completed self-report measures assessing physical and mental well-being (Medical Outcomes Survey Short Form 36), loneliness (revised UCLA Loneliness Scale-Version 3), and wisdom (3D Wisdom Scale). Two backwards stepwise multivariable regressions using Akaike information criterion selection were conducted; [1] SF-36 physical well-being subscale as the outcome, and [2] SF-36 mental well-being subscale as the outcome. Covariates were evaluated if they differed between groups (education, gender) or were associated (p<.05) with the outcomes (age, frequency of social interactions, emotional support). Interactions between loneliness and HIV status, and loneliness and wisdom, were also included.
Results: PWH reported more loneliness (t(df=200)=2.87, p=.005), and worse physical (t(df=197)=-3.42, p=.0008) and mental (t(df=197)=-4.01, p<.0001) well-being compared to people without HIV. Stepwise models predicting physical (F(df=190)=7.64, R^2=.24, p<.0001) and mental well-being (F(df=188)=26.91, R^2=.50, p<.0001) were significant. Greater loneliness was associated with worse physical well-being, but only among PWH (b=0.34, p=.01). A significant interaction between loneliness and wisdom revealed that lonelier people with higher affective wisdom reported worse physical health than lonelier people with lower affective wisdom (b=-0.29, p=.02); this was not anticipated. Age (b=-0.26, p=.001), education (b=0.61, p=.049), and gender (b=-3.17, p=.11) were retained as covariates in model 1. Similar to model 1, loneliness exacerbated the effect of HIV on mental well-being (b=0.31, p=.01). However,

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there was no interaction between loneliness and wisdom. Rather, a main effect of wisdom, specifically reflective wisdom, was observed in the expected direction (*b*=5.48, *p*<.0001). Additional main effects in model 2 included HIV status (*b*=5.12, *p*=.0006), age (*b*=0.18, *p*=.01), education (b=-1.01, p=.0006), and emotional support (*b*=-2.21, *p*=.04).
Conclusions: The maintenance of physical and mental well-being is of high concern among aging PWH, a population that often experiences multimorbidity. Findings underscore the importance of including loneliness when evaluating physical and mental well-being in clinic and research. The unanticipated negative relationship between affective (compassionate) wisdom and physical well-being became significant only after adjusting for loneliness, and the meaning of this complex set of relationships is unclear. Additionally, although reflective wisdom is a promising protective factor against poorer mental well-being, further research is needed to clarify the impact of wisdom on physical well-being in PWH.
Keywords: HIV/AIDS**,** quality of life**,** social processes
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22 Prospective Memory in Older Adults With HIV Disease and Subjective Cognitive Decline

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Objective: Subjective cognitive decline (SCD) is a risk factor for incipient neurocognitive disorders that is observed at higher rates in persons with HIV (PWH). Although SCD is partly defined by normatively unimpaired global cognition, studies of healthy adults show that SCD is associated with mild deficits in prospective memory (PM), which is also impaired in PWH. The aim of the current study was to determine whether SCD is associated with lower PM among older PWH.
Participants and Methods: The sample included neurocognitively unimpaired PWH age 50 and older that were classified as either SCD (n=29) or non-SCD (n=33). SCD was determined by normatively unimpaired global performance on a computerized battery of neurocognition and elevated self-reported cognitive symptoms on at least one questionnaire of general cognition, memory, or executive functions. The Cambridge Test of Prospective Memory (CAMPROMPT) was used to assess PM.
Results: A series of Wilcoxon rank-sum tests revealed the SCD group produced lower scores on the time-based scale of the CAMPROMPT (p = .008, d = .69), which were characterized by omission errors (p = .029, d = .57). The study groups did not differ on the event-based PM task (p = .275, d = .23).
Conclusions: These findings suggest that older PWH with SCD show moderate deficits in time-based PM, which is more strategically demanding. Prior studies show that these deficits are strongly associated with worse everyday functioning, poorer health behaviors, and lower quality of life in HIV disease. Screening for SCD in older PWH may flag individuals whose PM performance should be assessed, which may help to identify persons at risk for incident neurocognitive disorders and those experiencing current challenges with everyday functioning and health behaviors.
Keywords: memory: prospective

23 Importance of Biopsychosocial Factors in Distinguishing Cognitive Profiles Among Virally-Suppressed People with HIV

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Objective: Cognitive deficits are common among people with HIV (PWH), occurring in about 40% of PWH even when virally-suppressed. Patterns of cognitive deficits among PWH are heterogeneous with a variety of cognitive areas affected. Similarly, risk factors associated with cognitive deficits are heterogeneous. As the longer lifespan of PWH brings risk of age-related comorbid conditions, these risk factors include HIV-related (e.g., viral load) and non-HIV-related factors (e.g., cardiovascular comorbidities). Identifying different cognitive profiles among PWH and determining the risk/protective factors associated with each profile is important for identifying neurodegenerative mechanisms. In a large sample of virally-suppressed PWH, we used machine learning methods to cross-sectionally identify cognitive profiles and then determined how biopsychosocial factors distinguish profile membership.
Participants and Methods: Participants included 704 virally-suppressed PWH (mean age=43.9 [SD=10.2], 88% male, 58.9% non-Hispanic White) from the HIV Neurobehavioral Research Program who completed a neuropsychological test battery (1999-2018). Using demographically-adjusted T-scores from 13 test outcomes assessing motor skills, executive functioning, attention/working memory, episodic learning, delayed recall and recognition, verbal fluency, and processing speed, we implemented a pipeline involving dimension reduction (using Kohonen self-organizing maps) and clustering (using gaussian mixture models) to identify clusters of PWH with similar profiles of cognitive performance. After profile identification, random forest models on a 70/30 training/testing set with internal cross-validation were used to determine how biopsychosocial factors distinguish membership between an “unimpaired” profile and each cognitive deficit profile.
Results: Using a data-driven pipeline with the 13 neuropsychological tests, 6 cognitive profiles were identified including (1) “unimpaired” (n=140); (2) weakness in recall (n=109); (3) weakness in recall, verbal recognition and attention (n=182); (4) weakness in working memory, processing speed, attention, and verbal recall/recognition (n=57); (5) global weakness with spared verbal and visual recognition and visual learning (n=92); and (6) global weakness with amnestic impairment (n=124). In Random Forest models, training accuracy ranged from 86-99% (F1 scores 0.89:0.99) while the testing accuracy ranged from 54-80%. The most discriminative biopsychosocial factors varied by profile, ranging among HIV-related (e.g., CD4 T-cell count), clinical (e.g., depressive and anxiety/tension symptoms) and sociodemographic (e.g., reading level) factors with mood-related and self-reported cognitive/functional complaints showing discriminative utility across all profiles. The most discriminative factors of the cluster with greatest impairment (6) were reading level, tension/anxiety and depression/dejection symptoms, total mood disturbance, language complaints and estimated duration of HIV disease.
Conclusions: Consistent with prior studies, we found heterogeneous cognitive profiles among PWH. Deficits in learning/memory were most commonly identified across profiles. Some profiles reflect “subcortical” impairment (impairments in learning and recall but not recognition) that are commonly reported among PWH whereas others reflect “cortical” impairment (impairment in learning, recall and recognition) that is more characteristic of certain age-related dementias. Results also indicate heterogeneous biopsychosocial determinants of the cognitive profiles with mood-related and self-reported cognitive/functional complaints most commonly associated across profiles. Findings suggest variability in the factors contributing to cognitive deficits among PWH including comorbid conditions and sociodemographic characteristics and underscores the need for personalized risk reduction and therapeutic strategies.
Keywords: cognitive functioning**,** HIV/AIDS**,** mood disorders
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24 Physical Frailty and White Matter Abnormalities: The ARIC Study

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Objective: Physical frailty is associated with increased risk for dementia and other adverse neurologic outcomes. However, the neurobiological changes that underly frailty and frailty risk remain unknown. We examined the association of cerebral white matter (WM) integrity with current and future frailty in a large community sample.
Participants and Methods: Participants included individuals from the Atherosclerosis Risk in Communities Study (ARIC) Neurocognitive Study who underwent a baseline (Visit 5) 3T brain MRI and completed baseline and follow-up (Visit 6 and/or 7) frailty assessments. Frailty status was classified according to the Fried criteria. Cerebral WM integrity was defined by white matter hyperintensity (WMH) volume and WM microstructural integrity, as measured using diffusion tensor imaging fractional anisotropy (FA) and mean diffusivity (MD). WM microstructural integrity was analyzed using composite FA and MD values (gFA and gMD) comprised of white matter tracts previously associated with frailty (posterior internal capsule, superior longitudinal fasiculus, genu, body, and splenium). Multivariable linear regression was used to relate frailty status to WM structure at baseline. Multivariable logistic regression was used to relate baseline WM structure to frailty risk at Visit 6 and 7.
Results: A total of 1,754 participants were included in the cross-sectional analysis (mean age: 76) and 129 (7%) were classified as frail. After adjusting for age, sex, race, center, education, *APOE* ε4 status, cardiovascular risk factors, and intracranial volume, frailty was associated with 0.29 standard deviation (SD) greater WMH volume (95% CI: 0.13 – 0.45), 0.31 SD lower FA (95% CI: -0.47 – -0.14), and 0.43 SD greater MD (95% CI: 0.29 – 0.58). These associations remained consistent in analyses excluding participants with history of stroke or dementia, but were attenuated and non-significant when restricted to cognitively normal participants. Among the 1,379 non-frail participants at baseline with follow-up data, 270 converted to frail at a later visit. Among this group, greater WMH volume at baseline was associated with greater odds of future frailty (OR = 1.46 per SD increase, 95% CI: 1.15 – 1.87). This association was even stronger when analyses were restricted to cognitively normal participants (OR = 1.78, 95% CI: 1.26 – 2.51). In contrast, global measures of WM microstructure were not associated with future frailty (gFA: OR = 0.84, 95% CI: 0.67 – 1.04; gMD: OR = 0.93, 95% CI: 0.72 – 1.20).
Conclusions: We found a robust association of WMH volume with current and future frailty. Although frail individuals appear to have altered WM microstructural integrity, global WM microstructural integrity may not be a strong predictor of future frailty. Declining cerebrovascular health may be a risk factor for multi-system decline, as defined by the frailty phenotype, and possible cognitive impairment.
Keywords: aging disorders**,** cerebrovascular disease

25 Longitudinal Effects of Stem Cell Transplant among Adults with Sickle Cell

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Disease: A Description and Comparison with Unaffected SiblingsFunding Statement: Funded in part by the NCI Contract HHSN261200800001E 75N91019D00024, Task Order No. 75N9109F00129.

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Objective: Sickle cell disease (SCD) is associated with an increased risk of neurocognitive deficits across the lifespan. While research has examined cognition among individuals with SCD cross-sectionally, little is known about how functioning may change following stem cell transplant. Primary aims of this study are to (1) examine changes in neurocognitive functioning from pre-transplant to 12 months post-transplant among patients with SCD and (2) compare changes in neurocognitive functioning of patients and unaffected siblings over time.
Participants and Methods: The sample consisted of adolescents and adults with SCD (n=44) and their sibling stem cell donors (n=19) who were enrolled on a nonmyeloablative hematopoietic transplant protocol. Patients (M*age*=31.9±8.8) and siblings (M*age*=31.6 ± 9.2) completed assessments at baseline and 12 months post-transplant. Over half of patients (57.9%) and siblings (52.6%) identified as male. Among patients, 21% identified as African (born/raised in Africa); 74% identified as African-American.
Baseline neurocognitive assessments were completed before patients started pre-transplant conditioning and before siblings donated cells. Assessments included the Weschler Abbreviated Intelligence Scale (WASI), Coding, Symbol Search, and Digit Span (forward/backward) subtests of the Wechsler Adult Intelligence Scale – IV (WAIS-IV), the California Verbal Learning Test – II (CVLT-II), and the Trailmaking subtest of the Delis-Kaplan Executive Function System (D-KEFS). Wilcoxon paired signed-rank tests were used to compare patients and siblings on cognitive variables at both time points. Path analyses were used to examine models assessing associations between pre-transplant variables and sibling/patient group status and post-transplant function.
Results: Among the 44 patients, all cognitive scores were within normal limits at baseline and follow-up. Median patient scores on all measures were stable over time except for significant improvements in Coding (Z=2.42, p<0.05), Symbol Search (Z=2.53, p<.05), and the Processing Speed Index (Z=3.74, p<.05). Siblings improved significantly on Coding (p<.01) but not Symbol Search (p=.07). In paired comparisons, siblings had higher median scores on the Coding subtest (assessing processing speed) at baseline (patient median scaled score = 7.5; sibling median scaled score = 9; Z=2.42, p=.015) and follow-up (patient median scaled score = 8; sibling median scaled score = 10; Z=2.5, p=.013). No other group differences emerged on any other measures at either time point. Baseline performance predicted follow-up performance on all cognitive variables except for the CVLT-II short delay score. Results failed to provide evidence that patient/sibling status predicted follow-up performance on any of the cognitive measures.
Conclusions: In this small sample of older adolescents and adults with SCD, this study adds to evidence from prior research that patients demonstrate processing speed weakness compared to healthy sibling controls. In pre-post analyses among all patients, processing speed scores increased significantly but also improved among siblings, potentially due in part to practice effects. Thus, stem cell transplant may not improve processing speed in patients, although confirmation with larger samples is needed. Pre-transplant scores, but not patient/sibling status, predicted follow-up performance. Results provide promising evidence that neurocognitive functioning remains stable and there are no detrimental cognitive effects from pre- to 12-months post-stem cell transplant among individuals with SCD.

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Keywords: sickle cell disease**,** cognitive functioning**,** medical disorders/illness

26 Sepsis and Cognitive Research Considerations: A Narrative Review

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Objective: Sepsis disproportionally affects people over the age of 65, and with an exponentially increasing older population, sepsis poses additional risks for cognitive decline. This review summarizes published literature for 1) type of cognitive domains most often assessed; 2) timelines for cognitive assessment; 3) considerations for practice effects, normative samples, 4) analysis approach and reporting of differences in sex and diversity, and 5) whether a neuropsychologist was included in the authorship list.
Participants and Methods: Using key terms, a PubMed database review from January 2000 to January 2021 identified 3,050 articles and 234 qualified for full text review with 18 ultimately retained for summary.
Results: Of these, seven (39%) relied solely on cognitive screening tools for assessment with the remaining using a combination of standard neuropsychological measures. Cognitive domains typically included were declarative memory, attention/working memory, processing speed, and executive function. Analytically, 35% considered premorbid intellectual abilities such as education, and 17% included a baseline (pre-sepsis) data. Initial cognitive testing occurred within two months of hospital discharge for nine studies, with seven of those assessments being within 48 hours of discharge. Importantly, eleven studies conducting at least two follow up testing sessions, providing data for the course of cognitive changes and recovery post sepsis. Studies varied in terms of statistical models used: correlation/regression models (50%), structural equation modeling (5.6%), general estimating equations (11.1%), survival models (5.6%), parametric and non-parametric tests for group comparisons (33.3%), concordance rate models (5.6%), receiver operating characteristics (5.6%), weighted network analyses (5.6%), and linear mixed models (5.6%). Three studies statistically corrected for education, two studies (11.1%) reported age adjusted t-scores, and one study (5.6%) reported education adjusted t-scores. In studies reporting on sex (n=15), data was equally split between males (n=995) and females (n=1,067). Only five studies reported on race/ethnicity, with Caucasians making up the majority (74%). 61% of the articles included a neuropsychologist. Of the articles with neuropsychological measures, researchers reported acute cognitive impairment according to test results below normative levels and cut-off scores. Notably, in follow-up testing, six studies reported significant cognitive improvement (return to baseline from impairment).
Conclusions: In terms of strengths, 12 articles had at least one follow up assessment, all assessments were objective measures of cognition (opposed to subjective questionnaires), and 61% had a neuropsychologist listed as an author. Regarding weaknesses, seven studies administered only cognitive screening tools instead of performing more comprehensive cognitive assessments. Additionally, only six studies considered education in their statistical analyses, which is problematic given education's known influence on cognition and premorbid cognitive reserve. Few studies included baseline cognitive testing, making it difficult to accurately identify cognitive change. Sepsis appears to have an acute effect on cognition, as evidenced by a decline in cognitive performance in the acute phase compared to baseline, and most studies with a follow up assessment show cognitive improvement from acute levels. Future directions include a consolidation of cognitive assessment approaches in post-sepsis populations and conducting studies with control groups and/or baseline testing. We highlight the need for properly addressing the cognitive sequala in this understudied population.
Keywords: cognitive functioning**,** neuropsychological assessment**,** medical disorders/illness

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27 Neuropsychological Functioning in Gulf War Illness: A Longitudinal Case Study

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Objective: Deployed Gulf War Veterans (GWVs) were exposed to several neurotoxicants, including chemical/biological warfare such as sarin nerve gas, prophylactic anti-nerve gas pyridostigmine bromide pills, combustion byproducts from oil well fires and tent heaters, and pesticides. Post-deployment, many GWVs began reporting fatigue, pain, neurological, cognitive. mood, skin, gastrointestinal, and respiratory symptoms, collectively termed Gulf War Illness (GWI). Exposures are likely to have caused these symptoms and may be related to long-term deficits in neurocognitive functioning. However, there is a lack of longitudinal research examining the trajectory of cognition among Gulf War veterans. Therefore, this case study describes the longitudinal neuropsychological effects of neurotoxicant exposures in a Gulf War veteran.
Participants and Methods: The veteran, who participated in a longitudinal Gulf War research study, was a 56-year-old woman who had 16 years of education and worked as a clerk/secretary during the Gulf War and had numerous reported neurotoxicant exposures during deployment. She completed questionnaires and neuropsychological evaluations at two time points, nearly 25 years apart. Evaluations included a battery of neuropsychological tests examining attention, executive function, memory, motor function, visuospatial function and mood.
Results: Scores revealed that the veteran's attention, executive function, memory, motor function, visuospatial function and mood were in the average range at Time 1. At Time 2, no significant changes in performance were observed for tests of attention, executive function, motor function, or visuospatial function. However, a clinically significant decrease in performance, nearly two standard deviations difference, on a verbal memory task was observed, suggesting early memory decline. Additionally, a clinically significant increase in mood dysfunction was also observed, including increased anxiety, irritability, and fatigue.
Conclusions: Neurotoxicant exposures from deployment are associated with longitudinal cognitive and mood effects, including declines in memory performance and increased mood dysfunction. This study highlights the need for more longitudinal neurocognitive studies and for continued screening for changes in cognition within this population, so that proper intervention may be applied.
Keywords: neuropsychological assessment**,** quality of life
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28 Childhood hemispherectomy impacts social cognitive perception and judgment in adulthood

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Objective: Cerebral hemispherectomy (HE) has been found to be an effective surgical treatment for children with intractable epilepsy caused by either congenital or acquired cortical lesions. Clinical observations demonstrate that adults who have undergone HE have diminished psychosocial insight. The right hemisphere is particularly important for processing these complex social cognitive judgements. This study will investigate the impact of childhood HE on social cognition in adults using the Thames Awareness of Social Inferences Task (TASIT; McDonald, Flanagan, & Rollins, 2010) to see if HE patients score significantly below test norms.
Participants and Methods: Seven adult volunteers (age = 24.6, *SD* = 4.3; education = 14.7, *SD* = 2.1) completed a comprehensive assessment as part of a neuropsychology study. All underwent childhood hemispherectomy

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(right-HE = 6). All HE patients had intelligence quotients within the normal range (FSIQ > 80; *M* = 93.1, *SD* = 8.1, range: 80-102). Emotional perception and social cognition were evaluated using the TASIT. Participants watched video vignettes of actors portraying various interpersonal situations and then evaluated emotional expression (Part 1: Emotion Evaluation) and social intentions of the actors accounting for varied amount of contextual information (Part 2; Social Inference - Minimal; Part 3: Social Inference - Enriched). One sample t-tests for difference from the published test norms (McDonald et al., 2004) were conducted from results of each part of the TASIT.
Results: HE patients tended to score lower than the norms on Part 1: Emotion Evaluation (*M* = 24.14 .50, *SD* = 2.19; *t* = -1.64, *p* = .076, one-tailed) and Part 2: Social Inference – Minimal (*M* = 42.86, *SD* = 15.74; *t* = -1.79, *p* = .062, one-tailed) but the differences were not significant. HE patients scores significantly lower on Part 3: Social Inference – Enriched (*M* = 42.00, *SD* = 14.94; *t* = 2.39, *p* = .027, one-tailed), which involve tasks that require more complex social judgements. When the one left-HE patient was removed from the analysis, results were unchanged with Part 3: Social Inference – Enriched still significantly lower than test score norms (*t* = -2.04, *p* = .048, one-tailed). However, these statistically significant findings did not survive after the Bonferroni correction was applied to the sample data.
Conclusions: HE patients scored only marginally lower than test norms on evaluating emotional expressions and reading the intentions of others using verbal cues (i.e., sarcasm v. sincerity). Further, HE patients were significantly impaired in the detection of more complex social behaviors such as deception in communication when it is based on nonverbal cues or an individual's demeanor rather than verbal expression. These findings indicate that use of only one cerebral hemisphere makes processing more complex social perceptions and judgments a very challenging task. This finding needs to be examined in a larger sample in the future.
Keywords: social cognition**,** brain disorder**,** laterality

29 Adult Emotional Intelligence Following Childhood Hemispherectomy

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Objective: This study examined differences in long-term outcomes in psychosocial function for individuals who underwent a right (R) or left (L) hemispherectomy (HE) as a child due to intractable seizures. While previous research in HE has centered around issues of social cognition, this study examined specific patterns of emotional intelligence (EI) using the Mayer-Salovey-Caruso Emotional Intelligence test (MSCEIT; Mayer, Salovey, & Caruso, 2000). Based on previous research in patients with callosal agenesis, it was hypothesized that individuals with HE would exhibit deficits in overall emotional intelligence (EI) compared with the general population and that greater deficiencies would be apparent on scales involving higher order strategic processing of emotion (strategic EI) compared to the basic experiencing of emotion (experiential EI).
Participants and Methods: Eleven adults with childhood HE (M_{age} = 27; 4 LHE) completed the online MSCEIT. They had an average of 14 years of education (*SD* = 2, range 12 – 18 years) and mean FSIQ of 90.8 (*SD* = 9.97, range= 77 - 105). Epilepsy onset ranged from birth to age 11. Surgeries took place between the ages of 3 months and 12 years. Analyses were conducted on standard scores accounting for age and gender.
Results: All HE participants scored within 1.5 sd of the mean on experiential EI (88.90 – 123.02), while 10 out of 11 scored within 1.5 sd of the mean on total EI (84.87 – 112.31) and strategic EI (82.05 – 108.53). One LHE participant scored in impaired range on total EI (66.84) and strategic EI (59.31). Eliminating the LHE outlier from the results, significant deficits were seen in strategic EI compared to test norms: $t(10) = -2.32$, $p = .045$, 95% CI [-12.39 – -0.16], with a trend toward weaker performance on experiential than strategic EI: $F(1,9) = 4.77$, $p = 0.057$, $\eta_p^2 = .3461$. Further analysis revealed that strategic EI was deficient compared to

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norms in the LHE but not in the RHE population: $t(3) = -5.79$, $p = .029$, 95% CI [-22.71 – -3.35]. **Conclusions:** This study suggests that the removal of the right or left hemisphere does not necessarily impair individuals from developing typically with regards to perceiving and experiencing emotions, but may negatively impact their capacity to strategically understand and manage emotions. Consequently, individuals with HE tended to have difficulty with higher-order emotional reasoning, such as understanding complex relations between emotions and behavior in multi-directional social situations (Salovey & Mayer, 1990). Notably, our findings suggest that these deficits may be more pronounced in individuals who had a left rather than right HE. If supported in larger samples, this finding could clarify aspects of left hemisphere involvement in emotion processing.

Keywords: emotional processes**,** social cognition**,** laterality

30 Does severe acute respiratory syndrome coronavirus 2 impact the functioning of the anterior attentional-intentional system? A pilot study.

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Objective: Since December 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a worldwide pandemic associated with both substantial morbidity and mortality. It has been subsequently discovered that, apart from typical flu features like high fever, cough and general tiredness-fatigue, a subset of patients with coronavirus disease-19 (COVID-19) may also develop neurological disorders (e.g., anosmia, loss of taste, stroke, delirium). In addition, studies suggest that survivors of COVID-19 may present with some neuropsychological impairments, such as attentional-executive disorders, likely caused by o COVID-related white matter hyperintense lesions and inflammatory changes. However, the long-term neuropsychological effects of COVID-19 have not yet been systematically studied. Thus, the aim of this study was to investigate whether individuals who had COVID-19 but are now “coronavirus-free”, may have some remaining neuropsychological abnormalities even months after their general recovery. Specifically, based on the mechanisms of brain dysfunctions in COVID-19, we wanted to test if survivors of COVID-19 may predominantly present with the defective functioning of the anterior attentional-executive system.
Participants and Methods: The functions of the attentional-executive system of 8 non-demented experimental study participants who had COVID-19 were tested. Two of these individuals required hospitalization. Their mean time from the recovery was 4.2 months. The experimental participants were compared to 9 demographically matched healthy controls. Attentional-executive functioning was assessed using the ROtman-Baycrest Battery to Investigate Attention (ROBBIA); a battery that was designed to measure three attentional processes (i.e., energizing, task setting, and monitoring). Overall, four reaction time (RT) subtests from ROBBIA were administered: (1) Simple RT, (2) Choice RT, (3), Prepare RT, and (4) Concentrate. Each participant was instructed to press an appropriate button on a response pad, as quickly as possible, when a target stimulus (one of the following capital letters: A, B, C, or D) is detected, but also (in Choice RT, Prepare RT and Concentrate) to make as few errors as possible.
Results: Overall, the analyses revealed that individuals who survived COVID-19 were significantly slower on Choice and Prepare tasks. Also, participants who had COVID-19 exhibited a different effect of the warning stimulus compared to controls. Specifically, they showed an increase in reaction times from one second warning condition to three second warning condition, with the three second warning condition being significantly greater (121ms) than the control group’s increase (33ms). Also, only in the COVID-19 group, reaction times in Prepare task with 3s warning tended to be longer than those performed without warning (Choice). No group differences

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in monitoring (e.g., number of errors) or task setting emerged.
Conclusions: This pilot study provides preliminary evidence that individuals who survived COVID-19 have significantly slower reaction times than matched uninfected controls. Further, they seem have an inability to sustain attention due to defective energization that has been associated with medial frontal areas. However, future neuroimaging research with larger number of participants is needed to confirm if COVID-19 impaired the function of the medial frontal lobe.
Keywords: attention, executive functions, infectious disease

31 Cognitive and Psychiatric Functioning Among Cushing's Disease Patients in Remission

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Objective: Individuals with active Cushing's Disease (CD) experience elevated depression, anxiety, mania, and impairments in memory, attention, and executive functioning, which often persist despite long-term biochemical remission. No research to date, however, has used standardized, objective measures to investigate cognitive and psychiatric functioning in parallel among CD patients in remission with an appropriate comparison group. Due to compression of adjacent structures, non-functioning adenomas (NFAs) might alter reproductive, thyroid, and adrenal gland functions without resulting in excessive cortisol production, making patients with operated NFAs an optimal comparison group. Finally, researchers have yet to clarify whether and how psychiatric symptoms relate to cognitive dysfunction in people with CD in remission, as these can influence each other. The present study examined 1) the neuropsychological functioning of CD patients in remission, relative to that of NFA patients, 2) the potential mediating role of psychiatric dysfunction in the relationship between CD/NFA and cognitive functioning, and 3) associations between protective/risk factors (e.g., age at diagnosis, remission duration) and neuropsychological outcomes.
Participants and Methods: Participants included 20 patients in remission from CD (80% female, 70% White, mean age 45, mean months since surgery 61.6) and 20 with NFAs (80% female, 70% White, mean age 48, mean months since surgery 57) treated at the Emory Pituitary Center and matched based on age, gender, race, and intervention (i.e., surgery, radiation, both). Neuropsychological performance was evaluated through the use of the TestMyBrain Digital Neuropsychology Toolkit – a computerized battery of cognitive tests normed on samples ranging from 4,000 to 60,000 individuals. Additional psychiatric information was gathered through a Qualtrics survey. Two MANOVAs were conducted to compare cognitive and psychiatric performance between CD and NFA patients. Post-hoc independent two-sample t-tests were also conducted to compare age-normed z-scores from each of the cognitive tests included in the MANOVA. We also conducted three mediation analyses (attention, memory, and executive function as outcome variables). Finally, we conducted bivariate correlations between neuropsychological variables and protective/risk factors.
Results: There were no significant differences in neuropsychological outcomes between groups; however, modest proportions of both groups demonstrated mild impairments below -1 z-score in attention (CD:20-25% CD, NFA:15-25%), processing speed (CD:30%, NFA:25%), executive functioning (CD:20-25%, NFA:5-15%), and visual memory (CD:30%, NFA:30%). Patients endorsed low positive affect (CD:50%, NFA:50%), high social anxiety (CD:40%, NFA:35%), somatization (CD:30%, NFA:15%), and anxiety (CD:20%, NFA:20%). Results of our mediation models were not significant. Length of remission and processing speed were significantly and negatively correlated, with more time in remission associated with slower processing speed.
Conclusions: Results indicate the need for longitudinally-followed NFA and CD patients, as well as treatments targeting cognitive and psychiatric dysfunction in both patient groups.

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Similar neuropsychological outcomes between groups suggests that persistent impairments might be associated with the presence of a pituitary tumor broadly or effects of surgical intervention. Specific declines in processing speed over time might point to progressive decline associated with white matter integrity loss often seen in remitted CD patients. The present study also highlights the accessibility and feasibility of using digital neuropsychology, particularly with low-base rate patient populations.

Keywords: Cushing's disease**,** hormones**,** cognitive functioning

32 Persistent Pain and Risk of Cognitive Impairment Across Multiple Domains in Older Men

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Objective: Persistent pain, the experience of bodily pain lasting six or more months, is experienced more by older adults than any other age group. A higher prevalence of persistent pain can be attributed to the increased onset of age-related diseases as well as low rates of treatment in this population. Pain management may be important for optimal cognitive function as there is growing evidence that persistent pain has a negative impact on neuropsychological function later in young and middle-aged studies. The aim of our study was to investigate the association between persistent pain, cognitive function, and the risk of cognitive impairment across multiple domains compared to people without persistent pain.

Participants and Methods: Participants were from the Vietnam Era Twin Study of Aging (VETSA), a study of male twins assessing cognitive and brain health from late midlife and beyond. Participants (*n*=1,042) were recruited across three waves over 5-6-year intervals at average ages 56, 62, and 68 years. At each wave, there was a narrow age range of 9-10 years. At each wave, participants completed the SF-36 Bodily Pain Scale which asked participants to rate their pain intensity from none (1) to very severe (6) and pain interference from (1) none at all to (5) extreme interference. Persistent pain intensity was defined as rating pain intensity >3 at the first consecutive waves; persistent pain interference was defined as rating pain interference > 3 at the two consecutive waves. At each wave, participants completed a neuropsychological test battery from which factor scores were derived for executive function (and subdomain of working memory), episodic memory, processing speed, visuospatial ability, and fluency. Using modified Jak-Bondi criteria, MCI subtypes were defined as performing >1.5 *SD* below average after adjusting for age and early life cognitive ability. Amnestic MCI involved impairment in episodic memory, while non-amnestic MCI involved impairment in other domains. Age-based mixed models were used to determine how persistent pain related to levels and rates of cognitive function. Cox proportional hazard models determined the risk of amnestic and non-amnestic MCI at the age when impairment newly occurred. Analyses adjusted for the effects of age, opioid medication use, depressive symptoms, chronic health conditions, and family.

Results: Age-based mixed models showed that people with persistent pain intensity had lower executive function than those without persistent pain (*d*=-.13), as did people with persistent pain interference (*d*=-.15, *p*s <.05). Findings extended to lower working memory as well (*d*s= -.19 and -.17, *p*s<.05). Persistent pain of any type was not related to episodic memory, visuospatial ability, or fluency. Cox-proportional hazard models showed that people with persistent pain intensity were at twice greater risk of developing impairment non-amnestic MCI compared to people without persistent pain (*HR*=1.75;95%[1.001,3.06], as were people with persistent pain interference (*HR*=3.31;95%CI[1.44,7.62], which involved impairments in executive function and working memory.

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Conclusions: Men with persistent pain are at increased risk for developing problems in executive function and working memory as they age into their sixties, which translated to a higher risk of non-amnestic MCI. These findings emphasize the need to manage moderate-to-severe levels of pain because doing so may help to maintain good executive function, which is important in many aspects of everyday behavior.
Keywords: chronic pain**,** executive functions**,** working memory
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33 Associations between Preoperative Neuropsychological and Psychological Functioning in Lung Transplant Candidates

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Objective: Lung transplant recipients may encounter adverse outcomes and face some of the highest morbidity rates after organ transplantation. In the psychosocial domain, depression, anxiety, and cognitive dysfunction have been identified as unfavorable outcomes after lung transplantation. Analyzing the relationship between lung transplant candidates' neuropsychological and psychological functioning is essential to examine factors that may support or interfere with the candidates' medical care before the transplant.
Participants and Methods: One hundred seventy-seven patients (107 male; mean age=66.86, SD = 4.81; mean education=14.53, SD = 2.73) undergoing evaluation for lung transplantation completed a neuropsychological evaluation including cognitive testing and psychological/mood related self-report measures. A retrospective analysis of the data utilized the clinical trial battery composite (CTBC), a mean of six commonly used neuropsychological test scores, to assess overall cognitive functioning. Mood/anxiety was measured by the Beck scales (BAI/BDI-II). Additional psychological functioning was captured by the Million Behavioral Medical Diagnostic (MBMD) to identify problematic or unfavorable behaviors, including protective coping strategies, that may impact compliance post-transplant.
Results: A stepwise linear regression included all MBMD variables, mean CTBC scores, and Beck inventories (BDI-II/BAI). The stepwise regression revealed that subscales of the MBMD, subjective cognitive dysfunction scores (Scale CC) and candidates' depressive state (Scale BB), were associated with lung transplant candidates' neuropsychological testing performance, CTBC, $F(2,172)= 5.228$, $p<.006$, with = .057. Furthermore, depressive symptoms (BDI-II), candidates' future pessimism towards their future health status (MBMD Scale E), neuropsychological testing composite (CBTC), and anxiety (MBMD Scale AA) were associated with candidates' cognitive dysfunction concerns (Scale CC), $F(4,170)= 31.461$, $p<.001$, with = .425. Another regression revealed that the candidates' certain coping styles, such as being respectful (MBMD Scale 7), sociable (MBMD Scale 4), and cooperative (MBMD Scale 3), and stress moderators, such as pain sensitivity (MBMD Scale C), social isolation (MBMD Scale D), and lack of spiritual resources (MBMD Scale F), as well as treatment adjustment difficulties (MBMD Scale L) were associated with possible problematic compliance (MBMD Scale K), $F(7,167)=43.935$, $p<.001$, with = .648.
Conclusions: In lung transplant candidates, self-reported levels of cognitive dysfunction are unsurprisingly associated with mood, pessimism, and neurocognitive functioning before transplant. Taken together, candidates' depression and cognitive concerns are associated with one's neurocognitive functioning. Yet, one's medication/treatment compliance depends on an individual's coping styles and ability to moderate stress and adjust to treatments. These findings continue to support the need for both psychological and neuropsychological testing in lung transplant candidates. However, it also highlights the importance of assessing psychosocial factors, such as support from social networks and religion, to evaluate a candidates' ability to recover physically and mentally following a

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significant medical procedure when evaluating their candidacy. Importantly, identified psychosocial factors from pre-transplant evaluations can be utilized when developing appropriate interventions for lung candidates to maximize their treatment outcomes and reduce potential risks for complications, including morbidity. Future research will assess additional medical factors that contribute to positive and/or negative prognostics outcomes for patients who underwent lung transplantation.
Keywords: pulmonary disorders**,** cognitive functioning**,** depression

34 Association of Carotid Atherosclerosis with Cognition in Multi-Ethnic, Urban-Dweller Cohorts

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Objective: Atherosclerosis, the accumulation of lipids in the arteries' intima, is a process that is implicated primarily in the development and progression of cardiovascular disease. Cardiovascular disease imposes a burden on individuals by increasing the risk of myocardial infarction, ischemic stroke, congestive heart failure, and cognitive decline. Vascular risk factors such as hypertension, diabetes mellitus, and smoking, which contribute to atherosclerosis, are also associated with cognitive and brain aging. Thus, we studied whether carotid atherosclerosis is associated with poorer cognitive performance in older adults and whether such association is attenuated after adjusting for vascular risk factors.
Participants and Methods: A total of 114 adults (40% Non-Hispanic White, 34% Black, 23% White) with mean age 73 (SD= 13) from the multi-ethnic, Washington Heights-Inwood Columbia Aging Project (WHICAP, n=69) and the Offspring Study of Racial and Ethnic Disparities in Alzheimer's Disease (n=45) participated in this study. Participants include elderly (age 65+), urban-dwelling residents, and their offspring (age 28+) respectively. Participants completed neuropsychological testing that included the Selective Reminding Test (SRT), letter fluency, and animal fluency. We transformed the raw scores into z-scores and averaged the Z-scores of each of the tests to create a composite of cognitive performance. Carotid atherosclerosis was visualized and assessed with brain magnetic resonance angiography using Cardiovascular Suite (QUIPU) software. Carotid atherosclerosis was defined as a protrusion of the intima into the lumen of > 50% of the surrounding intima-media thickness. We built unadjusted models first, and then progressively adjusted for demographic and vascular risk factors.
Results: In univariate and multivariate analyses, carotid atherosclerosis was not associated with SRT total recall (B=-3.6, p=.34, 95% confidence interval (CI) =3.86 to 1.04), SRT delayed recall (B=-1.4, p=.12, 95% CI=.39 to 3.15), letter fluency (B=-1.5, p=.23, 95% CI=1.02 to 4.08), and animal fluency (B=-4.0, p=.09, 95% CI=.62 to 8.56). Using the combined cognitive performance score, however, we found a negative association between carotid atherosclerosis and cognitive performance (B=-.18, p=.046, 95% CI=-.002 to .73) and the association persisted after adjusting for age, sex, Race/Ethnicity, years of education, and prevalent vascular risk factors (B=-0.20, p=.033, 95% CI=-.03 to .75). In the fully adjusted models, cognitive performance was associated with education (B=0.3, p=.003, 95% CI=-.02 to .087) and with diabetes (B=-0.2, p=.017, 95% CI=-.07 to .71).
Conclusions: There is an association between carotid atherosclerosis and overall cognitive performance. The effect is independent of other vascular risk factors, which suggests that it is not the result of an epiphenomenon of vascular risk factors. Investigating whether healthy lifestyles or preventive measures aimed at mitigating carotid atherosclerosis have a beneficial effect on cognition should be examined in larger longitudinal studies or with clinical trials.
Keywords: carotid artery disease**,** cardiovascular disease**,** cognitive functioning

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35 Verbal Memory, Attention, and Executive Function Performance in Individuals with Autoimmune Encephalitis Compared to People with Temporal Lobe Epilepsy and Healthy Controls

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Objective: Autoimmune encephalitis (AE) is an inflammation of the brain that occurs when an individual's antibodies target the synaptic proteins or the extracellular epitopes of a cell-surface. Research suggests that decreased levels of consciousness, seizures, memory impairment, and disturbances in mood and behavior are the most frequently observed symptoms in AE. However, relatively little is known about the cognitive profile of AE. While information on cognition in AE is limited, the cognitive profile of temporal lobe epilepsy (TLE), a leading cause of seizures, has garnered extensive research, with memory problems being the most frequently observed. The purpose of this study was to examine cognitive patterns in patients with suspected or confirmed AE and to compare memory performances of individuals with AE to those with TLE.
Participants and Methods: This study utilized archival data collected from the Psychology Assessment Center at Massachusetts General Hospital from 16 individuals with AE. Similarly, we used retrospective data from the Royal Prince Alfred Hospital from 60 healthy controls and 15 individuals with TLE (Miller et al., 2015), matched to the AE group for education and sex distribution. All three groups were given the Wechsler Memory Scale IV (WMS-IV) Logical Memory I and II. AE patients were also given Trail Making Test (TMT) Parts A and B and the Wechsler Adult Intelligence Scale IV (WAIS-IV) Digit Span subtest, with results compared to normative values. For AE patients, a history of seizures, psychiatric symptoms, and time since onset were gathered from the hospital record. A majority (75%) of this group received treatment within 6 months of symptom onset and 35% received treatment within 4 weeks of symptom onset.
Results: Performance on the WMS-IV Logical Memory I and II, TMT Parts A and B, and WAIS-IV Digit Span was within average range for the AE group. There were no significant differences in cognitive performance between AE individuals with a history of seizure compared to AE individuals without a seizure history. Time between initial symptom onset and treatment was not significantly associated with cognitive performance in this AE sample. Linear regression models found that psychiatric history accounted for performance on Digit Span Backward and Digit Span Sequencing. No significant differences in verbal memory were found between the three groups, though healthy controls outperformed individuals with TLE on delayed verbal memory (WMS-IV Logical Memory II).
Conclusions: The current study found intact verbal memory and executive functioning in this retrospective sample of individuals with AE. However, the presence of a psychiatric history was associated with working memory abilities in this group. The fairly small AE sample size (n =16) and the relatively long time to testing post-onset may have limited the ability to detect differences in cognitive functioning associated with AE in the current study. However, the findings suggest a promising cognitive outcome after receiving treatment relatively early in the disease (i.e., within 6 months of onset) for patients with AE.
Keywords: encephalitis**,** epilepsy / seizure disorders**,** autoimmune disorders

36 Neuropsychological Assessment in Burn Centers: Special Considerations and a Recommended Battery for Burn Intensive Care Unit Settings

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Objective: Burn injuries, specifically large surface area burns, burns impacting the airway, and burn injuries in which the disease process progresses into systemic infection or impacts the cardiovascular or pulmonary systems, have been associated with cognitive deficits. These consist of specific impairments in frontal lobe and executive functioning, verbal and visual memory functioning, speech and language functioning, and motor coordination/bilateral dexterity. Yet, comprehensive neuropsychological assessment is not typically offered to patients within burn centers, sometimes due to the acute nature of the injury and intensive rehabilitation required. Inasmuch, there is limited literature on neuropsychological assessment of individuals with burn injuries and burn-related clinical sequelae. Owing to the unique neurocognitive, emotional, psychosocial, and adaptive functioning considerations of this complex patient population, careful neuropsychological assessment can provide comprehensive data on the status of these functions and how they may impact treatment trajectory and the recovery process. Prior research has highlighted the role of neuropathological etiologies in long-term disruptions to activities of daily living and psychiatric sequelae in patients status-post burn care; these, too, should be included in a battery standardized for this population. We outline a standardized assessment battery for use with patients receiving care in burn centers that yields data pertinent to their ICU treatment and post-discharge recovery. To illustrate, a qualitative analysis of different neuropsychological assessment data points of burn ICU patients is discussed, with focused discussion on neurocognitive status findings and implications for adaptive, emotional, and psychosocial functioning.
Participants and Methods: The authors present a qualitative analysis of multiple data points including clinical interviews, electronic medical record reviews, and neuropsychological assessments of patients in a burn ICU setting. Medical history of cases included diabetes, hypertension, alcohol use disorder, and presentations included airway edema, 30-50% total body surface area burns, and severe pain. The assessment batteries employed, among other measures, core measures of premorbid/intellectual functioning, a repeatable neuropsychological screening tool, select measures of verbal and visual memory and bilateral dexterity, a functional living scale, emotional functioning measures, and measures of burn-specific concerns. These data were critical in informing predictive post-discharge recovery and adaptive functioning considerations, treatment adherence, and emotional/psychosocial functioning recommendations.
Results: Qualitative analysis of these data points revealed a general profile remarkable for frontal systems slowing, executive functioning impairment, and executively-mediated verbal and visual memory impairments. Adaptive functioning concerns were also raised, as were clinically-significant depression and PTSD symptomatology. Analysis also revealed reports of severe pain, body image concerns, and concerns around mobility and functional use extremities. Discharge and recovery implications are discussed.
Conclusions: Neuropsychological evaluation of individuals experiencing burn injuries provides critical data for the treatment team. These data uniquely inform both the immediate clinical picture, and predictive discharge/recovery related concerns. The authors argue for a standardized battery to be developed for use in burn ICU settings; this standardized approach can yield useful information for multiple services involved in patient care, including neuropsychology, critical care medicine, nursing, social work, and occupational therapy.
Keywords: medical disorders/illness**,** assessment**,** transdisciplinary research

37 Inhalation Injuries & Systemic Poisoning: Neuropathological Sequelae and Recommendations for Neuropsychological Assessment & Treatment

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Objective: Inhalation injury refers to damage to the respiratory tract or pulmonary system secondary to smoke, heat, or chemical irritants, resulting in systemic poisoning due to the accumulation of toxic gases (e.g., carbon monoxide, hydrogen cyanide). Inhalation injuries and systemic poisoning are closely linked to the development of neuropathology and cognitive deficits; this relationship is mainly mediated by episodes of hypoxia and hypoxemia, which may occur in the context of either acute injury (e.g., smoke inhalation and loss of consciousness), or more longstanding disease process (e.g., chronic airway edema). Despite their obvious risk to neurocognition, inhalation injuries and systemic poisoning have received little attention in the neuropsychological literature. Neuroanatomical damage secondary to hypoxia and hypoxemia typically occurs in the hippocampus, basal ganglia, and watershed areas. Additionally, the cerebral cortex neurons, cerebellum, corpus callosum, deep white matter, fornix, and mamillary bodies also appear susceptible to even brief periods of hypoxia. Evidence suggests that neuropathology in these areas contributes to impairments in memory, executive function, working memory, emotional functioning, visuospatial functioning, and motor functioning, and such impairments may be common after inhalation injuries and/or systemic poisoning. To this end, we argue that there is considerable clinical utility in the monitoring of neuropsychological profiles in this population, especially as these profiles inform post-discharge treatment adherence, adaptive functioning concerns, comorbid emotional functioning changes, and recovery trajectory. Aims include: 1) to present a neuropsychological battery that is highly sensitive to inhalation injury and systemic poisoning-related neuropathology, and 2) to present neuropsychological treatment recommendations and specific areas of intervention to intervene on those aforementioned areas of neuropathology.
Participants and Methods: The authors present qualitative analysis of different data points of neuropsychological assessment from patients presenting to a regional burn ICU, including patients with a history of inhalation injury secondary to smoke inhalation and carbon monoxide poisoning. Data from a neuropsychological screening measure, and measures of cognitive, adaptive, and emotional functioning are presented. Specific neuropsychological treatment (e.g., cognitive remediation) strategies to intervene on targeted areas of the neuropsychological profile are discussed.
Results: The obtained neuropsychological data reveal neuropsychological profiles remarkable for multifocal neuropathology involving impairment in frontotemporal functioning (e.g., executive functioning, verbal and visual memory), adaptive functioning concerns, and clinically-significant depression and PTSD symptomatology.
Conclusions: Neuropsychological evaluation is a critical tool to characterize and serially monitor neuropathology that occurs secondary to inhalation injuries and systemic poisoning. Standardizing a battery of measures sensitive to such sequelae is key for clinical and research advances to serve this unique population, including algorithms to predict future patient outcomes including recovery outcomes, treatment adherence, and quality of life.
Keywords: hypoxia**,** neuropsychological assessment**,** transdisciplinary research

38 Cognitive Functioning and Frailty in Cirrhosis

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Objective: Falls are prevalent in individuals with liver cirrhosis due to frailty and neurological impairment and can lead to increased mortality and morbidity. Despite the immense need for fall prevention in this population, liver cirrhosis-specific factors contributing to falls are not well

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understood. In this study, we aim to elucidate the relationship between cognitive functioning and factors that contribute to motor instability in cirrhosis, including balance, gait speed, and falls. Identifying underlying factors in this relationship can contribute to reducing falls prevent further complications of cirrhosis.
Participants and Methods: 33 ambulatory patients with liver cirrhosis diagnosed by biopsy or imaging have been prospectively enrolled to date. Demographics of the sample include female (N=13) and male (N=19) adult participants (M_{age} = 59, SD_{age} = 8.5). Cognitive functioning and presence of hepatic encephalopathy (HE) were assessed using the Psychometric Hepatic Encephalopathy Score (PHES). Subtests of the PHES include Number Counting Test-A (NCT-A), Number Counting Test-B (NCT-B), Digit Symbol Test (DST), Serial Dotting Test (SDT), and Line Tracing Test (LTT). To measure frailty, patients completed the Short Physical Performance Battery (SPPB) which assesses balance, chair stand speed, and gait speed. The Fall Efficacy Scale (FES) was used to assess fear of falling. Linear regression analyses were used with SPPB as the outcome measure and individual tests from the PHES as predictors. Covariates include age, gender, and education.
Results: Results indicate that there was a significant effect between certain subtests of the PHES and the SPPB. NCT-A completion time was not associated with frailty (B = -.284, CI [-.023,-.021]; *SE* = 0.15) . NCT-B was not associated with frailty (B = =.263, CI [-.007, -.007]; *SE* = .006).. Higher DST scores was associated with less frailty (B = .469, CI [.071, .072]; *SE* = .024). Higher scores on the SDT were associated with less frailty (B = -4.04, CI [-.29,-.26]; *SE* = .12). Finally, higher LTT time was associated with greater frailty (B = -.279, CI [-0.115, -0.114]; *SE* = .009). Additional analyses revealed that FES scores moderated the relationship between DST and frailty (F (2, 44) = 19.6, p < .05), SDT and frailty (F (2, 45) = 20.6, p < .05), and LTT performance and frailty (F (2, 41) = 14.8, p < .05).
Conclusions: This study demonstrated the relationship between cognitive functioning and physical frailty in cirrhosis. Given the potential for HE and frailty leading to falls, there is significant risk for increased morbidity and mortality. These findings can be used to implement interventions, such as physical therapy to promote motor stability, nutritional counseling, medication, and cognitive training for HE to reduce mortality and improve health-related quality of life (HRQoL). Additionally, fear of falling and excessive worry can impact efficient cognitive functioning and HRQoL.
Keywords: liver disease**,** cognitive functioning**,** motor function

39 Measures of Condition Severity as Predictors of Attention and Executive Functioning in Youth with Spina Bifida

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Objective: Spina bifida (SB) is a common birth defect associated with neurological impairments, including hydrocephalus and Chiari II malformation. Shunts typically used to treat these neurological impairments frequently result in complications such as infections and revisions, which prompt additional surgical intervention and neurological insult. Individuals with SB are thus at increased risk for poorer neuropsychological functioning, particularly worse attention and executive functioning (EF). These outcomes, however, may vary according to different measures of SB severity: lesion level, shunt status (i.e., presence of shunt), or number of shunt revisions and infections. The current study aims to examine the relationship between measures of SB severity and attention and EF in a sample of youth with SB.
Participants and Methods: Youth with SB (N = 140) were recruited as part of a larger longitudinal study. Participants (M_{age} = 11.4 years, 53.6% female) completed a neuropsychological assessment involving performance-based and parent-report measures of attention and EF. Composites were created for performance-based measures (across measures) and parent-report measures (combining mother and father reports). Shunt status, shunt history (infections and revisions), and lesion level were collected through medical chart review. Socioeconomic status was

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collected through parent questionnaires and included as a covariate.
Results: Shunt revisions and infections predicted performance-based EF (ΔR^2 = .063, p = .026; ΔR^2 = .220, p = .016; respectively), with increased revisions and infections being associated with worse performance on measures of EF. Higher lesion levels predicted better parent-reported inhibitory control (ΔR^2 = .079, p = .002) and organization of materials (ΔR^2 = .035, p = .038). Shunt status predicted decreased functioning in all areas assessed: performance-based attention (ΔR^2 = .074, p = .001), parent-reported attention (ΔR^2 = .036, p = .034), performance-based EF (ΔR^2 = .054, p = .005), and several domains of parent-reported EF. These areas of parent-reported EF included initiation (ΔR^2 = .058, p = .006), working memory (ΔR^2 = .039, p = .031), and monitoring (ΔR^2 = .033, p = .035).
Conclusions: Results demonstrate that different measures of SB severity account for variance in performance-based and parent-reported attention and EF. Shunt status emerged as a significant predictor of all domains, with presence of a shunt being associated with decreased functioning in both performance-based measures and parent-reports. Shunt complications in particular were predictive of performance-based EF alone, which may be due to direct neurological implications. Notably, the association between lesion level and parent-reported EF was not in the expected direction. As lesion level is a more global measure of SB severity, impacting both neurological and non-neurological functions, these findings may reflect increased severity-related demands and parent involvement in youth with higher lesion levels.
Keywords: spina bifida**,** executive functions**,** attention

40 Neuropsychological Functioning in Preschoolers with Sickle Cell Disease

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Objective: Children with sickle cell disease (SCD) experience neurodevelopmental delays. There is limited research with preschool age children, and few studies have examined the neuropsychological effects of hydroxyurea treatment in young children. This study aims to examine neuropsychological risk and protective factors in preschoolers with SCD.
Participants and Methods: Sixty-two patients with sickle cell disease (60% HbSS/HbSβ^0-thalassemia; 40% HbSC/HbSβ^+-thalassemia) between the ages of 3 and 6 years (mean age, 4.8 years) received a neuropsychological evaluation as a part of systematic surveillance. Patients were not selected for disease severity, prior central nervous system findings, or existing cognitive concerns. Thirty-four patients (82% of HbSS/HbSβ^0-thalassemia) were receiving hydroxyurea therapy at the time of their neuropsychological evaluation for a mean (standard deviation) of 2.6 (1.2) years. Besides genotype, there were no group differences in medical (lab values) or demographic (socioeconomic status) factors based on hydroxyurea treatment status. The Social Vulnerability Index was used to classify individuals based on social determinants at the neighborhood level (e.g., poverty, education, housing data). The Barratt Simplified Measure of Social Status measured household socioeconomic status based on a composite of parent education and occupation status. Neuropsychological outcome measures included the Wechsler Preschool and Primary Scale of Intelligence - Fourth Edition (intellectual functioning), Wide Range Assessment of Visual Motor Abilities (visuomotor control), Bracken Basic Concept Scale: Receptive - Third Edition (school readiness), and Behavior Rating Inventory of Executive Function – Preschool (executive functioning).
Neuropsychological functioning was compared to normative expectations using one-sample t-tests or Wilcoxon signed-rank tests. Univariate and multivariate linear regression models were used to measure associations between neurocognitive measures and patient demographic and clinical characteristics. The multivariate models were adjusted for age at

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assessment, genotype, sex, hydroxyurea treatment status, community level social vulnerability, and household socioeconomic status. FDR (false discovery rate) adjusted p-values (p-FDR) were calculated to adjust for multiple testing.
Results: Overall, patients scored below normative expectations on measures of intellectual functioning (Mean=88.19, Standard Deviation=16.16) and school readiness (Mean=90.66, Standard Deviation=93.43). Age, severe sickle genotype, and hydroxyurea treatment exposure were not associated with any neuropsychological outcome (pFDR>0.05). Greater social vulnerability at the community level was associated with poorer performance on measures of intellectual functioning, visuomotor control, and school readiness, as well as parent report of executive dysfunction (all pFDR<0.05). Greater household socioeconomic status was positively associated with academic readiness. When community level social vulnerability and household socioeconomic status were entered into the model simultaneously, independent associations with neuropsychological outcomes did not reach significance at pFDR <0.05 due to shared variance.
Conclusions: Preschoolers with SCD perform below age expectations on measures of intellectual functioning and academic readiness. Consistent with the literature, sociodemographic factors were stronger drivers of neuropsychological performance than disease severity or treatment factors. Neurodevelopmental interventions targeting the home and broader community environment are needed for young patients diagnosed with SCD.
Keywords: sickle cell disease**,** neuropsychological assessment**,** child development disorders
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41 Processing Speed Mediates the Relationship Between White Matter Hyperintensity Volumes and Adaptive Functioning in Survivors of Childhood Cerebellar Tumor

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Objective: Long-term survivors of childhood cerebellar tumor are at increased risk of late effects after treatment (e.g., surgery, chemotherapy, radiation therapy), including slower processing speed and lower adaptive functioning skills compared to their peers. Processing speed has been shown to mediate the relationship between neurological risk and adaptative outcomes in survivors of childhood brain tumor. White matter hyperintensities (WMHs) are indicative of compromised white matter, a biological marker of increased neurological risk, and has been shown to be related to oral processing speed in survivors. The relationship between WMH burden and adaptive outcomes, including the potential contribution of processing speed, has yet to be explored in this population. This study aimed to determine the mediating role of processing speed in the relationship between WMHs and adaptive functioning domains.
Participants and Methods: 56 long-term adult survivors of childhood cerebellar tumor (M_{age}=22.34 years, SD=4.41) and 35 healthy controls (M_{age}=21.29 years, SD=6.51) underwent MRI. Segmentation and quantification of WMHs were completed using the Lesion Growth Algorithm in the Lesion Segmentation Tool toolbox for SPM12. Quantified values were normalized with whole-brain volume and log-transformed. Participants completed the Oral Symbol Digit Modalities Test (OSDMT) as a measure of oral processing speed and informants of participants completed the Scales of Independent Behavior-Revised (SIB-R) as a measure of adaptive functioning. The SIB-R includes domains of Motor, Social Communication, Personal Living, and Community Living skills. Mediation analyses were completed using the Process macro for SPSS.
Results: As previously reported elsewhere, survivors performed significantly poorer on the OSDMT and had significantly larger normalized WMH volumes compared to healthy controls. Informants reported lower adaptive functioning skills of Motor, Personal Living, and Community

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Living in survivors compared to healthy controls (*ps*<.01). Two partial mediations were shown with a significant indirect effect of WMH volume on both Motor and Personal Living skills through processing speed (*b*=-0.49, CI [-0.90, -0.17]; *b*=-0.82, CI [-1.34, -0.29]). A full mediation was shown with a significant indirect effect of WMH volume on Social Communication skills through processing speed (*b*=-0.34, CI [-0.69, -0.06]). There were no significant indirect effects on Community Living skills.
Conclusions: Results from the present study showed that oral processing speed mediates the relationship between WMH burden and adaptive skills (i.e., Motor, Personal Living, and Social Communication). Oral processing speed may be particularly influential to an adaptive skill like social communication because of the complex nature of conversations that require a quick understanding of verbal content to participate accurately and efficiently. Understanding how cognitive outcomes impact ecologically relevant outcomes like adaptive functioning skills is important for targeted interventions of survivors. Future research should investigate mediators of neurological risk and adaptive functioning to aid in more easily identifying at-risk survivors who require intervention.
Keywords: adaptive functioning**,** brain tumor**,** neuroimaging: structural
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42 Neuropsychological Functioning in Children with Congenital Heart Disease and Autism Spectrum Disorder

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Objective: Congenital heart disease (CHD) is the most common birth defect (Ringle & Wernovsky, 2016), with almost half of children requiring cardiac intervention struggling with neurodevelopmental consequences (Cassidy et al., 2018; Verrall et al., 2019). Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and restricted and repetitive behaviors (APA, 2014). Emerging evidence suggests that individuals with CHD are at higher risk for ASD (Tsao et al., 2017; Sigmon et al., 2019). Furthermore, children diagnosed with CHD and/or ASD demonstrate similar neuropsychological weaknesses, including deficits in attention, executive functioning, fine motor skills, and social skills domains (Cassidy et al., 2018). The aim of this study is to examine the neuropsychological and behavioral profiles of children with CHD compared to ASD.
Participants and Methods: Participants included 141 individuals with ASD (M_{age}= 11.38, SD= 3.2) and 82 with CHD (M_{age}= 8.81, SD= 3.13). Thirteen individuals with comorbid ASD and CHD were also included in separate exploratory analyses. Data were collected via retrospective chart review. Neuropsychological performance on measures of IQ, attention, executive functioning, visual motor integration, and fine motor skills as well as parent and teacher symptom ratings were completed as a part of broader neuropsychological evaluation and were analyzed via T-tests.
Results: Significant differences were seen between ASD and CHD groups on processing speed *t*(140)= -2.45, *p*= .015, set shifting *t*(76)= -2.06, *p*= .04, planning *t*(81)= -3.39, *p*= .001, and visual motor integration *t*(119)= -4.90, *p*< .001 measures, with the CHD group demonstrating higher scores than the ASD group. Per parent and teacher report, although the ASD group had higher elevations across emotional and behavioral scales, including anxiety, withdrawal, and social difficulties, the two groups did not differ on scales assessing learning problems, aggression, or hyperactive/impulsive symptoms, although parents reported learning problems and hyperactive/impulsive symptoms above the clinical threshold for both groups. Teachers reported significantly greater defiance *t*(140)= 3.72, *p*< .001, while parents identified significantly greater inattention *t*(196)= 4.12, *p*< .001 and executive dysfunction *t*(196)= 3.37, *p*< .001 in the ASD as compared to CHD group. In an exploratory analysis, a comorbid ASD and CHD group did not differ in terms of IQ; however, significant group differences were found for adaptive functioning between the ASD only, CHD only, and comorbid groups across subscales (*p*< .001). Post hoc comparisons

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found lower adaptive scores in the ASD only group compared to the CHD only group across subscales. The comorbid ASD and CHD group had lower adaptive scores compared to the CHD only group but not the ASD only group across subscales, with the exception of community use, functional academics, and home living skills.
Conclusions: Although prior research has shown individuals with CHD and ASD demonstrate similar neuropsychological deficits, our findings suggest that executive functioning, processing speed, visual motor skills, and adaptive functioning may be more impaired in ASD compared to CHD. Future research involving individuals with comorbid ASD and CHD is needed to further clarify the neuropsychological differences between these populations.
Keywords: congenital disorders**,** autism spectrum disorder**,** neuropsychological assessment

43 Preliminary Findings of Neurodevelopmental Outcomes in Patients with Septic Shock of a Non-Neurologic Origin

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Objective: Sepsis is one of the leading causes of death in children and is associated with over one-third of deaths in the Pediatric Intensive Care Unit (PICU). Children who have septic shock are a subset of those with sepsis who have a relatively high risk for death and neurological morbidity. Neurodevelopmental sequelae range from electrographic seizures, reductions in brain volume, and mild to moderate functional disability at the time of discharge. However, little is known about long-term neurologic outcomes in children with septic shock as most outcome studies have focused on the broader population of children with sepsis rather than on the smaller subset of children with septic shock. The aim of this study was to learn more about long-term neurodevelopmental outcomes in previously healthy children with septic shock of a non-neurologic origin.
Participants and Methods: Participants were 8 children hospitalized for septic shock (M_{age} = 13.55 years at hospitalization) who were on a vasopressor for at least 6 hours. Average length of hospital stay was 7.33 days, and 6 patients were intubated (M = 2 days). While in the hospital, parents completed retrospective ratings of children's stress and behavior pre-hospitalization using the PROMIS parent proxy and CBCL (baseline). Follow-ups were completed at two weeks (T2; N = 6) and three months (T3; N = 4) post-discharge. Parent ratings were readministered at the follow-ups while the children completed a battery of cognitive and achievement tests (DAS, Beery VMI, WRAML, CTOPP, KTEA, WRAT and NIH Toolbox). Preliminary results from performance on the cognitive battery and parent surveys were compared to the general population mean with one-sample t-tests.
Results: Participants' processing speed was significantly below normative levels on the CTOPP Rapid Non-Symbolic Naming task at both T2 and T3 (ps < .05). Scores on the NIH toolbox Picture Vocabulary task and Crystallized Composite were marginally worse at T2 (ps < .10). Although parent ratings revealed elevations relative to normative standards in pre-hospitalization physical stress on the PROMIS and more behavior problems on the CBCL (ps < .05), elevations in somatic problems were evident on the CBCL at T2 (p < .05). Analyses also revealed trends for reduced social and total competence on the CBCL at T2 (ps < .10), as well as significantly lower CBCL social competence and total competence and significantly higher psychological distress on the PROMIS at T3 (ps ≤ .05).
Conclusions: Preliminary results suggest that septic shock may result in both persistent impairments in processing speed and increased psychological distress. The results are consistent with previous findings of persisting behavioral changes after septic shock in children. Findings also provide new evidence for slowed processing speed as a cognitive consequence of septic shock. In light of heightened pre-hospitalization ratings of behavior problems in some areas, these

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preliminary findings need to be interpreted with caution. However, the sample was small and some of the behavioral problems, such as somatization, were only evident in post-discharge ratings. Recruitment is ongoing and will provide further information on disease consequences.

Keywords: cognitive functioning**,** neuropsychological assessment**,** transdisciplinary research

44 Adaptive Functioning in Children and Adolescents with Sickle Cell Disease

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Objective: Individuals with sickle cell disease (SCD) are prone to multiple complications, including insults to the brain that can cause ischemic lesions and neurocognitive deficits. These can contribute to difficulties with adaptive functioning skills, such as independence with decision making and ability to navigate everyday school and work environments. Much is known regarding risk for neurocognitive deficits in SCD, yet minimal research has evaluated the risk for adaptive functioning delays in children with SCD. In this study, we assessed adaptive functioning in a large cohort of individuals with SCD from school age to adolescence to determine if intellectual functioning, treatment, and demographic predictors were associated with adaptive functioning.
Participants and Methods: In total, 339 patients, 59% HbSS/HbSß^0-thalassemia (severe sickle genotype), and 41% with HbSC/HbSß$^+$-thalassemia (mild sickle genotype), ranging from ages 8–18 years, received neuropsychological screening as part of a larger prospective lifetime cohort study. Screenings were performed approximately every four years and the most recent evaluation data were selected for analyses. Intellectual functioning was measured using the Wechsler Abbreviated Scale of Intelligence (Second Edition). Adaptive functioning was measured using the Behavior Assessment System for Children, Second or Third Edition (parent report), which assesses five adaptive functioning domains (Activities of Daily Living, Adaptability, Functional Communication, Leadership, and Social Skills) and produces an Adaptive Composite Score. Patients' adaptive scores were compared with normative values and linear regression models were used to measure associations between adaptive functioning and age, hydroxyurea treatment status, and social vulnerability (Social Vulnerability Index). For all analyses, false discovery rate adjusted p-values (pFDR) were utilized to adjust for multiple comparisons.
Results: Parent ratings of adaptive functioning skills were average when compared to normative values for most measures (all pFDR>0.05), except for Activities of Daily Living, which was significantly lower in individuals with SCD across both mild and severe sickle genotypes (pFDR<0.05). Lower FSIQ was associated with decreased scores in Functional Communication, Leadership, Social Skills, and the Adaptive Composite Score (all pFDR<0.05) for patients with HbSS/HbSß^0-thalassemia. For patients with HbSS/HbSß^0-thalassemia, increased social vulnerability was associated with poorer adaptive scores on all scales (all pFDR<0.05), except for Activities of Daily Living (pFDR>0.05). Furthermore, in HbSC/HbSß$^+$-thalassemia patients, increased social vulnerability was found to be associated with decreased scores on Activities of Daily Living, Leadership, Functional Communication, and the Adaptive Composite Score (all pFDR<0.05). Age at assessment and hydroxyurea treatment were not significantly associated with any adaptive scale.
Conclusions: For children and adolescents with SCD, poorer parent-reported adaptive functioning skills were associated with lower FSIQ and increased social vulnerability. Surprisingly, the only adaptive scale that was significantly lower in individuals with SCD compared to normative expectations was Activities of Daily Living. Parent ratings of adaptive behavior may not fully capture the impact of disease complications and

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neurocognitive deficits on daily functioning. Future research would benefit from using longitudinal data and older participants to determine the trajectory of adaptive skills over the lifespan as adaptive deficits can limit future education and career opportunities.
Keywords: adaptive functioning**,** sickle cell disease
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45 Mother Knows Best: How Accurate are Caregiver Estimates of Intellectual Ability for Individuals with a Neurologically Complex Condition?

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Objective: Accurate estimation of intellectual ability for clinical research can be challenging when investigating medically complex populations with severe neurological and/or neurodevelopmental impairments. Further, when studying rare conditions, which are often spread across a wide geographical distribution, it may be infeasible to collect direct neuropsychological testing data for research. One such rare condition, cardiofaciocutaneous (CFC) syndrome, involves a range of complications that impact accurate evaluation of intellectual functioning. These complications commonly include seizures, structural brain anomalies, ocular abnormalities, fine motor impairment, and communication challenges. We sought to quantify neurodevelopmental functioning in a large cohort of individuals with CFC syndrome using data that could be collected virtually to ensure the widest enrollment possible. We analyzed the accuracy of caregiver estimates of intellectual functioning in relation to clinician-determined estimates derived from review of neuropsychological, educational, and medical records.
Participants and Methods: A multinational cohort of caregivers (N=138; 89% mothers) of individuals with genetically confirmed CFC syndrome (aged 7 months to 28 years) completed a survey about neurological and neurodevelopmental complications experienced by their child. Caregivers were asked to estimate their child's intellectual functioning by selecting among 5 ranked categories ranging from severe intellectual disability to average functioning, or to indicate that they were unable to make an estimation. Caregivers also completed the GO4KIDDS Brief Adaptive Scale, a validated measure of independent adaptive skills in individuals with intellectual impairment. Medical records were obtained with caregiver authorization, including neuropsychological and educational testing results. Caregiver estimates of intellectual functioning were available for 95/138 individuals (69%), and sufficient medical records were available 68/138 (49%) for clinicians to determine estimates. Caregiver and clinician-derived estimates were compared to ascertain level of agreement.
Results: Clinician and caregiver estimates of intellectual functioning showed moderate agreement, Cohen's kappa= 0.48 (95% CI: 0.33, 0.64). For 56/60 participants (93%), categorical estimates from caregivers and clinicians reviewing developmental records were equivalent or within one ranked category. Caregivers' ability to provide an estimate was reduced for younger children and those without previous standardized assessment. Agreement between caregiver and clinician estimates was similar for patients with and without seizures. Correlations between caregiver-rated adaptive behavior scores and estimates of intellectual functioning were similarly robust for caregiver- and clinician-determined estimates.
Conclusions: Our results emphasize the utility of caregiver estimates of intellectual functioning in rare, neurologically complex populations, and/or in widely dispersed populations, in which study protocols including standardized assessment might not be possible. In order to maximize accuracy of caregiver estimates, descriptive behavioral anchoring similar to that available in standardized adaptive or motor classification systems may be useful. Development of a descriptive rubric to classify intellectual abilities in medically complex populations across a wide age span would be useful for characterizing developmental trajectories and clinical monitoring in rare diseases.

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Keywords: intellectual functioning**,** assessment**,** genetic disorders
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46 Early Childhood Neurodevelopmental Outcomes and Trajectories in Congenital Heart Disease

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Objective: To characterize neurodevelopmental (ND) outcomes of children with congenital heart disease (CHD) in the first five years of life.
Participants and Methods: Participants were children with CHD who underwent surgical intervention in early childhood and completed at least two ND assessments. Assessments were conducted from 12 months to 5 years of age on a six month to annual basis using the Bayley Scales of Infant Development (BSID-III) or Wechsler Preschool and Primary Scales of Intelligence (WPPSI-IV) based on age. To characterize ND outcomes, participants' scores were classified as Average+ (≥ 1 SD of the mean), At-Risk (1-2 SDs below mean), or Delayed (>2 SDs below mean), and changes in scores from time point to the next were classified as stable, improved, or decreased. Analyses included: 1) rates of Average+, At-Risk, and Delayed performance was established overall; 2) chi-square tests of independence were conducted to determine if the number of participants falling in each range differed by timepoint; and 3) characterization of ND trajectories across timepoints. The BSID-III Cognitive and Language Composites were compared to the WPPSI-IV Full Scale Intelligence Quotient and Verbal Comprehension Index, respectively.
Results: A total of 633 ND assessments were conducted across 249 participants. The majority of BSID-III composite and WPPSI-IV FSIQ scores fell in the Average+ range (69.9%), with 18.9% in the At-Risk and 11.2% in the Delayed range. Significantly higher rates of Delayed performance were found for BSID-III Cognitive at 18- and 24- compared to 12-months, Receptive Language at 24- and 36- compared to 30-months, Expressive Language at 36- compared to 30-months, Fine Motor at 18- compared to 30-months, and Gross Motor at 12- and 18- compared to 24-months and 36- compared to 30-months (X^2=3.85-16.01, p=0.049-<.001). Significantly higher rates of At-Risk performance were found for BSID-III Cognitive and Fine Motor at 36- compared to 30-months, and Receptive Language at 36- compared to 24-months (X^2=5.66-9.39, p=0.017-.002). For cognitive scores, most participants' performance remained stable in the Average+ range (64.1%), while some were stable in the At Risk/Delayed (AR/D) range (14.5%). A decrease from Average+ to AR/D was observed in 15.7% of participants. Improved cognitive scores were noted for 5.7%. Language scores remained stable for 58.9% of participants in the Average+ range and 21.0% in the AR/D range. A decrease from Average+ to AR/D was observed in 9.7% of participants. 7.3% of participants had language scores that improved. 3.2% participants decreased from Average+ to AR/D and back to Average+ at a later visit. A total of 47 participants (18.9%) had at least one score that decreased over time.
Conclusions: Consistent with past findings, motor delays were most common during infancy/early toddlerhood while cognitive and language delays occur more frequently after 2 years of age. While most children with CHD make good developmental progress, some are consistently delayed or present with delays in early childhood highlighting the need for serial assessment. Better understanding of the trajectories in ND delay could have implications for early therapeutic intervention.
Keywords: language: development**,** cognitive functioning**,** pediatric neuropsychology
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47 Transcranial Doppler Ultrasound Velocities and Neurocognitive Outcomes in Children with Sickle Cell Disease

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Objective: Children with sickle cell disease (SCD) have elevated risk of stroke. Transcranial doppler (TCD) measures blood flow velocity through major brain arteries and is utilized as a screening assessment for primary stroke prevention, as elevated TCD velocities predict future stroke risk. Prior research with a relatively large sample (n=173) found children with abnormal TCD velocities have lower IQ scores, but this association was only significant when including patients with history of overt stroke. Other studies linking neurocognitive impairment to TCD indices have been limited by small sample size and inclusion of participants with overt stroke and global intellectual disabilities. We tested the hypothesis that elevated TCD velocities would represent a risk factor for neurocognitive deficits.
Participants and Methods: Our sample included 227 children and adolescents with SCD who received TCD screenings and participated in serial neurocognitive surveillance. TCD categories were normal (< 170 cm/sec), conditional (170-199 cm/sec), and abnormal (> 200 cm/sec). For participants with history of multiple TCD screenings, the highest overall value was selected. Participants with history of overt stroke (n=4) and intellectual disability (n=11) were excluded, leaving 212 patients in the final statistical analyses. Neurocognitive assessments occurred at ages 8-9, 12-13, and 16-17 years. Data from the most recent assessment timepoint was analyzed. Cognitive measures administered included versions of the Wechsler Intelligence Scales, Delis-Kaplan Executive Function System, Grooved Pegboard, Wide Range Assessment of Memory and Learning, and Beery Visual-Motor Integration. Laboratory values for hemoglobin, white blood cell count, and platelets were collected within three months of the assessment visit. Participants were stratified by hydroxyurea treatment. Neurocognitive measures were analyzed as dependent variables in univariate models. Statistically significant associations at $p<0.1$ were included in multivariable models using backward selection.
Results: The HbSS and HbSβ^0-thalassemia genotypes were most prevalent (94%) and 53% of participants were male. The rate of conditional TCDs was 25% and nearly 13% of participants had abnormal results. Mean interval between TCD screening and most recent neurocognitive assessment was 6.2 years (±3.5 years). Older age was associated with lower FSIQ (p=.02, Mean=87.9 and 92.6 for teens and school age) and lower fetal hemoglobin (p=.016, Mean=13.8 and 17.0 for teens and school age). Univariate analysis indicated higher TCD velocity was associated with worse visuo-motor skills (p=0.025), lower fetal hemoglobin (p=0.002), low hemoglobin (p=.022), and high white blood cell count (p=.014). When analyzed as a categorical variable, abnormal TCD was associated with visuo-motor (p=0.02) and vocabulary skills (p=0.03). TCD velocity was not retained in the final multivariate model when analyzed categorically. After adjusting for covariates, the association between TCD velocity and visuo-motor skills (estimate=-0.08, standard error [se]=0.04, p=0.04) remained statistically significant when analyzing TCD as a continuous variable.
Conclusions: In a large cohort of children and adolescents with SCD, history of elevated TCD in the absence of overt stroke should not be considered an additional risk factor for poor neurocognitive outcomes. Rather, providers should consider other previously established risk factors for slowed neurocognitive growth, including age, treatment factors, and social determinants of health, when developing recommendations and treatment plans.
Keywords: sickle cell disease**,** cognitive functioning

48 A Comparison of Neurodevelopmental Outcomes at 18 months of Children born Preterm to Children Diagnosed with Congenital Heart Disease

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Objective: Introduction: Children diagnosed with congenital heart disease (CHD) and children born preterm are at risk for poor neurodevelopmental outcomes including delays in language, motor, learning, behaviour, social functioning, and cognition. Prior research has highlighted similar patterns of brain dysmaturation in term neonates with CHD and preterm newborns without CHD. Despite these similarities, studies to date have primarily investigated neurodevelopmental outcomes of these children independently, leaving similarities and differences in neurodevelopmental profiles unclear.
Objective: The objective of the current study was to compare the neurodevelopmental outcomes and parent psychosocial ratings of term children diagnosed with CHD to preterm children at 18 months of age.
Participants and Methods: Participants and Methods: A clinical sample of 132 children born preterm (i.e., ≤ 32 weeks gestational age; n=54) or diagnosed with CHD (n=78) were included from a larger clinical sample of children followed in the neonatal follow up services at the Hospital for Sick Children in Toronto, Canada. Exclusion criteria consisted of congenital infection, intraventricular hemorrhage level 3/4, cerebellar hemorrhage, neonatal stroke (severe ≥ 2/3), or hypoxic-ischemic encephalopathy. CHD diagnoses were categorized as: two ventricles with no arch obstruction (61%), two ventricles with arch obstruction (4%), single ventricle with no arch obstruction (28%), and single ventricle with arch obstruction (7%). All were assessed at 18-months of age. Cognitive, language, and motor function were assessed using the Bayley Scales of Infant and Toddler Development – 3rd Edition. Parent rating of child behavioural and emotional concerns were examined using the Child Behavior Checklist for Ages 1.5-5 (CBCL 1.5-5). Descriptive statistics and chi-square analyses, controlling for multiple comparison, were used to compare the differences between groups.
Results: Results: Preterm and CHD children did not differ on cognitive (M_{CHD}=96.39; $M_{preterm}$=96.60), language (M_{CHD}=87.57; $M_{preterm}$=92.38), and motor scores (M_{CHD}=92.55; $M_{preterm}$=95.57; *p*s > .05). Similarly, there were no differences in the proportion of children with impaired scores (i.e., ≤70) on cognitive and motor performance (*p*s > .05). However, significantly more children in the CHD group (19%) had a score of ≤70 on Language composite compared to the preterm group (4%; $\chi^2(1)= 4.60$, $p = .032$, $V = .193$). Preterm and CHD children had similar proportions of clinically elevated scores (score ≥60), with 39% of the CHD group and 38% of the preterm group endorsing one or more elevated scores. More parents in the CHD group (17%) endorsed clinically elevated concerns on the attention problem subscale compared to parents in the preterm group (4%; $\chi^2(1)= 6.35$, $p = .012$, $V = .219$). Conversely, parents of preterm children (12%) were more likely to report clinically elevated concerns on the anxious/depressed subscale compared to the CHD group (0%; $\chi^2(1)= 6.69$, $p = .010$, $V = .225$).
Conclusions: Conclusions: Despite similar cognitive profiles, children with CHD were more likely to display language impairment compared to children born preterm at 18-months. Unique parent-reported concerns emerged among groups, with more concerns about anxious behaviours being reported among the preterm group and more attention related concerns being reported among the CHD group. Future longitudinal research is needed to better understand unique and overlapping biopsychosocial mechanisms underlying neurodevelopmental outcome.
Keywords: pediatric neuropsychology**,** cardiovascular disease**,** prematurity
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49 The Need for Neuropsychological Administration Modifications for Children with Multi-Factorial Neurodevelopmental, Multisensory, and Motor Challenges

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Objective: The extant literature is limited with respect to the availability of normative data for children with severe, neurodevelopmental, multisensory, and/or motor impairments. Subsequently, few neuropsychological measures exist when a child presents with one of these challenges, but most especially when these disabilities co-occur. Thus, standardized measures must be administered in non-standardized ways in order to characterize a child's relative strengths and weaknesses; these data are vital for treatment planning, educational programming, and other supportive services. As such, it is imperative to create a representative assessment battery that accommodates the multifactorial presentations of medically complex pediatric patients with simultaneous special needs. This case series describes the assessments of three children with co-occurring neurodevelopmental, multisensory, and/or motor impairments, along with our clinical observations and suggestions about how tasks can be adapted to meet the needs of this unique patient population.
Participants and Methods: Three medically-complex pediatric patients with multisensory impairments were administered a modified neuropsychological assessment and adaptive functioning measures, over a period of multiple visits.
Results: All of these pediatric cases benefitted from multiple novel modifications to complete the assessment of each cognitive domain (e.g., attention, executive functioning, learning, memory, language, visuospatial processing).
Conclusions: These pediatric cases illustrate the clinical utility of a flexible and creative approach when conducting neuropsychological assessment with medically complex individuals with multifactorial needs. Future studies, developing standardized measures that can be administered to children with such impairments is vital. Future studies are needed to develop a battery and normative datasets that represent this heterogenous population and respect their individuality.
Keywords: neuropsychological assessment**,** pediatric neuropsychology

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50 Does a Brief Cognitive Screening Measure Predict Candidacy for Bariatric Surgery?

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Objective: Bariatric surgery is the most effective treatment option for morbid obesity and is superior to non-surgical outcomes for weight loss and obesity-related comorbidities (Picot et al., 2009). Pre-surgical psychological evaluations, including the Stanford Integrated Psychosocial Assessment for Transplantation (SIPAT), measure a patient's understanding of bariatric surgery and the extent to which a patient is ready to adhere to post-surgical lifestyle and medication changes. Before and following surgery, patients must demonstrate goal-directed behavioral changes that rely heavily on self-regulatory processes. Intact general cognitive ability is required to prepare for and respond to this treatment approach. The present study investigated associations between patient factors, patients' readiness for surgery and general cognitive ability, and their relationship with surgical candidacy.
Participants and Methods: Adult patients (N=582) underwent a psychosocial evaluation for bariatric surgery (2017-2020) at an academic medical center. Participant Mage was 46.2 (11.7) years, and 81.5% were female (n=317). Patients identified as White/Non-Hispanic (66.7%), African American (24.4%), White/Hispanic (5.4%), and First Nations/Asian, or Bi-/Multiracial (3.5%). At the time of analysis, 271 patients received bariatric surgery. Participants completed the SIPAT and Montreal Cognitive Assessment (MoCA). The SIPAT Patient Readiness score, a domain score of the SIPAT, was used to assess readiness for

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surgery. The MoCA was used to assess general cognitive ability.
Pearson R correlations assessed convergent validity between SIPAT Patient Readiness domain score and MoCA total score. A hierarchical regression controlling for age assessed whether the SIPAT Patient Readiness score and total MoCA score predicted surgical candidacy. Models were conducted in SPSS (a=.05).
Results: Participants with higher SIPAT Patient Readiness scores, indicating difficulty adhering to health behaviors and less of an understanding of bariatric surgery, tended to score worse on the MoCA, $r = -.26$, $p < .001$. Higher SIPAT Patient Readiness scores predicted a decreased likelihood for a patient to be considered a bariatric surgical candidate, while controlling for patient age, $F(4, 274) = 4.39$, $p = .001$. The total MoCA score did not significantly contribute to the model.
Conclusions: Our findings indicate the SIPAT Patient Readiness domain score predicted surgical candidacy. Although this domain does not directly measure cognitive ability, it does consider a patient's ability to implement health behaviors and to have general knowledge of their future surgery. This finding provides support for the SIPAT as a valuable tool to assist providers when determining candidate eligibility.
We did not find evidence of the MoCA's predictive ability in determining surgical candidacy, despite its significant correlation with the SIPAT Patient Readiness score. General cognitive screening as part of a pre-surgical assessment can help identify patients with cognitive impairment. Given our patient sample of middle-aged adults with normal cognitive function, our findings suggest that a brief cognitive screener alone may not provide clinicians enough information regarding patient functioning and social contextual factors. Results may reflect a ceiling effect of the MoCA. Future studies may benefit from expanding our analyses to include more extensive neuropsychological batteries that more fully assess cognition across multiple domains.
Keywords: cognitive screening**,** cognitive functioning
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51 Case Series: Neuropsychological profiles in patients with pre-existing cognitive disorders who developed Covid-19 infection.

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Objective: Studies suggest individuals with COVID-19 can develop neuopsychiatric symptoms post-COVID. In this study, we present cases of patients with pre-existing significant medical conditions and their cognitive recovery post-COVID 19.
Participants and Methods: Inclusion criteria was PCR positive COVID-19 test, pre-existing cognitive concerns, and participation in neuropsychological evaluation. The sample was split into those with subjective cognitive decline post-COVID recovery (CogDecline) and subjective cognitive stability post-COVID recovery (CogStable).
The sample included 10 patients (5 CogDecline, 5 CogStable). Average age was 64 (38-78) and included 7 males, 2 females, and 1 transgender. Nine are white, non-Hispanic and 1 is white Hispanic. Neuropsychological evaluation was on average 75 days after a positive PCR test. Sixty percent required hospitalization for COVID. None required ICU admission or ventilator support.
Results: CogDecline: Three patients without baseline testing included 1 with Parkinsonism (PD), 1 with multiple sclerosis (MS), and 1 with vague cognitive concerns (cog). Neuropsychological evaluations showed weaknesses in executive functions (PD, MS, cog), processing speed (PD, MS), line angle judgments (MS), encoding based memory (cog) and semantic fluency (cog).
Two CogDecline patients had pre- and post-COVID cognitive testing. One patient with PD had 2 pre-COVID evaluations, which revealed interval decline in processing speed, executive functions, and verbal fluency. Post-COVID evaluation showed further declines in letter fluency, memory retention, processing speed,

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and he was unable to complete executive functioning tasks. The second patient was diagnosed with MCI in 2019 and testing revealed interval declines in executive functions and memory encoding. Interval improvements were observed in psychomotor speed and aspects of memory.
CogStable: 5 patients included, 2 awaiting left ventricular assistive device for heart failure (LVAD 1, LVAD 2), and 1 with preexisting severe anxiety and significant cognitive complaints (anx), 1 with Lg-1 autoimmune encephalitis (LG-1), and 1 with PD who underwent right high-intensity focused ultrasound (HiFU) thalamotomy (PD-HiFU) . Patients without baseline testing showed deficits in encoding based memory (anx, LVAD 1, LVAD 2), memory recall (Lg-1), semantic fluency (Lg-1), executive functioning (anx, LVAD 2, Lg-1), and processing speed (LVAD 2). Baseline testing for patient prior to HiFU treatment noted isolated deficits in executive functioning which abated 4 months later on another repeat evaluation, which showed a cognitively intact profile.

Patients with Lg-1 underwent repeat neuropsychological evaluation post IV steroids (Lg-1), 6 months after initial evaluation, which showed cognitive improvements in aspects of memory and executive function.
Conclusions: The most common neuropsychological findings were weaknesses in memory encoding, executive functions and psychomotor speed. Of those with pre-existing neurological illness and baseline neuropsychological evaluation, it is not clear that COVID altered the cognitive trajectory as some patients showed declines that began prior to COVID and others showed mild improvements. For those with cognitive deficits, it was difficult to separate expected findings for the pre-existing neurological illness from what might be expected with pre-existing condition. Limitations include a diverse sample at different disease stages. More research is recommended regarding disease-specific groups and the influence of COVID.
Keywords: cognitive course**,** neuropsychological assessment**,** mild cognitive impairment

52 Executive Functioning and Pain in Young Adults with Spina Bifida: The Mediating Role of Pain Catastrophizing

Diana M. Ohanian, Grayson N. Holmbeck
Loyola University Chicago, Chicago, IL, USA

Objective: Spina Bifida (SB) is a congenital birth defect of the central nervous system, which results in neurocognitive, physical, and psychosocial complications. Specifically, young adults with SB may contend with executive functioning (EF) deficits, such as problems with inhibition and shifting. Further, this population is also characterized by high rates of chronic pain. Research has demonstrated that individuals with chronic pain often exhibit subtle deficits in inhibition and shifting. Despite the prevalence of pain in SB, there is relatively little research on pain processes in this population, particularly in relation to the unique cognitive profile of SB. Pain catastrophizing, or the tendency to ruminate on the threat of pain, is considered one of the most reliable predictors of pain-related disability and severity and has been found to be more prevalent in populations with reduced EF. This study proposed that for young adults with SB, difficulties with inhibition or shifting would increase one's tendency to engage in pain catastrophizing, which in turn would result in increased pain severity and pain interference.
Participants and Methods: Participants were young adults with SB, ages 18-25 (52.5% female, 61.3% Caucasian), who were recruited as a part of a larger longitudinal study of youth and young adults with SB (N=80). Participants predominately had myelomeningocele SB (86.1%) and a shunt (78.5%). Participants reported on age, executive functioning (BRIEF), pain catastrophizing (PCS), and pain severity and interference (BPI). SES was derived from parent report. Healthcare professionals reported on SB severity. Preacher and Hayes' (2008) bootstrapping methods were used to determine the impact of EF deficits on pain severity and interference, as mediated by pain catastrophizing. Covariates included age, SB severity, SES, and gender.
Results: An indirect-only mediation model revealed that pain catastrophizing significantly mediated the relationship between inhibition and shifting and pain severity and pain interference.

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Specifically, greater difficulties with inhibition and shifting was associated with increased pain catastrophizing, which in turn was associated with greater pain severity and interference. The direct relationship between inhibition and shifting and pain severity and interference was nonsignificant.
Conclusions: For young adults with SB, reduced EF (inhibition and shifting) was associated with pain catastrophizing, which in turn was associated with both pain severity and pain interference. While reduced EF does not directly result in increased pain symptoms, it may leave young adults with SB vulnerable to developing maladaptive pain-related stress responses (i.e., catastrophizing), which are strongly associated with pain severity and pain-related disability. Therefore, due to the cognitive profile in SB, individuals with SB *and* pain are at increased risk for negative outcomes. Young adults with SB and pain should be monitored for catastrophic thoughts at regularly scheduled clinic visits and be taught pain coping strategies that address maladaptive cognitions, are developmentally appropriate, and consider the unique neurocognitive deficits (such as reduced EF) in this population.
Keywords: spina bifida**,** executive functions**,** quality of life
Correspondence: Diana Ohanian, Loyola University Chicago, dmohanian@gmail.com

53 The Effects of Obesity-Related Health Factors on Connectivity within Resting State Networks

Kailey G Langer[1], Keyanni J Johnson[1], John B Williamson[1], Joseph M Gullett[1], Eric C Porges[1], John Gunstad[2], Adam J Woods[1], Ronald A Cohen[1]
[1]University of Florida, Gainesville, FL, USA. [2]Kent State University, Kent, Ohio, USA

Objective: Obesity and related morbidities (e.g., type 2 diabetes, arthritis, cardiovascular disease) are risk factors for cerebrovascular disease. White matter lesions and metabolic disturbances may impact communication between brain regions that are important for a variety of higher-order cognitive functions. Prior research has demonstrated various brain structural and functional differences between patients with type 2 diabetes, rheumatoid arthritis, hypertension, and obesity and healthy controls. The aim of the present study is to determine whether, within a group of adults with obesity, health indicators and obesity-related disease status are related to altered connectivity between regions within established cognitive networks at rest.
Participants and Methods: Baseline resting state functional magnetic resonance imaging (rsfMRI), structural MRI, self-report data (e.g., height, weight, and yes/no status of type 2 diabetes, hypertension, and arthritis), and hemoglobin-a1c lab results were collected from 124 adults with obesity (mean age = 44.68 ± 12.43, mean BMI = 46.11 ± 7.87, 81.4% female). BMI was calculated using self-reported height and weight. MRI data were manually reviewed to assess quality. CONN toolbox was used to preprocess and analyze rsfMRI data. An atlas for seven-network resting state parcellation published by Yeo et al. (2011) was used. Participant data were imported into CONN and the effects of covariates were analyzed across all subjects for each of the seven resting state networks. For each connection between network regions of interest (ROI), a T-test was performed within CONN.
Results: An effect of arthritis was observed between two ROIs within the default mode network (DMN; T(122)=-3.64, p-uncorrected=0.0004, p-FDR=0.018). This effect was such that those with arthritis (n=49, 16% rheumatoid, 42% osteo, 42% uncertain of type) showed significantly reduced connectivity between DMN clusters in the anterior portion of the right superior temporal sulcus and the left prefrontal cortex positioned on the superior frontal sulcus. Findings indicated further effects of arthritis, BMI, type 2 diabetes, and hemoglobin-a1c were each significantly associated with within-network connectivity using an uncorrected p-value < .01 criterion; however, these did not survive correction for multiple comparisons.
Conclusions: In adults with obesity, various obesity-related health factors were associated with altered connectivity at rest between ROIs within higher-order cognitive networks. Specifically, individuals with all type arthritis

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displayed reduced connectivity between regions within the DMN. Other findings did not survive correction for multiple comparisons, though uncorrected p-values indicated potentially altered connectivity in the cingulo-operculate and frontal-parietal control networks in adults with obesity who have arthritis, higher BMI, higher hemoglobin-a1c, or type 2 diabetes. A potential mechanism for this effect may be brain changes due to pain related to arthritis; in the case of rheumatoid arthritis metabolic disturbances also may play a role. Overall, these findings provide evidence to suggest that interventions to prevent and treat arthritis may be viable to mitigate potential cognitive impairment within adults with obesity.
Keywords: brain function

Poster Symposium: Neuropsychiatric Effects of SARS-CoV-2 Infection

3:00 – 4:30 pm
Friday, February 4, 2022

28 Neuropsychiatric Effects of SARS-CoV-2 Infection

Chair

Kristine Lokken
UAB, Birmingham, USA

Discussant

Kristine Lokken
UAB, Birmingham, USA

It was apparent early on that the SARS-CoV-2 global pandemic, independent of actual infection of the virus, contributed to a milieu associated with increased neuropsychiatric issues. Sharp increases in adverse mental health conditions, including depression, anxiety, insomnia, substance use, trauma-related disorders, suicidal ideation, and emotional eating have been reported among the US general population beginning in March 2020 to the present. Certain groups, including minorities and those with pre-existing neuropsychiatric conditions, have had worse mental health outcomes. Increases in cognitive complaints, such as inattention due to disruptions in routine and the distractions of learning and working from home, and spikes in accelerated cognitive aging and neurodegenerative disease among older adults are also reported.
It is nearly impossible to disentangle situational pandemic-related neuropsychiatric outcomes from those associated with infection of SARS-CoV-2 virus confirmed with PCR testing. Moreover, it is well-known that neurocognitive and psychiatric issues can be inextricably linked and bidirectional. Acute and severe infection with SARS-CoV-2 has been shown to have both direct and indirect effects on the brain, with case reports of encephalitis, thrombotic events, cerebral edema, and possible neurovirulent effects. Proposed mechanisms under exploration are vascular and endothelial cell involvement and neuroinflammation secondary to an existing systemic pro-inflammatory state, blood-brain barrier disruption associated with the ACE2 receptor, and cytokine release syndrome. Complicating this is that the brain is affected by sedation, heart and lung organ failure, and hypoxemia, which can be present in severe SARS-CoV-2 infection. Substantial inequalities of age and race exist for COVID-19 outcomes, with older adults and Blacks having disproportionately higher morbidity and mortality. There is emerging data that approximately 30% of those infected with SARS-CoV-2 exhibit neuropsychiatric symptoms as a part of the acute disease course, and many go on to experience Post-Acute Sequelae of SARs-CoV-2 Infection (PASC). PASC is gaining more attention in the literature, with patients, even those with a mild disease course, reporting a myriad of symptoms including fatigue, “brain fog”, insomnia, and other somatic and emotional issues persisting for more than three months post-infection.
The focus of this symposium is to summarize existing knowledge of neurological, neuropathological, and neuropsychological manifestations of SARS-CoV2 infection and to identify key knowledge gaps. The symposium

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will begin with an overview of the neurological effects of COVID-19 by neuroimmunologist, Dr. Shruti Agnihotri, followed by a discussion of the neuropathological correlates of COVID-19 and methodological challenges of post-mortem observations led by Dr. Michael Williams. Our panel of experts has collected data from a large University Medical Center located in the Deep South and neuropsychologist, Dr. Roy Martin is uniquely poised to discuss the intersection of social determinants of health and racial disparities in COVID-19. Dr. Pariya Wheeler uses the CNS infection of HIV as a model to discuss predicted neurocognitive outcomes and dementia risk following infection with COVID-19. Dr. Gitendra Uswette will end the session with a discussion of promising pilot data for a novel therapeutic intervention for brain fog due to PASC.

Keywords: medical disorders/illness

822 Neurologic Manifestations of COVID-19

Shruti Agnihotri, Stephen Benesh, Kristine Lokken
UAB, Birmingham, AL, USA

Objective: The virus, SARS-CoV-2, which is responsible for the current pandemic of coronavirus disease 2019 (COVID-19), is primarily associated with respiratory illness. However, neurologic complications from COVID-19 have been noted since the early days of the pandemic. These include various symptoms like headache, dizziness, and anosmia as well as neurologic complications of severe COVID-19 like encephalopathy, seizures, and stroke. Furthermore, emerging evidence suggests that survivors of COVID-19 continue to experience various symptoms including neurologic symptoms after the resolution of the acute phase of infection. These have been referred to colloquially as “Long-COVID” and are now referred to scientifically as Post-Acute Sequelae of SARS-CoV-2 infection (PASC). Of particular interest is the long-term effects on cognition of COVID-19 in survivors and whether these individuals will have a higher risk of neurodegenerative disorders.

Participants and Methods: We performed an integrative literature review on neurologic complications of acute COVID-19 as well as PASC. Keywords for the search included Neurologic, Neurological, COVID-19, SARS-CoV-2, Encephalopathy, Stroke, Encephalitis, Delirium, cognition, memory loss, Long-COVID, PASC, post-COVID.

Results: Neurologic complications of COVID-19 can be divided into symptoms associated with acute COVID-19 infection, complications associated with severe COVID-19, and neurologic manifestations as part of PASC. In various studies, neurologic symptoms are reported in up to 94% of all patients with early COVID-19 and include headaches (45% to 80%), dizziness (8% to 16%), anosmia (65% to 85%), ageusia (55% to 85%) and myalgias (57% to 63%). Neurologic complications of varying severity including stroke, seizures, encephalitis, delirium, Guillain-Barre syndrome, transverse myelitis, and others have been reported in 36.4–82.3% of severe COVID-19 patients worldwide. In a large retrospective study on patients with neurologic sequelae after COVID-19 who were evaluated in a clinic setting, 70% were females. The main neurologic manifestations were “brain fog” (81%), headache (68%), numbness/tingling (60%), dysgeusia (59%), anosmia (55%), myalgias (55%) and fatigue (85%). Anxiety and depression were the most common co-morbidities in this group (42%). Recent data suggests that older individuals have persistent cognitive impairment after recovery from acute COVID-19. In another study, higher levels of total tau protein, neurofilament light, and glial fibrillary acid protein were found in hospitalized COVID-19 patients who suffered from encephalopathy.

Conclusions: Neurologic symptoms are very common in early COVID-19 infection and include headache, dizziness, anosmia, dysgeusia, and myalgias. In severe COVID-19, neurologic complications like stroke, encephalitis and delirium are associated with higher morbidity and mortality. Neurologic complications as part of PASC are more common in women and can be seen in patients with mild or asymptomatic acute COVID-19 infection. More work is needed to understand the long-term neurocognitive outcomes among survivors of COVID-19 and whether risk of

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neurodegenerative diseases like Alzheimer's dementia or Parkinson's disease is increased and whether this cohort may develop these diseases prematurely. Understanding of underlying pathophysiologic mechanisms will allow for appropriate treatment and prevention strategies in individuals with PASC.
Keywords: medical disorders/illness**,** infectious disease

825 Postmortem Neuropathologic Findings of COVID19 Infection

Michael Williams, Richard Powers, Rati Chkheidze
UAB, Birmingham, AL, USA

Objective: Increasing numbers of COVID-19 patients experience acute and chronic neurologic symptoms and complications, including loss of taste and smell, dizziness, headache, impaired consciousness, and confusion. Increased rates of ischemic stroke and spontaneous CNS hemorrhage have also been reported. Despite ample clinical evidence of CNS involvement by COVID-19, reported neuropathological findings in the postmortem brain tissues of COVID-19 patents to include a variety of hypoxic/ischemic changes (acute and subacute micro and macro infarct), thrombosis, intracerebral and subarachnoid hemorrhage, nonspecific microglial activation and/or lymphocytic infiltration. These studies usually focus on COVID-19 patients and lack evaluation of the control groups to determine whether these findings are specific to COVID-19 infection or not.
Participants and Methods: In this study, we examined brain specimens from 94 deceased COVID-19 patients who underwent autopsy procedures at UAB. As a control group, we selected 61 autopsy brain specimens with COVID-19 negative PCR test at the time of the autopsy procedure. Clinical data on the presence of comorbid conditions, such as hypertension, diabetes, hyperlipidemia, chronic cardiac, and renal disorders were collected for both groups. Using routine neuropathology approaches, the extent of vascular pathology; acute, subacute, and remote ischemic hemorrhagic lesions; microvascular thrombosis, cerebral edema, and intraparenchymal and subarachnoid hemorrhage were examined. For histopathologic examination hippocampus, frontal and parietal neocortices and white matter, basal ganglia, midbrain, pons, medulla, and cerebellum were selected.
Results: The mean age in the COVID-19 group was 63 years and 60 years in the control group. There were more males in both groups than females (COVID-19 – 2.8:1, Control – 1.5:1). There was no statistically significant difference between groups in the frequencies of systemic comorbid conditions; 93% of COVID-19 cases and 87% of control cases had at least one gross and/or microscopic neuropathologic finding. COVID-19 cases showed higher rates of combined acute findings, including brain edema, acute and subacute hypoxic/ischemic lesions, thrombosis, and hemorrhage (61% vs 39%, P-value – 0.002). When these features were compared separately, none reached statistical significance. Arteriolosclerosis (66% vs 66%), atherosclerosis (17% vs 26%), and remote infarcts (19% vs 18%) were quite common findings with similar frequencies in both groups.
Conclusions: In summary, our data show a higher tendency of acute events in the patients with COVID-19 infection. These findings do not quite explain the clinical symptoms seen in patients with neurologic complications, and likely represent the sequela of COVID-19 systemic complications. More comprehensive neuropathologic and molecular approaches are necessary to better understand the mechanisms of neurologic complications of COVID-19 infection.
Keywords: medical disorders/illness**,** infectious disease

826 Neurological Sequelae of COVID-19 in the Deep South: Examining Racial Disparities within a Social Determinants of Health Framework

Roy Martin, John Osborne, Shruti Agnihotri, Kristine Lokken, Richard Kennedy
UAB, Birmingham, AL, USA

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Objective: The objective of this presentation will be to (1) highlight recent research findings on racial disparities associated with the presentation and outcome of COVID-19 related subacute and long-term neurological manifestations (i.e., NeuroCOVID) with a focus on African Americans living in the U.S. Deep South region, and (2) examine individual level and structural level (i.e., systemic racism) factors possibly affecting NeuroCOVID outcomes in minority populations.
Participants and Methods: Coronavirus disease-19 describes the multi-organ disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2). Millions across the globe have been affected by this illness that includes long-term medical disability, death, loss of family members, and economic hardship. The U.S. literature clearly describes that COVID-19 has shown a disproportionate negative burden upon the health and socioeconomic status of minority populations (e.g., African Americans, Hispanic/Latino, and Native Americans). These outcomes are viewed against the backdrop of longstanding historical racial inequalities affecting global health outcomes. Findings of disproportionately worse medical-associated outcomes in minority populations are not a new phenomenon or unique to the COVID pandemic, and reflect recurrent societal factors that manifest themselves in worse COVID-related incidence and outcomes.
Results: What has been clearly demonstrated during this COVID-19 pandemic era is that racial minority populations experience higher COVID positivity infection rates, as well as higher morbidity and mortality rates. Multiple studies have detailed a serious and heterogeneous presentation of acute/subacute/long-term neurological morbidity associated with COVID-19 including encephalopathy, delirium, headaches, brain fog, and anosmia. Within these neurological populations, COVID-19 has been found to place a particular burden on those with dementia and cerebrovascular disease (both of which have higher incidences in African American population). Both conditions have a higher incidence in the U.S. Deep South region. In addition, little is known if an increased risk exists for post-COVID cognitive impairments in minority populations with either non-hospitalized or hospitalized COVID and the extent to which the disparate social/economic/healthcare structures play a role in such decline.
Conclusions: Our discussion will be framed within a social determinants of health context describing the complex and multi-factorial interplay between COVID-19 (i.e., biological), individual (i.e., medical health factors, psychosocial), and societal issues. We will present data from our institution (a large regional US Deep South medical center) examining these issues over the pandemic period. We will encourage discussion regarding these important issues as related to directions for future research, intervention, and policy advocacy.
Keywords: medical disorders/illness**,** infectious disease

832 Neurocognitive Outcomes and Dementia Risk in Adults with COVID-19: Using HIV as a Model

Pariya Wheeler, David Vance
UAB, Birmingham, AL, USA

Objective: Though research is rapidly evolving, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the associated syndrome, coronavirus disease 2019 (COVID-19), has demonstrated central nervous system (CNS) manifestations (dubbed NeuroCOVID). The frequency and severity of NeuroCOVID, mechanisms of action, and risk factors, including the relationship with severity of the acute syndrome, are not fully understood, as well as whether COVID-19 accentuates or accelerates risk for Alzheimer's Disease and Related Dementias (ADRD) in high-risk groups. One particularly high-risk group is people living with HIV (PLWH), who are already at higher risk of cognitive impairment than uninfected counterparts. Understanding whether PLWH are at higher risk for NeuroCOVID has important research and clinical implications, but further, given many similarities between the conditions, NeuroHIV may serve as a useful model for studying NeuroCOVID.
Participants and Methods: We performed an integrative literature review on both similarities

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between NeuroHIV and NeuroCOVID, as well as on whether there is any data-driven evidence of greater risk for NeuroCOVID among PLWH. **Results:** As of July 2021, data-driven studies examining cognitive outcomes among PLWH diagnosed with COVID were scarce. One large study of 3,411 participants found that prevalence and type of COVID-19 symptoms (only CNS symptoms examined were headache and loss of taste or smell) were similar in PLWH and seronegatives, while PLWH were more likely to have tested positive for COVID-19 than seronegatives. Studies discussing theoretical parallels between NeuroCOVID and NeuroHIV were more available. Results showed that while the virology of both diseases is vastly different, they share many biological and clinical similarities. These include risk factors for poorer prognosis (including cognitive impairment) including older age and higher rates of comorbidities, particularly vascular diseases. Both also share risk for poorer affective outcomes, including depression and anxiety, and PTSD in particular, which could exacerbate cognitive impairment. Though the etiology of CNS effects may be driven by multiple mechanisms, evidence for neurovascular/inflammatory processes has been consistent in biomarker studies (e.g., C-reactive protein, interleukin-6, tumor necrosis factor-alpha) for both HIV and COVID-19. All of these risk factors and mechanisms share links with ADRDs. In fact, both NeuroHIV and NeuroCOVID studies have shown alterations in traditional ADRD biomarkers (e.g., amyloid-beta 42, tau, neurofilament light chain). **Conclusions:** Though no studies have yet emerged, it may be presumed that as data becomes available, evidence may show synergetic effects of both COVID-19 and HIV on the cognitive health of PLWH. Currently, the MACS/WIHS Combined Cohort Study (a 30+ year longitudinal study of men and women with and with HIV) is collecting such data and may be able to provide such insights. Outside of the context of HIV, more work is needed in general to understand the long-term neurocognitive trajectories among those with COVID-19 and whether ADRD risk is increased. NeuroHIV may serve as a useful model for both the study and treatment of NeuroCOVID across diverse populations. For example, there is a growing body of work on protective factors and intervention strategies for successful cognitive aging among PLWH which may inform NeuroCOVID treatment strategies, ranging from physical activity to cognitive remediation therapies.

Keywords: medical disorders/illness**,** infectious disease

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842 Reduced Long-COVID Brain Fog: Findings from a Pilot Study of Constraint-Induced Cognitive Therapy

Gitendra Uswatte, Edward Taub, Karlene Ball, Brandon Mitchell, Jason Blake, Staci McKay, Victor Mark, Shruti Agnihotri, Terika Miller, Elizabeth Pollard, Riwad Iftekhar, Kristine Lokken
UAB, Birmingham, AL, USA

Objective: Persistent brain fog is common in adults with Post-Acute Sequelae of SARS-CoV-2 infection (PASC), in whom it causes distress and in many cases interferes with performance of instrumental activities of daily living (IADL) and return-to-work. There are no interventions with rigorous evidence of efficacy for this new, often disabling condition. The purpose of this pilot is to evaluate the efficacy, on a preliminary basis, of a new intervention for this condition termed Constraint-Induced Cognitive therapy (CICT). CICT combines features of two established therapeutic approaches: cognitive processing speed training developed by the laboratory of K. Ball and the Transfer Package and task-oriented training components of Constraint-Induced Movement therapy developed by the laboratory of E. Taub and G. Uswatte.
Participants and Methods: Participants were ≥ 3 months after recovery from acute COVID symptoms and had substantial brain fog and impairment in IADL. Participants were randomized to CICT immediately or after a 3-month delay. CICT involved 36 hours of outpatient therapy distributed over 4-6 weeks. Sessions had three components: (a) video game-like training designed to improve how quickly participants process sensory input, (b) training on simulated IADLs following shaping

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principles, and (c) a set of behavioral techniques designed to transfer gains from the treatment setting to daily life, i.e., the Transfer Package. The Transfer Package included (a) negotiating a behavioral contract with participants and one or more family members about the responsibilities of the participants, family members, and treatment team; (b) assigning homework during and after the treatment period; (c) monitoring participants' out-of-session behavior; (d) supporting problem-solving by participants and family members about barriers to performance of IADL; and (e) making follow-up phone calls. IADL performance, brain fog severity, and cognitive impairment were assessed using validated, trans-diagnostic measures before and after treatment and three months afterward in the immediate-CICT group and on parallel occasions in the delayed-CICT group. IADL and brain fog outcomes are described for the three participants in the immediate-CICT group for whom data have been tabulated.
Results: Family members reported that participants had clinically meaningful improvements (i.e., changes ≥ 2 points) in performance of IADL outside the treatment setting as measured by the Canadian Occupational Performance Measure Performance scale (S1-3: 3.2, 4.4, and 3.6 points, respectively). These correspondent reports were confirmed by improvements on an observational, in-laboratory, blinded test of simulated IADL, i.e., the Process scale of the Assessment of Motor and Process Skills (S1-3: 1.7, 1.3, and 0.3 *SD* units, respectively). Participants also reported large reductions in brain fog severity on the Mental Clutter Scale (S1-3: 6, 3, and 6 points, respectively). This scale ranges from 0 to 10. Notably, S1, who scored a 6 before treatment, scored a 0 afterward, i.e., her symptoms had resolved completely.
Conclusions: These preliminary findings warrant confirmation by a large-scale randomized controlled trial. To date, CICT shows high promise as an efficacious therapy for brain fog due to PASC. All three pilot participants had large, meaningful improvements in IADL performance outside the treatment setting, in addition to large reductions in brain fog severity.

Keywords: medical disorders/illness**,** cognitive rehabilitation

LIVE Plenary F: The Complexity of Racial Differences in Studies of Alzheimer Disease

Presenter: John Carl Morris

2:00 - 2:55pm
Friday, 4th February, 2022

Abstract & Learning Objectives:
The vast majority of research volunteers in observational studies of Alzheimer disease (AD) are non-Hispanic white persons (Whites). It is unknown to what extent findings from studies of non-diverse cohorts apply to members of groups under-represented in research. By far the largest such group in St. Louis, Missouri, self-identifies as African American (Blacks). Many, but not all, studies find that Blacks are at greater risk for AD than Whites despite a lower risk for AD conferred by the ε4 allele of apolipoprotein E in Blacks. The factors that may contribute to differences regarding AD risk and expression in Blacks and Whites are being examined, in part, by comparing molecular biomarkers of AD in individuals who self-identify their race. In this context, race is considered as a social, rather than a biological, construct. Social determinants of health (e.g., inequities in the quality and length of education) must be evaluated as potential mediators of any observed racial differences. To date, molecular biomarker differences between Blacks and Whites largely have been limited to cerebrospinal fluid concentrations of tau protein, both total tau and tau phosphorylated at threonine 191, and of soluble TREM2. However, small sample sizes, selection biases, and inadequate consideration of social determinants of health that relate to longstanding structural racism have limited interpretation of these observations.

Upon conclusion of this course, learners will be able to:
- Analyze race as a social construct
- Describe discordant findings as to differential risk for Alzheimer disease for Blacks versus Whites

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- Incorporate social determinants of health in analyses of potential racial differences in Alzheimer biomarkers

Live Meeting Close

2:55 - 3:00pm
Friday, February 4, 2022

LIVE INS Business Meeting

3:00 - 3:30pm
Friday, February 4, 2022

INS Student Liaison Committee Panel 02: Cross-Cultural Neuropsychology Across the Globe

Presenters: Dr. Alberto Fernandez, Dr. Sanne Franzen, Dr. Tedd Judd and Dr. Lingani Mbakile-Mahlanza

3:00 - 4:30pm
Friday, February 4, 2022

Symposium 09: Has Alzheimer's disease been cured? Perspectives on FDA approval of aducanumab, the first disease-modifying treatment for Alzheimer's disease

3:00 - 4:30pm
Friday, February 4, 2022

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17 Has Alzheimer's disease been cured? Perspectives on FDA approval of aducanumab, the first disease-modifying treatment for Alzheimer's disease

Chair

Adam Brickman
Columbia University, New York, USA

Discussant

Robin Hilsabeck
The University of Texas at Austin Dell Medical School, Austin, USA
Alexandra Weigand
San Diego State University/University of California San Diego Joint Doctoral Program in Clinical Psychology, San Diego, USA
Jennifer Manly
Columbia University, New York, USA

In June 2021, the US FDA granted accelerated approval for aducanumab (Adulhelm) to treat Alzheimer's disease (AD). The drug is marketed as the first "disease modifying" treatment for AD and has been celebrated by many as an advancement over existing symptomatic treatments. Aducanumab was approved based on its effect on lowering biomarkers of amyloid plaques, but not on its effect on cognitive and functional outcomes.
Most aspects of the approval process have been controversial. (1)The two clinical trials on which the primary evidence for approval was based were both discontinued after a planned interim analysis for futility and showed only *post hoc*, tenuous signal on cognitive and functional outcomes in a circumscribed subgroup of enrolled participants. Participants enrolled in the treatment arm had significant risk of brain edema and microhemorrhage. (2) An FDA external advisory committee voted unanimously that there was insufficient evidence to grant approval. After drug approval, 3 panel members resigned in protest. (3) The drug pricing was set at $56,000 per annum, not including associated costs of safety monitoring, clinical visits, and diagnostic workup. (4) The Alzheimer's Association invested significant resources into lobbying efforts and public messaging that endorsed approval for the drug, and an unprecedented collaboration between the drug manufacturer, Biogen, and the FDA appeared to take place during clinical testing of the drug. (5) The package insert, which describes drug indication, was revised because of confusion over appropriate use. (6) Finally, in the post-approval phase, Biogen launched an advertising campaign, which was viewed by some as preying on the fears of older adults.

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The purpose of this symposium is to provide neuropsychologists with an overview of the contextual factors that led to the approval of aducanumab and to highlight important considerations when discussing the FDA approval with patients and their families. Dr. Adam Brickman will describe the approval process of aducanumab and many of its controversial elements. He will argue through a historical lens that the AD research community helped "pre-ordain" the approval of aducanumab by shifting the research focus and conceptualization of AD as a neuropsychological syndrome towards a reductionist view of AD as synonymous with amyloidosis. Dr. Robin Hilsabeck will provide an overview of clinical trials methodology, both in general and specific to AD, and guidance about patient selection, drug administration, and treatment monitoring. Alex Weigand will discuss a 3-step approach to centering individuals with AD and their loved ones in the context of the aducanumab controversy. Finally, Dr. Jennifer Manly will describe the lack of evidence for safety and efficacy of aducanumab among Black, Indigenous, Latinx, and Native Hawaiian or Pacific Islander populations, discuss the implications of decades of disregard for inclusion in AD biomarker research, and provide recommendations for improving the rigor of AD and related dementia research.
The approval of a disease modifying drug for AD can be viewed as one of the most significant advances in recent history. But will this treatment make a positive impact on the symptoms that matter to individuals with AD and their loved ones?
Keywords: dementia - Alzheimer's disease, treatment outcome, cross-cultural issues

987 Introduction - Symposium 09: Has Alzheimer's disease been cured? Perspectives on FDA approval of aducanumab, the first disease-modifying treatment for Alzheimer's disease

Adam Brickman
Columbia University, New York, NY, USA

535 When "disease modification" does not include symptoms: Did the conceptualization of Alzheimer's disease contribute to the approval of an ineffective medication?

Adam M. Brickman
Columbia University, New York, NY, USA

Objective: The recent US FDA accelerated approval of Biogen's aducanumab (Aduhelm) for the treatment of Alzheimer's disease (AD) inspired spirited discussion among many scientists and practitioners working in the field. Aducanumab is a monoclonal antibody directed against beta amyloid protein, one of the putative core pathological features of AD. It is a monthly infusion that requires regular monitoring for brain edema and hemorrhage, termed ARIA-E and ARIA-H, respectively.
Participants and Methods: The approval of the medication followed two identically designed phase III clinical trials, EMERGE and ENGAGE, which were both halted when an independent monitoring group conducted a planned interim analysis and determined that treatment was "futile," or not likely to have a clinical benefit. Several months later, Biogen indicated that subsequent analyses of data from the discontinued trials evidenced a positive treatment effect for the highest dose of aducanumab on the primary and secondary endpoints (CDR-SB, ADAS-Cog, and MMSE) in the EMERGE study but no such effect in the identical ENGAGE trial.
Results: In both trials, there was strong evidence of dose-dependent reduction in amyloid levels via PET scanning. Based on the results of these *post hoc* analyses and evidence of target engagement, the FDA granted approval under an accelerated pathway despite consensus from an FDA advisory panel that there was insufficient evidence for clinical efficacy.
Conclusions: There were many problems with the pre-approval process and post-approval marketing of aducanumab, ranging from concerns about collaboration between the sponsor and FDA, disregard for advisory panel conclusions, composition of study participants, cost, access, and impact. One issue that has gone unexamined is the role of the academic

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establishment in the approval of aducanumab. Central to the claim that the results of the trials provide evidence that aducanumab is "reasonably likely to predict important benefits to patients" is the argument that amyloid clearance is, by definition, "disease modification." This concept reflects a gradual shift over the past 30+ years in the taxonomy of AD from conceptualization of AD as a neuropsychological syndrome with pathological correlates, to a diagnosis of inclusion that considers neuropsychological functioning with supportive biomarker evidence, to, most recently, a diagnostic framework that defines the disease purely in terms of biomarker evidence of pathology irrespective of presence of neuropsychological symptoms (so-called "AT(N)" criteria, for amyloid, tau, neurodegeneration). This shift is a direct clinical application of the Amyloid Hypothesis and was ushered in by high-profile consensus panels comprising academic thought leaders along with advancements in biomarker development. The field's consensus in defining AD as one of amyloidosis without respect to clinical symptomatology essentially pre-ordained the approval of a medication that reduces amyloid irrespective of its impact on cognition and function. This presentation will review available data that led to the approval of aducanumab in the context of historical trends in the conceptualization of AD pathogenesis and diagnosis, and suggest pathways forward in terms of incorporating cognition into disease conceptualization and efficacy trials that claim disease modification.

Keywords: dementia - Alzheimer's disease

536 Overview of clinical trials methodology and guidance for patient selection and treatment monitoring of aducanumab: what neuropsychologists need to know

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Objective: The accelerated approval of aducanumab (Aduhelm) by the Federal Drug Administration (FDA) for treatment of Alzheimer disease (AD) was a significant and historic event in the landscape of therapies for this devastating disease. Significant because it is the first drug approved for the treatment of AD in 18 years, and historic because it is the first to be labeled as a "disease modifying" versus "symptomatic" treatment.
Participants and Methods: In order to assist patients and families living with AD in decision making about this new treatment, neuropsychologists may benefit from a review of clinical trials methodology, both generally and specific to AD, and from guidance about patient selection, drug administration, and treatment monitoring.
Results: The following topics will be presented: (1) an overview of clinical trial phases, (2) FDA approval options, including what it means to obtain accelerated approval, (3) typical inclusion/exclusion criteria and outcomes measures used in AD clinical trials, (4) expert panel recommendations about what makes a patient appropriate for treatment with aducanumab, how the drug should be administered, and how to monitor for amyloid-related imaging abnormalities (ARIA), and (5) practical considerations for implementation in real-world clinical settings.
Conclusions: The historic accelerated approval of aducanumab has changed the landscape of treatment for AD. Many patients and families living with AD are eager to learn about this drug and whether they are appropriate treatment candidates. It is important for neuropsychologists to understand clinical trials methodology to critically evaluate the evidence for drug approval and to familiarize themselves with how the drug is administered, its safety risks, and who is most likely to benefit.

Keywords: dementia - Alzheimer's disease

537 Keeping the focus of aducanumab on individuals with Alzheimer's disease and their loved ones

Alexandra J. Weigand

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Objective: On June 7, 2021, the Federal Drug Administration (FDA) approved aducanumab (Aduhelm) for the treatment of Alzheimer's disease. This decision was immediately met with mixed reactions from the Alzheimer's research and clinical community. Some are hopeful about the promise of this drug, whereas others remain confused, and in some cases outraged, by the FDA's disregard for recommendations against approval from an external advisory committee based on lack of sufficient evidence from clinical trials. As pressure from the Alzheimer's research community and internal investigations lead to a rapidly evolving landscape around aducanumab, uncertainty abounds not only among professionals, but also among the general public. Centering the individuals for whom this drug was developed is critical for us to keep at the forefront of our discussions and decisions about aducanumab.
Participants and Methods: I propose a 3-step approach to centering individuals with Alzheimer's and their loved ones in the case of aducanumab: accessibility of information, effective communication, and inclusion in decision making.
Results: (1) Accessibility to information on aducanumab can be achieved on multiple levels. The first level necessitates open access to primary research, with transparency of methods including a priori hypotheses. The second level builds upon access to primary research through the creation of secondary articles summarizing the highlights of the research in an accessible format written for the general public. Finally, the third level requires active effort from researchers to engage their community in the latest research, and also from clinicians to take time discussing these topics with their patients. (2) Effective communication of information is a critical next step following access to that information. Examples of effective communication may include: understandable language free of jargon; use of graphics or videos as visual media for conveying information; elimination of acronyms; and avoiding assumptions about what people may know. (3) Finally, inclusion of individuals with Alzheimer's and their loved ones in decision making can occur on multiple levels. Individually, providers must be intentional about asking patients what information they want, refraining from pushing their own agenda, and allowing space for questions. Systemically, we must leverage the unique expertise of individuals with Alzheimer's and their loved ones in research and policy through use of focus groups, direct consultation with participants throughout the research process, and inclusion of these perspectives in large-scale initiatives to move forward the field of Alzheimer's disease.
Conclusions: As controversy over aducanumab continues among researchers and clinicians, we must remain mindful of our privilege and the impact of our decisions on individuals with Alzheimer's disease and their loved ones. They deserve access to the information that directly affects them. They deserve communication in a way that can empower them to make decisions. And they deserve to have a voice in their own future as well as the future of Alzheimer's disease.
Keywords: dementia - Alzheimer's disease

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538 Inclusion was an afterthought: What the aducanumab approval reveals about Alzheimer's Disease research

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Objective: Approval of aducanumab was based on trials that were not inclusive of the people who bear a disproportionate burden of AD, including Black, Hispanic/Latino/a/x/e, and American Indian or Alaska Native older adults.
Participants and Methods: Only 0.6% (i.e., 19 individuals) of participants in the aducanumab trials identified as Black, 3% as Hispanic (likely including participants recruited in Spain), 1 person (0.03%) as American Indian or Alaska Native, and 1 person was Native Hawaiian or Pacific Islander. Of the 9% who were identified as Asian, 94% were recruited in Asia. Depending on the study, older Black adults are

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estimated to have incidence of AD up to double the rates in older White people. Despite this, Biogen reported that only six (6) Black people were randomized to the high treatment dose approved by the FDA. This is a concern because the safety and efficacy of treatments among a narrow subgroup of the population cannot be assumed to generalize to other groups.
The omission of Black patients from the aducanumab trials is particularly troubling given racial inequities in hypertension and diabetes, ischemic and hemorrhagic stroke, and white matter hyperintensities. Vascular disease may exacerbate the common adverse events attributed to aducanumab, including micro-hemorrhages and vasogenic edema, i.e., amyloid related imaging abnormalities (ARIA). Adverse events were also far more common for APOE-e4 allele carriers. Although most research indicates APOE-e4 is not as strongly associated with AD risk in Black compared to White individuals, e4 is more common in Black Americans than Americans with European ancestry. These factors elevate the plausibility that ARIA will be more common in Black people, but because there is essentially no information on outcomes among Black people, these concerns remain speculative.
Results: Despite this lack of evidence, there is now an urgent cry by the Alzheimer's Association to ensure aducanumab access for all patients affected by early AD. The makers of aducanumab, who apparently did not consider it necessary to include Black people in the evaluation of medication safety and efficacy, now consider it essential to include Black people as paying customers. Despite the potential harm to public health, calls for equitable access or early identification seem beyond reproach, incentivizing others to jump on the bandwagon. Publishers of the Montreal Cognitive Assessment (MoCA), a screening test that differentially misclassifies Black people as having cognitive impairment, recently partnered with Biogen because now, "early detection is more important than ever".
Inclusion is a cornerstone of rigor; non-inclusive trials are operationally flawed. Designing trials that can establish safety and efficacy for people who are disproportionately burdened by the disease should be required for FDA approval.
Conclusions: Lack of evidence among Black populations in AD biomarker research reflects decades of disregard for inclusion. AD/ADRD biomarker studies often purport to be race-neutral, but center White people. Everyone, not just disparities researchers, but all scientists, all advocates, and all providers must insist on a culture shift toward inclusive research. AD studies that do not represent the diversity of humans affected by AD should no longer be acceptable.
Keywords: dementia - Alzheimer's disease

Symposium 10: Transitioning to Adulthood: Interventions to Guide the Way for Autistic Youth

3:00 - 4:30pm
Friday, February 4, 2022

16 Transitioning to Adulthood: Interventions to Guide the Way for Autistic Youth

Chair

Helen Genova
Kessler Foundation, East Hanover, USA

Discussant

Helen Genova
Kessler Foundation, East Hanover, USA

This symposium highlights new and innovative interventions designed to help young adults on the autism spectrum in their transition to adulthood. Young adults with autism face significant challenges during this particular period of time, however the majority of intervention research has focused on much younger children. Given the rising rates of individuals with autism being diagnosed internationally, it is imperative that those on the spectrum are supported throughout the lifespan, and especially as they enter adulthood and gain independence. For example, studies indicate that individuals on the autism spectrum are at

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greater risk for unemployment compared to the general population, and compared to those with other types of disabilities. In particular, transition age youth with autism are at a specific risk of unemployment, with those within 2 years of high school graduation at the greatest risk. This symposium will explore newly developed interventions focused on improving outcomes in transition age youth on the autism spectrum, with a focus on improving employment and potential barriers to transition services. First, Anne Roux, MPH, will present preliminary findings of Transition Odyssey, a pilot study addressing gaps in knowledge about the transition from high school into early adulthood with a focus on understanding the needs of disadvantaged autistic youth. Dr. Matthew J. Smith will present data from his recently completed RCT examining the effectiveness of a novel Virtual Interview Training for Transition Age Youth (VIT-TAY) program. Data from the RCT indicates that VIT-TAY is effective in improving odds of obtaining employment, as well as improving job interview skills and confidence. Dr. Helen Genova will present Kessler Foundation – Strength Identification and Expression (KF-STRIDE), a newly developed web-based intervention based on principles of positive psychology to help young adults with autism identify and express their personal strengths to future employers. This presentation will include both quantitative and qualitative data used in the development and refinement of KF-STRIDE, which is now being evaluated for initial effectiveness. Finally, Dr. Connie Sung will present Assistive Soft Skills and Employment Training (ASSET) an intervention geared toward improving work-related social skills or “soft skills”. ASSET focuses on skills involved in obtaining and maintaining employment (e.g., social communication, attitude and enthusiasm, problem solving), that are often needed for professional interactions with coworkers, employers and even customers in the workplace. Data from the pilot and RCT studies indicate that ASSET is effective in improving work-related social skills, self-efficacy, and anxiety in relation to employment success. Dr. Genova will provide a discussion of the interventions, and present future directions for implementation science to address other needs for youth on the spectrum.

Keywords: adolescence

424 *Development of a Protocol for Measuring the Transition Odyssey of Youth on the Autism Spectrum: Parent Perspectives*

Anne Roux, Kristy Anderson, Tamara Garfield
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Objective: Families of youth with disabilities, including autism, experience challenges in the transition to adulthood including lack of support from schools, difficulties accessing adult services, and lack of resources or information. Correlational studies suggest that early work experience, parental expectations, active youth involvement, and the quality or focus of transition planning are associated with employment and postsecondary outcomes for autistic young adults. However, only 67% of parents of transition-age autistic youth nationwide report meeting with special educators to create a transition plan to facilitate postsecondary employment and other goals. Parental reporting on transition can be impacted by question wording and differing perspectives. No published instruments systematically assess the timing, sequencing and coordination related to accessing services during transition. This study piloted a protocol for measuring the transition odyssey. We report on the perspectives of parents of youth from a large, urban school district.
Participants and Methods: Ten parents of young autistic adults (who were out of high school between 1-6 years, received special education services, and required support with transition) completed a background survey and an SRS-2 (Adult – Relative/Other Report), and eight completed a supplemental interview. Parents reported on topics including youth educational history and co-occurring conditions, youth and parent demographics, household income and hardship, transition service history, and outcomes to date.
Results: Parents were diverse in race (80% Black) and income (40% <185% FPL), and included parents of youth who were female (10%), minimally verbal (10%) and with co-occurring intellectual disability (60%). Half of

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youth had a service plan through an agency at the time of high school exit. Only 30% of parents felt transition services were appropriate, and 40% felt somewhat to very disappointed about how life was turning out. All youth were still living at home and only three had paid employment, despite half having Medicaid waivered services. Overall, service use declined dramatically between high school and the time of the survey with vocational service use falling from 90% to 30%. Interviews revealed delays and confusion regarding transition planning meetings, services, providers, and funding sources. Parents reported difficulty with retrospective recall of detailed information about services, but also reported improved recall of events across interviews.
Conclusions: Preliminary data suggest that prospective, longitudinal data collection regarding transition, with reduced professional jargon, may facilitate accuracy of reporting, along with links to administrative records when possible. Results also confirmed high needs for proactive and early information and guidance regarding transition-related decisions.
Keywords: adolescence

425 An RCT of Virtual Interview Training for Transition Age Youth with Autism in Special Education

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Objective: Autistic transition-age youth struggle with obtaining employment, and interviewing is a critical barrier to getting a job. Vocational services lack an evidence-based practice that facilitates training job interview skills for autistic transition-age youth. This randomized controlled trial evaluated whether the novel virtual interview training for transition age youth (VIT-TAY) program improved interview skills, interview anxiety, and employment access.
Participants and Methods: Participants included autistic transition-age youth (n=71) receiving pre-employment transition services (Pre-ETS) in five special education programs. We randomized students (n=48) to Pre-ETS+VIT-TAY and students (n=23) to Pre-ETS only. Local teachers were trained to implement VIT-TAY. We conducted repeated measures analyses of variance to evaluate group-level difference between pre- and post-test assessments. We conducted a Chi-Square analysis and confirmatory Firth logistic regression to evaluate employment rates by 6-month follow-up.
Results: The Pre-ETS + virtual interviewing group, compared to Pre-ETS only, had significant group-by-time interactions reflecting better job interview skills ($p<0.001$), lower job interview anxiety ($p<0.05$), and greater access to competitive employment (25.0% vs. 0.0%, $\chi^2=6.9$, $p<0.01$) and (OR=16.0; $p<0.05$; 95% CI 1.35, 189.17).
Conclusions: Virtual interviewing appears to be effective at teaching job interview skills and reducing job interview anxiety for transition age youth with autism. Moreover, enhanced job interview skills were associated with accessing competitive jobs. Overall, youth enjoyed and adhered to virtual interviewing and teachers feasibly implemented the tool within special education Pre-ETS. Future research needs to validate these findings and evaluated enhanced job interview skills as a mechanism of employment in a fully-powered trial.
Keywords: adolescence

440 The Development and Implementation of a Strength-Based Intervention to Improve Job Interview Skills in Youth with Autism: Perceptions of Community Stakeholders

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Helen M Genova[1,2], Mikayla Haas[1], Yu-Lun Chen[1,2], Michael Dacanay[1], Alexandra Edwards[1], Lauren Hendrix[1], Robert E McGrath[3], Matthew J Smith[4]
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Objective: Job interviews are a significant obstacle for autistic youth given the required social communication demands. Research suggests that autistic youth may struggle with identifying and expressing their unique strengths and talents to others, a skill necessary for successful job interviewing. The current study used qualitative and quantitative methods to examine community stakeholder's perceptions of a newly developed strength-based intervention to improve job interview skills: Kessler Foundation – Strength Identification and Expression (KF-STRIDE). Community Stakeholder feedback was used to refine the intervention.
Participants and Methods: Qualitative data was collected to examine how KF-STRIDE is received by the autism community by interviewing key stakeholders, including individuals with autism, a parent, two therapists, a special education teacher, and a scientist who is an expert in intervention development. In addition, two staff members trained to administer KF-STRIDE were interviewed. Each stakeholder participated in a semi-structured interview after watching a 30-minute pre-recorded presentation about KF-STRIDE regarding its development, structure, materials and implementation. Then participants were asked for their impressions of, and specific feedback regarding KF-STRIDE, as well as how the intervention should be expanded or modified if possible. Additionally, we collected feasibility and acceptability data on 9 adolescents with autism who underwent KF-STRIDE.
Results: From the qualitative data, several themes emerged including: the importance of learning about character strengths, the need to incorporate additional skills into the intervention, and needs for improved content delivery, including the use of additional visual stimuli and reducing reading demands. Quantitative data revealed positive overall perceptions of the tool. Feasibility data revealed that participants found KF-STRIDE enjoyable and helpful in improving their job interview skills.
Conclusions: The themes provided specific direction for refinements to KF-STRIDE to maximize and improve implementation. The refined KF-STRIDE is now being evaluated for initial effectiveness and feasibility. KF-STRIDE holds promise as an effective and accessible tool to be further examined for use in the autism community.
Keywords: adolescence

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544 Enhancing Work-Related Social Skills of Transition-Age Students with Autism: Efficacy of ASSET Intervention

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Objective: Transition Age Youth with autism spectrum disorder (TAY-ASD) often experience poor post-school employment outcomes (Shattuck et al., 2012). TAY-ASD have reported being perceived as "socially awkward" by coworkers and employers is a significant workplace obstacle (Giarelli et al., 2013). Despite these challenges, limited evidence-based interventions exist. Applying the Social Cognitive Career Theory (SCCT), the Assistive Social Skills and Employment Training (ASSET) program was developed using a community-based participatory research (CBPR) approach to address work-related social skill needs of TAY-ASD. This presentation will provide information on the ASSET program, and preliminary findings from a feasibility study and a randomized controlled trial (RCT).
Participants and Methods: The feasibility study included 27 TAY-ASD and the RCT included 17 TAY-ASD. ASSET was run as 90-minute weekly sessions over 10 weeks with 6-8 students per group. Participants were assessed at multiple time points on quantitative measures of social and mental health functioning, self-efficacy, and

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vocational skills. A fidelity assessment was conducted during each session.
Results: Results from the feasibility and RCT study indicated that fidelity was achieved at 90% and 95%, respectively, with statistically significant improvements in social functioning (*d*=.44), social cognition (*d*=.70), general self-efficacy (*d*=.87), social self-efficacy (*d*=.93), empathic self-efficacy (*d*=1.50), and anxiety (*d*=.68) were found post ASSET. Findings from the RCT indicated that significant intervention condition x time interactions consistent with greater improvement in the intervention group across all major variables. Posttest between group effect sizes were medium to large for vocational skills (*d*=.49-.80) and job self-efficacy (*d*=.57).
Conclusions: The two studies demonstrate the importance of the use of theory-driven, community participatory, and empirically-validated approaches in the development of programs such as ASSET, which shows promise as a cost-effective, manualized, interdisciplinary approach to supporting the successful transition to adulthood among TAY-ASD. Findings from the project provide initial empirical support for ASSET to fill an important gap and help students with ASD improve social functioning, self-efficacy, vocational skills, and mental health in relation to employment success.
Keywords: adolescence

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989 Discussion - Symposium 10: Transitioning to Adulthood: Interventions to Guide the Way for Autistic Youth

Helen Genova
Kessler Foundation, East Hanover, NJ, USA

Paper Session 12: Infectious Disease

3:00 - 4:30pm
Friday, February 4, 2022

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1 Differential Associations Between BDNF and Memory Across Older Black and White Adults with HIV Disease

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Objective: Brain derived neurotrophic factor (BDNF) has demonstrated consistent associations with cognitive outcomes, particularly memory, across many clinical populations, including dementia. Less is understood about the association between BDNF and memory functioning in people living with HIV (PWH).
Participants and Methods: A sample of 173 adults aged 50+ (n=100 HIV+ and n=73 HIV seronegative) completed a comprehensive neurobehavioral assessment and blood draw. Linear regressions predicting memory domains (learning, delayed recall, recognition) were conducted including race (White vs. African American/Black), HIV status, and BDNF, along with interactions.
Results: For learning and delayed recall, significant ($p<0.05$) main effects for race and interactions for BDNF x race and HIV status x race were found, while for recognition, only a BDNF x race interaction emerged. Interactions were followed up with correlations between BDNF and memory domains stratified by HIV serostatus and race, and small-medium positive associations between BDNF and learning and delayed recall (rho=0.29, $p<0.01$; rho=0.22, $p=0.045$), but not recognition (rho=0.12, $p=0.29$) were found among HIV+ African American/Black participants. BDNF was not significantly associated with memory domains in HIV+ White, HIV- African American/Black, or HIV- White participants. Follow-up analyses showed BDNF-memory specificity, such that HIV and race X BDNF interactions did not emerge for other cognitive domains.
Conclusions: While limited by cross-sectional design among a small sample, particularly of White individuals, results indicate that BDNF may serve as a promising biomarker reflecting memory functioning in PWH, particularly African Americans. Further work is needed to replicate

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findings, and determine mechanisms for racial differences in BDNF associations with memory.
Keywords: HIV/AIDS**,** cognitive functioning**,** brain plasticity

2 Plasma Biomarkers of Vascular Injury Uniquely Relate to a Classic 'Vascular' Profile of Neurocognitive Deficits in Virally Suppressed Adults with HIV

Rowan Saloner[1,2,3], Ni Sun-Suslow[1], Erin E Morgan[1], Judith D Lobo[1], Mariana Cherner[1], Ronald J Ellis[1,4], Robert K Heaton[1], Igor Grant[1], Scott L Letendre[1], Jennifer E Iudicello[1]
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Objective: Neurocognitive impairment (NCI) and cardiovascular disease (CVD) are prevalent in people with HIV (PWH), even among those on antiretroviral therapy (ART). Chronic inflammation and vascular injury (e.g., blood-brain-barrier permeability) are overlapping yet dissociable mechanisms implicated in the expression of HIV-associated NCI. However, it is poorly understood how these mechanisms differentially contribute to neurocognitive domain-specific NCI profiles in PWH. Clarifying the presence of a potential vascular subtype of HIV-associated NCI from non-vascular presentations may help identify optimal therapeutic targets for PWH with NCI. The present study empirically-derived profiles of NCI in PWH relative to people without HIV (PWoH), and examined relationships between these NCI profiles and peripheral biomarkers of inflammation and vascular injury.
Participants and Methods: Participants included 84 virally-suppressed PWH and 126 PWoH. Current substance use disorders or recent illicit substance use (determined via self-report and/or toxicology) was exclusionary. Plasma biomarkers were measured by immunoassay and levels were log_{10}-transformed, standardized, and averaged to derive composite z-scores of inflammation (IL-6, CXCL10, CCL2) and vascular injury (VCAM-1, ICAM-1, uPAR). Participants completed comprehensive neurocognitive testing from which demographically-corrected global and domain deficit and T-scores were derived. Cluster analysis identified deficit score cluster profiles. ANOVAs examined HIV serostatus and cluster group differences in composite biomarker z-scores. Confirmatory linear regressions modeled domain-specific T-scores as a function of HIV serostatus, biomarker z-score, and their interaction, controlling for CVD risk, depression, and estimated verbal IQ.
Results: HIV serostatus groups were demographically comparable (M_{age}=44 years, $M_{education}$=14 years, 56% non-Hispanic White), though PWH had a significantly higher proportion of males (89% vs. 57%, p<.001). Composite inflammation and vascular injury z-scores were positively correlated (r=.53, p<.001). Cluster analysis identified three groups: *Unimpaired* (n=129), *Learning/Recall* (n=52, isolated learning/recall deficits), *Dysexecutive/Slow* (n=29, executive function, working memory, processing speed, and motor deficits). CVD risk was higher in PWH (vs. PWoH) and members of the *Dysexecutive/Slow* group (vs. *Learning/Recall* and vs. *Unimpaired*). Compared to PWoH, PWH had higher odds of *Dysexecutive/Slow* membership (OR=2.41, p=.029) and higher inflammation (d=0.68, p<.001) and vascular injury (d=0.32, p=.025) z-scores. Within PWH, *Dysexecutive/Slow* exhibited higher composite vascular injury z-scores (ds>0.68, ps<.034), but not inflammation z-scores (ps>.093). Biomarker z-scores did not differ by cluster group in PWoH (ps>.203). Vascular injury, but not inflammation, moderated adverse HIV effects on executive function (b=-0.23, p=.022), processing speed (b=-0.21, p=.046), and working memory (b=-0.23, p=.021) such that PWH had lower T-scores only when vascular injury markers were high.
Conclusions: HIV confers significant risk for vascular injury and CVD due to both disease and treatment factors. In PWH with controlled

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HIV disease, peripheral markers of vascular injury, but not inflammation, are selectively associated with an empirically-derived subgroup that exhibits a classic 'vascular' profile of deficits in domains mediated by frontal-subcortical networks. Findings support the presence of a vascular NCI subgroup of PWH who may benefit from interventions that directly target the neurovascular unit. Identifying modifiable risk factors for vascular injury and associated NCI in PWH will improve early detection and treatment of NCI, as well as preventing further decline, particularly as the HIV population grows older.
Keywords: HIV/AIDS**,** vascular cognitive impairment**,** executive functions

3 Cognitive outcome in Long COVID-19 patients using a standard neuropsychological battery

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[1]University of Minnesota, Minneapolis, MN, USA. [2]Mayo Clinic, Rochester, MN, USA

Objective: Research has associated COVID-19 with a variety of neurological and psychiatric symptoms including stroke, depression/anxiety, and more rarely intracranial hemorrhage and psychotic disorders (Taquet et al., 2021). However, very limited research exists that directly investigates the short-term or long-term cognitive sequelae of COVID-19 infection. The first study found to examine cognition directly in COVID-19 (Zhou et al., 2020) reported that only one measure of attention was associated with COVID-19 infection. However, the authors did not utilize a comprehensive neuropsychological assessment battery and did not assess domains such as memory and executive functioning. More recently, Jawant et al. (2020) examined short-term cognitive outcome in medically stable inpatients who were recovering from COVID-19, and they reported that attention and executive functioning were the most impacted domains. Finally, a case series by several of the authors of this paper (Whiteside et al., 2020) examined three severe post-COVID patients and found evidence for possible working memory and executive functioning deficits. The current study aims to begin to provide empirical data on cognitive outcomes in "long COVID," the emerging syndrome of protracted recovery from COVID-19.
Participants and Methods: This study examined 54 consecutive outpatients diagnosed with COVID-19 who were referred for neuropsychological evaluation. Four participants failed performance validity tests (PVTs) and were excluded from the sample. All participants had positive PCR laboratory test results and were evaluated an average of 6.5 months post-diagnosis (*M*(*SD*)=197.47(53.20) days). All patients reported cognitive concerns and were administered a battery of standardized neuropsychological tests. The test battery assessed performance validity, global cognitive functioning, attention/working memory, processing speed, memory, language, visual spatial abilities, executive functioning, and motor functioning. In addition, emotional functioning was evaluated with brief symptom inventories. The patient sample was mostly white (89.8%) and female (83.6%). Mean (*SD*) age was 49.65(14.34). Mean(*SD*) education was 14.47(2.16). The majority of patients (67.3%) did not require hospitalization for COVID-19.
Results: No significant differences were found in demographics (age, gender, ethnicity) or hospitalization status on objective cognitive testing, either compared to normative data or between groups (non-hospitalized vs. hospitalized patients). Overall, no mean scores fell in the impaired range (<2 SD) across cognitive tests. Overall, mood measures were elevated. BDI-II mean(*SD*) was 19.88(9.823), while BAI mean (*SD*) was 14.94(10.765). Non-hospitalized participants endorsed higher anxiety scores ($F_{2,46}$ = 6.702, p=0.013).
Conclusions: The results were noteworthy for the absence of significant mean deficits in any cognitive domains and for elevations on mood/anxiety measures, which suggests that psychological distress is prominent and likely contributed to cognitive complaints. Other contributing factors may include fatigue and sleep issues, but there was no convincing evidence for neurologically based cognitive deficits.

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Keywords: cognitive functioning**,** medical disorders/illness**,** assessment

4 Neurocognitive Profile and Psychosocial Characteristics of Pediatric Patients with Long COVID

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Objective: Per the CDC, over 34 million cases of SAR-CoV-2 have been reported in the United States. Studies suggest over 25% of patients develop persistent symptoms following COVID-19 regardless of course severity – a clinical presentation coined as “long-COVID” (i.e., symptoms persistent beyond 4 weeks from onset of infection). While investigations on adult patients with long-COVID have recently been published, the neuropsychological sequelae among children remain unknown. Here we provide neuropsychological, mood, and behavioral profiles of pediatric patients with long-COVID who were seen in a multidisciplinary rehabilitation clinic.
Participants and Methods: This study involved a retrospective chart review of the first 20 pediatric patients with long-COVID who were seen at a pediatric post-COVID-19 rehabilitation clinic at an academic medical center. Among these, 14 patients were referred for neuropsychological testing, with 10 completing the evaluation. All but one was tested via home-based telehealth. Two of the fourteen patients completed developmental assessments, one was unable to engage in testing and discontinued prematurely, and one was offered consultation services given recent testing. The semi-flexible neuropsychological screening battery assessed the following domains: performance validity, verbal fluency and category switching, sustained auditory attention, auditory working memory, processing speed, and verbal learning and memory. Caregivers also completed the BRIEF-2, ADHD Rating Scale 5th Edition, and a Conners inventory (Conners Behavior Rating Scale or Conners Early Childhood). Patients completed the MASC-2 and CDI-2 when developmentally appropriate.
Results: Among the 20 patients seen in clinic, the most common neurologic symptoms reported by caregivers were fatigue/lethargy (70%), attention/concentration difficulties (65%), sleep disturbance (60%), headaches (55%), and dizziness/vertigo (55%). Among the 10 patients who completed neuropsychological testing, approximately half of the patients’ caregivers reported significant day-to-day problems with inattention (5/9) while only one caregiver reported concerns with hyperactivity/impulsivity (1/9) or executive functioning (1/6). Most caregivers also rated significant concerns for depressed mood and anxiety (7/8 and 5/8). Nearly half of patients who completed self-report inventories reported problems with depressed mood or anxiety (3/7 and 3/7). Importantly, most caregivers reported problems with attention (6/10) and depressed mood/anxiety (7/10) that were present before COVID-19 infection, but most did not report prior neurodevelopmental concerns (8/10). All patients who completed neuropsychological testing passed a stand-alone performance validity measure. The majority of patients performed within the broad average range or above (≥16th percentile) across the following domains: immediate and delayed recall of verbal information (10/10 and 9/10), auditory working memory (10/10), set-switching (9/9), verbal fluency (letter and category fluency: 7/9 and 9/10), and processing speed (9/10). In contrast, over half of patients presented with below average performance (<16th percentile) on a measure of auditory attention (5/9).
Conclusions: Results suggest attention and emotion regulation may be particularly vulnerable among pediatric long COVID patients. However, it will be important for clinicians and researchers to consider the effects of concurrent mood difficulties or preexisting mood/attention concerns that could contribute to these cognitive domains. Possible effects of telehealth administration should also be considered.
Keywords: attention**,** neuropsychiatry**,** pediatric neuropsychology

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5 Subjective and Objective Cognitive Impairment Following COVID-19 in a Finnish Cohort

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Objective: COVID-19 is a new disease that has reported to have cognitive consequences. The aim was to evaluate neuropsychological findings and subjective symptoms at 6 months post-COVID in a cohort of Finnish patients treated in the intensive care unit, at a normal ward, or at home (ClinicalTrials.gov Identifier NCT04864938).
Participants and Methods: Total of 213 subjects - 54 % female, with a mean age of 54.1 years (sd 12,5, range 19 – 78) - participated in neuropsychological evaluation at 6 months after discharge. Patients, all with confirmed COVID-19, came from the Helsinki-Uusimaa hospital district, treated at ICU (ICU-group n=73), other hospital wards (HOSP-group, n=49), or at home (HOME-group, n=46). A non-COVID control group was also evaluated (NCO-group, n=45). At 6 months, subjects filled out a mailed questionnaire on subjective cognitive symptoms (The A-B neuropsychological assessment schedule ABNAS), depression, anxiety, and post-traumatic stress. Cognitive performance at 6 months was evaluated with a comprehensive neuropsychological examination in including general ability (WAIS-IV Vocabulary and Matrix reasoning), and the domains of Memory (WMS-III Word list delayed recall, WMS-III Logical memory delayed recall, Rey Complex Figure delayed recall), Executive functions (Trail Making B time, Stroop interference time, FAB total score) and Attention (WAIS-IV Coding, Trail Making A time, Stroop naming time). In the three domains, the raw scores of the test variables were standardized, and the time-related scores were reversed for comparability. General linear models (multivariate) were applied with age and education as covariates. NCO-group was selected as the reference group for contrasts. Partial Eta squared (ηp^2) is reported for effect size.
Results: All patient groups reported more subjective cognitive symptoms than the NCO-group, ($\eta p^2 = 0.090$, pair-wise $p < .001$ for all). They also reported more symptoms on all mood scores compared to the NCO-group (depression $\eta p^2 = 0.077$, anxiety $\eta p^2 = 0.034$, stress $\eta p^2 = 0.047$).
The groups did not differ in general cognitive ability (Vocabulary total mean scaled score 12.07, sd 3.125, $\eta p^2 = 0.002$; Matrix reasoning 12.91, sd 3.198, $\eta p^2 = 0.008$). In the three domains overall, the ICU-group had the lowest and the HOME-group the highest performance means. In the memory domain, HOME-group showed better performance than the NCO-group in the WMS-III Logical memory delayed recall ($\eta p^2 = 0.047$, pair-wise $p = .01$). In the executive domain, the ICU-group and the HOSP-group showed poorer performance than the NCO-group in the Stroop Interference task ($\eta p^2 = 0.042$, pair-wise $p = .02$ for both). In the attention domain there were no significant differences (multivariate model $\eta p^2 = 0.020$).
Conclusions: COVID-19 was found to be associated with both subjective and objective cognitive consequences. On a group level, COVID-19 patients treated at home seem to suffer from subjective cognitive symptoms but perform relatively well in neuropsychological examination compared to controls. Hospitalized patients with a more serious illness show objective impairment, especially in the executive domain. There are presumably several factors underlying subjective cognitive decline. Taking steps to support recovery, such as keeping patients well-informed, is recommended.
Keywords: infectious disease**,** executive functions**,** neuropsychological assessment

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6 Cognitive Consequences of COVID-19: Results from A South American Cohort Study.

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Objective: We aim to investigate the impact of COVID-19 on cognitive functions in adults without cognitive complaints before infection and to study cognitive dysfunction according to disease severity and cognitive risk factors.
Participants and Methods: Forty-five post-COVID-19 patients, evaluated an average of 142 days after illness, and forty-five healthy controls matched for age, gender, and education underwent an extensive neuropsychological evaluation, including psychiatric symptomatology scales. Data were collected on the severity of infection, premorbid medical conditions, and functionality for activities of daily living pre- and post-COVID-19. Results from neuropsychological tests were calculated using composite scores.
Results: Significant differences between groups were found in memory, attention, executive functions, and language measures. Neuropsychiatric variables of depression and anxiety were not different across groups. The change from premorbid to post-infection functionality was significantly different between severity groups, and the results show a differential impact of cognitive functionality between disease severity levels. Self-reported anxiety was associated with the presence of cognitive impairment in covid-19 subjects.
Conclusions: This study focused on the description of cognitive performance in previously healthy adults with no history of cognitive impairment. Our results suggest that cognitive symptoms may be common in patients after recovery from COVID-19 and may last for months after disease remission and advocate including cognitive assessment as a protocolized stage of the post-COVID examination.
Keywords: neuropsychological assessment**,** cognitive functioning**,** executive functions

Paper Session 13: Cultural 2

3:00 - 4:30pm
Friday, February 4, 2022

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1 Is the MoCA a Culturally Fair Screener in a Diverse Geriatric Primary Care Setting? Lessons from the Bronx

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Objective: The Montreal Cognitive Assessment (MoCA) is a well-validated, 30-point cognitive screener which has demonstrated good diagnostic accuracy for mild cognitive impairment (MCI) and dementia. An original cut-point of 26 was deemed appropriate to identify older adults at risk of MCI or dementia. Further studies have highlighted the limitations of the MoCA in assessing individuals with diverse backgrounds and lower education and have suggested a cut-off of 23 or 24 as more appropriate. However, few studies have been conducted in a diverse, multi-ethnic setting such as the Bronx, New York. The present study evaluates the utility of the Spanish and English MoCA in correctly identifying MCI and dementia, given the current cut-points indicated in the literature.
Participants and Methods: A total of 231 individuals (Mean Age= 72.8; 72.3% women; 61% Hispanic; 32% non-Hispanic Black/African American) were recruited from a Montefiore primary care clinic in the Bronx as part of an ongoing randomized controlled trial evaluating a paradigm to improve dementia care for patients with subjective cognitive concerns. As part of this study, participants were administered the MoCA and a neuropsychological battery in their preferred language (Spanish or English) by a research assistant (118 individuals completed the Spanish MoCA and 113 completed the English MoCA). A clinical neuropsychologist provided diagnoses based on

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neuropsychological testing (blinded to MoCA results).
Results: Overall mean on the Spanish/English MoCA (including 1 point education-correction as indicated) was a 17.7 (SD=4.3). Among cognitively "normal" participants with cognitive concerns (N=90), MoCA mean was 19.9 (SD=4.1), among participants with MCI (N=133), MoCA mean was 16.6 (SD=3.7), and among participants with dementia (N=8), MoCA mean was 10.6 (SD=3.1). A one-way ANOVA found the MoCA had good discrimination between all cognitive status groups, F (2) = 33.902, p <.001. T-test comparison found that individuals who completed the Spanish MoCA performed significantly lower (Mean=16.7) as compared to those who completed the English MoCA (18.6), t(229)=3.337, p<.001. Spanish MoCA individuals also had significantly less education (Mean=9.8 years), compared to English MoCA individuals in our sample (Mean=12.6 years), t(229)=5.446, p<.001. ROC analyses had good discrimination for normal versus MCI/dementia cognitive status on both the Spanish (AUC=.789) and English MoCA (AUC=.785). A cut-point of 19 on the English MoCA and 17 on the Spanish MoCA may provide better diagnostic accuracy in our sample.
Conclusions: In a multi-ethnic, diverse primary care setting, the MoCA shows good utility and diagnostic accuracy for a group of older adults with subjective cognitive concerns. The MoCA was able to distinguish normal cognitive status as compared to MCI/dementia. However, the present cut-points for possible MCI/dementia that are presented in the literature (23+) are inappropriate in this setting, particularly given the high variability in demographic and educational backgrounds of our patient population. A more conservative cut-off of 17 for the Spanish MoCA and 19 for the English MoCA should be considered when interpreting the MoCA as a screener for MCI/dementia in a multi-ethnic and diverse setting such as the Bronx.
Keywords: assessment**,** multiculturalism**,** mild cognitive impairment

2 Associations Between Loneliness and Cognitive Performance in a Multi-Ethnic Sample of Midlife Women

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Objective: Loneliness can illicit hypervigilance to social threat, which activates neurobiological mechanisms that lead to cognitive impairment. The Reserve Capacity Model posits that ethnic minorities experience chronic stressors more frequently than advantaged groups, which increases the risk of poor cognitive outcomes. Loneliness is a stressor that may be higher in ethnic minorities due to systemic racism (i.e., feeling 'othered' due to discrimination). Thus, ethnicity may moderate the association between loneliness and cognitive outcomes such that the association is stronger in ethnic minorities compared to whites. For example, in an immunocompromised, older adult sample, the association between loneliness and cognition was stronger in Black older adults than their white counterparts. However, research on whether ethnicity moderates the association between loneliness and cognition is limited and has not been evaluated in Asian and Latinx populations. We tested the hypotheses that (1) loneliness and cognitive performance would be negatively associated in midlife women and (2) ethnic minorities would have stronger associations between loneliness and cognition compared to whites.
Participants and Methods: Data were from Black (*n* = 711), Asian (*n* = 480), Latinx (*n* = 173), and white (*n* = 1240) women aged 45-57 from the Study of Women's Health Across the Nation (SWAN; Sowers et al., 2000). Loneliness was measured by responses to the question, "How often in the past week did you feel lonely?" Cognitive measures were of episodic memory (East Boston Memory Test [EBMT]), processing speed (Symbol Digit Modalities Test [SDMT]) and working memory (Digit Span Backwards [DSB]).
We performed multiple linear regressions using MPlus. First, we regressed cognitive outcomes on loneliness and ethnicity without and with covariates. Second, we ran a moderated

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regression model that regressed cognitive outcomes on loneliness, ethnicity (i.e., Black, Asian, and Latinx), and interactions between ethnicity and loneliness. Covariates included age, education, income, marital status, income, social support, and nativity status (i.e., U.S born). We set our significance threshold to .01 to prevent Type I errors.
Results: As expected, loneliness was negatively associated with all cognitive outcomes (*ps* < .001). After including covariates, the association between loneliness and cognitive outcomes were no longer significant. Latinx had stronger, negative associations between loneliness and EBMT delayed recall (b = -0.65, p < .001) than white women.
Conclusions: Loneliness was associated with poorer cognition and this association is at least partly explained by sociodemographic factors (e.g., education, income). Loneliness was associated with worse episodic memory in Latinx than white women, a result not replicated in our Black and Asian participants. The proportion of Latinx women born outside of the US was significantly higher than other groups. Perhaps loneliness stemming from being born outside the US (e.g., language barriers, less social integration) is a burden that differentiates the experiences of Latinx women from other groups, which contributes to greater stress and worse cognitive outcomes. Future research should determine how loneliness manifests and is perceived across racial/ethnic groups, especially in Latinx women.
Keywords: cognitive functioning**,** social processes**,** minority issues

3 Ethnic Enclaves, Nativity, and Their Relationship to Cognitive Ability in Hispanic/Latinx WHICAP Participants

Karen A Dorsman[1], Dominika Seblova[2,3,4], Daniel J Pohl[5], Erin R Kulick[4,6], Joan A Casey[7], Richard Mayeux[2,3,4], Jennifer J Manly[2,3,4]
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Objective: Living in ethnic enclaves may offer protection against adverse health outcomes associated with psychosocial stressors and resource deprivation in highly segregated areas. We examined the relationship between block group level residential segregation and cognitive ability across country of origin among Hispanic/Latinx populations living in Northern Manhattan in New York City.
Participants and Methods: We included 2257 residents of Washington Heights/Inwood who identified as Hispanic/Latinx and were born outside the US or in Puerto Rico (69% female; mean age 75.5, SD=6.1), excluding those with prevalent dementia. Cognitive composites for language, memory, visuospatial, and processing speed domains were obtained at first visit. Addresses were geocoded and matched to a block group level isolation index, a residential segregation exposure measure we derived from the 2005-2009 American Community Survey. This index measured how isolated a given group of people sharing the same ethnic identity (i.e., Hispanic) are in a block group, and represents how much they are exposed only to one another versus other ethnic groups. We used the sample mean value as a cut-off to identify each unit as isolated or integrated. The association between residential isolation and performance in each cognitive domain was examined using multilevel linear models to account for clustering of observations, adjusted for age, sex/gender, recruitment year, years of education and proportion of life in the US. A second model examined the effect modification by country of origin.
Results: Clustered in 188 census block groups, participants reported their country of birth as the

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Dominican Republic (n=1457), Puerto Rico (n=269), Cuba (n=316) or Mexico, Central & South America (n=214). People living in isolated block groups had lower cognitive scores than people living in integrated areas; however, living in an isolated area had a weaker association with memory among Puerto Rican participants (β= 0.12, CI [-0.03, 0.28]) compared to other groups. Living in an isolated area was associated with lower processing speed scores among Dominican participants (β= -0.13, CI [-0.26, 0.00]) compared to other groups.
Conclusions: Hispanic/Latinx participants living in highly segregated/isolated blocks groups had lower cognitive scores than those living in more integrated areas even after adjusting for individual factors, but this relationship depended on country of origin and cognitive domain. Future work should examine the role of neighborhood social cohesion and social support network as mediators of these relationships.
Keywords: cross-cultural issues**,** cognitive functioning

4 The Effect of Diabetes and Neighborhood Adverse Factors on Memory Functioning

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Objective: Diabetes mellitus is associated with decreased memory functioning and changes in brain structure such as white matter disease and hippocampal atrophy. The link between diabetes and memory functioning may be modifiable and dependent on both clinical and self-management of blood glucose levels. Environmental factors such as adverse neighborhood factors may pose barriers and limit access to diabetes care and control of blood glucose. The aim of this study was to examine the moderating role of adverse neighborhood factors (e.g., neighborhood safety, cohesion, and overall satisfaction) on the association between diabetes and memory in a multi-ethnoracial cohort. We hypothesized that increased neighborhood safety, cohesion, and satisfaction will mitigate the negative association of diabetes on memory functioning.
Participants and Methods: A total of 726 participants (n = 393 Latinx (54.1%), n = 155 Non-Latinx Black (21.3%), n = 164 Non-Latinx Whites (22.6%) and n = 14 other (1.9%)) from the ongoing Offspring Study were recruited for this study. Participants had a mean age of 55.7 years, (SD = 10.6) and most had more than 13 years of education (67.8%). A total of 459 participants reported their sex as female (63.2%). Memory functioning was assessed via the Selective Reminding Test with total recall (learning over 6 trials) and delayed recall as primary outcomes. A neighborhood and home Likert scale questionnaire was used to measure levels of perceived 1) neighborhood and home safety, 2) cohesion and, 3) satisfaction. Separate linear regression models were conducted to determine both the main effect of diabetes and each neighborhood factor independently on cognition as well as the interactive role of adverse neighborhood scores and diabetes. Models were adjusted for sociodemographics (age, education, race/ethnicity, and sex).
Results: A total of 109 individuals had a diagnosis of diabetes (15%). Participants with diabetes had lower scores on total word recall than participants without diabetes (β = -3.12 p = .023, CI [-5.80, -0.44]). Neighborhood dissatisfaction was negatively associated with total word recall (β = -0.56 p = .024, CI [-1.07, -0.08]) and delayed recall (β = -0.19 p = .001, CI [-0.30, -0.07]). Individuals with a diagnosis of diabetes and greater neighborhood satisfaction had better memory functioning than those with diabetes and lower levels of neighborhood satisfaction (β = -1.50, p = .047, CI [-2.97, -0.02]). Neighborhood safety and cohesion had no relationship with memory scores and did not moderate the relationship between diabetes and memory functioning.
Conclusions: In addition to confirming an association between diabetes status and lower cognition in a community-based cohort of middle-aged adults, this study indicated that low-perceived neighborhood satisfaction is

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associated with worse learning and memory. For individuals who expressed strong neighborhood dissatisfaction, the effect of diabetes on memory was further exacerbated. Policymakers can leverage the opportunity to improve neighborhood-level factors as a potential intervention for improving diabetes care and brain health among middle-aged and older adults.

Keywords: memory disorders**,** diabetes**,** environmental pollutants / exposures

5 Associations Between Healthcare Factors and Multidomain Neuropsychological Outcomes in Older Adults with Prediabetes and Diabetes

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Objective: Diabetes affects more than 25% of older adults in the United States and is more prevalent in Hispanic/Latinx and Black/African American populations. Further, diabetes is associated with poorer cognitive functioning and higher rates of dementia. Given the potential for diabetes to be a modifiable risk factor, we examined the associations between healthcare access and utilization variables and cognition separately within Hispanic/Latinx, non-Hispanic White, and non-Hispanic Black participants with diabetes or prediabetes.
Participants and Methods: Older adults without dementia from the Health and Retirement Study Harmonized Cognitive Aging Protocol with diabetes (self-report or A1c > 6.5%) or prediabetes (A1c of 5.7-6.4%) were included (Hispanic/Latinx N=170; non-Hispanic White N=793; non-Hispanic Black N=228). Cognitive domain composite scores were created for global cognition, memory, executive functioning, language, and visuospatial functioning. Healthcare access/utilization variables were dichotomous (yes/no) and included: rural location, could not afford medical care, have governmental insurance, have private insurance, and attended a doctor visit in the past 2 years. Linear regression models, adjusting for age, sex, education, depressive symptoms, prediabetes or diabetes status, vascular risk burden, and engagement in vigorous physical activity, were stratified by race/ethnicity and examined the associations between the healthcare access/utilization variables and cognitive domain score.
Results: In our sample of older adults with diabetes/prediabetes, not being able to afford medical care was associated with lower global cognition (β = -.169, p =.006), executive functioning (β = -.129, p = .017) and language (β = -.197, p = .008) within Hispanic/Latinx participants only. Within non-Hispanic Whites, attending a doctor visit in the past 2 years was associated with higher global cognition (β = .062, p = .036), executive functioning (β = .061, p = .033), and language (β = .083, p = .012). Having private insurance was associated with higher memory (β = .078, p = .014) and higher global cognition (β = .068, p = .023) for non-Hispanic Whites and higher executive functioning (β = .117, p = .027) and global cognition (β = .017, p = .043) for non-Hispanic Black participants. Within non-Hispanic Black participants only, living in a rural location was associated with lower levels of global cognition (β = -.126, p = .017), executive functioning (β = -.126, p = .013), and language (β = -.146, p = .025); having government insurance was associated with higher global cognition (β = .106, p = .046) and memory (β = .131, p = .014); and attending a doctor's visit in the past 2 years was associated with higher executive functioning (β = .103, p = .035) and visuospatial functioning (β = .145, p = .023).
Conclusions: Among older adults with diabetes/prediabetes, healthcare access and utilization variables were associated with cognitive functioning, especially global cognition

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and executive functioning. Importantly, the factors that emerged as uniquely predicting aspects of cognition often varied across race/ethnicity. This pattern highlights the importance of studying healthcare access and utilization factors within race/ethnicity, rather than comparing or combining groups, since there may be relevant life experiences unique to each group.

Keywords: aging (normal), diabetes, diversity

6 *Mirando Hacia el Futuro [Looking to the Future]*: Bilingual Neuropsychological Training for Spanish/English-Speaking Neuropsychologists and Trainees

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Objective: In the last two decades, several "Calls to Action" have advocated for the expansion of culturally competent neuropsychological care to meet service demands of the growing number of culturally and linguistically diverse patients. Given that Spanish is the second most spoken language in the US, this is especially pertinent for Latine patient populations. However, graduate programs lack a well-defined roadmap and guidelines for achieving these goals; as such, efforts to increase the recruitment of bilingual trainees and improve multicultural education/training within neuropsychology often fall short. Therefore, we propose a neuropsychological training model for the development of training guidelines for Spanish speakers. We (1) examined graduate programs that provide bilingual neuropsychology training opportunities and assessed their training guidelines; (2) compared bilingual neuropsychology training to that of other healthcare-related fields; and (3) propose a bilingual neuropsychological training model to augment the development of Spanish-English bilingual trainees in the US.
Participants and Methods: Databases were searched for peer-reviewed articles reporting on training guidelines for bilingual trainees using bilingual, multicultural, and training-specific keywords (e.g., bilingual clinical training, bilingual training, training guidelines, multicultural, bilingual trainees). Predoctoral internship opportunities were also examined using the available APPIC directory using these keywords: neuropsychology, bilingual, Spanish, and Spanish-speakers. Searches were not limited to the field of neuropsychology (i.e., related fields like counseling psychology, public health, etc., were also examined).
Results: In 2018, the APA listed 15 graduate programs that offer specialized training in Spanish, ranging from brief international immersion programs to doctoral-level programs, with coursework and training opportunities working with the Latine population. Currently, 51 predoctoral internships listed in the APPIC directory reported providing services to Spanish-speaking patients, 11 sites stated offering opportunities for bilingual neuropsychological assessment, with 10 having Spanish supervision available. While the number of sites that provide bilingual Spanish-English training continues to grow, an analysis of the literature failed to reveal consistent, comprehensive guidelines for bilingual neuropsychological training.
A broader literature review covering articles from related fields demonstrated that counseling and school psychology have been developing training models that "integrat[e]/infus[e]" multiculturalism in *all* aspects of training. These fields also incorporate a "bilingual specialization" component to better serve the needs of diverse communities with supervision from bilingual and bicultural faculty. Medical programs have increasingly focused on providing formal interpreter training in medical Spanish to bilingual medical students and advocating for medical Spanish education.
Conclusions: Neuropsychology lags behind related fields in offering specialized training in

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Spanish, despite a clear need for services. In addition, there are no US standards or measures of competency for Spanish service delivery. Until professional organizations and regulatory bodies establish standards of practice, it will be left up to supervisors/employers to evaluate the language and cultural competency of practitioners who provide services in Spanish, while also supporting the growth of those who have basic conversational proficiency. In addition to presenting the state of the current literature, a neuropsychology-specific model for specialized (Spanish-English) bilingual training will be presented in detail as a standard of multicultural/bilingual training to incorporate in neuropsychology programs throughout the US.

Keywords: neuropsychological assessment**,** multiculturalism**,** bilingualism/multilingualism

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