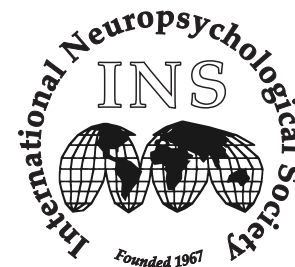


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# Final Program Addendum

## Forty Fourth Annual Meeting

### International Neuropsychological Society



February 3-6, 2016  
Boston, Massachusetts, USA

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#### PROGRAM ADDITIONS

*The following two abstracts were re-accepted into the program and were presented by their authors during the sessions noted below (the abstracts were initially withdrawn because of scheduling conflicts, and hence the abstracts do not appear in the original meeting proceedings). The abstracts are included in their entirety here:*

#### WEDNESDAY, FEBRUARY 3, 2016

##### Poster Session 1. Behavioral Neurology, Electrophysiology/EEG, Epilepsy, & Memory

3:00 PM–4:15 PM

**T. FRANCIS, B. HUMMER, & D. TUCKER. Predictive Value of Dichotic Listening (DL) for Memory VS Language Performance on Wada Examination.**

**Objective:** Evidence supporting the use of DL to predict language laterality is controversial. This study examines the predictive value of two common DL tasks, Bergen Dichotic Listening (BDL) and SCAN, for language and memory laterality measured by Wada.

**Participants and Methods:** Subjects were 45 persons undergoing neuropsychological and Wada examination for potential surgical intervention for medically refractory complex partial seizures (29 male and 16 female; median age of 39.6 yrs; 39 right hand dominant). Twenty-six had primary L hemispheric seizure foci, 17 R, 1 bilateral, and 1 indeterminate. Wada examination was performed using sodium amytal or brevitil. Wada Language Total Laterality Index (LI) included items testing auditory comprehension, spontaneous output, reading, and naming ability. Language LIs were calculated based on deviations from baseline following each ICA injection as such: (L – R injection)/L + R injection). Free and recognition recall (deviations from baseline) were tested using both objects and words. DL lateral indices were calculated using the following formula: (R Ear + L Ear)/(R Ear – L Ear).

**Results:** None of the DL indices predicted the Wada Language Laterality Index. However, when the Ss was directed to report the left ear first, both DL tasks predicted memory for object following the L-ICA injection during Wada; SCAN free recall ( $p=.034$ ,  $R2=.141$ ), BDL (free;  $p=.005$ ,  $R2=.369=8$  and recognition;  $p=.026$ ,  $R2=.174$ ).

**Conclusions:** DL tasks did not show predictability for language lateralization. The LE first conditions of both tasks accounted for significant amounts of capacity for memory for objects in the right hemisphere. Only when attention is preferentially directed to the LE do these tasks have predictive value for object recall by the right hemisphere. Theoretical and clinical implications as well as future research directions are discussed.

Correspondence: Taylor Francis, Scott & White R&E, 702 SW H.K. Dodgen Loop, Temple, TX, 76504, United States. E-mail: taycfran@gmail.com

#### THURSDAY, FEBRUARY 4, 2016

##### Poster Session 4. Assessment (Child), EF/Frontal, & Medical/Neurological Disorders (Child)

3:30 PM–5:00 PM

**T.S. RIVERO, D.A. PEREIRA, L.M. HERRERA NÚÑEZ, L. MALLOY-DINIZ, & O.F. AMODEO BUENO. The Effects of Reward and Experience Valence in a Videogame-task Designed to Evaluate Response Inhibition.**

**Objective:** To evaluate the impact of valence of experience during gameplay (VEG) and rewards on a new video game task (Dragon Hunter Task, DHT) designed to assess response inhibition.

**Participants and Methods:** 101 typical developing adolescents (ages 10-12) were evaluated in relation to: a) DHT measures (commission error (C-errors), rewards and total time on task); and b) EVG. Using EVG the participants were divided in two experience groups: positive (ExpP) or negative (ExpN). Bayesian comparison of group and repeated measures analysis (ANOVAmr) were employed. The total time on task was correlated to C-errors. Lastly, multiple regressions using path analysis and mediation analysis, were run to comprehend the influence of rewards and experience valence on C-errors.

**Results:** The ANOVAmr shown difference between groups only during the 2 half of the task, in which ExpN made a higher number of C-errors, gained less rewards and stayed less time on task, than ExpP group. The total of C-errors were negatively correlated with the total time on task ( $\rho=-0,81$ ). The path analysis revealed a positive influence of EVG on rewards gain, which was negatively correlated to C-errors. The best fit model, considered rewards as having a causal impact on total number C-errors.

**Conclusions:** DHT was adequate to assess response inhibition and to evaluate its relation with rewards and VEG. ExpN group employed impulsiveness as a strategy to escape from delay during the 2 half of the game, finishing the task quicker than ExpP. Motivation played an important role, since VEG was directly influenced by reward gains. These results shed a light on the importance of motivation and rewards during tasks that involves cognitive and motivational control processing. These factors must be considered during the design of new video game instruments to evaluation and rehabilitation. More studies should employ DHT to evaluate subjects with impulse control deficits, such as ADHD and Bipolar Disorder.

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## PROGRAM CHANGES & AUTHOR REVISIONS

The following abstracts were **revised** by their authors after being accepted for presentation at the INS Meeting:

### THURSDAY, FEBRUARY 4, 2016

9:00 AM–10:30 AM

#### Poster Session 2. ABI (Child), ADHD/Attention, Autism, and Learning Disabilities/Academic Skills

15. HEINKS, T

The Influence of Young Age at Diagnosis for Cognitive Performance in Brain Tumor Patients Before Treatment (N. Eggenberger, K. Zimmermann, K. Leibundgut, M. Steinlin, & T. Heinks)

*Revision Details: Noëmi Eggenberger presented this paper on behalf of Theda Heinks, and was moved to the first author position. T. Heinks was moved to the final author position. The title was also revised.*

72. GRIFFIN, JW

Moderation Analysis of Episodic Memory in Autism Spectrum Disorders: A Meta-Analytic Review (J.W. Griffin, J. Saurman, & B.E. Gavett)

*Revision Details: Jessica Saurman was moved to the 2nd author position.*

3:30 PM–5:00 PM

#### Poster Session 4. Assessment (Child), EF/Frontal, and Medical/Neurological Disorders (Child)

34. HOLCOMBE, BD

Exploring Relationships in Executive Functioning Based on Neurocognitive Performance, Parent Ratings, and Social Support (B.D. Holcombe, A.M. Crooks, A.L. Cotton, D.L. Rainey, E.D. Mays, & H.M. Hill)

*Revision Details: Elexus D. Mays was added as the 5th author.*

100. COOK, C

Effects of Screening for Postconcussive Syndrome (PCS) on PCS Symptom Self-Report and Neuropsychological Test Performance (C. Cook & J. Suhr)

*Revision Details: This abstract was rescheduled from where it currently appears in the proceedings (Poster Session 10) and presented as poster #100 in Poster Session 4.*

### FRIDAY, FEBRUARY 5, 2016

2:15 PM–3:45 PM

#### Poster Session 7. Imaging (Functional & Structural) and Medical/Neurological Disorders (Adult)

7. HOSSEINI-KAMKAR, N

The Neural Correlates of Cognitive and Behavioral Self-Regulation in Preadolescents: A Multidisciplinary Approach (N. Hosseini-Kamkar, & J.B. Morton)

*Revision Details: J. Bruce Morton was added as the 2nd author.*

3:30 PM–5:00 PM

#### Poster Session 5. Cancer, Cross Cultural, Forensic, Malingering/Effort Testing, and MS/ALS

6. GOGIA, B

Neuropsychological Implications of Gliomas in Left Fronto-Parietal Operculum with respect to Tumor Size and Grade (B. Gogia, L.S. Chavali, V.A. Kumar, A.J. Kumar, R.Valenzuela, L.A. Hayman)

*Revision Details: 5 additional authors were added to this abstract as underlined above.*

### SATURDAY, FEBRUARY 6, 2016

9:00 AM–10:30 AM

#### Invited Symposium 4. Cognitive Rehabilitation and Neuroimaging in Clinical Populations

3. CHIARAVALLOTI, ND

Cognitive Rehabilitation and Neuroimaging in Traumatic Brain Injury (TBI) (N.D. Chiaravalloti, E. Dobryakova, J. DeLuca)

*Revision Details: Ekaterina Dobryakova and John DeLuca were added to the author list as shown.*

10:45 AM–12:00 PM

#### Poster Session 9. Emotional Processes, Genetics, HIV/AIDS, and Psychopathology/Neuropsychiatry

49. OBERMEIT, LC

Frontal Systems Behaviors Significantly Impact Everyday Functioning Outcomes in HIV Disease and Methamphetamine (MA) Dependence (L.C. Obermeit, B.S. Mckenna, R. Kamat, I. Babakhanyan, K.L. Doyle, E.E. Morgan, J.E. Iudicello & R.K. Heaton)

*Revision Details: Rujvi Kamat was added as the 3rd author.*

## WITHDRAWN ABSTRACTS

The following abstracts were *withdrawn* by their submitting authors after they were accepted for the Annual Meeting, and were *not presented* at the Forty-Fourth Annual Meeting in Boston:

### WEDNESDAY, FEBRUARY 3, 2016

#### 3:00 PM–4:15 PM

63. ÁVILA, R

#### Poster Session 1. Behavioral Neurology, Electrophysiology/EEG, Epilepsy, & Memory

Working Memory Mediates the Relationship Between Aging and Memory Performance in Older Adults with Heterogeneous Cognitive Background

### THURSDAY, FEBRUARY 4, 2016

#### 12:45 PM–2:15 PM

13. COSTA, MV

84. GARCIA, MT

88. OLIVERA FIGUEROA, LA

#### Poster Session 3. Assessment (Adult) and Cognitive Neuroscience

Diagnostic accuracy of GDS-15, PHQ-9 and HAMD-17 in a community sample of elderly with late life depression

Skills of Theory of Mind in Mexican children of 3 to 5 years old

A Time to be Stressed? Time Perspectives and Cortisol Dynamics Among Healthy Adults

#### 3:30 PM–5:00 PM

18. SELEME, ME

39. LØVSTAD, M

41. MULHAUSER, K

#### Poster Session 4. Assessment (Child), EF/Frontal, and Medical/Neurological Disorders (Child)

Pilot Study to Assess the Development of Executive Functions in Cuban Preschoolers Using Two Tests Developed in Brazil

The utility of the Behavior Rating Inventory of Executive Function across neurological and neuropsychiatric conditions - associations with cognition and emotional distress

Differential Relationships Among Speeded Neuropsychological Test Performance and Facets of Impulsivity in Individuals with Substance Use Disorder

#### 3:45 PM–5:05 PM

2. BAKER, L

#### Paper Session 4. HIV/AIDS

Topological Organization of Whole-Brain Networks in HIV+ Individuals

### FRIDAY, FEBRUARY 5, 2016

#### 9:00 AM–10:30 AM

37. BRANSON, R

#### Poster Session 5. Cancer, Cross Cultural, Forensic, Malingering/Effort Testing, and MS/ALS

Detecting Suboptimal Effort in Undergraduate Students Who Simulate Brain Injury

#### 12:30 PM–2:00 PM

16. GERTSBERG, AG

85. CHIU, C

#### Poster Session 6. Aging, MCI, and Visuospatial/Neglect

Cognitive reserve: The Role of Occupational Experience

Tablet-based visuospatial battery briefly assesses a wide range of hemispatial neglect symptomatology

#### 2:30 PM–3:30 PM

4. DONELAN, J

#### Paper Session 8. Executive Functions/Frontal 1

Early lead exposure in children. Is there a neuropsychological effect?

### SATURDAY, FEBRUARY 6, 2016

#### 9:00 AM–10:30 AM

7. CHOUDHURY, TK

29. WEKKING, EM

75. MULHAUSER, K

#### Poster Session 8. Cognitive Intervention/Rehabilitation, Dementia, and Drugs

Comparative Patient Satisfaction and Efficacy of a Parkinson's Disease Enrichment Program (PEP)

Improving the Sequelae of Cognitive Deficits in Patients with Severe Mental Illness: an Individual Approach

Abstinence-based Changes in Neurological Functioning During Residential Treatment for Alcohol and Cocaine Use Disorders

#### 9:00 AM–10:30 AM

85. NEHRA, A

86. NEHRA, A

87. KAUR, H

88. NEHRA, A

#### Poster Symposium 2. Neuropsychological Assessment

Neuropsychological Assessment & Rehabilitation from Literates to Illiterates: An Indian Perspective

Neuropsychological Assessment in India: Impact of Education Revolution

Development & Effectiveness of a Home Based Neuropsychological Rehabilitation Program for Patients Suffering from Aphasia

Cognitive Rehabilitation of Individuals after Traumatic Brain Injury Using an Eclectic Literacy and Culture Free Intervention Program

#### 10:45 AM–12:00 PM

61. CHOUDHURY, TK

70. GELUZ, ZS

80. OVERLY, T

#### Poster Session 9. Emotional Processes, Genetics, HIV/AIDS, & Psychopathology/Neuropsychiatry

Deep brain stimulation (DBS) for treatment of therapy-refractory obsessive compulsive disorder (OCD): a case study highlighting neurocognitive and psychiatric changes

Neurocognitive Correlates of Internet Addiction in University Students

Neurocognitive Correlates of Schizotypal Personality Traits in University Students

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# Final Program

## Forty Fourth Annual Meeting

### International Neuropsychological Society

February 3-6, 2016  
Boston, Massachusetts, USA

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#### WEDNESDAY, FEBRUARY 3, 2016

- 9:00 AM–12:00 PM**      **CE 1. Functional MRI: The History, Basics, Cutting Edge, and Future**  
**Presenter: Peter A. Bandettini**  
**Salon F**
1.    BANDETTINI, PA      Functional MRI: The History, Basics, Cutting Edge, and Future
- 9:00 AM–12:00 PM**      **CE 2. Science and Practice Considerations for Bilingual Neuropsychology: A Focus on the Hispanic/Latino Community**  
**Presenters: Melissa Lamar, Maria T. Schultheis**  
**Salon G**
1.    LAMAR, M      Science and Practice Considerations for Bilingual Neuropsychology: A Focus on the Hispanic/Latino Community
- 9:00 AM–12:00 PM**      **CE 3. Advancing Developmental Science Through the Application of Pediatric Neuropsychology in Africa**  
**Presenters: Michael J. Boivin, Bruno Giordani**  
**Back Bay (Dartmouth-Fairfield)**
1.    BOIVIN, MJ      Advancing Developmental Science Through the Application of Pediatric Neuropsychology in Africa
- 12:00–3:00 PM**      **INS Student Liaison Committee Workshop: Social Competence in Pediatric Neurological Disease & Injury**  
**Presenters: Miriam H. Beauchamp, Keith O. Yeates**  
**Salon HIJK**
- 1:00–4:00 PM**      **CE 4. Characterizing and Guiding Brain Plasticity Across the Lifespan**  
**Presenter: Alvaro Pascual-Leone**  
**Salon F**
1.    PASCUAL-LEONE, A      Characterizing and Guiding Brain Plasticity Across the Lifespan
- 1:00–4:00 PM**      **CE 5. Cognitive Aging in the Digital Era: Role of Global Partnerships**  
**Presenter: Rhoda Au**  
**Salon G**
1.    AU, R      Cognitive Aging in the Digital Era: Role of Global Partnerships

**1:00–4:00 PM**

**CE 6. Dynamic Considerations in Neuropsychological Assessment of Depressive Disorders: State, Trait, Scar and Burden**  
**Presenter: Scott A. Langenecker**  
**Back Bay (Dartmouth-Fairfield)**

1. LANGENECKER, SA

Dynamic Considerations in Neuropsychological Assessment of Depressive Disorders: State, Trait, Scar and Burden

**3:00–4:15 PM**

**Poster Session 1. Behavioral Neurology, Electrophysiology/EEG, Epilepsy, and Memory**  
**Gloucester Hall**

**Behavioral Neurology/Cerebral Lateralization/Callosal Studies**

1. ALIOTO, A

White Matter Integrity of the Corpus Callosum Mediates the Relationship Between Cardiorespiratory Fitness and Processing Speed in a Population of Cognitively Normal Older Adults

2. BURNETT, KA

Inflexible Social Norm Perception in Agenesis of the Corpus Callosum

3. HA, J

Verbal Problem Solving in Individuals with Agenesis of the Corpus Callosum

4. HEILMAN, KM

Callosal Ideomotor Apraxia in Alzheimer's Disease

5. HOLLAND, AK

Reductions in Design Fluency and Cardiovascular Regulation Vary Selectively as a Function of Trait Hostility Level

6. MILLER, JS

Adaptive Skills in High-Functioning Adults with ACC and ASD

7. MOES, P

Left Happy Female, Right Angry Male: Hemisphere Differences in the Perception of Gender and Emotion

8. OSWALD, K

Variability in Bimanual Coordination Dependent on Strength of Hand Dominance

9. RENTERIA-VAZQUEZ, TA

Social Inferences from Animated Interacting Triangles in Agenesis of the Corpus Callosum: Labeled Topic Modeling

10. VAILLANCOURT, AA

Personality Characteristics of Individuals with Agenesis of the Corpus Callosum

**Electrophysiology/EEG/ERP**

11. CLUNIES-ROSS, KL

Hemispheric Differences in T<sub>b</sub> Responses to Tone-pairs with Short and Long Interstimulus Intervals in Children

12. DUGGAN, EC

Inhibitory Control in Bilinguals with and without Musical Training- A Pilot Study

13. EGETO, P

Behavioural and EEG Indices of Conflict Monitoring

14. EULER, M

Distinct Effects of Neural Activation and Consistency in Novelty Processing and Relations with IQ

15. HAUGER, SL

Counting Own Name -Clinical Robustness of Electrophysiology in Assessing Residual Cognition in Disorders of Consciousness

16. HERRERA, S

Analysis of Contrast Processing Deficits in Schizophrenia and Schizoaffective Disorder Using

Electrophysiological and Psychophysical Measures

17. MANGAL, P

Intentional Enhancement Of Electrocortical Responses To Emotional Pictures By Parkinson Patients: Relation To Executive Function

18. MOORE, WR

Neurophysiological Marker of Attention Switching Advantages in Bilinguals: A Pilot Study

19. NUNEZ, V

A Neurophysiological Marker of Inhibition in Bilinguals: A Pilot Study

20. OSWALD, V

Fronto-Parietal and slow oscillations correlate with working memory performance: resting state MEG study

21. STEFANATOS, G

Electrophysiological Signature of Selective Auditory Attention

22. STEFFEN-ALLEN, F

Modulation of Neural Oscillation as a Function of Time During Successful Working Memory Performance In Schizophrenia

23. STOLZ, E

Ketamine Induced Neurophysiological and Neurochemical Changes in Healthy Controls: A Translational Model Using Simultaneous Imaging Modalities

**Epilepsy/Seizures**

24. BARRETT, LE

Age of Diagnosis Impacts Lateralization Profile in Pediatric Focal Epilepsy

25. BREWSTER, RC

White Matter Correlates of Verbal Memory Explored with DTI in Temporal Lobe Epilepsy

26. DEKHTYAR, M

Aicardi Syndrome: A Case Report of a Well Developing 15 Year Old

27. FACELLA-ERVOLINI, J

Functional Significance of Hippocampal Abnormalities in Pediatric Focal Epilepsy

28. FERNANDO, H

Medication and Executive Function in Temporal Lobe Epilepsy

29. FISCHER, M

Everyday Working Memory Function in Temporal Lobe Epilepsy

30. GRANADER, Y

Parent-Reported Comorbidities in Youth with ASD and Epilepsy without Intellectual Disability

31. HARP, JP

Neuropsychological Differential Diagnosis of Posterior Periventricular Nodular Heterotopia: A Case Study

32. HERMANS, E

Memory and fMRI Activation in Temporal Lobe Epilepsy: Towards Predicting Surgery Outcome

33. HINNEBUSCH, A

Symptoms of Inattention and Hyperactivity/Impulsivity in Pediatric Epilepsy

34. JACOB, SN

Memory and Coping in Patients with Epilepsy

35. KAVANAUGH, BC

Distinct Patterns of Younger versus Older Seizure Onset in Individuals with Autism Spectrum Disorders

36. KAVANAUGH, BC Differential Relationship between Depression and White Matter Integrity in Adult versus Child Onset Temporal Lobe Epilepsy
37. KIERSTEAD, S Female Protective Effects for Social Impairment in Autism and Epilepsy
38. LEVAN, A The Relationship between Executive Functioning and Social Skills in Children with Epilepsy
39. LIN, G Multidisciplinary Evaluation of "Subclinical Seizures" in Pediatric Parietal Lobe Epilepsy: The Value of Neuropsychological Evaluation
40. LIPPÉ, S Putamen Volume Predicts Working Memory Performance in Children with BECTS
41. MACALLISTER, WS The Utility of the WISC-V in Child and Adolescent Epilepsy
42. MAHONEY, EJ The Relationship between Perceived and Objective Cognitive Change Following Temporal Lobectomy
43. MAIMAN, M Inter-rater Reliability of the Parent versus Teacher Forms of the Behavior Rating Inventory of Executive Function in Children and Adolescence with Epilepsy
44. MARTIN, A The Influence of Executive Function on Memory and Learning in Pediatric Focal Epilepsy
45. MULLANE, AA Patients with Memory Retrieval Difficulties are at Risk for Objective and Subjective Memory Declines Following Left Temporal Resection for Epilepsy
46. NOBLE, SM Preliminary Validation of a Novel Method of Presurgical fMRI Language Localization through Functional Connectivity Analysis
47. PELLETIER, CL RBANS Embedded Effort Measures in Adults with Focal Epilepsy
48. POWELL, S The Relations Between Performance-Based Measures of Executive Dysfunction and Teacher-Reported Executive Dysfunction in Children with Epilepsy
49. REY, GJ Verbal Memory Assessment of Spanish-Speaking Patients with Temporal Lobe Epilepsy
50. REYES, A The Fractional Amplitude of Low-frequency Fluctuation on Resting State fMRI Differentiates Temporal Lobe Epilepsy with and without Mesial Temporal Sclerosis
51. ROTH, RM Self-Rated Executive Dysfunction in Adults with Focal Epilepsy
52. RUM, R Seizure Remission Status Following Surgery for Localization-related Epilepsy Associated with Differences in Postoperative WAIS-IV Performances
53. RUM, RS Impact of seizure remission status and neuropsychological functioning on quality of life among postoperative epilepsy patients
54. SALEH, MI The Utility of Neuropsychology in Predicting Functional Reorganization in Presurgical Pediatric Epilepsy Cases
55. SCHRAEGLE, WA Pattern of Memory Performance in Children with Frontal or Temporal Lobe Epilepsy
56. SHIELDS, B The Relation between Executive Functioning and Psychological Disturbance in Youth with Pediatric Generalized Epilepsy
57. SOMBOON, T Lateralizing Value of Memory Function Test (Translated) in Thai Patient with Temporal Lobe Epilepsy due to Hippocampal Sclerosis
58. STEFANATOS, AK Neurocognitive Sequelae of Frontal and Temporal Lobe Epilepsy in Children: Support for Network Impairment
59. BERL, M Survey Results of Neuropsychological Evaluation in Presurgical Pediatric Epilepsy
- Memory Functions**
60. BERL, M Profiles of Memory and Learning of the CVLT-C using Graph Theory
61. ANDERSON, DM Assessing the Relationship Between Episodic Memory and the Volume of the Hippocampus in Young Children Born Prematurely
62. ANDERSON, JR Effects of Sleep Quality and Glucoregulation on Sustained Attention, Working Memory, and Inhibitory Control in Healthy Young Adults
63. ÁVILA, R Working Memory Mediates the Relationship Between Aging and Memory Performance in Older Adults with Heterogeneous Cognitive Background
64. BAIN, KM Longitudinal Assessment of Verbal Learning in Patients with Psychotic Disorders
65. DHIMA, K Processing Speed as a Predictor of Memory Performance in Multiple Sclerosis, Parkinson's Disease, and Alzheimer's Disease
66. FEINBERG, JH Visual Memory Errors and Language Functioning: A Factorial Analysis of BVRT Memory Errors, WAIS-III, and MAE Subtests
67. GRAVES, L Recognition Discriminability in Huntington's and Alzheimer's Disease
68. HIZEL, L Contribution of Organization to ROCF Recall in Idiopathic Parkinson's Disease Beyond Processing Speed and Motor Abilities
69. KELLOGG, EJ Associations Among a Task of Prospective Memory, Executive Functions, and Impulsivity within a Non-Clinical Sample
70. KORTHAUER, LE Contributions of Executive Functioning to Spatial Navigation Performance
71. LARSON, SW How does having Comorbid ADHD affect Memory Deficits in Children with Reading Disorders?
72. MARKOWSKI, S Greater Neuroticism Predicts Higher Performance in Immediate Memory, Language, and Attention in Healthy Individuals
73. MUNRO, CE Mapping the Metabolic Correlates of Subjective Memory Concerns in Cognitively Normal Elderly Individuals
74. NATION, DA Cognitive Effects of High Altitude Exposure in Military Pilots and Aircrew
75. NOVITSKI, J Relationship between Contextual Recall and Semantic Fluency Performance in Healthy Older Adults and Mild Cognitive Impairment
76. QUINN, C Association of motor function and cognitive performance in a sample of older adults with and without Parkinson's disease

77. RASKIN, S Psychometric Properties of the Memory for Intentions Test-Short Form  
 78. RASKIN, S Use of Electrophysiological and Clinical Measures of Prospective Memory in individuals with Mild and Severe Brain Injury  
 79. TALBOT, KS Investigating General Time-Based Prospective Memory in Children Using a Novel Naturalistic Paradigm  
 80. TEAFORD, MA Convergent Validity of the Poreh Nonverbal Memory Test

### **HIV/AIDS/Infectious Disease**

81. GAMEZ, M Composite Scores Increase Detection of Neurocognitive Impairment in the HIV-Positive Native Spanish-Speaking Older Adult: A Pilot Study  
 82. SARNO, M Neuropsychological Profile of HIV-positive Spanish-speaking Hispanic Older Adults

**3:00–4:15 PM**

### **Poster Symposium 1. Predicting Postsurgical Outcome Using Neuroimaging Markers in Temporal Lobe Epilepsy**

**Organizer: Karol Osipowicz**  
**Gloucester Exhibit Hall**

#### **Epilepsy/Seizures**

83. OSIPOWICZ, K Predicting postsurgical outcome using Neuroimaging Markers in Temporal Lobe Epilepsy  
 84. TRACY, JI Frontal Gray Matter Abnormalities Predict Seizure Outcome in Refractory Temporal lobe Epilepsy Patients  
 85. TRACY, JI Pre-Surgery Resting-State local Graph-Theory measures predict Neurocognitive Outcomes after Brain Surgery in Temporal Lobe Epilepsy  
 86. OSIPOWICZ, K fMRI, Resting State, and DTI Predict Verbal Fluency Outcome Following Resective Surgery for Temporal Lobe Epilepsy

**4:15–4:30 PM**

**Program Welcome**  
**Program Chair: Rosemary Fama**  
**Salon ABCDE**

**4:30–5:30 PM**

**Plenary A. The Human Brain Connectome and Cognitive and Affective Function: Normal Individual Variability, Aging, and Neurodegeneration**  
**Presenter: Brad Dickerson**  
**Salon ABCDE**

1. DICKERSON, B The Human Brain Connectome and Cognitive and Affective Function: Normal Individual Variability, Aging, and Neurodegeneration

**5:30–6:30 PM**

**INS Awards Ceremony**  
**Salon ABCDE**

**6:30–7:30 PM**

**Welcome Reception**  
**3rd Floor Atrium & Lounge**

## **THURSDAY, FEBRUARY 4, 2016**

**7:20–8:50 AM**

**CE 7. Chemical Exposures and the Nervous System: Clinical Findings and Research Evidence**

**Presenter: Roberta F. White**  
**Salon F**

1. WHITE, RF Chemical Exposures and the Nervous System: Clinical Findings and Research Evidence

**7:20–8:50 AM**

**CE 8. Mild Cognitive Impairment and Preclinical Alzheimer's Disease: Concepts in Need of Input from Neuropsychology**

**Presenter: Mark W. Bondi**  
**Salon G**

1. BONDI, MW Mild Cognitive Impairment and Preclinical Alzheimer's Disease: Concepts in Need of Input from Neuropsychology

**9:00–10:30 AM****Poster Session 2. ABI (Child), ADHD/Attention, Autism, and Learning Disabilities/Academic Skills  
Gloucester Hall****Acquired Brain Injury (TBI/Cerebrovascular Injury & Disease - Child)**

1. ARES, K Homeless Youths' Self-Reported Executive Functioning as Mediated by Traumatic Brain Injury Severity
  2. BOSENBARK, DD Attention and Executive Functioning Profiles in Children Following Perinatal Arterial Ischemic Stroke
  3. BOSENBARK, DD Relationship Between Performance Testing and Parent Report of Attention and Executive Functioning Profiles in Children Following Perinatal Arterial Ischemic Stroke
  4. BOUTZOUKAS, EM Efficacy of Amantadine Treatment During the First Week Following Sports-Related Concussion
  5. SADY, MD Relationship between School Concussion Policy and Symptoms, Self-Efficacy, and Supports
  6. BURNS, AR Ratings in cognitive exertion differ across neuropsychological measures following a concussion
  7. BURNS, AR Reliability and validity of the Progressive Activities of Controlled Exertion- Self Efficacy (PACE-SE) scale: A novel measure assessing children's self-efficacy following a concussion
  8. CHIU, P Training-related Changes in Counting Stroop task Activation in Pediatric Traumatic Brain Injuries (TBI): an fMRI study
  9. COLLIER, S The Association between Change in Post-Concussion Symptoms and Self-Efficacy over Recovery from Concussion
  10. CROCFER, K Patterns of Performance on Neuropsychological Assessment in Pediatric TBI and Control Samples
  11. EPSTEIN, GB Concussion-Related Cognitive Exertion Ratings in Uninjured High School Athletes
  12. GHILAIN, C Pediatric ImPACT: Detecting Age and Gender Based Differences of Baseline Functioning
  13. GOODRICH-HUNSAKER, NJ Altered Corpus Callosum Integrity in Children with Mild Traumatic Brain Injury (mTBI)
  14. GRETENCORD, AA Self-Report of Symptoms in Sports-Related Concussions
  15. HEINKS, T The Influence of Age at Diagnosis for Cognitive Performance in Pediatric Brain Tumor Patients Before Treatment
  16. KOEHL, LM Validating Neurocognitive Measures in an Adolescent Sports Concussion Sample: ImPACT Computerized Testing versus Traditional Neuropsychological Measures
  17. LAFLEUR, J Attention Networks in Children with early Traumatic Brain Injuries
  18. MAXWELL, EC Impact of Counselor-Assisted Problem Solving on Parental Coping in Families of Children with Traumatic Brain Injury
  19. MIETCHEN, JJ Frontal Volumetrics and Social Functioning in Children following Traumatic Brain Injury
  20. MONAHAN, KA Feasibility and Acceptability of a Brain Injury Education Program on a Pediatric Inpatient Rehabilitation Unit
  21. PLOURDE, V ADHD symptoms predict quality of life following pediatric moderate-to-severe traumatic brain injury
  22. ROSENTHAL, SL Subconcussive Related Changes in High School Football Player Reaction Time
  23. SANDEL, N Deficits in Memory and Processing Speed following Acute Sports Concussion
  24. TREBLE-BARNA, A Profile Analysis of Long-Term Neuropsychological Functioning following Traumatic Brain Injury in Early Childhood
  25. VARGAS, G Child Versus Parent Reported Recovery Post-concussion: Differences and Correlates
  26. VAUGHAN, CG Examining a 3 Subtest Format of the Tasks of Executive Control (TEC) in a Concussed and Non-concussed Sample
  27. WILDE, EA Relation of DTI with Reading and Language Skills in Pediatric TBI
  28. WOJTOWICZ, M Comparing Baseline Concussion Measures in High School Student Athletes
  29. WOJTOWICZ, M Pre-season Concussion Testing in High School Students with Academic Difficulties or Attention Deficit Hyperactivity Disorder
  30. CHAMBERS, AM Problems with Executive Planning are Associated with Social Withdrawal in Adolescent Traumatic Brain Injury
  31. COOK, NE Processing speed in pediatric head injury: Examining the impact of psychiatric and learning comorbidities
- ADHD/Attentional Functions**
32. CHAMBERS, AM Sustained Attention Moderates the Relationship between Sleep Schedule Variability and Verbal Memory in Children with ADHD
  33. COOK, NE Do sluggish cognitive tempo and slow processing speed represent the same construct? Evidence for differentiation of functional correlates in children and adolescents with ADHD
  34. ARENTSEN, TJ The ADHD Symptom Questionnaire (ASQ): Pilot Study on a DSM-5 Specific, Self-Report Questionnaire with Embedded Validity Items
  35. BALDWIN, F Goodbye to the Processing Speed Deficit? Performance of Clinically-referred Children with and without ADHD on the WISC-V
  36. BEEBE, DW fMRI Correlates of Diminished Sustained Attention among Sleep-Restricted Adolescents
  37. BORSCHUK, AP The Influence of Comorbid Asthma on the Severity of Symptoms in Children with Attention Deficit Hyperactivity Disorder
  38. CAIRNCROSS, M The Efficacy of Mindfulness-Based Therapies for Attention-Deficit/Hyperactivity Disorder: A Meta-analytic Review



39. DYKSTRA, JB Self-Handicapping Strategies in Emerging Adults Concerned about ADHD  
 40. HALE, JB Research Domain Criteria for Deciphering ADHD Executive Heterogeneity  
 41. KANDASAMY, A Eye-Tracking as a Behavioural Measure of Impulsivity  
 42. KIM, J Attention-Deficit/Hyperactivity Disorder (ADHD) in Adults: Neuropsychological Referrals in an Academic Medical Center  
 43. LARSON, JC Can a 75-Second Motor Persistence Test Predict ADHD in School-Aged Children?  
 44. LEE, EY Self-Reported Impulsivity and Self-Regulation in Relation to ADHD and Executive Function Tasks  
 45. LIEBEL, SW ADHD Symptoms among College Students: Cross-Informant Agreement, Intra-Informant Agreement and Relationships with Neuropsychological Functioning  
 46. LIEBEL, SW Auditory and Visual Working Memory in College Students with ADHD  
 47. MAZZOLA, KS The Effect of Comorbid Depression in Adult ADHD on the CAARS  
 48. OSWALD, K Working Memory Assessment and Symptoms of Attention Deficit Hyperactivity Disorder in Children  
 49. PIEVSKY, MA The Use of Neuropsychological Measures in ADHD Diagnosis  
 50. PINJALA, M Component Structure of Multiple Tests of Attention in a Mixed Clinical Child Sample  
 51. RECIO, RC Effects of One Neurofeedback Session on Verbal and Visuospatial Search  
 52. TABAQUIM, MM Child attentional functions with Cleft Lip and Palate  
 53. THOMASON, MM Concentration Deficit Disorder: Prevalence, Associated Impairment, and Comorbidities in a Population-Based Sample  
 54. UDHNANI, MD Not All Visual Memory Tasks Are Created Equal: Sustained Attention May Explain Pediatric Performance Differences  
 55. VAN MEURS, B Processing Speed, Attention and Executive Functioning in ADHD with and without Co-morbid Anxiety  
 56. VAN PATTEN, R The Effect of Premorbid Attention-Deficit/Hyperactivity Disorder on Neuropsychological Functioning in Individuals with Acute Mild Traumatic Brain Injuries  
 57. WEIGARD, A A Model-Based Assessment of Slow vs. Variable Information Processing in ADHD  
 58. FRIED, R Clinical Correlates of Working Memory Deficits in Youth with and without ADHD: A Controlled Study

### Autism Spectrum Disorders

59. FRIED, R Examining Driving Behavior in Young Adults with High Functioning Autism Spectrum Disorders (HF-ASD): A Pilot Study Using a Driving Simulation Paradigm  
 60. FRIED, R Neuropsychological Correlates of Autism Spectrum Disorders: A Controlled Study of Adults with High Functioning ASD  
 61. BEN-AVI, E Elevated White Matter Abnormalities in Females with Autism Spectrum Disorder  
 62. BONEBAKKER, A Autism spectrum disorders in dual-diagnosis patients  
 63. BRADBURY, KR Birth Order Impacts Psychometrics on M-CHAT-R with Follow-up Phone Interview (M-CHAT-R/F)  
 64. CABILES, PA Is Emotional Processing a Predictor of Traits of Autism Among University Students?  
 65. CARLEW, AR A Virtual Classroom Continuous Performance Task for Assessing Persons with Autism  
 66. CLAWSON, A Conflict Adaptation in Autism Spectrum Disorder: A Family Study  
 67. CORDEAUX, C Profiles of Children Missed at Initial Autism Screening Compared to Early-Identified Peers  
 68. DOLAN, B Examining PEERS for Young Adults: Improvements in Social Motivation and Relations to Neural Activity  
 69. ELOI, JM The Contribution of Intelligence, Empathy and Personality Traits to Adaptive Living Skills in Individuals with Autism Spectrum Disorder  
 70. FATOORECHI, S Atypical Cerebral Lateralization for Handedness in Autism Spectrum Disorder  
 71. FLORES, A Relationship Between Neural Coherence and Social Inference and Prediction in Autism Spectrum Disorder  
 72. GRIFFIN, JW Moderation Analysis of Episodic Memory in Autism Spectrum Disorders: A Meta-Analytic Review  
 73. KENWORTHY, L Real-World Executive Functions in Adults with Autism Spectrum Disorder: Profiles of Impairment and Associations with Adaptive Functioning and Co-morbid Anxiety and Depression  
 74. LAJINESS-O'NEILL, R Altered P3 Neuromagnetic Evoked Response Related to Language Functioning in Children with Autism Spectrum Disorder  
 75. LEE, C Poor Motor Functions Relate to Visuomotor Adaptation in Children with Autism Spectrum Disorders  
 76. MOULTON, E Cognitive and Language Functioning of Children Who Lose Their ASD Diagnosis  
 77. NADER, A An increased role of perception in learning for autistic children  
 78. PAWLUK, L Initiation of Joint Attention (IJA) and Executive Functioning in School-Aged Children with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD)  
 79. RICHARD, AE Neural Synchrony during Visual Attention Shifting in Autism Spectrum Disorders  
 80. STRANG, J The Flexibility Scale: A Parent-Report Inventory of Flexibility Skills in Children With Autism Spectrum Disorders Without ID  
 81. VERBALIS, AD Experience of Parent Burden from Cognitive Inflexibility in ASD for Poor and Rich Communities

### Learning Disabilities/Academic Skills

82. CHILD, A A Cognitive Dimensional Approach to MD, RD, ADHD Comorbidity  
 83. ELIAS, J Contributions of Executive Functions, Math Anxiety, and Parental Expectations toward Math Achievement

84. FRITZ, C Exploratory Factor Analyses of Neurocognitive and Reading-Related Factors in Struggling Readers At Different Ages
85. HASLER, HM Moved to Learn: Movement Abilities Correlate with Cognition in Preschoolers Born Very Preterm
86. MARCHAND, M Simple and Complex Motor Coordination Abilities in Children with Dyslexia and/or Attention Deficit Disorder
87. MENGHINI, D Reading Improvement Following tDCS and Cognitive Treatment in Children and Adolescents with Dyslexia
88. PAO, LS Rapid Automatized Naming Speed Predicts Reading Comprehension in Impaired and Typical Readers
89. RIGGALL, E Implicit Sequence Learning and Memory and Phonological Awareness in Developmental Dyslexia and Specific Language Impairment
90. WESONGA, EM Age Moderates the Predictive Utility of Spatial Working Memory for Mathematical Achievement
91. WINTER, R The Relationship between Phonological Short-Term Memory, Working Memory, and Changes in Reading Scores in Children with Dyslexia
92. WISEHEART, R How Derivational Morphology Intervention Improves Reading in Adult English Language Learners
- Drug/Toxin-Related Disorders (Including Alcoholism)**
93. WILSON, MJ Effects of Sex and Drug Class on Neurocognitive Impulsivity Among Drug Users in Protracted Abstinence
- Genetics/Genetic Disorders**
94. CUKIER, YR The Neuropsychological Profile of a Child with Diamond-Blackfan Anemia and the Impact of Hemoglobin Level on Aspects of Cognition
- Language and Speech Functions/Aphasia**
95. VEGA, M Comparison of Nonverbal Skills in Children with Hearing Loss and Autism Spectrum Disorder

**9:15–10:45 AM****Symposium 1. Malformations of Cortical Development and Cognition****Chair: Karen Blackmon****Salon ABCDE**

1. BLACKMON, K Malformations of Cortical Development and Cognition
2. BLACKMON, K Focal cortical anomalies and neuropsychological phenotypes in 16p11.2 syndrome
3. GALABURDA, AM Do minor cortical anomalies need to look like minor cortical anomalies to produce learning problems? Lessons from rodent studies
4. SCOTT, RC Can early environmental enrichment improve cognitive functions in MCD?
5. KORMAN, B Factors that influence neuropsychological performance in children with FCD-associated intractable epilepsy
6. CHANG, BS Modulation of brain networks in gray matter heterotopia using connectivity-guided transcranial magnetic stimulation

**9:15–10:45 AM****Symposium 2. Neuropsychology and Neuroimaging in Alcohol Use Disorders: A Better Understanding for a Better Treatment****Chair: Anne Lise Pitel****Back Bay (Dartmouth-Fairfield)**

1. PITEL, A Neuropsychology and Neuroimaging in Alcohol Use Disorders: a Better Understanding for a Better Treatment
2. SULLIVAN, EV Brain Structure and Function in Alcohol Use Disorder
3. BEAUNIEUX, H Cognitive Screening for a Better Treatment
4. MAURAGE, P Social Neurosciences in Alcohol-Use Disorders
5. BATES, ME Cognitive Remediation and Different Trajectories of Cognitive Recovery in Persons with Alcohol Use Disorders

**9:15–10:45 AM****Paper Session 1. Acquired Brain Injury (ABI), Adult****Moderator: Eli Vakil****Salon F**

1. JOHNSON, EM Long-Term Effects of Traumatic Brain Injury in the Framingham Study
2. BIEKMAN, B Early and Late Neurodegenerative Changes in White Matter Integrity following TBI
3. KRCH, D The Sagittal Stratum as a Candidate Biomarker for Degree of Neuropathology after Chronic TBI
4. CLARK, AL Links Between Perfusion, White Matter Integrity, and Cognition in Veterans with History of Mild-to-Moderate TBI
5. SANDRY, J Pre-treatment differences in clinical estimates of working memory capacity determine memory rehabilitation efficacy in TBI
6. HILL, BD Utility of Auditory ERPs to Evaluate Linguistic Processing in TBI

**9:15–10:45 AM****Paper Session 2. Medical/Neurological Disorders, Adult**  
**Moderator: Margaret G. O'Connor**  
**Salon G**

1. POSSIN, KL  
Egocentric and Allocentric Working Memory in Premanifest Huntington's Disease: a Double Dissociation with Caudate and Hippocampus Volumes
2. KOPELMAN, M  
Amnesia In An Actor
3. GONZALES, M  
Divergent Influences of Multiple Cardiovascular Risk Factors on Cognition, Grey and White Matter Morphology
4. KESSELS, RP  
The effect of cognitive reserve on vascular cognitive impairment after stroke
5. VILLARD, SN  
Between-Session and Within-Session Intra-Individual Variability in Attention in Aphasia
6. PATERSON, TS  
Self-efficacy Mediates the Relationship Between Traditionally Measured Intelligence, but not Everyday Problem Solving Ability, and Medication Adherence, in Renal Transplant Recipients
7. WALKER, KA  
Low Mean Arterial Pressure in Critically Ill ICU Patients is Associated With Poorer Memory and MMSE at Discharge and Follow-Up

**10:45–11:00 AM****AM Coffee Break**  
**Gloucester Exhibit Hall****11:00 AM–12:00 PM****Plenary B. There's More There: Extracting New Information From the Functional MRI Signal Using Novel Acquisition and Processing Methods**  
**Presenter: Peter A. Bandettini**  
**Salon ABCDE**

1. BANDETTINI, PA  
There's More There: Extracting New Information From the Functional MRI Signal Using Novel Acquisition and Processing Methods

**12:45–2:15 PM****Poster Session 3. Assessment (Adult) and Cognitive Neuroscience**  
**Gloucester Hall****Assessment/Psychometrics/Methods (Adult)**

1. ADLER, MC  
Demoralization and the Metacognitive Index: A MMPI-2-RF and BRIEF-A Study
2. AHN, SS  
Social Desirability and the Relationship between Subjective Ratings on Cognition and Actual Performance
3. AITA, SL  
Revisiting the Biber Cognitive Estimation Test: A Novel IQ-Criterion Based Approach to Scoring
4. ALBUQUERQUE, MR  
Fixation duration predicts performance in the Grooved Pegboard Test: An analysis of two different tasks using the preferred and non-preferred hands
5. ARENTSEN, TJ  
MMPI-2-RF Content Validity Indicators and BDI-II / BAI Responding
6. ASHISH, D  
Wechsler Adult Intelligence Scale-4th Edition (WAIS-IV) Performance in a Mixed Clinical Sample of Monolingual and Bilingual Veterans
7. BABAKHANYAN, I  
NIH Toolbox Emotion Domain: Creation of Census Stratified Normative Data, Summary Scales and Base Rates for Distressed Emotional Functioning
8. BAERRESEN, KM  
Screening for Cognitive Decline in a Veteran Population with the Montreal Cognitive Assessment (MoCA) and the Benson Figure
9. BERNSTEIN, J  
Validity of the King-Devick Test in Post-Acute Concussion and Chronic Partial Sleep Restriction Populations
10. CALAMIA, M  
Self-Reported vs. Informant-Reported Depressive Symptoms in an Outpatient Neuropsychology Clinic Sample
11. CARSTENS, J  
Concurrent Validity of the Goal Management Training Questionnaire – Self in Undergraduates
12. CARTER, KR  
Base Rate Comparison of Failed RBANS Effort Scale and Effort Index in Parkinson's Disease
13. COSTA, MV  
Diagnostic accuracy of GDS-15, PHQ-9 and HAMD-17 in a community sample of elderly with late life depression
14. CRANSTON, CC  
Alternate Form of the Trail Making Test Parts A & B: Preliminary Validation
15. DONDEERS, J  
D-KEFS Color-Word and Verbal Fluency Performance after Traumatic Brain Injury
16. DUNCANSON, H  
Errors versus Speed on the Trail Making Test: Relevance to Driving Safety and Cognitive Impairment
17. EMMERT, NA  
The RBANS Factor Structure in Older Adults with Suspected Cognitive Impairment: Evidence of a 5-Factor Structure
18. ENG, ME  
Verbal and Nonverbal Mediation Strategies of the Boston Naming Test
19. FAUSTO, B  
The utility of neuropsychological tests and measurement of comorbidity in predicting driving competence among memory clinic patients
20. FELLOWS, RP  
Multicomponent Analysis of a Novel Digital Trail Making Task
21. FULLER, JS  
Gender Differences in Item Function on a Common Clock Drawing Test
22. GALUSHA-GLASSCOCK, JM  
Comparison of the Texas Assessment of Processing Speed (TAPS) with Common Neuropsychological Tests among Older Individuals With and Without Cognitive Impairment
23. GASS, CS  
Psychological Variables in WAIS-IV (Intelligence Test) Performance

24. GAVETT, BE Using Item Response Theory to Evaluate and Improve the Ecological Validity of Neuropsychological Tests: An Example of Phishing Susceptibility
25. GONZÁLEZ, DA Auditory and Visual Naming Tests: Psychometric Properties and Performance Patterns among Veterans with and without Cognitive Impairment
26. GONÇALVES, MA WAIS-III's Vocabulary holds as a good measure of pre-morbid functioning after brain injury
27. GURNANI, A Measurement Invariance of the Latent Dementia Phenotype in the ADNI Dataset
28. HOLDNACK, JA Estimating Premorbid Cognitive Functioning Using the NIH Toolbox Oral Reading Test
29. HOLDNACK, JA Multivariate Base Rates for Interpretation of NIH Toolbox Cognition Tests and Application to Individual with TBI and Stroke
30. HOYMAN, LC Preliminary Effects of Heavy Drinking and Age on Cognitive Functioning in Veterans with Posttraumatic Stress Disorder
31. JEFFERSON, AL Psychometric Properties of a Visual Learning and Memory Test: The Biber Figure Learning Test
32. JURICK, SM Examination of cut scores on the validity subscale of the Neurobehavioral Symptom Inventory in Iraq and Afghanistan Veterans with a history of mild to moderate traumatic brain injury
33. KREISEL, CJ Individual Differences in Performance on the Tower of Hanoi and NASA Task Load Index
34. KRIVENKO, A Decomposition of the Trail Making Test in a Clinical Population of Dementia
35. LEITNER, D Assessing the Efficacy of a Cognitive Model on Concurrent Functional Outcome in Acute Stroke Patients
36. LUU, H MMPI-2-RF Validity Scales in Electrical Injury, Mild Traumatic Brain Injury, and Depression
37. MALLECK, M The Brief Estimate of Seconds Test (BEST): A Pilot Study Examining Initial Psychometrics and Norms for a New Chronometric Clinical Test
38. MARSHALL, KK The Role of Executive Functions in Externally-Valid Decision-Making Processes
39. MCAULEY, TL Quantifying the Qualitative Aspects of Affective Word Production on the Emotion Word Fluency Test in Somatic Anxiety
40. MCCABE, D Centralized, Collective, Neuropsychological Databases: Perceived Value and Feasibility
41. MIETCHEN, JJ Factor Structure and Predictive Model of the Rey Auditory Verbal Learning Test
42. MILLER, JB Comparing the Test of Premorbid Functioning with the Wide Range Achievement Test, 4th Ed. Reading Subtest as Estimates of Premorbid Ability
43. MORGAN, KN Can Lumosity Assessment Tools Provide An Accurate Snapshot of Executive Functioning? An Independent Investigation of Test-Retest Reliability and Convergent Validity
44. MULLEN, C Problem Solving in Space: Factors Accounting for Short Category Test Performance
45. OHLHAUSER, L Convergent Validity of the Functional Independence Measure and Common Neuropsychological Tests in a Stroke Population
46. OHLHAUSER, L Glycemic Control and Neuropsychological Test Performance in Adults With Type II Diabetes
47. PAOLILLO, E Utilization of Instruments with Alternate/Parallel Test Forms among Clinical Neuropsychologists in the U.S. and Canada
48. PARANAWITHANA, C Neurocognitive Impairment in First Episode Bipolar Disorder and Schizophrenia
49. PARKER, AF Lesion Localization and Performance on the California Verbal Learning Test-II Following Stroke
50. PATT, VM Characterizing Heterogeneity in Normal Neurocognition
51. PIERS, RJ Displacement of the Minute Hand as a Preclinical Marker of Dementia: Clock Drawing in the Framingham Heart Study
52. PIERS, RJ Percent Intra-Component Think Time: Digital Clock Drawing in the Framingham Heart Study
53. PIERS, RJ Digital Assessment of Speed and Graphomotor Decision Making by Age Group: Framingham Heart Study
54. POLEVOY, A Utility of the RBANS in Detecting Cognitive Impairment in Alcohol Use Disorders: A ROC Study
55. QUASNEY, EE Neurobehavioral Examination Performance and Motor Intrusion Errors in Mild Cognitive Impairment versus Dementia
56. RAAK, J Predicting Variance in Neuropsychological Test Performance from Heart Rate and Anxiety
57. REYNOLDS, M A Significant Threat to Neuropsychological Test Validity
58. ROSEN, A Neuropsychologists' Expectations are High for Poor Cognitive Performance in Recreational Cannabis Users
59. ROSENBLATT, AS Evidence for Clinical Utility of Neuropsychological Data Despite Performance Validity Failures
60. ROWLAND, JA Construct Validity of Auditory Consonant Trigrams
61. ROYE, S Booklet Category Test: Factor Structure and Neuropsychological Correlates in a Mixed Clinical Sample
62. SALINAS, SL Older Patients Who Present With Comorbid Depression and Cognitive Complaints: Why Full Neuropsychological Testing Is Recommended
63. SALMON, R Lexical Characteristics of Emotion Word Fluency Test Responses and Depression in Healthy Young Adults
64. SCHUSTER, AM The Efficacy of Neuropsychological Assessment Composite Scores as a Predictor of Discharge Destination After Stroke
65. SEGAL, E The Clinical Utility of the Boston Naming Test as a Measure of Semantic Memory
66. SEIDENBERG, M The Relationship Between Demographic Variables and Performance on a Newly Developed Remote Memory Test of Famous Name Discrimination
67. SNYDER, AR Confirmatory Factor Analysis on the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) at Baseline

68. SORRELL, A Construct Validity of the NIH-Toolbox Cognition Battery Fluid and Crystallized Composite Scores in Cognitively Healthy Older Adults
69. STERN, SK General Unhappiness and Dissatisfaction Impacts Elevations on the Behavior Rating Inventory of Executive Function-Adult: An Emotional, Not Cognitive, Connection
70. TROYANSKAYA, M Choosing Appropriate Control Group Participants in Studies of Veterans: Characteristics of Orthopedically Injured and Uninjured OEF/OIF/OND Veterans
71. TULSKY, DS Confirmatory Factor Analysis of the NIH Toolbox Cognition Battery Among Individuals with Acquired Brain Injury
72. VERMILION, B Can You Hear Me Now? Phonetic and Semantic Analysis of a List-Learning Task
73. WELTON, E A Brief Attention, Memory, and Frontal Abilities Screening Test (AMFAST) for Children and Adults
74. WOLLMAN, SC Order of Test Administration Affects Verbal Fluency Performance
75. ZANE, KL Detecting Insufficient Effort in Persons with Post-Acute Traumatic Brain Injury using the Conners' Continuous Performance Test-II

### Cognitive Neuroscience

76. ALKOZEI, A Exposure to Blue Wavelength Light Suppresses Anterior Cingulate Cortex Activation in Response to Uncertainty During Anticipation of Negative or Positive Stimuli
77. ALKOZEI, A Exposure to Blue Wavelength Light is Associated with Increased Dorsolateral Prefrontal Cortex Responses During a Working Memory Task
78. ASSAR, N The Effect of Self-Criticism on Working Memory Performance Following Success and Failure
79. AZAR, M Awareness of Cognitive Abilities in Individuals with Essential Tremor
80. CARBINE, KA The Effects of Exercise and Time of Day on Inhibitory Control towards High- and Low- Calorie Food Cues
81. COHEN-GILBERT, JE Impact of Acute Alcohol and Nicotine use on Emotional Impulsivity: Associations with Resting State Perfusion in Reward Circuitry
82. CORBO, V Early Life Trauma Impacts the Association between Gray Matter Integrity and Memory in Combat-Exposed Veterans
83. GALINDO, C Effect of Emotional Valenced Stimuli on Working Memory Performance
84. GARCIA, MT Skills of Theory of Mind in Mexican children of 3 to 5 years old
85. HARRISON, CE Identifying the Specific Frontal-Executive and Processing Speed Deficits in Parkinson's Disease
86. ISHIDA, M Perceptual Integration of Locally Time-reversed Speech in Japanese
87. MCCUDDY, WT Cognitive and Cardiovascular Flexibility Relates to Stress Induced Habitual Decision-Making
88. OLIVERA FIGUEROA, LA A Time to be Stressed? Time Perspectives and Cortisol Dynamics Among Healthy Adults
89. PALOMBO, DJ The Effect of Semantic Future Thinking on Temporal Discounting: A Critical Role for the Medial Temporal Lobes
90. REITER, K Cognitive reserve offsets memory decline and the influence of APOE  $\epsilon 4$
91. SMITH, D Development of Cognitive Tests of Cerebellar Function
92. SMITH, R Successful Goal-Directed Memory Suppression is Associated with Increased Inter-Hemispheric Coordination Between Right and Left Fronto-Parietal Control Networks
93. SNEIDER, J Acute Alcohol and Nicotine Effects on Hippocampal-based Memory Performance and Resting State Quantitative Perfusion
94. THAI, M Intermittent Theta Burst Stimulation of the Dorsal Attention Network Cerebellar Node Improves Selective and Sustained Attention
95. WANK, AA Future Thinking About Self Versus Other in Patients With Medial Temporal Lobe Amnesia
96. WATSON, E Neurophysiological Behavioral Inhibition (BIS) and Behavioral Activation (BAS) Systems Are Related to Sleep Quality
97. WEISS, H Exploring the Relationships of Dissociative Experiences, Sleep and Cognition in Undergraduates
- Acquired Brain Injury (TBI/Cerebrovascular Injury & Disease - Adult)**
98. KEENAN, PT Neurobehavioral Symptom Inventory (NSI) Cognitive Items Do Not Predict Cognitive Dysfunction
99. PRILUCK, JL Prolonged Neuropsychological Deficit Following mTBI
100. TROYANSKAYA, M Deployment-Related and Demographic Characteristics as Predictors of Community Integration Following Combat Deployment

### 12:45–2:15 PM

### Invited Symposium 1. The Contributions of Neuroimaging to Understanding Autism

**Chair: Deborah Fein**

**Discussant: Deborah Fein**

**Salon ABCDE**

1. FEIN, D The Contributions of Neuroimaging to Understanding Autism
2. SCHULTZ, R MRI Findings from the Collaborative Infant Brain Imaging Study (IBIS)
3. DIMARTINO, A An Emerging Paradigm for Examination of Autism in Early Brain Development
4. MENON, V Functional and Structural Brain Organization in Autism: Linking Physiology and Behavior
5. EIGSTI, I Functional Brain Activation During Language Comprehension in Youth with Verbal Autism Spectrum Disorder (ASD), Typical Development, and Optimal Outcomes from ASD

**12:45–2:15 PM****Symposium 3. Neuropsychology's Role in Preventing, Understanding, and Treating Alcohol and Marijuana Use in Adolescents and Young Adults****Chair: Lindsay M. Squeglia****Discussant: Staci A. Gruber****Salon F**

1. SQUEGLIA, LM Neuropsychology's Role in Preventing, Understanding, and Treating Alcohol and Marijuana Use in Adolescents and Young Adults
2. SQUEGLIA, LM Neurocognitive Predictors of Initiating Heavy Alcohol Use during Adolescence
3. JACOBUS, J The Adolescent Brain Pre- and Post Alcohol and Marijuana Initiation
4. BIDWELL, LC Neuropsychological Correlates of Risk-taking and Substance Use in Emerging Adults
5. SCHACHT, J Dopaminergic Genetic Effects on the Neural Correlates of Response Inhibition Among Young Adults with Alcohol Use Disorder

**12:45–2:15 PM****Symposium 4. Chaotic Order, Language Connectivity, and a Generalizing Treatment of Aphasia****Chair: Stephen E. Nadeau****Back Bay (Dartmouth-Fairfield)**

1. NADEAU, SE Chaotic Order, Language Connectivity, and a Generalizing Treatment of Aphasia
2. NADEAU, SE Language Function Through the Lens of Population Encoding and Parallel Distributed Processing
3. BOHSALI, A Neural Connectivity Underlying Language Function
4. KENDALL, DL Phonomotor Therapy: an Intrinsically Generalizing Approach to Aphasia Therapy

**1:00–2:20 PM****Paper Session 3. Aging****Moderator: Benjamin M. Hampstead****Salon G**

1. SHAW, EE The ready brain: Amyloid burden alters the longitudinal relationship of performance to neural responses during task anticipation and execution
2. MANNING, KJ The Effect of Blood Pressure on Processing Speed and White Matter Microstructure Abnormalities in Healthy Older Adults
3. BERTOLA, L Sociodemographic and cognitive predictors of memory trajectories across educational groups
4. ZAHODNE, LB Racial Disparities in Cognitive Performance across Mid and Late Adulthood: Analyses in Two Cohort Studies

**2:30–3:30 PM****Plenary C. Modulating Brain Networks to Promote Recovery from Brain Injury****Presenter: Alvaro Pascual-Leone****Salon ABCDE**

1. PASCUAL-LEONE, A Modulating Brain Networks to Promote Recovery from Brain Injury

**3:30–3:45 PM****PM Coffee Break****Gloucester Exhibit Hall****3:30–5:00 PM****Poster Session 4. Assessment (Child), EF/Frontal, and Medical/Neurological Disorders (Child)****Gloucester Hall****Assessment/Psychometrics/Methods (Child)**

1. BEETAR, JT Comparison of Parent and Teacher Reports of Adaptive Behavior: A Diagnostic Perspective on Special Education Students
2. DAVIS, K Development of a Self-Regulation Subscale Using Specific Items From the Behavior Rating Scale of the Bayley Scales of Infant and Toddler Development
3. FEIRSEN, N Relationship Between Executive Function Performance and Collateral Reports in Pediatric Populations
4. FERNANDEZ, AL Reliability of the Test de Velocidad de Denominación for Early Detection of Dyslexia
5. FERNANDEZ, AL Normative Data and Influence of Demographic Variables on a Speed Naming Test For Spanish-Speaking Children- The "Test de Velocidad de Denominación"
6. GEURTEN, M Psychometric properties of the Questionnaire of Executive Self-Awareness (QESA) for Children
7. GREENE, J Behavior Rating Inventory of Executive Function, Second Edition (BRIEF2): Analyzing and Interpreting Ratings from Multiple Raters
8. HAMBERGER, MJ Auditory and Visual Naming Tests for Children

9. HINDS, DJ Taking the (NIH) Toolbox to Trinidad and Tobago
  10. HUANG, I Functional consequence of cognitive impairment in long-term survivors of childhood acute lymphoblastic leukemia (ALL): the role of cancer symptoms
  11. O'BRIEN, AM Test-Retest Reliability of the ImPACT with a Canadian Sample of Healthy Young Athletes
  12. O'DESKY, I Use of Executive Functioning as a Predictor of ADHD and NLD
  13. OLIVIER, TW Preliminary Examination of WISC-V Indices in a Clinical Sample of Children with Hearing Loss
  14. PRESTON, T A Comparison of Two Prospective Memory Tests in Clinically Referred Children: Influence of Distracter Task
  15. RACH, AM Age-Based Child-SCAT3 and SCAT3 Normative Values Using a Youth Football Population
  16. RENTERIA-VAZQUEZ, TA Reading Skills in a 3 Year-Old Boy Diagnosed With Hyperlexia: Case Report
  17. SCHMID, AD An Examination of WAIS-IV Digit Span Sequencing in a Clinical Sample
  18. SELEME, ME Pilot Study to Assess the Development of Executive Functions in Cuban Preschoolers Using Two Tests Developed in Brazil
  19. SKILLICORN, K Psychometric Equivalence of Online and Paper-and-Pencil Caregiver Behavior Ratings
  20. VASSERMAN, M WISC-V Profiles in Children with ADHD and Learning Disabilities
- Executive Functions/Frontal Lobes**
21. BAILEY, BA The Role of Executive Functioning in Youth Self-Esteem
  22. BAILEY, BA The Role of Parent-Reported vs. Performance-Based Executive Functioning in Youth Academic Achievement
  23. CARLIER, M Assessment of inhibition predetermines the tolerance to physical effort
  24. CLEM, M Parental Ratings of Executive Functioning in Pediatric Survivors of Medulloblastoma and Pilocytic Astrocytoma
  25. CRAUN, E Executive Functioning Moderates the Association Between Parent-Child Relationship and Alcohol Use
  26. CROCFER, K Parent Ratings of Executive Function in Children with a History of Hearing Loss
  27. DOTY, N Executive Dysfunction as a Moderator of the Link Between Depression and Externalizing Behavior in Children and Adolescents
  28. DOYLE, A Extending the "cross-disorder" relevance of executive functions to dimensional neuropsychiatric traits in youth
  29. FEDER, A Working Memory Load Negatively Impacts Moral Acceptability Judgments
  30. FRANCHOW, EI Expressive Suppression in Older Adulthood Differentially Depletes Executive Functioning
  31. GESSNER, C D-KEFS Normative Data from the Nathan Kline Institute – Rockland Sample (NKI-RS) Open-Access Data Resource
  32. GORTER, B The relationship between cognitive inhibition and disinhibited social behaviors in internationally adopted children
  33. HERNANDEZ, K Increased Anxiety Predicts Superior Set-Shifting Performance in Healthy Adolescents
  34. HOLCOMBE, BD Exploring Relationships in Executive Functioning Based on Neurocognitive Performance, Parent Ratings, and Social Support
  35. HOLLAND, AK The Association Between Exposure to a Traumatic Event and Compromised Functional Cerebral Systems in the Left and Right Frontal Lobes
  36. KAYLEGIAN, J The Relationship between Level of Executive Functioning and Engagement in High-Risk Behavior among Urban Homeless Youth
  37. KLIPFEL, K The Relative Contribution of Executive Dysfunction to Psychological, Physical, & Sexual Dating Aggression
  38. LETTERI, A Effortful Control Skills in Deaf Children with and without Additional Disabilities
  39. LØVSTAD, M The utility of the Behavior Rating Inventory of Executive Function across neurological and neuropsychiatric conditions - associations with cognition and emotional distress
  40. MARK, VW Anti-saccade Testing May Reflect Impaired Sustained Attention of Acute Rehabilitation Inpatients
  41. MULHAUSER, K Differential Relationships Among Speeded Neuropsychological Test Performance and Facets of Impulsivity in Individuals with Substance Use Disorder
  42. NIERMEYER, M Motor Sequence Learning in Older Adulthood: Effects of Complexity and Relationships with Executive Functioning
  43. NIXON, KH Is Executive Functioning Related to Resilience in Humanitarian Aid Workers?
  44. OH, Y Longitudinal investigation of memory and executive functioning in internationally adopted children
  45. OKABE, H Sex differences in sustained attention and inhibitory control across the lifespan
  46. PAN, J The Executive Function–Dysexecutive Behavior Connection: Perspectives on the Contributions of Other Neuropsychological Domains
  47. REYNOLDS, B Behavioral Correlates of the WCST in a Neurologically Normal Sample: Perseveration Corresponds with Risky Acts
  48. RIDGE, BE Connecting the Dots: Relating Executive Dysfunction to the Externalizing Spectrum of Psychopathology
  49. RIVERA, A Competing bilingual advantages and disadvantages: Performance on a linguistic Simon task
  50. SARGENIUS, HL An Examination of the Q-Score as a Method for Coding how Morbidly Obese Subjects Copy the Rey-Osterrieth Complex Figure
  51. SHEEHAN, JC A Tale of Two Towers: Investigation of Tower Tasks in Preschool Children
  52. SINGH, P A Voxel Based Morphometric Analysis of Ventromedial Prefrontal Cortex Volume related with Executive Function Task Performance Post Mild Traumatic Injury

53. SULLIVAN, E Assessing the Effect of Trauma and PTSD Symptoms on Executive Functioning in a General Population Sample
54. SULLIVAN, SK Personality Correlates of Executive Function: The Role of Extraversion
55. TELLEZ-ALANIS, B Reasoning and Behavioral Rating of Executive Function in Children Aged 11-12 Years
56. TORRES, S "Touch Your Head Means Touch Your Toes?" Executive Function Deficits In Preterm Children
57. UMEKUBO, KA Performance Differences on the Iowa Gambling Task in High Versus Low Schizotypy
58. VANDEN BUSSCHE, AB Assessing the Impact of Trauma on Hot and Cold Executive Functions Independent of Diagnosis
59. VERA-ESTAY, E All for one: Combined contributions of executive functioning and social cognition to moral reasoning in childhood
60. VOS, LC The Relationship between Creativity, Intelligence, and Executive Function
61. WELSH, M Effects of Task Context and Individual Differences on the "Heat" of Cool Executive Function Tasks
62. WELSH, M Homeless Men Living in Transitional Housing: The BrainWise Curriculum and Improvements in Executive Functions and Coping Self-Efficacy
63. WILSON, C Clinical Utility of the Barkley Deficits in Executive Functioning-Children and Adolescents Scale in a Mixed Clinical Sample
64. WITKIN, G Utility of Tower of London in Identifying Executive Impairment in Children with ADHD and/or Learning Disability
65. WONG, MM Sleep quality and neuropsychological functioning among children of alcoholics and controls
66. ZIEMNIK, RE Reaction to Novelty as a Predictor of Reduced Executive Functioning Following an Expressive Suppression Task
67. ZUMBA, M Effect of Trauma Exposure on Cognitive Functioning in a Sample of High-risk Adults
- Medical/Neurological Disorders/Other (Child)**
68. ALI, J Neurocognitive Functioning among Young Patients with Sickle Cell Disease: Associations with Demographic and Disease-related Factors
69. ANTONINI, T Attention and Executive Functions Following Proton Beam Radiation Therapy in Pediatric Patients with Brain Tumors
70. BADALY, D Executive Dysfunction and Social Maladjustment among Children with Congenital Heart Disease
71. BEARDEN, DJ Cognitive, School, and Emotional Functioning in Children and Adolescents with Recurrent Abdominal Pain
72. CALDERON, PH.D., J Cognitive Predictors of Social Cognition Outcomes in Adolescents with Congenital Heart Disease after Infant Open-Heart Surgery
73. CHAMBERS, AM The Relationship Between Childhood Sleep Initiation Problems and Verbal Memory
74. CONDIE, LO Adapted Developmental Assessment for Ages 18 months to 7 years
75. DOXIE, J The Impact of Parental Stress in the Relationship Between Verbal IQ and Adaptive Functioning in Children with Early Neurological Insult
76. FREDRICKSON, S Cognition following Decompression Surgery among Children with Chiari Malformation Type 1
77. GERNER, GJ Contributions of Executive Function to Math Achievement in Children Born Preterm and Children Born at Term with ADHD
78. GROSS, L Specificity of Memory Deficits in Children and Adolescents with Prenatal Alcohol Exposure
79. HEITZER, A School Readiness and Perinatal Risk in Preschoolers Born Preterm
80. KULESZ, PA The Longitudinal Effects of Shunt Treatment Predict Alterations in the Neural Correlates of the Posterior but not Anterior Attention Network in Spina Bifida Myelomeningocele
81. LUCCHETTI, A Neuropsychological Profiles in Parry Romberg Syndrome: A Case Series
82. MENTZER, M Case Study of Krabbe Disease Post-Bone Marrow Transplant
83. MITTAL, A Implications of Congenital Heart Defect on Neurocognitive Development: Case Study of Ebstein's Anomaly
84. MOSS, NC Parenting Quality and Neurocognitive Outcomes in Children born Term and Preterm
85. NORRIS, T Improvements in Functional Independence During Inpatient Rehabilitation for Children with Brain Tumors
86. ODDI, K Neurocognitive Development Among Children Diagnosed with Methylmalonic Aciduria (MMA)
87. PETERS, B Perinatal Risk and Motor Abilities in Preterm-Born Preschoolers
88. SCHREIBER, JE Cognitive and Academic Functioning After Initiation of Hydroxyurea in Pediatric Patients with Sickle Cell Disease
89. STERN, S Verbal and Visual Memory Performance in a Cohort of Children with Chiari Malformation Type 1
90. TAM, H Neuropsychological Case Presentations of Two Common Monogenic Diabetes KCNJ11 Gene Variants
91. YUND, B Parent Reported Temperament in Young Children with Neurofibromatosis type 1
- Acquired Brain Injury (TBI/Cerebrovascular Injury & Disease - Adult)**
92. LEVITCH, C Soccer Heading during Games is Associated with Neuropsychological Function in Amateur Players
93. LICHTENSTEIN, J Prevalence Rates of Concussion in Ultimate Frisbee: Preliminary Findings of the Concussion in Ultimate Frisbee Survey (CUFS)
94. LINNEA, K The Effects of a Yoga and Mindfulness Intervention on Executive Functioning in Traumatic Brain Injury



**ADHD/Attentional Functions**

95. GAUDET, CE The Role of Cultural Bias in the Continuous Performance Test Second Edition (CPT-II) in a Pediatric Sample

**Cancer**

96. POTVIN, D Traditional versus Computerized Assessment of Executive Dysfunction in Preschoolers within the Pediatric Oncology Population

**Medical/Neurological Disorders/Other (Adult)**

97. STENCLIK, JH Depression Uniquely Contributes to Performance on the MoCA in Deep Brain Stimulation Surgery Candidates with Parkinson's Disease  
 98. STENCLIK, JH The Effect of Depression on Executive Functioning in Deep Brain Stimulation Surgery Candidates with Parkinson's Disease

**3:45–4:45 PM**

**INS Arthur Benton (Mid-Career) Award Presentation: The Evolving Role of Neuropsychological Investigations in Multiple Sclerosis**  
**Presenter: Ralph Benedict**  
**Salon HIJK**

1. BENEDICT, RH The Evolving Role of Neuropsychological Investigations in Multiple Sclerosis

**3:45–5:00 PM**

**Symposium 5. Genes, Neuropsychology, and Child Psychopathology**  
**Chair: Alys Doyle**  
**Discussant: Larry J. Seidman**  
**Salon ABCDE**

1. DOYLE, A Genes, neuropsychology, and child psychopathology  
 2. WILLCUTT, E Using Twins to Understand the Etiology and Neuropsychology of Comorbidity between ADHD and Learning Disorders  
 3. ADAMO, N Do Polygenic Risk Scores Predict Persistence and Remission of ADHD in Young Adulthood?  
 4. BURTON, CL A Genome-Wide Association Study of a Cognitive Endophenotype of ADHD in a Community-Based Pediatric Sample  
 5. DOYLE, A Association between Polygenic Risk for Schizophrenia and Executive Functions in Clinically-Referred Youth

**3:45–5:05 PM**

**Invited Symposium 2. Sleep and Cognition**  
**Chair: Ian M. Colrain**  
**Salon G**

1. COLRAIN, IM Sleep and Cognition  
 2. BLIWISE, DL Cognition and Sleep in Normal and Pathological Aging  
 3. ALOIA, MS Neuropsychological Consequences of Obstructive Sleep Apnea  
 4. COLRAIN, IM Alcoholism: Sleep, Brain and Cognitive Consequences

**3:45–5:05 PM**

**Paper Session 4. HIV/AIDS**  
**Moderator: Michael R. Basso**  
**Salon F**

1. DEVLIN, KN Empirically Derived Subtypes of Neuropsychological Impairment in HIV-1 Infection  
 2. BAKER, L Topological Organization of Whole-Brain Networks in HIV+ Individuals  
 3. CASALETTO, KB Metacognition is Associated with Executive Dysfunction and Manifest Everyday Functioning in HIV Infection  
 4. MENON, J Effect on HIV and TB co-infection on Neurobehavioural functioning- Evidence from Zambia

**3:45–5:05 PM**

**Symposium 6. Elucidating Depressive Symptom, Cognitive, and Affective Dimensions through Integrated Neuropsychological and Cognitive Neurosciences**  
**Chair: Shawn M. McClintock**  
**Back Bay (Dartmouth-Fairfield)**

1. MCCLINTOCK, SM Elucidating Depressive Symptom, Cognitive, and Affective Dimensions through Integrated Neuropsychological and Cognitive Neurosciences  
 2. DOTSON, VM Symptom Dimensions in Late-Life Subthreshold Depression: Evidence from Cognitive, Neuroscience, and Exercise Intervention Studies  
 3. LANGENECKER, SA Cognitive Control Dysfunction in Major Depression Disorder: a Lifespan Perspective

4. TREADWAY, M Neural Mechanisms of Effort-Based Decision-Making in Depression  
 5. MCCLINTOCK, SM Elucidating Complex Interactions Among Depressive symptoms, Neurocognitive Function, and Neurotherapeutic Stimulation

5:15–6:15 PM

**Plenary D (The INS Herbert Birch Memorial Lecture). Adolescence as a Sensitive Period of Social Brain Development**  
**Presenter: Sarah-Jayne Blakemore**  
**Salon ABCDE**

1. BLAKEMORE, S Adolescence as a Sensitive Period of Social Brain Development

7:00–9:00 PM

**Student Social, Hosted by the INS Student Liaison Committee**  
**Lir Irish Pub & Restaurant (903 Boylston St)**

## FRIDAY, FEBRUARY 5, 2016

7:20–8:50 AM

**CE 9. Cognitive and Behavioral Aspects of Frontotemporal Degeneration**  
**Presenter: Katya Rascovsky**  
**Salon F**

1. RASCOVSKY, K Cognitive and Behavioral Aspects of Frontotemporal Degeneration

7:20–8:50 AM

**CE 10. Mild Traumatic Brain Injury and the Postconcussion Syndrome: How Does the Science Translate to Clinical Practice?**  
**Presenters: Michael McCrea, Grant L. Iverson**  
**Salon G**

1. MCCREA, M Mild Traumatic Brain Injury and the Postconcussion Syndrome: How Does the Science Translate to Clinical Practice?

9:00–10:30 AM

**Poster Session 5. Cancer, Cross Cultural, Forensic, Malingering/Effort Testing, and MS/ALS**  
**Gloucester Hall**

### Cancer

1. ASHFORD, JM Parental Distress and Associated Treatment and Neurocognitive Factors among Children Diagnosed with Craniopharyngioma  
 2. BADALY, D Disordered Sleep and Attention Problems among Children with Histories of Cancer and Stem Cell Transplantation  
 3. BANERJEE, P Voxel-Based Lesion-Symptom Mapping of Phonemic Fluency versus Semantic Fluency in Brain Tumor Patients  
 4. FOURNIER-GOODNIGHT, AS Predictors of Learning and Memory Performance in Patients Diagnosed with Pediatric Craniopharyngioma  
 5. GIOIA, A Profiles of Attention-Mediated Neurocognitive Functioning in Survivors of Pediatric Brain Tumors: Comparison with Children with Neurodevelopmental ADHD  
 6. GOGIA, B Neuropsychological Implications of Gliomas in Left Fronto-Parietal Operculum with respect to Tumor Size and Grade  
 7. HAMILTON, J The Impact of Family Functioning on Executive Functioning in Pediatric Medulloblastoma  
 8. HILE, S Functional Impairment in Childhood Cancer Survivors: Relationship with NIH Examiner Executive Measures and General Intellectual Functioning  
 9. IRISH, J Childhood Cancer Survivors' Executive Functioning Skills: Does Scaffolding Bolster Behavioral Functioning?  
 10. JACOLA, LM The Utility of Parent Report in Predicting Future Neurocognitive Outcomes in Very Young Survivors of Childhood Acute Lymphoblastic Leukemia (ALL) Treated with Chemotherapy Only  
 11. NA, S BOLD Activity in Adult Survivors of Childhood Brain Tumors Following Continued Exposure on a Working Memory Task  
 12. PALTIN, I Neuropsychological Functioning at Baseline and at least 2 Years Post Cranial Proton Radiation Therapy  
 13. PETERSEN, J Late-Delayed Effects on Verbal and Visual Memory from Photon Radiotherapy for Pediatric Brain Tumors  
 14. TAIWO, Z The Neurological Predictor Scale Is Associated with Long-term Core Cognitive Outcomes in Adult Survivors of Childhood Brain Tumors

15. TRAVERS, LV Executive Functioning and Quality of Life in Pediatric Brain Tumor Patients Post-Proton Radiation Therapy
16. VAN DYK, K Cognitive Complaints in Breast Cancer Survivors (BCS): Association with Mood and Cognition
17. VAN DYK, K Resting State EEG, Depression, and Memory in Breast Cancer Survivors (BCS)
18. WISE, S Rates of Neuropsychological Impairment among Children Being Treated for High-Risk Acute Lymphoblastic Leukemia

### Cross Cultural

19. ALI, J Challenges in Cross-cultural Neuropsychological Consultation: a Case Study of a Non-verbal Guatemalan Immigrant
20. AVILA, J Differential Reading Achievement-IQ Associations Across Ethnic Groups
21. BOIVIN, MJ The Use of Eye Tracking Technology in a Modified Fagan Test to Assess Neurocognitive Development in Rural Ugandan Infants Exposed to HIV
22. BOIVIN, MJ Automated Eye Tracking Technology Improves the Sensitivity of an Early Childhood Vigilance Test (ECVT) of Attention in Ugandan Children Perinatally Exposed to HIV
23. BOYER, K Assessment of Arabic-speaking international patients: Experience from a Pediatric Epilepsy Center
24. BRYANT, KR Education and Reading Ability Affects BNT Item Difficulty in a Rural Adult Sample
25. CARRION, C Measures of Executive Functioning as Predictors of Adaptive Functioning in a Hispanic Sample with Limited English Proficiency
26. FUNES, CM The Impact of Explicit Strategy Instruction on the Verbal Learning Outcomes of English- and Spanish-speaking Older Adults
27. HOLLER, KA The Role of Cultural Bias: Childhood Intellectual Performance in a Psychiatric Inpatient Sample
28. LUONG-TRAN, C Differences in Executive Functions and Behaviors of Asian and Caucasian Children
29. MUSIELAK, KA Effects of Mediation Intervention for Sensitizing Caregivers (MISC) and a Health and Nutrition Education Program on the Sustained Attention of Ugandan Children with HIV
30. NEHRA, A Are we getting Smarter? Generational change of cognitive test performance in India
31. RIEGER, RE Differential Associations Between Verbal IQ and Performance IQ and Executive Functioning Measures in Ethnically Diverse Preschoolers
32. SEDO, MA Advanced Pre-alphabetic Stroop Describes Processing Speed and Executive Control in Foreign-language-speaking Children and Adults
33. SOTO, A Neuropsychological Assessment: Operationalizing “Quality of Education” as High School Rankings Instead of Reading Level
34. WILNER, E Cross-cultural Literacy Screening in Low-educated Immigrants: A Pilot Study

### Forensic Neuropsychology

35. PECK, CP Utility of FBS-r scores in Differentiating Conversion Disorders from Probable Malingering

### Malingering/Effort Testing

36. BAEK, R Diagnostic group differences in embedded performance validity testing among patients who scored below Word Memory Test or Medical Symptom Validity Test failure cutoff
37. BRANSON, R Detecting Suboptimal Effort in Undergraduate Students Who Simulate Brain Injury
38. BREARLY, TW Understanding the Word Memory Test: Performance Validity Beyond Learning and Memory
39. BROWER, M Utility of the WAIS-IV Digit Span for Detecting Poor Effort
40. CALLOWAY, JA Initial Validation of a New and Quick Performance Validity Test: Green’s License Plate Test
41. CAVACO, S Predictors of adequate performance on the Coin in the Hand Test: findings from a clinical sample
42. COLLIER, S Evaluation of Automatized Sequences Task as an Index of Performance Validity in Pediatric Concussion
43. DOUGAN, J Effectiveness of the ImPACT, TOMM, and an Emotional Stroop Paradigm to Detect Simulated “Sandbagging” on Baseline Concussion Testing
44. FARRER, TJ Clinical Utility of TOMM Trial 1 in Academic Accessibility Populations
45. GRABYAN, JM Errors on the First 10 Items of the Test of Memory Malingering Predicts Failure on Later Trials of the Test of Memory Malingering
46. HENDRIKS, M Indicators of suboptimal effort embedded in the Wechsler Memory Scale – Fourth Edition (WMS-IV)
47. HOELZLE, J Development and Preliminary Validation of the Vegas Odds Test
48. HONG, D Sensitivity and specificity of the Dementia Profile of Word Memory Test and Medical Symptom Validity Test among Patients Who Failed the Easy Subtests
49. KANSER, RJ Detection of Simulated versus Bona Fide Traumatic Brain Injury Using Response Time on a Performance Validity Test
50. KLAVER, JM The Relationship between Self-Reported Symptom Validity and Performance Validity in Children with Neurologic Disorders
51. LAURENT, R Detecting Feigned ADHD Symptoms in College Students with the Test of Variables of Attention
52. LIPPA, SM Subjective Memory Problems, Performance Validity Test Failure, and Objective Neurocognitive Performance
53. MARTIN, P Does Performance Invalidity Impact the Accuracy of TOPF Word Reading Predictions of Premorbid FSIQ?
54. NORDSTROM, L Performance Validity Testing Among OEF/OIF/OND Veterans in Research and Clinical Contexts

55. PASTOREK, NJ Choice of Performance Validity Test Drastically Alters the Relation between PTSD Diagnosis and Cognitive Testing
56. RABKIN, AN Classification Accuracy of an Embedded Forced Choice Measure of Effort in the Rey Auditory Verbal Learning Test Among Youth
57. RITCHIE, KA Effectiveness of the Vegas Odds Test in Comparison to Traditional and Embedded Performance Validity Tests
58. ROSSETTI, M Performance Validity in Deep Brain Stimulation Candidates
59. STEGMAN, RL Equal versus Separate Distributions of Neuropsychological Data Relative to Numbers of Performance Validity Measures
60. TOLFO, SE Base Rate and Norms for the Embedded Rey Auditory Learning Test in Samples of Patients Suspected of Dementia, Forensic Patients, Simulators, and Normal Control
61. WHEARTY, K Evaluation of the Validity of the Reliable Spatial Span as an Effort Index on the MATRICS Consensus Cognitive Battery in Schizophrenia
62. WHITESIDE, D Cross Validation of a Cross-Domain Logistically Derived Performance Validity Test in a Psychiatric Sample

### Multiple Sclerosis/ALS/Demyelinating Disorders

63. CHAVARRO, V Cognition, Fatigue And Depression in Neuromyelitis Optica Patients
64. CLEM, M Premorbid Cognitive Problems in Pediatric Multiple Sclerosis: Could grade retention be an early sign?
65. FAYAD, A Fatigue, Sleep, Quality of Life and Academic Functioning in Pediatric Multiple Sclerosis (MS)
66. FAYAD, A Impact of Fatigue, Sleep and Quality of Life on Cognition in Pediatric Multiple Sclerosis (MS)
67. LEAVITT, VM Warmer Body Temperature is Associated with Better Cognitive Efficiency in Relapsing-Remitting Multiple Sclerosis: A Multi-Center Study
68. RANDOLPH, J Association between Cognitive Complaints and Vulnerability to Environmental Distraction in Multiple Sclerosis
69. ROMAN, CA Structural Correlates of Emotion Processing in Multiple Sclerosis
70. SANDROFF, BM Acute Effects of Varying Intensities of Treadmill Walking Exercise on Cognition in Persons with Multiple Sclerosis
71. SEGALÀ, L The Effects of Dispositional Optimism on Cognition in Multiple Sclerosis
72. SUMOWSKI, JF Reading, Writing, and Reserve: Literacy Activities are linked to Hippocampal Volume and Memory in Multiple Sclerosis
73. TILL, C Age at onset predicts working memory following acute demyelinating syndrome in children
74. ZAMZOW, J The Association Between Sleep Disorder Symptoms and Cognitive Function in Relapsing-Remitting Multiple Sclerosis
75. ZUPPICHINI, MD Structural White Matter Differences related to Learning and Memory Impairment in Multiple Sclerosis: An Exploratory DTI Analysis

### Cognitive Intervention/Rehabilitation

76. BERGQUIST, TF Relationship between Injury Severity and Outcome in Adults with Traumatic Brain Injury (TBI) Receiving Post-Acute Rehabilitation
77. RAMIREZ, FE Use of oral lavender oil for anxiety in a depression medical residential program

### Dementia (Alzheimer's Disease)

78. BRYANT, AM Family History of Alzheimer's Disease Predicts Performance on Executive Functioning Measures in Cognitively Intact Adults
79. HUA, M Content- and Context-Component Memory Task Performance in Elderly Individuals with Subjective Cognitive Decline
80. SPALDING, KN Two-Day Intervention Significantly Reduces Stress in Dementia Caregivers
81. SPAT, J The Neuropsychological Profile and Neuroimaging Biomarkers in a Patient with Corticobasal Syndrome with Underlying Alzheimer's Pathology: A Case Study

### Drug/Toxin-Related Disorders (Including Alcoholism)

82. RAMIREZ, FE Lead Exposure and Mental Health

### Epilepsy/Seizures

83. SRNKA, KD Examination of Attention "Stability" in Children with Recent Onset Epilepsy

### 9:15–10:45 AM

### Symposium 7. Advances in Understanding the Organization and Cognitive/Behavioral Functions of the Cerebellum

**Chair: Carol L. Armstrong**

**Discussant: Mark Mahone**

**Salon ABCDE**

1. ARMSTRONG, CL Advances in Understanding the Organization and Cognitive/Behavioral Functions of the Cerebellum
2. LIMPEROPOULOS, C The vulnerable immature cerebellum: Structural and functional consequences following early-life injury

3. WALSH, K Cerebellar Cognitive Affective Syndrome in Pediatric Neuro-Oncology: Intensification and Acceleration of Emerging Late Effects
4. SMITH, D The Paradox of Cerebellar Lateralization of Cognitive Function
5. ARMSTRONG, CL Mood Disorders Related to Cerebellar Activation and Cerebellar Injury

**9:15–10:45 AM****Paper Session 5. Dementia 1****Moderator: Dorene M. Rentz****Salon F**

1. RACINE, AM Cluster Analysis of Biomarkers and Memory Test Scores Provide Empirical Support for Preclinical AD Staging and Non-AD Cognitive Decline in Late Middle Age: Findings from the WRAP Study
2. PAPP, KV The Neuropsychology of Biomarker-Defined Preclinical Stages of Alzheimer's Disease
3. WATSON, CW Socioeconomic and Educational Factors Account for Racial Inequities in Dementia Incidence in a Community Dwelling Population
4. HOHMAN, TJ Asymptomatic Alzheimer's Disease: Building a Better Resilience Phenotype
5. YEW, B Increased Cerebrovascular Resistance is Associated with Greater Amyloid- $\beta$  Deposition and Worse Cognitive Performance in Preclinical and Clinical Alzheimer's Disease
6. SCHULTZ, SA Sedentariness and moderate-intensity physical activity are associated with CSF biomarkers of Alzheimer's disease: Findings from the Wisconsin Registry for Alzheimer's Prevention
7. BOOTS, EA BDNF Val66Met Polymorphism Predicts Cognitive Decline in the Wisconsin Registry for Alzheimer's Prevention

**9:15–10:45 AM****Paper Session 6. Medical/Neurological Disorders, Child****Moderator: Celiane Rey-Casserly****Salon G**

1. PIERCY, JC Multiple Gestation and Neuropsychological Performance in Preschoolers Born Preterm
2. CALDERON, PH.D., J Impact of Early-Term Birth on Neuropsychological and Psychiatric Outcomes in Adolescents with Congenital Heart Disease
3. ANDERSON, PJ Toddler Behavior is Associated with School-age Cognitive Performance in Children Born Very Preterm
4. WASSERMAN, R Profiles of Neuropsychological Functioning in Children and Adolescents with Spina Bifida: Associations with Biopsychosocial Predictors and Functional Outcomes
5. FOX, ME Pituitary Disorders as a Predictor of Apathy and Executive Dysfunction in Adult Survivors of Childhood Brain Tumors
6. MRAKOTSKY, C Brain Structure and Neuropsychological Function in Pediatric Crohn's Disease
7. CASNAR, C Longitudinal Examination of Fine Motor Skills in Children with Neurofibromatosis type 1

**9:15–10:45 AM****Symposium 8. Deployment Trauma: Insights from the TRACTS Cohort on the Clinical, Cognitive, and Neuroanatomical Effects of Mild TBI and its Comorbidities in OEF/OIF/OND Veterans****Chair: Catherine B. Fortier****Discussant: Grant L. Iverson****Back Bay (Dartmouth-Fairfield)**

1. FORTIER, CB Deployment Trauma: Insights from the TRACTS Cohort on the Clinical, Cognitive, and Neuroanatomical Effects of Mild TBI and its Comorbidities in OEF/OIF/OND Veterans
2. AMICK, M The Deployment Trauma Phenotype and Employment Status in OEF/OIF/OND Veterans
3. POOLE, V Chronic Military-related Mild Traumatic Brain Injury is Associated with Decreased Sustained Attention Ability, Not Decreased Global Neuropsychological Functioning
4. FORTIER, CB Deployment Trauma: Clinical Phenotypes and their Impact on Cognition in OEF/OIF/OND Veterans
5. TROTTER, BB Neuroanatomical correlates of blast exposure and PTSD, including brain aging trajectories
6. KENNA, A Feasibility and Acceptability of STEP-Home: A Rehabilitation Workshop to Facilitate Civilian Reintegration Among OEF/OIF/OND Veterans

**10:45–11:00 AM****AM Coffee Break  
Gloucester Hall****11:00 AM–12:00 PM****Plenary E. The Statistical Crisis in Science****Presenter: Andrew Gelman****Salon ABCDE**

1. GELMAN, A The Statistical Crisis in Science

**12:30–2:00 PM****Poster Session 6. Aging, MCI, and Visuospatial/Neglect  
Gloucester Hall****Aging**

1. ALLEN, K Distractibility, Aging, and Driving: Relationship of Scores on the Useful Field of View Across Mini Mental State Exam, Age, Diagnosis and Drivewise Assessment Outcome Scores
2. ALLISON, S Route Repetition and Reversal in Older Adults
3. BARULLI, D Cognitive Strategies as a Possible Mechanism of Cognitive Reserve
4. BHERER, L Effects of combined physical exercise and cognitive training on executive functions and dual-task performance in older adults
5. BIRDSILL, AC Executive Function, Not Memory, Is Associated with White Matter Structure in Middle Age
6. CAMPBELL, LM Comparisons of Traditional and Comprehensive Approaches in Defining SuperAgers
7. CHANG, JE Discriminant Validity and Diagnostic Utility of the Test of Practical Judgment (TOP-J)
8. CHERRY, BJ Blood Pressure and Cognition
9. CHOI, A Cerebral Oximetry and Leukoaraiosis Contributions to Working Memory in Older Adults
10. CHUNG, H Assessing Medication Management Abilities in Older Adults in an Inpatient Medical Rehabilitation Setting
11. COHEN, J The Oblique Effect: Applying Ophthalmological and Neurophysiological Principles of Visuospatial Processing to Cognitive Aging and Vascular Health
12. DEFORD, NE Does Less Efficient Pattern Separation Contribute to Age-Related Deficits in Spatial Memory?
13. DENNY, K Assessment of a Multi-Modal Intervention to Enhance Cognitive Compensation Strategies and Promote Brain Health Activities
14. DENNY, K Progression from Normal Cognition to Mild Cognitive Impairment in a Diverse Clinic- and Community-Based Elderly Cohort
15. DO, N Predictors of Premorbid Intelligence and Cognitive Decline
16. GERTSBERG, AG Cognitive reserve: The Role of Occupational Experience
17. GRACIAN, EI Executive function and memory contributions to medication management ability in cognitively normal, older adults
18. GROSS, EZ Convergent and Discriminant Validity of Ex-Gaussian Parameter Estimates
19. GUZMAN, VA Vascular Injuries to The Brain: Which Holes Matter?
20. HIMES, L White Matter Lesion Burden and Functional Connectivity of Resting State Network in Healthy Aging
21. HO, JK Protective Effects of Angiotensin II Type 1 Receptor Blockers on Cognition and Alzheimer's Disease
22. HOLDEN, HM Time-Based Prospective Memory Uniquely Predicts Financial Management Capacity in Older Adults
23. JOANNETTE, M The Ability to Detect Changes in the Spatial Relations of Faces Is Impaired in Alzheimer's Disease
24. KARSTENS, A The Separate and Interactive Effects of Trauma and Depression on Cognition in Urban Dwelling Adults
25. KIELB, S Objective Cognitive and Functional Loss and Dementia Risk in Subjective Cognitive Decline
26. LAST, BS The Cost of Brain Aging: Medicare Expenditure Correlates of Atrophy and Cerebrovascular Disease in Older Adults
27. LAVALLÉE, M Holistic face processing is impaired in Alzheimer's disease and Lewy Body dementia
28. MCALISTER, C Executive Function Subcomponents and their Relations to Everyday Functioning in Healthy Older Adults
29. MCALISTER, C Everyday Functioning and Cognitive Correlates in Healthy Older Adults with Subjective Cognitive Concerns
30. MCINTOSH, E MetS and Cortical Thickness of Entorhinal Cortex in Middle-Aged and Older Adults
31. MCNEELY, J Blood Glucose Mediates the Relationship between Cognitive Function and Sleep Quality in Middle-Aged Adults
32. MEMEL, MB The Role of Visual Integration and Working Memory in Age-Related Associative Memory Deficits
33. MORENO, C Recall and Recognition Discriminability in Healthy Aging
34. MORIN, R Predictors of WAIS Vocabulary Among Black and White Older Adults
35. MUNIZ, MC Associations between Subjective Cognitive Decline, Depression, and Objective Cognitive Performance in Hispanic Elderly
36. OLESON, S Apolipoprotein E Genotype Moderates the Relationship Between Carotid Atherosclerosis and Executive Function in Middle-Aged Adults
37. PERRY, CE Latent Toxoplasmosis Association with Executive Function in Older Adults
38. PERRY, CE Association between Memory Functioning and Latent Toxoplasmosis in Older Adults
39. RADIGAN, LJ Cardio-metabolic Outcomes Following Close-Range Blast Exposure
40. RHODES, E Grit Is Protective of Late-Life Cognition: Non-Cognitive Factors as Cognitive Reserve
41. SANTORELLI, GD Neuroanatomical Correlates of Alexithymia in Younger and Older Adults
42. SAURMAN, J Measurement Invariance of Dementia Severity in ( $\delta$ )
43. SEEWALD, P Age-Related Differences on a New Test of Temporal Order Memory for Everyday Tasks
44. SEIDER, T Cognitively Engaging Activity is Associated with Preserved Cortical and Subcortical Volumes
45. SELIGMAN, SC Effects of Goal and Cognitive Load on Eye Movements to Everyday Objects in Healthy Older Adults
46. SOLOMON, T Cognitive Outcomes in a Randomized, Double-Blind, Placebo Controlled, Parallel Group, Efficacy Study of Alpha BRAIN® Administered Orally

47. SONG, H  
Fronto-parietal Network Mediates the Education Effects on Reasoning Ability in Healthy Elderly People
48. STRAINGE, L  
Processing Speed, but Not Memory, Predicted Attrition in a Longitudinal Study of Health Elderly
49. SÉVIGNY DUPONT, P  
Impact of Amyloid Burden and White Matter Hyperintensities on Cognition in Normal Aging
50. TAM, JW  
A Video-based Intervention to Increase Aging Services Technologies Awareness and Promote Functional Independence
51. THOMAS, KR  
Complex Everyday Task Error Types and the Association with Neuropsychological Measures
52. THOMPSON, J  
Sex Differences in Memory Decline in Mild Cognitive Impairment and Alzheimer's Disease
53. TIERNEY, SM  
Retrieval Cue and Delay Interval Influence the Relationship Between Prospective Memory and Activities of Daily Living in Older Adults
54. TRIFILIO, E  
Cognitive Correlates of Consummatory vs. Anticipatory Anhedonia in Older Adults
55. VENKATESAN, UM  
Neuroimaging Source Memory in Aging: Putting the Context Memory Deficit in Context
56. WALZAK, LC  
Investigating Illness Burden as a Risk Factor for Cognitive and Affective Theory of Mind in Older Adults
57. WATERS, AB  
The Relationship Between Worry and Executive Functioning in Older Adults
58. WILLIAMS, M  
Computerized Speed Training Reduces Falls in Older Adults
59. ZLATAR, ZZ  
Cognitive Complaints Are Associated with Depressive Symptoms and Not with Concurrent Cognitive Performance in A Clinic-Based Sample of Older Adults
- MCI (Mild Cognitive Impairment)**
60. ACOSTA, L  
Error in Category Fluency Among Individuals with Mild Cognitive Impairment: The Vanderbilt Memory & Aging Project
61. BROWN, DS  
Use of Cognitive Complaint and the Montreal Cognitive Assessment to Predict Future Mild Cognitive Impairment
62. EDMONDS, EC  
Empirically-Derived MCI Subtypes Show Distinct Patterns of Cortical Atrophy Not Captured By Conventional Diagnostic Criteria
63. EPPIG, J  
Statistically-Derived Subtypes in MCI: A Latent Profile Analysis
64. FARRAR, D  
Structural Network Differences in Individuals with High versus Low Executive Abilities in Mild Cognitive Impairment
65. FLOWERS, AT  
Neuropsychological Tests and Functional Ability
66. GIOVANNETTI, T  
Subtypes of Functional Impairment in People with MCI
67. JEFFERSON, AL  
Assessing performance on the Philadelphia (repeatable) Verbal Learning Test in non-demented older adults: The Vanderbilt Memory & Aging Project
68. KANG, Y  
A Validity Study of the Korean-Subjective Cognitive Decline Questionnaire (K-SCD-Q)
69. KAUZOR, K  
Daily Functioning in MCI Patients With and Without Caregivers
70. LUST, BC  
Interdisciplinary Studies Begin to Reveal Language Deficit in Prodromal AD and to Predict Corollary Neural Degeneration in Brain Network Connectivity
71. MAHENDRA, N  
Effects of Mild Cognitive Impairment on Linguistic Communication
72. MOORE, C  
Ventilatory Efficiency and Memory Decay in Older Adults with amnesic MCI
73. NOVITSKI, J  
Autobiographical and Spatial Fluency in Healthy Older Adults and Mild Cognitive Impairment
74. PUTCHA, D  
Neuropsychological Predictors of Instrumental Activities of Daily Living in Mild Cognitive Impairment
75. ROCHETTE, AD  
Mild Cognitive Impairment is Prevalent in Persons with Severe Obesity
76. SEIDENBERG, M  
Semantic Fluency Performance in MCI for Different Categories
77. SHERMAN, JC  
Language in Prodromal Alzheimer's Disease: Advancing Clinical Examination
78. SIMON, SS  
Cognitive and Activation Changes After Memory Training in Amnesic Mild Cognitive Impairment: Preliminary Results of a Randomized, Single-Blind Study
79. STABLER, AR  
Conversion to mild cognitive impairment at follow-up among baseline cognitively normal, older adult research participants and clinic patients with subjective cognitive impairment
80. WERHANE, ML  
The Role of White Matter Lesions and APOE Genotype in Reduced Cortical Thickness in Older Adults with Mild Cognitive Impairment
- Visuospatial Functions/Neglect/Agnosia**
81. ALVAREZ, G  
Sleep/Wake Problems Are Associated With Reduced Visuospatial Performance During Adolescence
82. BALAVAGE, KT  
The Effects of the Allocation of Focal Attention and Habituation on the Line Bisection Task
83. BIELICK, D  
Hemispheric Lateralization of Attentional Background Distraction
84. BOTT, NT  
Left Entorhinal Cortex is Associated with Route Learning Based on Self-motion and Local Cues
85. CHIU, C  
Tablet-based visuospatial battery briefly assesses a wide range of hemispatial neglect symptomatology
86. CLAESSEN, M  
Navigation Ability After Stroke: An Analysis of Types of Navigation Impairment in Chronic Stroke Patients
87. GRAVANO, J  
A Case Study of Simultagnosia in an Anoxic Brain Injury
88. KINCAID, KJ  
Influence of Viewing Eye on Altitudinal Attentional Bias
89. KNIGHT, L  
Effects of Focal and Global Spatial Attention on Compound Line Bisection Tasks
90. ROGERS, S  
How Important is it to Distinguish between Specific Visuospatial Abilities in PD and AD?
91. THOMPSON, DA  
Judgment of Line Orientation: Verbal and Non-Verbal Mediation

**12:45–2:05 PM****Symposium 9. Social Cognition and Function After Child TBI: Relation to Imaging****Chair: Harvey S. Levin**  
**Salon ABCDE**

1. LEVIN, HS
2. BABIKIAN, T
3. BEAUCHAMP, MH
4. BIEKMAN, B
5. RYAN, NP

Social Cognition and Function After Child TBI: Relation to Imaging  
 Neuroimaging correlates of long-term neurobehavioral outcomes in pediatric traumatic brain injury  
 Moral Reasoning after Pediatric TBI: A Brain-Behavior Perspective  
 DTI and Peer Relationships Following Pediatric TBI  
 Theory of Mind Mediates the Prospective Relationship Between Abnormal Social Brain Network Morphology and Chronic Behavior Problems after Pediatric Traumatic Brain injury (TBI)

**12:45–2:15 PM****Invited Symposium 3. Genes, Environments and Their Interplay in Cognitive Aging and Dementia****Chair: Nancy Pedersen**  
**Discussant: Sudha Seshadri**  
**Salon F**

1. PEDERSEN, N
2. KREMEN, WS
3. MCGUE, M
4. GATZ, M
5. PEDERSEN, N

Genes, Environments and Their Interplay in Cognitive Aging and Dementia  
 Contributions of Behavior Genetics to Cognitive and Brain Aging  
 Late-Life Change in Cognitive Function: Evidence from Longitudinal Twin Research  
 Contributions of Twin Studies to Discerning Sex Differences in Dementia  
 Epigenetic processes: A Potential Mechanism for Gene Environment Interplay?

**12:45–2:15 PM****Paper Session 7. Imaging and Neuropsychology****Moderator: Derin Cobia**  
**Salon G**

1. MEREDITH-DULIBA, T
2. BIGLER, ED
3. BUTTS, AM
4. BERNIER, RA
5. BILDER, RM
6. JENKINS, LM
7. AILION, A

Multi-Modal Neuroimaging Approach to the Developing Human Brain: Infancy Through Early Adulthood  
 Clinical Application of Individualized Quantitative Neuroimaging for Neuropsychology – Precision Medicine Meets Neurocognitive Assessment  
 Cortical and Hippocampal Volume Differences in Typical and Atypical Variants of Alzheimer’s Disease  
 Examining Network Strength and Cost during Recovery from Moderate and Severe Traumatic Brain Injury  
 White Matter Volume is Associated with Exceptional Creativity: Preliminary Findings from the “Big C” Project  
 Similarities in White Matter Integrity across Internalizing disorders: A Voxel-Based Meta-Analysis of Fractional Anisotropy  
 Interaction between Age at Diagnosis and Radiation Therapy is related to Cerebellar Atrophy in Long-Term Survivors of Pediatric Brain Tumors

**1:00–2:20 PM****INS Student Liaison Committee Panel Discussion: The Internship & Post-Doctoral Match: An Insider’s Guide for Trainee Success****Presenters: Jeff Baker, Amy Heffelfinger, Kelly E. Jones, Kristina Patrick**  
**Back Bay (Dartmouth-Fairfield)****1:00–2:20 PM****Symposium 10. Risk and Protective Factors for Outcomes in MS and Sports-Related mTBI****Chair: Peter Arnett**  
**Salon HIJK**

1. ARNETT, P
2. UKUEBERUWA, D
3. CADDEN, M
4. MEYER, J
5. MERRITT, VC

Risk and Protective Factors for Outcomes in MS and Sports-Related mTBI  
 Coping Style is a Protective Factor for Emotional Consequences of MS Neuropathology  
 Cognitive Reserve Attenuates the Effect of Disability on Depression in Multiple Sclerosis (MS)  
 Risk Factors for Domain-Specific Post-Concussion Cognitive Deficits  
 Relationship Between Traditional Markers of Injury Severity and Post-Concussion Symptom Clusters in Concussed Collegiate Athletes



**2:15–3:30 PM****Symposium 11. Neurotoxicants and the Etiology of Neurodevelopmental Disorders: A Multidisciplinary Approach****Chair: Amy E. Margolis****Discussant: Larry J. Seidman****Salon ABCDE**

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|----|--------------|---|
| 1. | MARGOLIS, AE | Neurotoxicants and the Etiology of Neurodevelopmental Disorders: A Multidisciplinary Approach   |
| 2. | MARGOLIS, AE | Effects of Prenatal Exposure To Air Pollutants (Polycyclic Aromatic Hydrocarbons) on Inhibitory Control And Academic Achievement            |
| 3. | RAUH, V      | Signature Neuropsychological Profile of Children with Prenatal Exposure to a Common Organophosphate Pesticide                               |
| 4. | HERBSTMAN, J | Prenatal Exposure to Brominated Flame Retardants (PBDE) and Problems with Attention and Cognition: Results from a Longitudinal Birth Cohort |

**2:15–3:45 PM****Poster Session 7. Imaging (Functional & Structural) and Medical/Neurological Disorders (Adult)****Gloucester Hall****Imaging (Functional)**

- |     |                    |  |
|-----|--------------------|--|
| 1.  | BERNIER, RA        | Loss of Long-distance Functional Connections in Chronic TBI  |
| 2.  | DRISKELL, LD       | The Relationship Between Somatic Symptoms and Regional Cerebral Blood Flow in Individuals with Generalized Anxiety Disorder  |
| 3.  | DUPERROUZEL, JC    | Functional Neuroimaging Consensus Regarding Executive Function Alterations Among Cannabis Using Adolescents and Young Adults |
| 4.  | FORTENBAUGH, F     | Early Life Trauma Impairs Sustained Attention Ability and Alters Functional Connectivity in OEF/OIF/OND Veterans             |
| 5.  | GARCIA, A          | The Relationship between DMN Activation and Intelligence in Older Adults   |
| 6.  | HALLOWELL, ES      | Substance Use Effects and Insula Response during a functional MRI Working Memory Task in Rural African Americans             |
| 7.  | HOSSEINI-KAMKAR, N | The Neural Correlates of Cognitive and Behavioral Self-Regulation in Preadolescents: A Multidisciplinary Approach            |
| 8.  | LENGU, K           | Neural Correlates and Predictors of Infant Social-Emotional Development Explored with Functional Near-Infrared Spectroscopy  |
| 9.  | LETZEN, JE         | Functional Connectivity of the Default Mode Network Under Different Mood States  |
| 10. | LEVY, S            | Functional Connectivity in Long-Term Abstinent Alcoholics  |
| 11. | LI, AX             | A Survey of Clinical Language fMRI Use in Epilepsy in 2015   |
| 12. | MARGOLIS, AE       | Using Neuroimaging to Understand Brain-Behavioral Associations During Cognitive Control                                      |
| 13. | MCWILLIAMS, K      | The Effects of Emotion on Visual Memory Processing Network Connectivity  |
| 14. | NGUYEN, PT         | Functional Connectivity of the Frontoparietal Network as a Predictor of Working Memory Performance                           |
| 15. | NYMAN, T           | Social Communication Explored via Eye Gaze Processing in 9 Month Old Infants: A fNIRS Study                                  |
| 16. | SCHWAB, NA         | Pre-surgical cognition predicts decline in default mode network after total knee replacement surgery                         |
| 17. | SUGARMAN, MA       | The Semantic Memory Imaging in Late-Life Pilot Study   |
| 18. | ZAJAC, L           | Brain Networks Involved in the Aesthetic Judgment of Visual Stimuli  |
| 19. | ZLATAR, ZZ         | Interactive Effects of APOE Genotype And Cognition on Brain Perfusion in Normal Aging And Mild Cognitive Impairment          |
| 20. | KILLGORE, WD       | Baseline Responsiveness of the Ventral Striatum Predicts Overeating During Subsequent Sleep Deprivation                      |
| 21. | KILLGORE, WD       | Predicting Resistance to Sleep Deprivation using Multimodal Neuroimaging   |

**Imaging (Structural)**

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|-----|-----------------|---|
| 22. | KILLGORE, WD    | Prefrontal GABA Correlates with the Ability to Sustain Vigilance During Sleep Deprivation   |
| 23. | BEATTIE, JF     | Anterior Hippocampal Dentation Predicts Episodic Memory Performance in Healthy Adults   |
| 24. | BUCHHOLZ, JL    | Expressive Suppression is Associated with Greater Lateral Orbitofrontal Cortex Volume in Adults with Major Depressive Disorder  |
| 25. | CAGLE, LM       | Elevated Depression Scores Predict Long-term Decline in White Matter Integrity Among Older Adults   |
| 26. | CHEN, M         | Spatial Co-registration of Functional Near-Infrared Spectroscopy to Magnetic Resonance Imaging in Older Adults  |
| 27. | CHRISTENSEN, ZP | Temporal Lobe Pathology and Increased Somatic Complaints in Pediatric TBI   |
| 28. | CHRISTENSEN, ZP | Neuroimaging Correlates of Aggression in Pediatric Traumatic Brain Injury   |
| 29. | CROWLEY, SJ     | Brain Voxel Based Morphometry in Idiopathic PD: The Influence of Total Intracranial Volume  |
| 30. | CROWLEY, SJ     | Testing the Reliability and Validity of Three Total Intracranial Volume Measurement Methods   |
| 31. | FRIDMAN, A      | Gray Matter Volume in Left Medial Prefrontal Cortex Is Related to Life Satisfaction in Individuals with Mild Traumatic Brain Injury   |
| 32. | HUFF, T         | Trevor Huff, Tracy Abildskov, Elisabeth Wilde & Erin Bigler et al. MRI Tissue-based intensity standardization for multi-site neuropsychological outcome studies: Problems and Potential Solutions |

33. KIRTON, JW Regional White Matter Lesion Volume and Depressive Symptom Dimensions
34. MAHMOOD, Z The Interactive Effects of HIV and Marijuana Use on Cognition and White Matter Integrity
35. MCGREAL, AE Relationship Between Resilience and Hippocampus Volume in Adults With and Without Posttraumatic Stress Disorder
36. MCLAREN, ME Symptom Dimensions of Depression and Age Impact Subfield Hippocampal Volume
37. MEWBORN, C Microstructural White Matter Integrity Predicts Performance on Instrumental Activities of Daily Living (IADLs) in Older Adults
38. NG, K Automated versus Manual Measurement of Hippocampus and Entorhinal Cortex in a Memory Clinic Sample
39. OOT, E Nucleus Accumbens Volume Predicts Delay Discounting in Emerging Adult Binge Drinkers
40. PIERS, RJ Association between Atrial Fibrillation and Volumetric MRI Brain Measures: Framingham Offspring Study
41. ROBINSON, KE Diffusion Tensor Imaging Following Pediatric Brain Tumor: Associations with Neuropsychological and Psychosocial Functioning
42. SALMINEN, L Tract-Specific Changes in White Matter Fiber Bundle Lengths with Age
43. SHAKED, D Differential Relations of Socioeconomic Status to Prefrontal Cortex Volumes among African American and White Adults
44. SINGH, P Volumetric Differences in Gray Matter in Healthy Versus Overweight/Obese Individuals Post Mild Traumatic Brain Injury: A Voxel Based Morphometric Study
45. SMITH, K Corpus Callosum Volume and Reading Skill in Adult Survivors of Childhood Brain Tumors
46. STEIN, E Insula Cortical Thickness Relates to Impulse Control in Adolescents and Emerging Adults
47. SZYMKOWICZ, SM Structural Abnormalities in Cortical Thickness, Surface Area, and Volume of the Precuneus in Older Adults with Depressive Symptoms
48. WILLIAMS, VJ Increased Gyrfication and Thinner Cortex in Children with Poor Single Word Decoding Skills
49. STELMOKAS, J A Direct Comparison of Medial Temporal Lobe Volumes and Memory Using NeuroQuant® and FreeSurfer in Healthy Controls and Mild Cognitive Impairment
- Medical/Neurological Disorders/Other (Adult)**
50. STELMOKAS, J The Relationship Between Emotional Distress, Somatic Preoccupation, and Neurobehavioral Symptoms in Veterans with Mild Traumatic Brain Injury
51. BEZDICEK, O Long-term Cognitive Sequelae of Methanol Poisoning
52. BONO, AD Evaluation of Facial Emotional Expression: Parkinson's Disease and Gender Effects
53. BRETT, BL Neuropsychological Phenotypes in Essential Tremor and Parkinson's Disease Patients
54. BRETT, BL Neuropsychological Predictors of Levodopa Equivalent Dose in Parkinson's Patients Undergoing Deep Brain Stimulation
55. CARAHER, KJ Neuropsychological, Mood, and Quality of Life Impact of Weight Status in Parkinson's Disease
56. CARLOZZI, NE Self-reported cognition in Huntington disease
57. CHAN, ML Predictors of Functional Ability in Corticobasal Degeneration and Progressive Supranuclear Palsy
58. CHAYTOR, N The Relationship Between Neuropsychological Performance, Diabetes Numeracy, and Instrumental Activities of Daily Living in Older Adults with Type 1 Diabetes
59. DEMIAN, M Health Literacy Predicts Medication Adherence in Kidney Transplant Recipients Beyond the Effect of Common Indicators of General Literacy
60. DENNEY, DA Cognitive and Behavioral Predictors of Fall Risk in Parkinson Disease
61. DUNN, CB Associations Between Cognitive Functioning and the JNC-8 Guidelines for Hypertension in Older Adults
62. FARRER, TJ Post-Operative Delirium Fails to Predict Cognitive Functioning Longitudinally
63. HARLEY, A Rate of Cognitive Decline in PSP vs. CBD
64. HIGHSMITH, J Cardiovascular Risk Models Predict Processing Speed Performance: Initial Evidence from a Veteran Sample
65. JONES, J Regional Leukoaraiosis, Lacunes, and Cognition in Atrial Fibrillation: A Pilot Investigation
66. JONES, J Cognition and Parkinson's Disease: the Influence of Health Comorbidities and Leukoaraiosis
67. KANG, S Attentional Engagement Underlies Rey Complex Figure Test Performance in Systemic Lupus Erythematosus
68. KOZORA, E Functional MRI Abnormalities in Systemic Lupus Erythematosus and Antiphospholipid Antibody Positive Patients
69. KOZORA, E Symptom Presentation and Cognitive Dysfunction in Patients with Sarcoidosis
70. LEVY, S No Titanic Effect on Digit Symbol in Idiopathic Non-Dementia Parkinson's Disease
71. LEVY, S One-Year Reliable Change of Cognition and Mood in Idiopathic Non-Dementia Parkinson's Disease
72. LIEBEL, SW Cognitive Processing Speed Mediates the Relationship between Age and Executive Functions in Cardiovascular Disease
73. NGUYEN, L Clinical Correlates of Sleep Disturbance in Non-demented Parkinson's Disease Patients
74. O'MARA, A The Effects of Subthalamic Nucleus (STN) Deep Brain Stimulation (DBS) Across Phonemic, Semantic and Action Fluency Measures in Parkinson's Disease
75. PAQUETTE, S A Compromised Neural Noise-Cancellation Mechanism at the Center of Tinnitus Perception
76. RECKOW, J Cognitive Changes Following Transcatheter Aortic Valve Implantation
77. REY, OL Cognitive Performance of Hypertensive Adults
78. SABBAAH, LE Hashimoto's Encephalopathy Case Report

79. SALAZAR, R Self-Perceived Stigma in Parkinson's Disease: Relation to Motor Symptoms, Age, Gender, and Mood  
 80. SCHNEIDER, HL Does REM Behavior Sleep Disorder Alter Deep Brain Stimulation Outcome in Parkinson's Disease?  
 81. SCOTT, BM Differential effects of apathy, depression, and anxiety on cognitive function in Parkinson's disease, essential tremor, and dystonia  
 82. SHAH, M Impact of sleep loss on attention in student with high or low Internet use  
 83. SLYNE, KE The Association Between Cognition and Depression on Disease Severity in Huntington's disease  
 84. SUN-SUSLOW, N Components of Metabolic Syndrome in Predicting Deep Brain Stimulation (DBS) Outcome in Idiopathic Parkinson's Disease Patients  
 85. VOGEL, S Neuropsychological Function in Lung Transplant Survivors  
 86. WADSWORTH, H Cognition and Balance in Normal Pressure Hydrocephalus Pre- and Post-Lumbar Drain  
 87. WARD, A Perceived Cognitive Difficulties and Objective Neuropsychological Performance in Former Smokers with and without Chronic Obstructive Pulmonary Disease  
 88. WASSERMAN, VJ Parkinson's Disease Affects the Perception of Motion-Defined Gestures  
 89. WOJTOWICZ, M Olfaction and Cognition in First-Degree Relatives of Individuals with Parkinson's Disease  
 90. WOJTOWICZ, M Olfaction, Information Processing Speed, and Performance Variability in Early Parkinson's Disease  
 91. WYMAN-CHICK, KA Verbal fluency in parkinsonism with and without dopaminergic deficiency on [123I]-FP-CIT SPECT imaging  
 92. WYMAN-CHICK, KA Equivalency of verbal fluency categories among older adults with Parkinson's disease

### Dementia (Non-AD)

93. BUTTS, AM Clinical Profiles of Logopenic Primary Progressive Aphasia based on FDG-PET  
**Psychopathology/Neuropsychiatry (Including Schizophrenia)**  
 94. TROYANSKAYA, M A Preliminary Investigation of Stress Symptoms and Cognitive Control-Related Brain Function Following OEF/OIF Deployment

### 2:30–3:30 PM

### INS Early Career Award Presentation: Non-Pharmacologic Treatment of Memory Deficits in Mild Cognitive Impairment Presenter: Benjamin M. Hampstead Salon HIJK

1. HAMPSTEAD, BM Non-Pharmacologic Treatment of Memory Deficits in Mild Cognitive Impairment

### 2:30–3:30 PM

### Paper Session 8. Executive Functions/Frontal 1 Moderator: Katherine L. Possin Salon F

1. BETTCHER, BM Neuroanatomical Substrates of Executive Functions: Beyond Prefrontal Structures  
 2. DULAY, MF Study of the executive function network after focal stroke to frontal lobe, cerebellum, thalamus or pons  
 3. MILLER, AK Neuropsychological and Behavioral Correlates of Impulsivity among Substance Abusing Women  
 4. DONELAN, J Early lead exposure in children. Is there a neuropsychological effect?

### 2:30–3:30 PM

### Paper Session 9. Mild Cognitive Impairment (MCI) Moderator: Jill Razani Salon G

1. BANGEN, KJ Cortical Amyloid Burden in Empirically-Derived Mild Cognitive Impairment Subtypes  
 2. PETTIGREW, C Cortical Thickness and Cognitive Reserve in Relation to Clinical Symptom Onset in Preclinical AD  
 3. LIBON, DJ Dissociating Constructs Underlying Working Memory in Mild Cognitive Impairment: A Competitive Queuing Analysis  
 4. BETTCHER, BM Pro- and Anti-Inflammatory SNPs Predict Memory Performance in Mild Cognitive Impairment

### 2:30–3:30 PM

### Paper Session 10. Cancer Moderator: Kevin R. Krull Back Bay (Dartmouth-Fairfield)

1. CHEUNG, Y White Matter Integrity, Neurocognitive and Neurobehavioral Outcomes in Long-term Survivors of Childhood Acute Lymphoblastic Leukemia (ALL)  
 2. CONKLIN, HM Cognitive Performance Before and After Proton Therapy in Children Recently Treated for Craniopharyngioma  
 3. VUOTTO, S The Impact of Alcohol Consumption on Neurocognitive Dysfunction in Adult Survivors of Childhood Cancer  
 4. STUDAWAY, AR Neurocognitive and Quality of Life Outcomes of Chronic Hepatitis C Infection among Adult Survivors of Childhood Cancer: A Report from the St. Jude Lifetime Cohort

- 3:30–3:45 PM** **PM Coffee Break**  
**Gloucester Exhibit Hall**
- 3:45–4:45 PM** **Plenary F. The Development of Executive Functions: Principles and Strategies for Aiding that and Differences by Genotype and Gender**  
**Presenter: Adele Diamond**  
**Salon ABCDE**
1. DIAMOND, A The Development of Executive Functions: Principles and Strategies for Aiding that and Differences by Genotype and Gender
- 5:00–6:00 PM** **Plenary G. Developing Neuropsychology in Developing Countries: An African Perspective**  
**Salon ABCDE**
1. WATTS, A Developing Neuropsychology in Developing Countries: An African Perspective
- 6:00–6:30 PM** **INS Business Meeting**  
**Salon ABCDE**
- 6:30–7:30 PM** **President's Reception**  
**3rd Floor Atrium & Lounge**

**SATURDAY, FEBRUARY 6, 2016**

- 7:20–8:50 AM** **CE 11. War and the Brain: Neuropsychological Alterations among Returning Veterans**  
**Presenter: Jennifer Vasterling**  
**Salon F**
1. VASTERLING, J War and the Brain: Neuropsychological Alterations among Returning Veterans
- 7:20–8:50 AM** **CE 12. Introduction to Ethics in the Mind- And Neuro-Sciences (Neuroethics)**  
**Presenter: Eric Racine**  
**Salon G**
1. RACINE, E Introduction to Ethics in the Mind- And Neuro-Sciences (Neuroethics)
- 9:00–10:30 AM** **Poster Session 8. Cognitive Intervention/Rehabilitation, Dementia, and Drugs**  
**Gloucester Hall**
- Cognitive Intervention/Rehabilitation**
1. ALTMANN, LJ Effects of Depth of Semantic Processing on Action Initiation
2. ALVA, JI Memory Skills Class Impact on Healthcare Utilization in Older Veterans with PTSD
3. ANDERSON-HANLEY, C Neuropsychological Effects of Interactive Physical & Cognitive Exercise System (iPACES) for Older Adults: Pilot Comparison of In-Home Neuro-Exergame Versus Neuro-Game
4. BARLOW-KRELINA, E Efficacy of Working Memory Training for Individuals with Early-Stage Huntington's Disease: A Pilot Study
5. BARTHELEMY, O The Effects of Sustained Attention Training on Cognitive and Functional Outcomes in Parkinson's Disease: A Pilot Study
6. BONO, AD The Effect of the Lee Silverman Voice Treatment (LSVT) on Facial Mobility, Social Engagement, and Emotional Experience in Parkinson's Disease (PD)
7. CHOUDHURY, TK Comparative Patient Satisfaction and Efficacy of a Parkinson's Disease Enrichment Program (PEP)
8. CLARK, EL Using a Mindfulness Approach to Reduce the Imagination Inflation Effect in Older Adults
9. DALEY, RT Age Well through Interaction and Scientific Education (AgeWISE): A Cognitive Intervention for Older Veterans
10. ESKES, G Does Working Memory Training Work? A Pilot Study in Parkinson's Disease
11. FRANZ, H Preliminary Effectiveness of the STEP-Home Workshop in Facilitating Post-Deployment Reintegration among OEF/OIF/OND Veterans

12. GUIMOND, S Increase in Prefrontal Activity Following a Brief Memory Training in Schizophrenia Patients
  13. HO, MD Increased Functional Connectivity in Default Mode Network Associated with Application of Transcranial, Light-Emitting Diodes to Treat Chronic Aphasia: Case Series
  14. HUNT, AW A Top-Down Approach to Management of Youth with Prolonged Recovery Following Concussion
  15. JAYWANT, A From Seeing to Moving: A Translational Intervention to Enhance Walking in Parkinson's Disease
  16. KILLGORE, WD Blue Wavelength Light Therapy Reduces Daytime Sleepiness following Mild Traumatic Brain Injury
  17. KILLGORE, WD Blue Wavelength Light Therapy Improves Balance following Mild Traumatic Brain Injury
  18. LANGENECKER, SA Degree of engagement in cognitive remediation predicts improvement in family support and cognitive skills in adults with Autism Spectrum Disorder
  19. MARTINDALE, SL Sleep Quality as a Mediator Between Combat Experiences and Neuropsychological Outcomes in Iraq/Afghanistan Veterans
  20. MCCURDY, MD Feasibility and Acceptability of a Computerized Cognitive Training Program in Survivors of Pediatric Brain Tumor
  21. MCFARLAND, CP Improving Inhibition: The Effectiveness of Implementation Intentions and Visual Imagery may be Limited by Cue Specificity
  22. NOVAKOVIC-AGOPIAN, T Executive Function Training in Veterans with PTSD and mTBI
  23. OLIVIER, TW Effectiveness of a Comprehensive Cognitive Rehabilitation Protocol with a Neurologically-Compromised Adolescent
  24. R.-MERCIER, A A study of Feasibility and Acceptability using a Computerized Cognitive Remediation program with youth suffering from Psychiatric disorders with Maltreatment
  25. RASKIN, S Use of Goal Management Training to Improve Prospective Memory Performance in Individuals with Brain Injury
  26. THIBAUDEAU, E Improving Verbal Memory in Teenagers with Psychiatric Disorder and a History of Maltreatment: A Multiple Case Study
  27. THOMAS, KR Age as a Moderator of Change Following Compensatory Cognitive Training in Severe Mental Illness
  28. UPSHAW, J Beyond Simple Narrative: Biological, Neuropsychological, and Social Support Factors Involved in Atypical Recovery from Stroke in a Single Case Study
  29. WEKKING, EM Improving the Sequelae of Cognitive Deficits in Patients with Severe Mental Illness: an Individual Approach
  30. WIEGAND, LA Factors Associated with Positive Rehabilitation Outcome from Cerebrovascular Insult as Measured by Change in Functional Ability Using Mayo-Portland Adaptability Inventory Change Scores
- Dementia (Alzheimer's Disease)**
31. AGHJAYAN, SL Subjective Memory Concerns and Amyloid Burden in Clinically Normal Individuals: the Impact of Age, Education, and Sex
  32. BONNER-JACKSON, A Variables Affecting Caregiver Burden in a Memory Clinic Population
  33. CASTILLO, GM Tower Test Performance between MCI and AD Individuals
  34. COTHRAN, TP A Preliminary Analysis of Differences in Neuroimaging Biomarkers between Middle-Aged African-American and White/Non-Hispanic Individuals with a Parental History of Alzheimer's Disease
  35. DEFEIS, BL Healthcare Outcomes of Dementia Diagnosis Disclosure: Patients Uninformed of Dementia Diagnoses Are More Likely to Be Hospitalized
  36. DURANT, J Comparing the Test of Practical Judgment with the Neuropsychological Assessment Battery Judgment subtest in a Dementia Population
  37. ENNOK, M Performance of WAIS-III Digit-Symbol subtest and Incidental Learning procedures in patients with Alzheimer's disease
  38. FALLOWS, RR The Relationship Between Subjective Instrumental Activities of Daily Living (IADL) Complaints and Objective Measures of Functioning
  39. FERRER-ARAGÓN, J Semantic processing of concrete and abstract words in Alzheimer's disease and primary progressive aphasia
  40. FIGUEROA, CM Sensitivity of Component Attentional Measures to Subtle Cognitive Changes and Real-World Driving Performance in Early Alzheimer's Disease: A Longitudinal Examination
  41. GOLDBERG, JS Neuroanatomical Correlates of Apathy on The Frontal Systems Behavior Scale in Frontotemporal Dementia And Early-Onset Alzheimer's Disease
  42. HANULIK, I Longitudinal Assessment of Two Types of Prospective Memory in Healthy Aging and Mild Cognitive Impairment
  43. HARTMAN, ER Effects of Cerebrovascular Risk on White Matter Network Characteristics in Mild Cognitive Impairment and Alzheimer's Dementia
  44. HAYS, C Relationship between Cerebral Blood Flow and Cerebrospinal Fluid Levels of Amyloid Beta and Tau in Normal Cognitive Aging
  45. HAZLETT ELVERMAN, K Preclinical Markers of Risk for Alzheimer's Disease in a Task of Inhibitory Control
  46. HE, A Longitudinal Assessment of Metacognition in Mild Cognitive Impairment and Dementia
  47. HOIDA, E Memory Age and Semantic Specificity of Famous Names in AD and Individuals at Genetic Risk for AD
  48. JACOBSON, AJ Executive Dysfunction and Reduction in Cortical Thickness Distinguish Behavioral Variant Frontotemporal Dementia From Early-Onset Alzheimer's Disease
  49. JOHN, SE Effectiveness and Unique Contribution of Neuropsychological Tests in the Differential Diagnosis of Dementia

50. LANE, EM Insulin Sensitivity, Neuropsychological Performance, and Cognitive Diagnosis: The Vanderbilt Memory & Aging Project
51. LARA-RUIZ, J Functional Outcome, Cognitive Decline and Symptoms of Depression in Participants with Alzheimer's
52. LEBOWITZ, BK Stability of HART Estimated IQ in Clinically Referred Patients
53. LOBUE, C Earlier Age of Diagnosis in Alzheimer Disease by Sex: The Additive Effect of Traumatic Brain Injury History and Apolipoprotein e4
54. NATION, DA Older Adults Taking AT1-Receptor Blockers Exhibit Reduced Cerebral Amyloid Retention and Progression to Dementia
55. POSADA, C Depression with Spiritual Delusions as a Manifestation of Early-Onset Alzheimer's Disease: A Case Report
56. RADKE, A Recognition Memory as a Cognitive Biomarker for Alzheimer's Disease
57. ROSTAMI, R The Association between Executive Function and Lipid Levels in the CSF of Individuals with Pre-symptomatic Alzheimer's Pathology
58. SHERMAN, JC An investigation into cognitive and test factors that impact performance on the Free and Cued Recall Test among patients with MCI and Dementia
59. TAT, MJ Caregiver and clinician impressions of false memory in patients with Alzheimer's disease: A questionnaire study
60. TATE, DF Global Measures of Brain Volume and Neuropsychological Performance in the Cache County Memory and Aging Study
61. VILA-CASTELAR, C Detecting response to Cholinergic treatment in AD after 6 week double-blind placebo controlled trial: sensitivity of attentional measures on accuracy, fatigue and variability
62. VILA-CASTELAR, C Attentional Blink predicts treatment response to cholinesterase inhibitors in patients with AD: accuracy on a high load top-down task
- Dementia (Non-AD)**
63. BERTOUX, M Social cognition distinguishes amnesic behavioural variant frontotemporal dementia from Alzheimer's disease
64. CARR, A Perceived Emotional Intelligence (EI) and Social Behavior Disturbance in Behavioral Variant Frontotemporal Dementia (bvFTD) and Early-Onset Alzheimer's Disease (eAD)
65. FEDOR, A Cognitive Function does not Moderate the Relationship Between Subjective and Objective Physical Activity in Older Adults
66. KORSNES, M The Mini-Mental State Exam (MMSE) and the Montreal Cognitive Assessment (MoCA) as a diagnostic screening tool in an old age psychiatry department
67. LATREILLE, V Neuropsychological Correlates of Dementia Development in Parkinson's Disease
68. PARANAWITHANA, C Validation of the Repeatable Battery for the Assessment of Neuropsychological Status for individuals diagnosed with Dementia
69. SCHAEFER, LA Vowel Versus Consonant Letter-Word Fluency: Differences Between Dementia Types?
70. STALEY SHUMAKER, BE Variation of Verbal Memory in Healthy Older Adults with Diastolic Blood Pressure and Cholesterol
- Drug/Toxin-Related Disorders (Including Alcoholism)**
71. BAZINET, A Neuropsychological Performance of Adults with Active Methamphetamine Dependence Compared to Adults in Early Remission and Never Users
72. LE BERRE, A Differential Impairment in Prospective and Retrospective Metamemory Monitoring in Nonamnesic Alcoholism: Evidence toward Mnemonic Anosognosia
73. MAHONEY, JJ The Impact of Comorbid Drug Use and Cocaine Use Patterns on Cognitive Functioning in Individuals with Cocaine Use Disorders
74. MAHONEY, JJ Cognitive Functioning in Cigarette-Deprived Smokers
75. MULHAUSER, K Abstinence-based Changes in Neurological Functioning During Residential Treatment for Alcohol and Cocaine Use Disorders
76. ROSS, JM Effects of Cannabis Use on Neurocognition among Persons Living with HIV: Preliminary Observations
77. ROSS, JM Decision-Making and Cannabis Use Interact to Predict Risky Sexual Behavior
78. SASSOON, SA Visuospatial Construction and Memory in Adolescence: Relations with Age, Sex, Alcohol Drinking, and Organizational Strategy
79. SULLIVAN, K Herbicide Exposure and Brain Magnetic Resonance Imaging (MRI) in South African Farmers
80. TIMKO, A Psychiatric Symptom Clusters are Associated with Social Perception Task Performance among Individuals with Alcohol Use Disorder
81. TOMLINSON, E Smoking Effects on Cognitive Function in Veterans with Comorbid PTSD and Alcohol Use Disorder
82. WRIGHT, NE Young Adult Marijuana Use and Gender Effects on Frontolimbic Function: Depression, Anxiety, Impulsivity, and Executive Dysfunction
- Electrophysiology/EEG/ERP**
83. MIGNAULT GOULET, G Music Lessons in Teenagers with Congenital Amusia
- Memory Functions**
84. O' SHEA, DM Older adults with poor self-rated memory have less depressive symptoms and better delayed memory performance when perceived self-efficacy is high

**9:00–10:30 AM****Poster Symposium 2. Neuropsychological Assessment & Rehabilitation from Literates to Illiterates: An Indian Perspective****Organizer: Ashima Nehra**  
**Gloucester Exhibit Hall****Cognitive Intervention/Rehabilitation**

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|--------------|---|
| 85. NEHRA, A | Neuropsychological Assessment & Rehabilitation from Literates to Illiterates: An Indian Perspective                                   |
| 86. NEHRA, A | Neuropsychological Assessment in India: Impact of Education Revolution  |
| 87. KAUR, H  | Development & Effectiveness of a Home Based Neuropsychological Rehabilitation Program for Patients Suffering from Aphasia             |
| 88. NEHRA, A | Cognitive Rehabilitation of Individuals after Traumatic Brain Injury Using an Eclectic Literacy and Culture Free Intervention Program |

**9:00–10:30 AM****Invited Symposium 4. Cognitive Rehabilitation and Neuroimaging in Clinical Populations****Chair: John DeLuca**  
**Discussant: Erin D. Bigler**  
**Salon ABCDE**

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|-----------------------|--|
| 1. DELUCA, J          | Cognitive Rehabilitation and Neuroimaging in Clinical Populations                          |
| 2. DELUCA, J          | Cognitive Rehabilitation in Multiple Sclerosis   |
| 3. CHIARAVALLLOTI, ND | Cognitive Rehabilitation and Neuroimaging in Traumatic Brain Injury (TBI)                  |
| 4. OJEDA, N           | Cognitive, Functional and Brain Changes in Parkinson's Disease After Cognitive Remediation |
| 5. KESHAVAN, M        | Cognitive Rehabilitation and Neuroimaging in Schizophrenia                                 |

**9:00–10:30 AM****Symposium 12. Health Factors Related to Cognitive and Neural Plasticity****Chair: Elizabeth Leritz**  
**Discussant: William P. Milberg**  
**Salon F**

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|--------------|---|
| 1. LERITZ, E | Health Factors Related to Cognitive and Neural Plasticity   |
| 2. LERITZ, E | Neuroanatomical and Neuropsychological Correlates of Conjoint Cerebrovascular Disease Risk                                    |
| 3. SALAT, DH | Differential Associations between Systemic Markers of Disease and White Matter Tissue Health in Middle Aged and Older Adults  |
| 4. HALEY, A  | Mechanisms linking abdominal obesity to neuronal viability in midlife   |
| 5. HAYES, SM | Cognitive and Neural Correlates of Physical Activity in Aging   |
| 6. VOSS, M   | Investigating the Relationships Between Physical Activity, Exercise, and Fitness with Functional Brain Health in Older Adults |

**9:00–10:30 AM****Paper Session 11. Pediatric Neuropsychology****Moderator: Mary Best**  
**Salon G**

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|----------------|---|
| 1. DENTON, CA  | Effects of Attention-Deficit/Hyperactivity Disorder (ADHD) Treatment and Intensive Reading Instruction for Children with Comorbid ADHD and Significant Word Reading Difficulties (RD) |
| 2. SCOTT, J    | Cognitive Functioning in Adolescent and Young Adult Cannabis Users: Results from a Large Community-Based Sample   |
| 3. GONZALEZ, R | Decision-Making as a Risk for Development of Cannabis Dependence among Teens: Preliminary Observations  |
| 4. HINTON, VJ  | The Cognitive and Behavioral Phenotype Associated with Glut 1 Deficiency Syndrome   |
| 5. MANGIN, KS  | Trajectories of Cognitive Development in Very Preterm and Typically Developing Children   |
| 6. HOOPER, SR  | First Grade Predictors of Early Elementary School Writing Skills Through Fourth Grade   |
| 7. TROYB, E    | Examining the Relationship Between Restricted and Repetitive Behaviors and Executive Functioning in Children with Autism Spectrum Disorders   |

**9:00–10:30 AM****Symposium 13. Risk Factors in the Development of Executive Functioning in Children****Chair: Rachel Weber**  
**Back Bay (Dartmouth-Fairfield)**

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|---------------|---|
| 1. WEBER, R   | Risk Factors in the Development of Executive Functioning in Children      |
| 2. DUVAL, S   | Risk Factors for Executive Function in Preschoolers Born Preterm          |
| 3. WEBER, R   | Risk Factors for Executive Functioning in Linguistically Diverse Children |
| 4. LAFAVOR, T | Executive Function in Homeless and Highly Mobile Children                 |

10:30–10:45 AM

**AM Coffee Break**  
**Gloucester Exhibit Hall**

10:45 AM–12:00 PM

**Poster Session 9. Emotional Processes, Genetics, HIV/AIDS, and Psychopathology/Neuropsychiatry**  
**Gloucester Hall****Emotional Processes**

1. BEAUCHAMP, MH Attribution of moral emotions to social decision-making from childhood to early adulthood
2. DENO, M Salivary Stress Hormones, Emotional Responses to Stress and Trait Emotional Intelligence: A Monozygotic Twin Study
3. ECHLIN, HV Executive Processes in Emotion Regulation
4. ELLIS, A Neural Response to Monetary Reward versus Loss Predicts Symptoms in Mood Disordered Youth
5. FEIGON, M Gender Differences in Emotional Valence on the Semantic List learning Task
6. FIGUEROA, PA Cognitive and Emotional Dimensions of Empathy in Individuals with Agenesis of the Corpus Callosum
7. HAAK, CL Social Language Abilities as a Moderator of Child and Parent Report of Internalizing Symptoms
8. HARRIS, K Predictive Value of Motoric and Depressive Symptoms on Functional Impairment in Parkinson's Disease Patients
9. IKANGA, JN An Empirical Approach to Defining Emotional Communication Disorders (ECD)
10. IKANGA, JN An Empirical Approach to Defining Emotional Communication Disorders (ECD)
11. KLINEBURGER, PC Frontal Lobe Deactivation During Intense Music-Evoked Emotion
12. KRAUSE, WH Validity and Utility of Novel Primary Emotions in Multichannel Emotion Perception Tasks
13. LAFO, JA Startling Facts about Emotion in Essential Tremor: Blunted emotional reactivity as indexed by the startle eyeblink response
14. LAU, L Global-Local Visual Attention, Mood and Temperament
15. LEBLANC, É Affect Recognition as a Predictor of Rule-Breaking and Aggressive Behaviour in Childhood
16. MCKINNEY, TL The development and validation of the Alberta Implicit Scale of Emotional Reactivity (AISER)
17. MELTZER, EP Validation of the Emotion Regulation Questionnaire (ERQ) and Cognitive Emotion Regulation Questionnaire (CERQ) in Non-Demented Older Adults with Varying Degrees of Cognitive Complaints and/or Difficulties
18. MYERS, TE The "In-Group Advantage" for Perceiving Emotion across Demographic Groups and Communication Channels
19. PARTHIBAN, C Emotion Dysregulation & Apathy: Subjective and Physiological Responses Following a Mood Induction
20. PISNER, D Highways of the Emotional Intellect: White Matter Microstructural Correlates of an Ability-Based Measure of Emotional Intelligence
21. REIFE, I Social Cognition and Internalizing Symptoms: A Pilot Analysis
22. SANTOSPAGO, B Alexithymia, Apathy, and Depressive Symptoms: Convergence and Divergence
23. VANUK, JR Resting RSA Correlates with Coordinated Resting State Activity Between Brain Networks Involved in Emotional Perception
24. VANUK, JR Greater Resting State Functional Connectivity within the Default Mode and Task Positive Networks is Associated with Trait Emotional Intelligence
25. WADE, J The Relationship Between Marital Status and Happiness in Neurological Illness
26. WILLIAMS, C Parents' Anxiety Indirectly Predicts Children's Executive Functioning

**Genetics/Genetic Disorders**

27. FEE, RJ Parental report on the BRIEF does not distinguish performance on clinical measures of executive function in boys with Dystrophinopathy
28. FISCHER, MP Neuropsychological Profile and Initial Treatment Outcomes in a Child with Beta-Mannosidosis
29. HAMPTON, L Association of Russell-Silver Syndrome Phenotype and Autism Spectrum Disorder: A Review of Two Case Studies
30. HAMPTON, L Neuropsychological Outcome Across Phenotypes in Sialic Acid Storage Disease: Case Review of Two Affected Male Siblings
31. HARLEY, D Influence of CETP on Executive Functioning in Healthy Aging Adults
32. LEAFFER, EB Reversal of cognitive decline in a case of myotonic dystrophy treated for sleep problems
33. MORIN-MONCET, O BDNF Val66Met Polymorphism, Motor Learning and Intermanual Transfer of Sensorimotor Skills : A Neurophysiological TMS Study
34. TSAPANOU, A Examining the association between Apolipoprotein E-ε4 and self-reported sleep disturbances in non-demented older adults

**HIV/AIDS/Infectious Disease**

35. AMBROZIAK, AR Depression and HIV: effects on regional activity in resting state fMRI and cognitive performance
36. ARCE RENTERIA, M Functional Assessment of HIV+ Adults in South Africa: Utility of the Patients' Assessment of Own Functioning Questionnaire and Instrumental Activities of Daily Living Scale



37. ARCE RENTERÍA, M An Evaluation of the Construct Validity of a Neuropsychology Tablet App for Lay Health Workers to Screen for HAND in South Africa
38. BANERJEE, NS Executive Functioning, Coping and Depression in HIV
39. DASHER, NA Nonverbal versus Verbal Learning and Memory in Asymptomatic HIV Patients
40. DOYLE, KL Verbal Memory Profiles in HIV-associated Neurocognitive Disorders: A Comparison with Huntington's Disease and Temporal Lobe Epilepsy
41. DOYLE, KL The Effects of HIV-associated Neurocognitive Disorders Across An Integrated Functional Model of Health Literacy
42. FAZELI, PL The Montreal Cognitive Assessment to Screen for HIV-associated Neurocognitive Disorders in Older Adults: Sensitivity, Specificity, and External Validity
43. KABUBA, N The Use of Neuropsychological Tests in assessing HIV-associated neurocognitive disorders in Zambia
44. KAMAT, R Apathy Is Associated with Lower Mental and Physical Quality of Life in Persons Infected with HIV
45. KORDOVSKI, V Prospective Memory Is Related To Job Performance in Persons With HIV Infection
46. KUHN, T The Effects of HIV and Aging on Subcortical Shape Alterations: A 3D Morphometric Study
47. MIRANDA, C The Roles of Health Literacy, Neuropsychological Functioning, and Demographics in Health Disparities among HIV+ Adults
48. MORGAN, EE HIV-seropositive Individuals are at Risk for Misattributing the Source of Health-Related Information
49. OBERMEIT, LC Frontal Systems Behaviors Significantly Impact Everyday Functioning Outcomes in HIV Disease and Methamphetamine (MA) Dependence
50. OBERMEIT, LC Self-Reported Attribution of Everyday Dysfunction: Defining Functional Dependence in HIV
51. OLSEN, P Non-Verbal Ability As An Estimator Of Premorbid Intelligence: Does It Remain Stable Among Ethnically Diverse HIV+ Adults?
52. SCHELL, E Relations Between Poverty and Neurocognitive Function in HIV+ Adults
53. SHEPPARD, DP Random Number Generation in HIV Disease
54. VILLALOBOS, J Social Cognition is Associated with Greater Conflict on Social Aspects of a Medical Decision-Making Task
55. WACLAWIK, K The Contributions of Viral Infections, Substance Use and Psychiatric Diagnosis to Change in Memory over One Year in a Marginally Housed Sample
56. WEBER, E Self-generation improves prospective memory performance in HIV-infected adults
- Psychopathology/Neuropsychiatry (Including Schizophrenia)**
57. BLANCHETTE, B Impaired Cognitive Abilities in a Lifetime Obsessive-Compulsive Disorder Sample
58. BURTON, CZ Neuropsychological Correlates of Performance-Based Measures of Functional Capacity and Social Skills in Severe Mental Illness
59. BURTON, CZ Effects of Cognition and Psychiatric Symptom Severity on Work Outcomes in Severe Mental Illness
60. CALLAHAN, JL Verbal Learning and Memory Impairments Among World Trade Center Responders: Differential Correlates Among PTSD Sub-dimensions
61. CHOUDHURY, TK Deep brain stimulation (DBS) for treatment of therapy-refractory obsessive compulsive disorder (OCD): a case study highlighting neurocognitive and psychiatric changes
62. CZEPIELEWSKI, LS Cognitive Performances and Neuroanatomical Volumes at Early and Late Stages of Bipolar Disorder
63. DAHLGREN, MK Inhibitory Task Performance Is Not Worsened by Comorbid Marijuana Use in Patients with Bipolar Disorder
64. ESTEVIS, E Neuropsychological Correlates on Decisional Capacity for Informed Consent among Depressed Inpatients
65. FEIGON, M Detecting PTSD in Individuals with an Electrical Injury
66. FORTE, M Attentional Control Deficits in Schizophrenia
67. FOX, J Default Mode Functional Connectivity Predicts Working Memory in Low Functioning Schizophrenia
68. FUKUNAGA, R Reduced Rostral Anterior Cingulate Volume is Associated with Greater Frequency of Negative Automatic Thoughts in Adults with Major Depressive Disorder
69. GAT-LAZER, S Harm Avoidance and Reward Dependence in Patients with Eating Disorders
70. GELUZ, ZS Neurocognitive Correlates of Internet Addiction in University Students
71. GORLYN, M Neurocognitive Impairment in Depression is an Independent Symptom Dimension
72. HINRICHS, KH Baseline Intellectual Ability is Protective Against Decline in Neuropsychological Functioning: Support for a Cognitive Reserve Process
73. KEATS, LB The Relevance of Online and Offline Theory of Mind (ToM) Processes in Predicting Social Skill Capacity among Inpatients with Schizophrenia-Spectrum Disorders
74. KOO, B Functional coherence along the hippocampal longitudinal axis fingerprints episodic memory problems in Schizophrenics
75. LEWANDOWSKI, KE Cognitive Variability in Psychosis: Cluster Solution Replication and Association with Resting State Networks
76. MAKSIMOVSKIY, A Synergistic Impact of Drinking and Smoking on White Matter Integrity and Cognitive Function in Young Veterans
77. MORRA, L The Role of Metabolic Abnormalities in the Generalized Neurocognitive Deficit in Schizophrenia
78. OKRUSZEK, L Memory of basic emotions in schizophrenia
79. OLSON, EA Delay Discounting and Anhedonia are Independently Associated with Suicidal Ideation in Depression
80. OVERLY, T Neurocognitive Correlates of Schizotypal Personality Traits in University Students

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| 81. PARIKH, SA             | ROC Analysis of the Trauma Symptom Inventory in Assessing PTSD in Patients with Electrical Injury  |
| 82. PAULSON, J             | Verbal Memory and Inflammation in Veterans with PTSD, Past PTSD, and No PTSD   |
| 83. PERAZA, JR             | Does Neurocognitive Ability Predict Treatment Success for PTSD?  |
| 84. PETERSEN, J            | Diffuse Cortical Differences in Schizophrenia: A Resting-State fMRI Study  |
| 85. PIMONTEL, MA           | Cortical Predictors of Persistence of Apathy in Late-life Depression   |
| 86. PINSONNEAULT, M        | Transactional Relationships Between Vocabulary and Physical Aggression during the Transition to Formal Schooling   |
| 87. SARAPAS, C             | Relationships Between Attention and Anxiety in Low- and High- Stress Contexts  |
| 88. SULLIVAN, SK           | Impaired Effort-Cost Computation in Schizophrenia is Associated with Avolition   |
| 89. THOMAS, KR             | Predictors of Work Attainment After a Combined Treatment of Compensatory Cognitive Training and Supported Employment in Severe Mental Illness: Preliminary Results |
| 90. TIMPANO SPORTIELLO, MR | Neurocognitive Profile of Patients with Obsessive-compulsive Disorder: Role of Executive Dysfunction   |
| 91. TORRES, I              | Metacognitive Monitoring in Bipolar Disorder   |
| 92. TZOURIS, TA            | The Effect Of Hallucinations on Cognition in Alzheimer's and Parkinson's Disease   |
| 93. TZOURIS, TA            | The Effects of Hallucinations and Delusions on the Cognition of Older Adults   |
| 94. VADHAN, NP             | Acute Neurocognitive Effects of Smoked Marijuana in Prodromal Psychosis  |
| 95. WANG, NY               | The Role of Neurocognition, Psychiatric Symptoms, and Substance Use in Predicting Social and Occupational Functioning in a Marginally Housed Sample                |
| 96. WOOLVERTON, CB         | Self-imagining Improves Memory in Individuals with First-episode Psychosis   |

**10:45 AM–12:15 PM****Paper Session 12. Executive Functions/Frontal 2****Moderator: Stuart Hall****Salon ABCDE**

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|----------------|--|
| 1. CIRINO, PT  | A Structural Framework for Executive Functions in Children                         |
| 2. JONES, KE   | Preliminary Validation of the BRIEF-2: Examination of Profiles Among ADHD Subtypes |
| 3. ISQUITH, PK | Profiles of Everyday Executive Function with the BRIEF2                            |
| 4. ISQUITH, PK | Development and Validation of Screening Forms for the BRIEF2                       |

**10:45 AM–12:15 PM****Symposium 14. Driving is More Than Cognition: Integrating Evidence Across Neuropsychological Populations****Chair: Maria T. Schultheis****Salon F**

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|-------------------|--|
| 1. SCHULTHEIS, MT | Driving is more than cognition: Integrating evidence across neuropsychological populations   |
| 2. WHIPPLE, E     | The relationship between anxiety and driving performance in combat veterans with PTSD and TBI  |
| 3. RAPHAEL, A     | The Effect of Symptom Severity on Driving in Multiple Sclerosis: The Interaction Between Cognitive and Physical Impairments in a Functional Task |
| 4. GRAEFE, AC     | Neurocognitive Mediators of Virtual Reality Driving Behaviors and ADHD Symptomatology in Young Adults  |
| 5. PATRICK, K     | Autism Spectrum Disorders and Driving: Cognitive and Social Impairment May Impact Driver Training  |

**10:45 AM–12:15 PM****Paper Session 13. Acquired Brain Injury (ABI), Child****Salon G**

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|----------------|--|
| 1. FABER, J    | Facial Recognition Memory and Diffusion Tensor Imaging in Children with TBI  |
| 2. WILDE, EA   | Adaptive Functioning Skills and Diffusion Tensor Imaging in Children with TBI  |
| 3. HYSENI, I   | Atypical Tractography in Children Sustaining Traumatic Brain Injury at a Young Age: The Possible Role of Plasticity                              |
| 4. WARE, AL    | Age of initial shunt operation and shunt revisions predict long-term IQ and fine motor dexterity in myelomeningocele                             |
| 5. AFSHAR, S   | Time Spent Waiting for Liver Transplantation Predicts Long-Term Cognitive Outcomes in Children with End-Stage Liver Disease                      |
| 6. MORSE, C    | The Cerebellar Cognitive Affective Syndrome: Insights from Joubert Syndrome  |
| 7. NICHOLS, SL | Associations of Memory and Executive Functioning with Academic and Adaptive Functioning among Youth with Perinatal HIV Exposure and/or Infection |

**10:45 AM–12:15 PM****Symposium 15. Resilience to Brain Aging and Alzheimer's Disease: Evidence from Imaging and Biomarker Studies****Chair: Ozioma C. Okonkwo****Back Bay (Dartmouth-Fairfield)**

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|----------------|--|
| 1. OKONKWO, OC | Resilience to Brain Aging and Alzheimer's Disease: Evidence from Imaging and Biomarker Studies |
| 2. VEMURI, P   | Effect of Intellectual Enrichment on AD Biomarker Trajectories                                 |

3. SOLDAN, A Relationship between Cognitive Reserve and Longitudinal Change in Cognition in Middle-Aged and Older Adults
4. RENTZ, DM Cognitive Resilience in Preclinical Alzheimer's disease: The Association of Tau and Amyloid Burden on Cognitive Performance
5. SCHULTZ, SA Cardiorespiratory Fitness Modifies the Association between a Polygenic Risk Score and CSF Biomarkers in Preclinical Alzheimer's Disease
6. BELLEVILLE, S Early- and Late-Life Cognitive Stimulation: Effects on Brain Structure and Function and Relation to Reserve Models

**12:45–2:00 PM****Poster Session 10. ABI (Adult) and Language/Speech  
Gloucester Hall****Acquired Brain Injury (TBI/Cerebrovascular Injury & Disease - Adult)**

1. ANDREWS, RJ Prediction of Neurobehavioral Symptom Inventory Total Score Using Psychological and TBI Measures
2. ASKEN, B "Playing Through It": Delayed Reporting and Removal from Athletic Activity Following Concussion Predicts Prolonged Recovery
3. BABAKHANYAN, I Construct Validity and Factor Structures of the Automated Neuropsychological Assessment Metrics
4. BALASUBRAMANIAN, V Lexical and Syntactic Processing in Left and Right Brain Damaged Adults
5. BANKS, SJ Admitted Anabolic-Androgenic Steroid Use in Professional Fighters: Relationship with Hippocampal Volume and Cognition
6. BEAULIEU, C BDNF Val66Met polymorphism effects on neuropsychological function in concussed athletes
7. BENNETT, L The Impact of Primary Playing Position and Athletic Exposure on Performance Across Cognitive Domains in Disability-Seeking Retired NFL Players
8. BLOCK, CK An Individualized Quantitative Behavioral Assessment (IQBA) Can Detect Consciousness Following Brain Injury Prior to Standardized Assessments
9. BOUCHARD, A Estimating Premorbid Intellectual Functioning in TBI Survivors with a Schizophrenia-Spectrum Diagnosis: the Clinical Utility of the Wide Range Achievement Test
10. BRYSON, CN Applying the Interpersonal Theory of Suicide to a Traumatic Brain Injury Sample
11. BUCHHOLZ, A Actual and Perceived Performance on Cognitive Tasks as Correlates of Subjective Fatigue in Traumatic Brain Injury
12. CANNIZZARO, MS Prefrontal Cortical Activity During Discourse Processing: Implications for Cognitive-Communicative Impairments
13. CHIOU, KS Functional Activation During Metacognitive Confidence Judgments After Traumatic Brain Injury
14. COOK, C Effects of Screening for Postconcussive Syndrome (PCS) on PCS Symptom Self-Report and Neuropsychological Test Performance
15. CREW, EC Acute Sleep Changes Following Sport-Related Concussion are Associated with Increased Intra-Individual Cognitive Variability on the ImPACT
16. CROCKER, LD The Role of Depression and Posttraumatic Stress Disorder Symptoms in Cognitive Functioning in Veterans with a History of Mild Traumatic Brain Injury
17. DEDERER, J Self-reported Fatigue and Cognition in Veterans with History of Concussion and PTSD
18. DOBRYAKOVA, E Investigating the relationship between depression and motivation in TBI
19. DOIRON, MJ Machine Learning Algorithms and Virtual Reality: Using Technology to Inform Our Understanding of Cognition and Driving in TBI
20. EDMUNDSON, M Impact of Mild Traumatic Brain Injury on Personality
21. EVANGELISTA, ND Brain-Derived Neurotrophic Factor (BDNF) Genotype is Related to Executive Function But Not Memory Performance in Veterans with History of Mild Traumatic Brain Injury
22. FATOORECHI, S Relationship between Performance Validity and Perceived Workload in Healthy Adults and Adults with Traumatic Brain Injury
23. FAYTELL, MP Using Disability Rating Scale Recovery Curves to Predict Performance on the PASAT After Closed Head Injury
24. FECHTER, B Examining Predictors of Growth in Traumatic Brain Injury Rehabilitation
25. FEDIO, AA Addressing Anger and Aggression during Recovery from Traumatic Brain Injury
26. FONDA, J Association between Traumatic Brain Injury and Opioid Overdose
27. FUNES, C Population Objective, Population Subjective (POPS): Gender Differences in the Importance of TBI Community ReIntegration Variables
28. GASS, CS Psychological Characteristics in Acute Traumatic Brain Injury: An MMPI-2 Study
29. GAYNOR, LS Base Rates of Concussion-like Symptoms in Healthy Collegiate Athletes: a Predictive Tool for Post-Concussive Recovery Time
30. GULLETT, JM Increased Delta Wave Sleep Associated with Central Apnea Events in Mild Traumatic Brain Injury
31. HALL, MG Motor Perseveration Predicts Ideational Perseveration on the Wisconsin Card Sorting Test
32. HAMMOND, J Bicycle Helmet Use Among College-Aged Individuals
33. JACKSON, CE Post-concussive Symptom Reporting Among OEF/OIF/OND Veterans: Comparison Between Research and Clinical Contexts
34. JONES, J White matter integrity and self-reported sleep complaints in OEF/OIF/OND Veterans with deployment-related mild TBI

35. KAKAVAND, H Cognitive Components of Verbal Encoding Deficits Following Traumatic Brain Injury
36. KAKAVAND, H Memory Process Deficits for Verbal Material in Retired Professional Football Players
37. KARK, SM Sleep Quality vs Quantity: Differential Effects on Cognitive and Functional Status in Veterans with TBI and PTSD
38. KEELAN, RE Diminished Auditory Emotion Perception Accuracy in Moderate to Severe Traumatic Brain Injury
39. KIM, RT Is Subjective Disinhibition Associated With Response Inhibition Performance in Veterans with Mild-Moderate Traumatic Brain Injury?
40. KLIMOVA, A Neural Correlates of Cognitive and Emotional Impairments in Acute Versus Chronic Mild Traumatic Brain Injury: a Diffusion Tensor Imaging Study
41. KRISHNA, R Using DTI to Narrow the Diagnosis of TBI in Cases of Global Cognitive Disorder
42. LANCASTER, M Acute White Matter Changes Following Sport-Related Concussion: A Longitudinal Diffusion Tensor and Diffusion Kurtosis Imaging Study
43. LARA-RUIZ, J Differential Association of Activity Memory Components and Memory Process Deficits Following Traumatic Brain Injury
44. LEE, Y Does Psychoeducation Promote Recovery for Patients with Persistent Concussion Symptoms?
45. LEVEILLE, E Emotion Recognition in Concussed Athletes
46. MADIGAN, N Factors Contributing to Executive Functioning Symptoms in mTBI
47. MANDERINO, L Athletes with ADHD or History of Academic Difficulties Show Intact Performance on Baseline ImPACT Testing
48. MARTIN, R Effect of Modifications in ICD-10 Criteria on Diagnostic Rates for Post-Concussive Syndrome
49. MAXWELL, K Examining Psychological Diagnoses and Memory Performance in Relationship with Performance Validity within Veterans Presenting with History of Mild Traumatic Brain Injury (mTBI)
50. MELLINGER, M Assessment and Remediation of Adult Abulia Following Severe Traumatic Brain Injury in Infancy
51. MERZ, Z Exploratory Analysis of the Reintegration to Normal Living Index in a Stroke Population
52. MIELKE, JB Correlation of the ToPF and the WAIS-IV IQ scores in a High Functioning, Active Duty, Military Population
53. MILLER, D White Matter Abnormalities in Blast-Related mTBI are Associated With an Overall Index of Cognitive Impairment
54. MONCRIEF, GG Cognitive Reserve and Postconcussive Symptoms Reported by Blast Exposed Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans
55. MOORE, R Engagement in an Active Lifestyle is Associated with Better Neurocognitive Functioning Among Veterans with Mild Traumatic Brain Injury
56. NAYLON, K Impact of Cognitive Fatigue on Reported Post-Concussive Complaints
57. O'CONNOR, TA The Impact of Traumatic Brain Injury and Aggregate Comorbidities on Cognitive Functioning in a Marginally Housed Sample
58. OHLHAUSER, L Predictors of Length of Hospital Stay, Rate of Functional Improvement, and Functional Abilities at Discharge Following Stroke
59. OSBORNE-CROWLEY, KL Can Reversal Learning Deficits Explain Social Disinhibition Following Severe Traumatic Brain Injury?
60. OSBORNE-CROWLEY, KL Hyposmia, But Not Emotion Perception Impairment, Predicts Psychosocial Outcome after Severe Traumatic Brain Injury
61. PAXTON, J Executive Control and Memory Acquisition in Traumatic Brain Injury
62. PETERSON, SK Attention and Working Memory in OEF/OIF/OND Veterans with Mild Traumatic Brain Injury
63. PISNER, D Resilience Following Mild Traumatic Brain Injury is associated with Gray Matter Volume in the Left Precentral Gyrus
64. RAU, HK Intra-individual Variability on Neuropsychological Measures in OEF/OIF/OND Veterans: Associations with Blast-related mTBI and PTSD
65. ROBINSON, ME Close-Range Blast Exposure is Associated with Greater Clinical Burden
66. ROTHONG, N Neuropsychological Associations of Mild Traumatic Brain Injury and Psychopathology
67. SAMARINA, V Cognitive, Somatic, and Emotional Changes in Patients with Mild Traumatic Brain Injury (mTBI) and Orthopedic Injuries at Baseline and 3 Months Post-Injury
68. SANDERSON-CIMINO, M Use of the TOMM Response Consistency Indices in Veterans with History of Mild Traumatic Brain Injury and PTSD
69. SINGH, P Time Dependent Differences in Gray Matter Volume in Individuals Post Mild Traumatic Brain Injury: A Voxel Based Morphometric Study
70. SULLAN, M The relationship between post-concussive sleep symptoms and recovery time in Division 1 collegiate athletes
71. TATE, DF Subjective Reports of Cognitive Dysfunction and Objective Neuropsychological Test Results Among Active Duty Service Members
72. TERRY, DP Microstructural White Matter Changes in Non-Professional Football Players 20-45 Years After Two or More Concussions
73. VAKIL, E Title: Direct and indirect measures of context in patients with moderate-to-severe Traumatic Brain Injury (TBI): The additive contribution of eye tracking
74. VAN PATTEN, R Predicting Return to Work at Six-Month Follow-up in Mild to Moderate Stroke Patients: The Relative Importance of Physical Disability and Neurocognitive Functioning
75. VELEZ, CS Base Rates Neuropsychological Performance in Service Members with Mild TBI, PTSD and Orthopedic Controls

76. VYNORIUS, KC Lifetime Multiple Mild Traumatic Brain Injuries are Associated with Cognitive and Mood Symptoms in Young Healthy College Students
77. WALKER, KA Total Sedation and Delirium are Related to Memory Functioning, but Not General Cognition, in Critically Ill ICU Patients at Time of Discharge
78. YEE, MK Multiple Self-Reported Brain Injuries are Associated with Increased Health Symptoms in a Cohort of 1990-1991 Gulf War Veterans
79. YEE, MK Self-Reported Exposures to Mild Traumatic Brain Injury and Neurotoxicants Predict Current Total Health Symptoms in a Cohort of 1990-1991 Gulf War Veterans

### Language and Speech Functions/Aphasia

80. DANGUECAN, A Challenging the Phonological/Deep Dyslexia Continuum: A Case Study
81. FONG, A Do Bilinguals Have an Advantage in Learning a New Language?
82. JOHNSON, JP Evaluating Responsiveness to Treatment and Generalization in Patients with Acquired Reading and Writing Deficits
83. LAI, PT Language and Prosodic Measures in Typically Developing Children and Children with High Functioning Autism
84. LEVÄNEN, S Influence of Visual Speech on Audiovisual Speech Perception in Language-Impaired Children
85. LOPEZ, AR Sustainable Language Production in Typically Developing Children and Children with Focal Lesions
86. PILLAY, SB Brain Regions Mediating Recovery of Word Reading in Phonological Aphasia: An Event-Related fMRI Study
87. PURDY, M The Impact of Dichotic Listening Training on Auditory Comprehension in Aphasia
88. SAVOIE, J Boston Naming Test Performance among French-speaking Acadians in Canada
89. STINSON, JM Logopenic Progressive Aphasia in Patient with Meningioma: Neuropsychological Evaluations Over Time

### 1:00–2:30 PM

### Symposium 16. Disentangling Autism Symptomology Across Pathologies: Investigations of Shared Phenotypic Traits

Chair: Brian Willoughby

Salon ABCDE

1. WILLOUGHBY, B Disentangling Autism Symptomology Across Pathologies: Investigations of Shared Phenotypic Traits
2. COMAN, D Sensory Abnormalities Beyond Autism Spectrum Disorders (ASD): An Investigation of a Shared Phenotypic Trait Across Other Major Psychiatric and Neurodevelopmental Conditions
3. PINEDA, J Investigation of Restricted and Repetitive Behaviors Across Clinical Populations
4. DOOLEY, K Autism Spectrum Disorder Diagnosis as a Potential Moderator of the Relationship Between Social Impairment and Externalizing/ Internalizing Problems

### 1:00–2:30 PM

### Symposium 17. Predictors and Outcomes of Pediatric Concussion: Insights from the Prospective, Multicenter 5P Project

Chair: Miriam H. Beauchamp

Salon F

1. BEAUCHAMP, MH Predictors and Outcomes of Pediatric Concussion: Insights from the Prospective, Multicenter 5P Project
2. BEAUCHAMP, MH Predictors of Neuropsychological Outcome after Pediatric Concussion
3. KEIGHTLEY, M Neuromuscular and Neuromotor Performance following Pediatric Concussion
4. BROOKS, B Psychological Functioning after Pediatric Concussion
5. YEATES, KO Neuropsychological Functioning as a Predictor of Quality of Life after Pediatric Concussion

### 1:00–2:30 PM

### Paper Session 14. Dementia 2

Moderator: Maxine Krengel

Salon G

1. BLANKEN, AE Endophenotypes of Preclinical Alzheimer's Disease Empirically-Derived from Both Cognitive and Cerebral Spinal Fluid Biomarkers
2. HASENSTAB, J CSF Biomarkers and Cognitive Decline in Autosomal Dominant Alzheimer's Disease
3. TRIVEDI, MA APOE genotype effects on resting state functional connectivity of the default mode network in middle-aged individuals with a parental history of Alzheimer's disease
4. MINOR, A Social and cognitive factors relate to the presence of subjective cognitive decline in non-demented older adults
5. NADKARNI, NK The Cognition-Mobility Interface is Associated with Cerebral Amyloid Deposition in Clinically Normal Older Adults
6. COLEMAN, BW Subjective Cognitive Complaints Predict Conversion to MCI and Alzheimer's Disease Dementia
7. JEFFERSON, AL Lower hematocrit and hemoglobin values relate to worse cognitive performance in older adults: The Vanderbilt Memory & Aging Project

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# Abstracts Presented at the Forty Fourth Annual Meeting International Neuropsychological Society

February 3-6, 2016  
Boston, Massachusetts, USA

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WEDNESDAY MORNING, FEBRUARY 3, 2016

**CE 1. Functional MRI:  
The History, Basics, Cutting Edge, and Future**

**Presenter: Peter A. Bandettini**

**9:00 a.m.–12:00 p.m.**

**P.A. BANDETTINI. Functional MRI: The History, Basics, Cutting Edge, and Future.**

In this three hour lecture, I will give a broad yet hopefully informative and entertaining perspective of fMRI technology, methodology, signal interpretation, and to some degree, fMRI applications. The lecture will start with a detailed overview of how fMRI began. It will then continue with an in-depth description of fMRI contrast mechanisms – including blood oxygen level dependent (BOLD) contrast but going beyond this to other less common but nevertheless important contrast mechanisms – including blood perfusion, volume, and cerebral oxidative metabolic rate (CMRO<sub>2</sub>). Following this, the lecture will include a discussion of the principles of fMRI temporal and spatial resolution, as well as how to avoid common mistakes in fMRI signal interpretation. In the “cutting edge” section of this lecture I will discuss some of the more recent developments of fMRI, including resting state fMRI, fMRI decoding, individual classification with fMRI, and real time fMRI. I will conclude with some thoughts on the most interesting directions where fMRI is heading. These include the clinical use of fMRI on individuals to aid in psychiatric/neurologic/developmental disorder diagnosis as well as prediction of outcome and monitoring of therapy.

**Learning Objectives**

Following this lecture, the student should be able to:

State the year when the first BOLD papers came out as well as the first groups that demonstrated fMRI,

Describe in detail two other contrast mechanisms other than BOLD contrast,

Describe specifically what limits both spatial and temporal resolution in BOLD-based fMRI,

Describe a clinical application of real time fMRI, and

List at least two other potential clinical applications of fMRI on individual subjects.

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**CE 2. Science and Practice Considerations for  
Bilingual Neuropsychology:  
A Focus on the Hispanic/Latino Community**

**Presenters: Melissa Lamar, Maria T. Schultheis**

**9:00 a.m.–12:00 p.m.**

**M. LAMAR & M.T. SCHULTHEIS. Science and Practice Considerations for Bilingual Neuropsychology: A Focus on the Hispanic/Latino Community.**

There are ~55 million Hispanics/Latinos living in the US representing 17% of the total US population, these numbers will more than double to ~130 million or 31% of the US population by 2060 (CDC, 2014); thus, understanding the needs of this community as it relates to the science and practice of neuropsychology is critical. This course will first review the literature on cognition and brain aging as it relates to Hispanics/Latinos and highlight key areas of concern for both research and clinical work with this population. Second, clinical considerations will be addressed more specifically as they relate to adequate assessment, including review of considerations for selection of tests, norms and interpretation of Hispanic/Latino evaluations. Third, ethical considerations for working with bilingual individuals will be addressed. The workshop will conclude with a brief discussion of areas for future directions for both research and clinical needs.

As a result of participation in this course, the learner will achieve the following objectives:

Obtain a deeper understanding of the key issues impacting brain aging in Hispanics/Latinos,

Identify strengths and weaknesses of existing measures for bilingual assessment of Hispanic/Latino adults, and

Discuss ethical issues of working with bilingual adults.

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### CE 3. Advancing Developmental Science Through the Application of Pediatric Neuropsychology in Africa

**Presenters: Michael J. Boivin, Bruno Giordani**

**9:00 a.m.–12:00 p.m.**

#### **M.J. BOIVIN & B. GIORDANI. Advancing Developmental Science Through the Application of Pediatric Neuropsychology in Africa.**

Using exemplars from our research over the past 25 years, we present an overview of the application of neuropsychology to evaluate public health factors related to risk and resilience in sub-Saharan African children in resource-limited settings. We will present examples of clinical intervention and observational studies in early and middle childhood pertaining to pediatric infectious disease (e.g., HIV, Malaria), chronic disease (e.g., sickle-cell anemia), environmental risk factors (e.g., konzo disease), and neurodevelopmental intervention studies (e.g., computerized cognitive training, caregiver training). The theoretical construct of a universal brain/behavior omnibus (Boivin & Giordani, 2009) will be used as an organizational framework for understanding the orchestration of developmental plasticity in brain/behavior development,

including illustrations of interactions in brain/behavior development at culture-brain, culture-gene, and gene-brain levels. Our principal resource for this workshop will be our edited book *The Neuropsychology of Children in Africa: Perspectives on Risk and Resilience* (Springer Publishing, May 2013), as well as a forthcoming review of child neurodisability in the global context, to be published in *Nature*, 2016. The integration of neuropsychological science with risk and resilience in the global health context can provide a powerful vantage point for outcome in clinical trials, specifically, and for the universal advancement of brain-behavior science in children, in general.

#### **Learning Objectives**

Recount at least several public health factors related to risk and resilience in neuropsychological development in African children.

Recount several evidence-based interventions in African children to enhance neurodevelopmental and neuropsychological outcomes in low-resource settings.

Articulate several ways in which neuropsychology research with children in Africa has advanced child development science in general.

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## WEDNESDAY AFTERNOON, FEBRUARY 3, 2016

### CE 4. Characterizing and Guiding Brain Plasticity Across the Lifespan

**Presenter: Alvaro Pascual-Leone**

**1:00–4:00 p.m.**

#### **A. PASCUAL-LEONE. Characterizing and Guiding Brain Plasticity Across the Lifespan.**

The human brain is made up of neurones, highly sophisticated and stable cellular structures. However, neurones are engaged in dynamically changing networks that provide a most energy efficient, spatially compact, and precise means to process input signals and generate adaptable responses to a changing environment. Plasticity is an intrinsic property of such networks, and may be best conceptualized as evolution's invention to enable the nervous system to escape the restrictions of its own genome (and its highly specialized cellular specification), and thus adapt to environmental pressures, physiologic changes, and experiences. Consider the challenges faces by a musician. Playing a musical instrument, requires more than factual knowledge about the musical instrument, and about the mechanics of how it is played. The central nervous system has to acquire and implement a "translation mechanism" to convert knowledge into action. These translation capabilities, acquired over years of practice, result in changes in the organization of the brain. Initially, while learning a musical instrument (as indeed while acquiring any other skill) rapid changes take place in the brain, that probably represent the unmasking and activation of existing pathways. Eventually, over months and years of sustained practice, more stable, structural changes appear to take place.

Beyond such learning-related brain changes, the brain also changes across the lifespan in response to environmental influences, life events, experiences, etc. At the same time, the mechanisms of plasticity and the resulting brain dynamics vary, as indeed they vary across individuals and are modified by genetic predispositions, environmental influences, life experiences and even age. Innovative experimental paradigms can assess cortical plasticity in humans, in vivo, across the lifespan, and offer translatable biomarkers that can bridge the gap between animal models and humans.

Ultimately, changes in brain plasticity and dynamics may prove maladaptive and lead to disease. Aberrant, excessive or insufficient, or mistimed plasticity may represent the proximal pathogenic cause of neurodevelopmental and neurodegenerative disorders such as autism spectrum disorders, schizophrenia, or Alzheimer's disease. On the other hand, optimizing activity within and across brain networks can promote brain health, sustain cognitive function and well-being across the life-span, and leverage the impact of brain function on overall health (salutogenesis).

#### **Learning objectives:**

1. Explain the concept of plasticity as a life-long intrinsic property of the human brain.
2. Describe mechanisms of plasticity
3. Demonstrate about methods to assess the mechanisms of plasticity in humans.
4. Discuss implications of brain plasticity for brain health.

Supported by grants from the National Institutes of Health, the Sidney-Baer Foundation, and Harvard Catalyst.

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### CE 5. Cognitive Aging in the Digital Era: Role of Global Partnerships

**Presenter: Rhoda Au**

**1:00–4:00 p.m.**

#### **R. AU. Cognitive Aging in the Digital Era: Role of Global Partnerships.**

Current approaches to study cognitive aging and dementia take a largely silo approach that leads to incremental progress tied to pre-existing presumptions. Accepting the reality that what we know may be far less than what we don't know, and that true paradigmatic shifts in science often are galvanized by those coming from outside the inner academic

circles, it is important to look beyond the traditional and embrace new approaches. Digital technology and big data is fueling unprecedented new directions in the commercial community. President Obama's Precision Medicine Initiative and NIH's interest in a million person megastudy is also creating a ground shift in what might be the more effective means for conducting medical research. Within this context, how we study outcomes of cognitive aging, including those associated with traumatic brain injury, progressive and non-progressive neurological disorders, developmental learning processes needs to be considered. The objective of this course is to introduce how digital technologies and global partnerships can lead to transformative research methods from which to develop more effective strategies for promoting cognitive health, AD disease prevention and early detection capabilities of previously believed asymptomatic stages to facilitate effective intervention strategies (e.g., drug development and psychosocial/behavioral interventions).

#### Learning Objectives

Describe how digital technology can be used to enhance cognitive assessment and the factors affecting it

Explain how to balance between novel and innovative in the context of the current peer-review system

Describe how to develop a global research initiative that includes academic and non-academic partners that builds short and longer-term capacity.

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### CE 6. Dynamic Considerations in Neuropsychological Assessment of Depressive Disorders: State, Trait, Scar and Burden

Presenter: **Scott A. Langenecker**

1:00–4:00 p.m.

#### S.A. LANGENECKER. Dynamic Considerations in Neuropsychological Assessment of Depressive Disorders: State, Trait, Scar and Burden.

Depression is a frequently occurring psychiatric disorder, with a yearly prevalence of nearly 10% in the adult population, and lifetime prevalence around 20%. Depression is also frequently observed as a comorbid condition with other disorders, such as dementia, cardiovascular illness, traumatic brain injury, multiple sclerosis, learning disability, etc., frequently as a secondary outcome. Tremendous strides have been made toward understanding the neuropsychological, neuroanatomical, and neuroimaging findings associated with depression. Whereas understanding of the neuroanatomical networks involved in depression and related mood disorders remains in an adolescent phase, neuropsychological findings in depression and related mood disorders are fairly well codified at this point. The neuropsychological findings in depression include difficulties in attention, psychomotor speed, executive functioning, memory, and emotion recognition. In addition, there are a number of clinical, course, lifespan and demographic features that substantially impact cognitive performance in the context of a mood disorder. These include family history, age of onset, polypharmacy/substance abuse, medical complications, symptom levels, greater severity, number of episodes, and resistance to traditional treatments. Whereas the etiologies for depression-associated cognitive difficulties are heterogeneous, the co-occurrence of features of depression and cognitive difficulties of specific types suggests a common set of neural networks that may be adversely affected, including medial and ventral frontal, limbic, and basal ganglia structures. Neuroimaging paradigms offer meaningful and translational techniques for probing these affected circuits and for understanding treatment options and targets.

#### Learning Objectives

Attendees will be able to meet the following learning objectives:

Describe key domains of neuropsychological dysfunction in Major Depressive Disorder

Describe neuroanatomical regions and circuits associated with Major Depressive Disorder

Explain the moderating impact of family history, age of onset, polypharmacy/substance abuse, medical complications, symptom levels, greater severity, number of episodes, and resistance to traditional treatments

List strategies for using cognitive measures as predictors of treatment response

Compare, contrast and critique key issues in understanding the presence and course of cognitive difficulties in major depressive disorder and related mood disorders

Compare and critique mixed use neuropsychological/neuroimaging probes in mood disorders and related conditions: memory, emotion processing, reward, and executive functioning.

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### Poster Session 1. Behavioral Neurology, Electrophysiology/EEG, Epilepsy, and Memory

3:00–4:15 p.m.

#### Behavioral Neurology/Cerebral Lateralization/Callosal Studies

**A. ALIOTO, S. BORISH, C.C. MEAD, V. LIU-JOHNSON, C. WATSON, M. WYNN, J.M. FOLEY & J.H. KRAMER. White Matter Integrity of the Corpus Callosum Mediates the Relationship Between Cardiorespiratory Fitness and Processing Speed in a Population of Cognitively Normal Older Adults.**

**Objective:** There is increasing evidence that cardiorespiratory fitness (CRF) protects against age-related declines in processing speed ability (PS), although the underlying biological mechanisms remain unclear. One possibility is that white matter integrity (WM), known to correlate with reduced PS in normal aging, mediates this relationship. In this study, we investigated the impact of white matter (WM) integrity on the relationship between CRF and PS in a population of functionally intact older adults.

**Participants and Methods:** The study included 150 functionally intact older adult subjects (mean age=73) recruited from the University of California San Francisco Memory and Aging Center. Subjects underwent neuropsychological assessment and MRI. CRF was calculated from an equation based on age, gender, body weight, blood pressure, and self-reported physical activity (Jurca et al., 2005). Mean fractional anisotropy (FA) of the corpus callosum (CC) using diffusion tensor imaging was our measure of WM integrity. We ran linear regression models to evaluate the hypothesis that the relationship between PS and CRF is mediated by WM.

**Results:** CRF was significantly correlated with PS, and the relationship remained significant after controlling for education ( $p = .014$ ; 4.1% of variance explained). When WM was included in the first step of the regression model, it uniquely accounted for 8.8% of variance, and when CRF was entered into the model next, the contribution of CRF on PS was no longer significant ( $p = .159$ ).

**Conclusions:** Findings support the hypothesis that CRF contributes to PS ability via WM integrity of the CC in cognitively normal older adults. Results support prior research of the protective benefits of CRF against age-related cognitive and neurological decline, and amplify the need to consider lifestyle factors that can prevent cognitive change among older adult populations. Importantly, the impact was observed only in the presence of objective WM abnormality and CRF alone may be insufficient to produce behavioral change.



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**K.A. BURNETT, A.A. VAILLANCOURT, P.A. FIGUEROA, L.K. PAUL & W.S. BROWN. Inflexible Social Norm Perception in Agenesis of the Corpus Callosum.**

**Objective:** High-functioning adults with agenesis of the corpus callosum (ACC) tend to have a deficient theory of mind and to lack psychosocial insight, exhibiting socially awkward behavior and naiveté. These social deficits affect mental health and quality of life, yet are often overlooked due to normal IQ. To enhance the clinical neuropsychological profile of ACC, the present study tested whether adults with ACC correctly identify appropriate behaviors within social norms.

**Participants and Methods:** This study included 17 adults with ACC and normal IQ (age 19–55; FSIQ 88–118), and 21 neurotypical adult controls with normal IQ (age 19–64; FSIQ 103–115). Groups did not differ significantly in age, FSIQ, or gender. All participants resided in the U.S. and completed the Social Norms Questionnaire (SNQ22), a measure of social knowledge (Rankin et al., 2009). The SNQ22 asks whether certain social behaviors are appropriate based on dominant U.S. culture.

**Results:** Overall, the ACC group scored significantly lower in understanding social norms ( $M = 17.9$ ) than controls ( $M = 19.4$ ),  $\eta^2 = .16$ ,  $F(1, 36) = 6.99$ ,  $p = .01$ . Specifically, the ACC group over-adhered to social norms ( $M = 3.41$ ) significantly more than controls ( $M = 1.24$ ),  $\eta^2 = .29$ ,  $F(1, 36) = 14.33$ ,  $p < .001$ . There was no significant difference regarding breaking of social norms.

**Conclusions:** As expected, adults with ACC scored lower than controls on the SNQ22, indicating deficient knowledge of the nuances of social norms. The ACC group did not endorse breaking norms, but over-adherence to perceived social norms suggesting lack of nuance or exceptions (e.g. choosing “not appropriate” to “eat ribs with your fingers”). Adults with ACC may thus know social norms concretely (i.e. “use silverware when eating”), yet lack the ability to integrate context in specific scenarios. Previous ACC research suggested deficient complex novel problem-solving. Lack of appreciation of context and exception may be a reflection of this more general deficiency.

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**J. HA, L.K. PAUL & W.S. BROWN. Verbal Problem Solving in Individuals with Agenesis of the Corpus Callosum.**

**Objective:** Previous research demonstrated that individuals with agenesis of the corpus callosum (ACC) have difficulty in tasks requiring complex novel problem-solving and abstract thinking (Brown & Paul, 2000). However, whether this difficulty includes verbal problem-solving is not clear. This research examined the hypothesis that individuals with ACC also have difficulty in verbal abstract reasoning, hypothesis testing, and mental flexibility using the Word Context Test subtests of the Delis-Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2001).

**Participants and Methods:** The D-KEFS was administered to 25 individuals with ACC (age 16–52;  $M = 24.9$ ; FSIQ 78–129,  $M = 94.6$ ; VIQ 78–134,  $M = 95.4$ ), and 15 neurotypical controls (age 20–44,  $M = 29.5$ ; FSIQ 84–116,  $M = 101.8$ ; VIQ 86–117,  $M = 103.5$ ). The Word Context subtest of the D-KEFS has 2 measures: Consecutively Correct Responses (CCR) and Repeated Incorrect Responses (RIR). CCR describes the total number of consecutively correct responses that the participants obtain in the 10-item test. The RIR is the total number of responses that are consecutively incorrect.

**Results:** The ACC group performed significantly worse than the control group,  $F(1, 38) = 8.54$ ,  $p = .01$ ,  $\eta^2 = .18$ . However, the groups did not differ on the RIR ( $F(1, 38) = 2.01$ ,  $p = .16$ ,  $\eta^2 = .05$ ). Since there was a trend suggesting a difference in VIQ between ACC and the control

groups, analyses were rerun covarying VIQ. The group difference for CCR remained significant,  $F(1, 37) = 4.63$ ,  $p < .05$ ,  $\eta^2 = .11$ . The result for RIR also remained consistent with no significant difference between groups,  $F(1, 37) = 0.99$ ,  $p = .33$ ,  $\eta^2 = .03$ .

**Conclusions:** These findings indicate that individuals with ACC are less efficient in their analytic ability and problem-solving. They had difficulty integrating multiple bits of information in order to generate and test hypotheses. However, the lack of group difference on RIR score suggests that they were not more likely than controls to repeat the same incorrect response.

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**A. CIMINO-KNIGHT, L. GONZALEZ-ROTHI & K.M. HEILMAN. Callosal Ideomotor Apraxia in Alzheimer's Disease.**

**Objective:** Studies of right handed patients with corpus callosum injury have revealed an impaired ability to perform skilled movements with their left upper limb (callosal apraxia). Whereas some patients make left upper limb spatial and temporal errors primarily in response to verbal commands (verbal callosal disconnection apraxia), other patients with callosal injury make these errors with imitation and even when using actual tools, (callosal ideomotor apraxia). Some patients with callosal injury can also make content errors selecting and using the incorrect tool with their left upper limb (callosal conceptual apraxia). Patients with Alzheimer's disease (AD) reveal anatomic evidence of callosal degeneration and the purpose of this study was to learn if patients with AD have one or more forms of callosal apraxia.

**Participants and Methods:** Participants were 22 right handed patients with AD and 24 matched controls. Both upper limbs were tested by having subjects pantomime transitive movements to command and imitation. We also had them view pictures of an incomplete task and asking them to pantomime the action needed to complete the task.

**Results:** When compared to controls the participants with AD demonstrated an ideomotor and conceptual apraxia of both upper limbs. They also had a more severe ideomotor apraxia of their left than right hand.

**Conclusions:** These results suggest that patients with AD do have callosal disconnection apraxia.

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**A.K. HOLLAND, A. ROSA, C. BLANCO, M. DOSTER & D.W. HARRISON. Reductions in Design Fluency and Cardiovascular Regulation Vary Selectively as a Function of Trait Hostility Level.**

**Objective:** Right hemispheric functional cerebral systems are proposed to be compromised in individuals with high levels of trait hostility (Holland, et al., 2012). For the current research, it is hypothesized that high hostile individuals will evidence a reduced ability to regulate right hemisphere cerebral systems relative to their low hostile counterparts as measured through design fluency performance and regulation of sympathetic tone.

**Participants and Methods:** High hostile ( $n=24$ ) and low hostile ( $n=21$ ) undergraduates rating the Controlled Oral Word Association Task (COWAT) as moderately to extremely difficult completed the COWAT and the Ruff Figural Fluency Task (RFFT). Blood pressure and heart rate (HR) measures were taken between each experimental manipulation.

**Results:** A Hostile x Trial interaction for the number of unique designs produced was found ( $F(4, 176) = 2.73$ ,  $p = .03$ ), indicating that high hostiles failed to produce the same number of unique designs on the RFFT compared to their low hostile counterparts. This interaction was not found for words produced on the COWAT ( $F(4, 176) = 0.50$ ,  $p = 0.74$ ). A Condition x Trial interaction for (HR) was found ( $F(1, 43) = 7.04$ ,  $p = .01$ ), indicating a reduction in HR after completion of the

COWAT and an increase in HR after completion of the RFFT. A Hostile x Condition interaction approaching significance was found ( $F(1, 43)=3.45, p=.07$ ), indicating an increase in SBP in high hostiles after completion of both tasks.

**Conclusions:** The Hostile x Trial interaction provides evidence that high hostile individuals evidence reduced right hemisphere capacity compared to their low hostile counterparts. The current results indicate that functional cerebral systems may be especially compromised in high hostiles when recruitment of right hemispheric cerebral resources are required.

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### **J.S. MILLER, A.H. PANOS, W.S. BROWN & L.K. PAUL. Adaptive Skills in High-Functioning Adults with ACC and ASD.**

**Objective:** Prior research has identified cognitive and behavioral similarities between high functioning persons with agenesis of the corpus callosum (ACC) and autism spectrum disorder (ASD). However, adaptive functioning data in these populations is scarce. The purpose of this study was to examine adaptive skills in high-functioning adults with ACC and ASD in order to (1) forecast outcomes and (2) identify similarities and differences.

**Participants and Methods:** Thirty adults with ACC (Mage = 28.70, 16-55; MFSIQ = 96, 78-129) and 24 adults with ASD (Mage = 30.38, 17-56; MFSIQ = 108, 92-133) completed the Adaptive Behavior Assessment System 2nd Edition: Self-Report Adult Form (ABAS-II). The ABAS-II is an inventory that measures several adaptive skill areas with age-referenced norms. Scores were compared between ACC and ASD, and to norms.

**Results:** The ACC group scored significantly ( $p < .05$ ) higher than norms in Health and Safety, and similar to norms on all other composite and skill areas. In contrast, the ASD group scored below expectation for overall adaptive functioning based on the Global Adaptive Composite, (GAC) as well as on Social, Practical, Conceptual composites, with the largest effect size on Social ( $d = -2.40$ ). The ASD group performed significantly below expectation for most skill areas, including: Communication, Community Use, Functional Academics, Home Living, Leisure, Self-Care, Self-Direction, Social skills. Between ACC and ASD, the ACC group scored significantly better on the GAC, Social, and Practical composites as well as the following skill areas: Community Use, Home Living, Health and Safety, Leisure, and Social skills.

**Conclusions:** High-functioning individuals with ACC perceived their adaptive skills to be similar to neurotypical persons. However, those with ASD reported skills to be considerably poorer than age-related peers, and poorer than those with ACC. These findings are in support of recent ASD studies that found normal intelligence was not an accurate predictor of adaptive skill outcomes.

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### **P. MOES, R. JAROH, E. MATTHEWS & E. KIM. Left Happy Female, Right Angry Male: Hemisphere Differences in the Perception of Gender and Emotion.**

**Objective:** The study was designed to examine the lateralization of gender perception in interaction with emotion perception and observer gender. We hypothesized that female and male faces would be processed most efficiently in the left and right hemispheres, respectively. In addition, happy and angry expressions would accentuate the female-left and male-right advantage, respectively.

**Participants and Methods:** Experiment 1: Subjects (26 female, 30 male) responded to 200 msec. presentations of a face. Independent variables were: male vs. female face; angry, happy, or neutral expression; visual field (LVF vs. RVF), and participant gender. Primary measures were RT and PC. Experiment 2: Subjects (16 female, 13 male)

responded to the same conditions as Exp. 1 except that faces were presented centrally and the primary measure was P300 amplitude from the ERP wave.

**Results:** Exp. 1: RT produced a strong field x face-gender interaction [ $F(1,49)=40.1; p<.001$ ] with left hemisphere-female and right hemisphere-male advantages. Angry facial expressions reduced the left hemisphere-female advantage, but accentuated the right-hemisphere-male advantage [ $F(1,49)=25.3; p<.001$ ]. PC data produced mixed results for the lateralization of face-gender perception with neutral female faces showing a significant left hemisphere advantage that was accentuated with happy expressions.

Exp. 2: P300 (average amplitude) results at T3/T4 produced a 4-way interaction [ $F(1,27)=5.3; p<.029$ ] with female participants showing higher amplitudes for left hemisphere-happy female, right hemisphere-angry male combinations. Males produced a stronger right hemisphere response across conditions.

**Conclusions:** The results of both studies suggest an approach-related, left hemisphere dominant response to happy-female faces and strong avoidance-related right hemisphere response to angry male faces. These results have implications for the evolutionary basis of gender-related motivations as well as clinical and social consequences associated with lateralized lesions.

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### **K. OSWALD, M. WRIGHT & J. BO. Variability in Bimanual Coordination Dependent on Strength of Hand Dominance.**

**Objective:** Bimanual coordination is an essential human function requiring efficient interhemispheric communication to produce coordinated movements. Motor deficits affect a variety of clinical populations, yet a complete understanding of bimanual coordination has yet to be achieved. Previous research suggests completing bimanual tasks results in less variability than unimanual tasks, or a bimanual advantage. Also, strength of hand dominance has been shown to influence coordinated performance. The present study sought to replicate evidence of a bimanual advantage, and it was predicted participants with strong hand dominance would display a weaker bimanual advantage compared to those with weak hand dominance.

**Participants and Methods:** Fifty-six young adults completed five finger tapping conditions in a visually cued tapping paradigm: unimanual left/right, bimanual in-phase, and left/right-lead out-of-phase. Hand dominance was estimated using a self-report handedness questionnaire.

**Results:** Results generally revealed unimanual conditions resulted in greater variability compared to the bimanual in-phase condition, supporting the presence of a bimanual advantage ( $P=0.002-0.036$ ). Furthermore, results revealed that strong-handed individuals displayed a strong bimanual advantage in both right hand ( $P=0.002$ ) and left hand ( $P=0.009$ ) performance. An alternate pattern was observed in weak-handed participants, with weak-handed participants not displaying a bimanual advantage in either right or left hand performance.

**Conclusions:** These results contradicted the proposed hypotheses and suggest that strong hand dominance results in a more pronounced bimanual advantage compared to more stable performance across coordinated conditions as observed in those with weak handedness. In light of the present findings, relevant studies, behavioral and neuroimaging, are needed to gain further insight into bimanual coordination and the underlying processes of motor movement.

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**T.A. RENTERIA-VAZQUEZ, C.H. KANG, M. GRAVES, L.K. PAUL & W.S. BROWN. Social Inferences from Animated Interacting Triangles in Agenesis of the Corpus Callosum: Labeled Topic Modeling.**

**Objective:** Individuals with agenesis of the corpus callosum (ACC) and normal intelligence have deficits in social inference, but it is difficult to objectively describe the deficit. This research used a text classification approach (labeled topic modeling) to analyze differences in semantic content of free-response descriptions of four theory-of-mind animations involving two triangles interacting that normally elicit attributions of mental states (coaxing, mocking, seducing, surprising; Castelli et al, 2002). It was hypothesized that topics characteristic of individuals with ACC would not include themes reflecting attribution of mental and emotional states.

**Participants and Methods:** Sixteen adults (age 20-51) with ACC (FSIQ > 80) and 15 age-and FSIQ-matched controls (age 18-61) described what they saw in each animation. Labeled topic modeling extracted three topics from all participant responses for each animation: one topic from each group (control and ACC) and a common topic.

**Results:** The control group's topics included attributions of emotional states (e.g. angry, happy, upset) that were not found in the ACC group. Additionally, language reflecting the inference of animate agents occurred in topics from all animations for controls (e.g. male, female, house, parent), but only one instance of this in individuals with ACC (coaxing: mother, child). Both the control group and ACC group utilized words with goal directed intention for every animation, and both utilized attribution of mental states and interaction between agents for two animations.

**Conclusions:** Overall the hypothesis was supported in that the topics from persons with ACC were not as likely as controls to include words denoting emotional states or animate agents. Contrary to the hypothesis, the topics from the ACC group reflected attributions of intentional mental states. However, it was evident that the controls used attributions of mental states in a more sophisticated manner in that their topics suggested intentional manipulation of another agent.

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**A.A. VAILLANCOURT, K.A. BURNETT, P.A. FIGUEROA, L.K. PAUL & W.S. BROWN. Personality Characteristics of Individuals with Agenesis of the Corpus Callosum.**

**Objective:** Previous research demonstrated that individuals with agenesis of the corpus callosum (ACC) have poor social problem-solving, judgment, and inference (e.g., Brown & Paul, 2000). However, there is currently no research on the personality traits of individuals with ACC. The objective of this study was to determine if a distinctive personality profile exists for individuals with ACC.

**Participants and Methods:** The NEO-Five Factor Inventory (NEO-FFI) was administered online to 17 individuals with ACC (age: 19-55; FSIQ: 88-116) and to 24 age and IQ-matched controls (age: 19-64; FSIQ: 98-115). Two multivariate analyses of variance assessed group differences on the 5 personality dimensions and 13 personality trait clusters.

**Results:** The multivariate effect was not significant between groups when examining the 5 personality dimensions,  $F(5, 34) = 1.3, p = .42, \eta^2 = .131$ . However, univariate tests revealed a tendency toward lower Openness in the ACC group than in controls ( $\eta^2 = .08$ ). Groups did not differ overall on the multivariate analysis of the 13 personality cluster traits,  $F(13, 26) = 1.64, p = .14, \eta^2 = .45$ , but univariate tests revealed differences on 2 traits: less Unconventionality ( $\eta^2 = .13$ ) and greater Prosocial Orientation ( $\eta^2 = .12$ ) compared to controls.

**Conclusions:** The current results are consistent with parental reports that individual's with ACC do not cope well with change, and thus are tend to be conventional. The high Prosocial Orientation score for the ACC group should be considered in light of previous research showing that persons with ACC have diminished self-awareness. Thus, Brown

& Paul (2000) report that two adults with ACC studied intensively had MMPI-2 profiles with large L-K differences, suggesting a tendency for social and psychological nativity and rating themselves as highly positive. Otherwise, individuals with ACC were remarkable in Neuroticism, Agreeableness, Conscientiousness, and Extraversion.

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## Electrophysiology/EEG/ERP

**K.L. CLUNIES-ROSS, C. CAMPBELL, J.L. OHAN, M. ANDERSON, C. REID & A.M. FOX. Hemispheric Differences in Tb Responses to Tone-pairs with Short and Long Interstimulus Intervals in Children.**

**Objective:** The asymmetric sampling in time hypothesis (AST) suggests that the left and right secondary auditory areas function according to different sampling rates. In adults, asymmetries in the Tb response, of the T-complex AERP, to stimuli presented with different interstimulus intervals (ISIs) reflect a rapid sampling rate (~20 Hz) in the left hemisphere and a slow sampling rate (~5 Hz) in the right hemisphere. As significant changes in temporal processing occur between age 7 and 9, we investigated whether asymmetries consistent with the AST are observable in children at age 7 and whether they become more pronounced at age 9. We predicted that Tb responses to the second tone of tone-pairs with short ISIs would be enhanced over the left hemisphere and Tb responses to the second tone of tone-pairs with long ISIs would be enhanced over the right hemisphere.

**Participants and Methods:** Forty-two children attended a research program at age 7 (22 male, 20 female;  $M = 7.5$  years,  $SD = 0.27$ ) and were followed up at age 9 ( $M = 9.47$ ,  $SD = 0.26$ ). Children were presented with tone-pairs, each composed of two 50 ms, 1000 Hz, sinusoidal tones separated by ISIs of 25, 50, 100, or 200 ms. Stimuli were presented binaurally whilst the EEG was recorded.

**Results:** There was no significant effect of session on Tb responses. Over the left hemisphere, Tb responses to 50 ms ISI tone-pairs were enhanced relative to other tone-pairs. Over the right hemisphere, Tb responses elicited by 100 and 200 ms ISI tone-pairs were enhanced relative to other tone-pairs.

**Conclusions:** Our findings support the predictions of the AST. Auditory areas of the left hemisphere preferentially respond to fast presentation rates, and those of the right hemisphere preferentially respond to slow presentation rates. Previous studies have observed hemispheric asymmetries in the processing of fast and slow speech modulations and our findings suggest that hemispheric specialisation also occurs with the processing of non-linguistic auditory stimuli, and are present during childhood.

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**E.C. DUGGAN, W.R. MOORE & M.A. GARCIA-BARRERA. Inhibitory Control in Bilinguals with and without Musical Training- A Pilot Study.**

**Objective:** Event related potential (ERP) research has demonstrated music training and bilingualism have differential effects on inhibitory control (Moreno et al., 2014). Specifically, Moreno et al. found no behavioral differences between bilinguals, musicians, and controls, but maximal N2 amplitudes and a more protracted P3 response for bilinguals. For the current pilot study, we aimed to 1) replicate these findings; and 2) expand this research by investigating if bilingual individuals with musical training demonstrate further effects.

**Participants and Methods:** 9 monolingual non-musicians, 9 monolingual musicians, 9 bilingual non-musicians, and 9 bilingual musicians (age range=18-25) completed a modified progressive matrices task, a

verbal fluency task, and a go/nogo ERP paradigm. FCz peak amplitude, latency, and difference waves for the N2, P3, and N2P3 complex were calculated. Go versus nogo trials were examined using repeated measures ANOVAs and group by condition interactions were examined using one-way ANOVAs

**Results:** There was a significant main effect for go and nogo trials for the N2P3 complex ( $p=.000$ ) and a trending main effect for N2 peak amplitude ( $p=.075$ ). The only significant between group differences was found on a sensitivity index ( $d'$ ), with bilingual musicians demonstrating greatest sensitivity on the go/nogo task ( $p=.039$ ).

**Conclusions:** While all groups showed the expected increase in the N2P3 complex in response to nogo relative to go trials, this pilot study did not replicate Moreno et al.'s findings. Group by condition differences were not found for any ERP measures. We found behavioral differences by adding a bilingual-musician group, who demonstrated the most response sensitivity on the go/nogo task. Although limited by sample size (approx. half of Moreno et al.'s), results indicated a compounding effect of bilingualism and music training may be found in a larger sample. These results also support research indicating the N2P3 complex may a better measure of inhibitory control (Falkenstein et al., 1999).

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#### **P. EGETO, T.J. ORNSTEIN & E.H. ABRAHAM. Behavioural and EEG Indices of Conflict Monitoring.**

**Objective:** Conflict monitoring (CM) is a cognitive function that regulates competing potential responses for a given situation and the subsequent execution of the winning response. Studies using electroencephalography (EEG) have linked the N2 component to CM; however, there is no validated behavioural measure of CM. A few reports have related reaction time (RT) with N2, though this association has not been fully elucidated. We examined this link further by taking the RT difference between two tasks, a choice RT task (Stop Signal Task, SST) and a simple RT task (SRT), and comparing it with N2 magnitude. As response selection is the main difference between these two tasks, we reasoned that subtracting the RTs would better approximate CM after "parsing out" common cognitive processes. We hypothesized that the RT difference would provide a "purer" behavioural measure of CM and would correlate with the magnitude of N2.

**Participants and Methods:** EEG data from 64 channels were recorded from 25 healthy participants (mean age 32.8 [14.4]) during SST and SRT performance. Peak (250-350ms post-stimulus) and mean ( $\pm 24$ ms around peak) amplitudes of N2 were obtained at the Fz, FCz and Cz electrodes. Mean correct trial RT of the SST, as well as mean correct SST RT minus SRT RT were correlated with the N2 measures.

**Results:** SST RT correlated with mean N2 amplitude at Fz ( $r=-.41$ ,  $p<.05$ ). The RT difference measure had trending correlations with N2 means at Fz and Cz (both  $r=-.27$ ,  $p=.07$ ). Other correlations ranged between  $-0.07$  to  $-0.29$  (all  $p>.05$ ).

**Conclusions:** Mean N2 amplitudes at Fz correlated best with both SST and SST-SRT RT indices, indicating that longer conflict monitoring is associated with a larger N2. Thus, this performance index may be a viable behavioural measure of CM. Limitations include a small sample size and under-refined EEG artifact processing methods. Future studies can scrutinize this neural-behavioural association further.

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#### **M. EULER, M. HALVERSON, T.L. MCKINNEY, M. NIERMEYER & Y. SUCHY. Distinct Effects of Neural Activation and Consistency in Novelty Processing and Relations with IQ.**

**Objective:** Effective performance in novel situations is a hallmark of adaptive behavior, and shows promise as a marker of general cerebral integrity. EEG studies have shown how novelty impairs the strength

and consistency of some neural responses, and how resilience to those effects predicts higher cognitive functioning. Yet, the relations between those phenomena are not well understood. This study aimed to clarify how novelty impacts distinct neural response features and their relations with IQ.

**Participants and Methods:** Thirty-six healthy undergraduates completed assessments of intellectual ability as well as a complex motor sequencing task during EEG recording. Contextual familiarity was pseudo-randomly varied across four levels, while rare novel sequences ensured task vigilance. Mean event-related-potentials (ERPs) quantified neural activation at left and right parieto-occipital electrodes from 200-600 milliseconds post-stimulus. Mean inter-trial phase clustering (ITPC) quantified neural consistency at the same sensors and time range from 1-3.9 hertz. Repeated measures ANOVAs tested effects of hemisphere and familiarity on ERPs and ITPC.

**Results:** Preliminary analyses of pre-stimulus activity showed stronger preparatory activation in the left vs. right hemisphere ( $p = .008$ ), but no such effects for ITPC. Stimulus-evoked ERPs were larger following novel vs. familiar contexts across hemispheres ( $p = .003$ ) with no interaction, while ITPC increased from novel to familiar contexts in the right hemisphere only ( $p < .001$ ). Left but not right hemisphere ERPs strongly predicted IQ across conditions (all  $r_s = .53-.45$ , all  $p_s \leq .006$ ), whereas only familiar left ITPC predicted IQ ( $r = .34$ ,  $p = .04$ ).

**Conclusions:** The study findings suggest that novel contexts recruit more neural resources yet impede their efficient recruitment. Lateralized effects of novelty on right hemisphere ITPC, but left hemisphere preparatory activity and relations with IQ suggest that dissociable, lateralized mechanisms may underlie behavioral novelty effects.

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#### **S.L. HAUGER, C. SCHNAKERS, S. ANDERSSON, F. BECKER, T. MOBERGET, J. GIACINO, A. SCHANKE & M. LÖVSTAD. Counting Own Name -Clinical Robustness of Electrophysiology in Assessing Residual Cognition in Disorders of Consciousness.**

**Objective:** Event Related Potentials (ERPs) have shown promise in detecting residual cognitive capacity without behavioral requirements in patients with disorders of consciousness (DoC). Despite increased knowledge of brain function in DoC from functional imaging and electrophysiological methods, their diagnostic utility at an individual patient level remains to be established. This study investigated the robustness of two active ERP tasks with different cognitive load.

**Participants and Methods:** Twenty patients in a minimally conscious state (MCS; mean age = 40, 11 males, 13 traumatic brain injury, injury onset range= 3.6-117 months), either showing (9 MCS+) or lacking (11 MCS-) behavioral response to command, were compared to 20 healthy controls (mean age = 38, 10 males). Level of consciousness was established with the Coma Recovery Scale-Revised. The ERP-task included: (1) active listening to change in pitch to subject's own first name (SON) repeated 100 times (SOA: 2 sec) and (2) active counting of SON (SON: 50 times), randomly interspersed between an unfamiliar name (UN: 50 times), both contrasted to a passive condition. Data was collected using a 32 electrodes cap and a portable NuAmp EEG- amplifier, epoched from -200-1500 ms post stimulus-onset and analyzed with custom MATLAB scripts in EEGLAB.

**Results:** The control group showed significantly larger P300 amplitudes in the active counting of SON compared to listening to pitch. At an individual level, all but one of the controls displayed enhanced P300 in the counting task, while 9/20 patients (4 MCS+/5 MCS-) showed higher P3 amplitudes in the active counting condition.

**Conclusions:** Of the two ERP tasks, active counting of SON constitutes the most robust paradigm, and may reveal covert command following in some MCS- patients who lack behavioral responses. However, the task did not differentiate between the two MCS subgroups. Behavioral and electrophysiological methods should thus be used in combination.

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**S. HERRERA, P. BUTLER, J. GORDON & V. ZEMON. Analysis of Contrast Processing Deficits in Schizophrenia and Schizoaffective Disorder Using Electrophysiological and Psychophysical Measures.**

**Objective:** Individuals with schizophrenia show deficits in visual processing, particularly to low levels of contrast. Contrast gain refers to the rate of increase in response magnitude with increases in contrast, and gain control refers to response adaptation as contrast increases. These processes may be impaired in this disorder. The goal here was to explore these deficits using a novel visual evoked potential (VEP) paradigm and a psychophysical contrast sensitivity task.

**Participants and Methods:** 42 patients meeting DSM-IV criteria for schizophrenia or schizoaffective disorder and 59 healthy volunteers were tested. Steady-state VEPs (ssVEPs) were elicited using hexagonal arrays of dark dots (30' diameter, 15' interdot spacing) designed to match the mosaic of retinal cells, swept in contrast from 1-32%, modulated on-off at 10 Hz (targeting magnocellular-OFF cells). A nonlinear biophysical model was fitted to response functions to assess contrast gain and gain control. Participants performed a psychophysical task with horizontal gratings at spatial frequencies from 0.5-21 cycles/deg to obtain contrast sensitivity functions. Mixed ANOVAs evaluated between-group differences.

**Results:** ssVEPs (10 Hz frequency component) revealed reduced amplitudes, signal-to-noise ratios, and contrast gain in patients, but no between-group differences in contrast gain control. The psychophysical task revealed lower contrast sensitivities in patients across all spatial frequencies.

**Conclusions:** Patients demonstrate impairments in processing low contrast stimuli, particularly in contrast gain, as measured by the hexagonal-dot ssVEP paradigm and the psychophysical task. Basic visual functions are typically not evaluated in patients with schizophrenia and frequently go undetected. Further development of VEP techniques and characterization of deficits may inform effects of low-level visual processing deficits on higher-level perceptual deficits, as well as contribute to the development of biomarkers for schizophrenia.

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**P. MANGAL, J.A. LAFO, B.M. SCOTT, M.S. OKUN & D. BOWERS. Intentional Enhancement Of Electrocortical Responses To Emotional Pictures By Parkinson Patients: Relation To Executive Function.**

**Objective:** Previous research has reported that non-demented Parkinson's patients exhibit blunted physiologic reactivity to emotional stimuli as indexed by startle eyeblink and electrophysiologic response (late positive potential, LPP). This blunted reactivity has been associated with apathy and worsening disease severity. The aim of this study was to learn whether Parkinson's patients could increase their emotional reactivity, as measured by the LPP, using standard emotion regulation strategies. We hypothesized that intentional up-regulation of emotional reactivity by PD patients would be related to integrity of frontal-executive systems.

**Participants and Methods:** Participants included 20 PD and 14 age- and education-matched Controls. Event related potentials (LPP) were recorded while participants viewed standard sets of unpleasant and neutral pictures (IAPS) for 3 sec each. Each picture was preceded by a 3 sec cue to "look" at the subsequent picture or "increase" one's emotional reactivity to the picture. The PD and Control groups were not demented or depressed based on cognitive and mood screening.

**Results:** The LPP was extracted from 400 -700 ms post-picture over centroparietal sensors. Results of a repeated measures Group (PD, NC) X Cue (look, increase) ANOVA resulted in a significant task main effect,

indicating greater amplitude LPP during the "increase" than "look" cueing condition. No other significant effects were present. The LPP "increase" amplitude was predicted by Trails B Time and HVLTL-delayed recall in PD patients, and by scores on an anhedonia scale in Controls.

**Conclusions:** We found that PD patients could increase their electrocortical responses to pictures when cued, and this intentional enhancement was associated with scores on fronto-executive and memory tasks. For Controls, the ability to upregulate reactivity depended on levels of anhedonia, or loss of pleasure. Findings will be discussed in terms of treatment approaches for apathy in PD. Support provided by T32NS082168, 1R21NS079767-01, 5T32AG020499-12.

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**W.R. MOORE, K. KARAS, I. GORDON & M.A. GARCIA-BARRERA. Neurophysiological Marker of Attention Switching Advantages in Bilinguals: A Pilot Study.**

**Objective:** The ability to switch between languages is thought to enhance specific executive function (EF) mechanisms, resulting in a 'bilingual advantage.' However, evidence from the young adult literature on the bilingual advantage is mixed. This may be attributed to either the EF maturity peak in early adulthood, or to the fact that the current measurement methods (e.g., reaction time, accuracy) are not sensitive enough to pick up subtle differences between groups. We assessed a neurophysiological marker of attention switching (i.e., P300) to examine if early bilinguals demonstrate advantaged neural processing over both late bilinguals and monolinguals in a young adult population.

**Participants and Methods:** A subset of 30 undergraduates (Mage = 20.67, SD = 1.63, 73% women) from a larger ongoing study was selected for analysis. These participants completed a language history questionnaire and several tasks including a computerized switch task, which served to elicit the P300. The sample was separated into three groups: early bilinguals who learned two languages before age six (n=10); late bilinguals who learned a second language after age 12 (n=10); and monolinguals (n=10).

**Results:** Participants performed similarly on the matrices and letter fluency tasks. Measured at site CPz, a repeated measures ANOVA revealed a significant main effect of trial type (Switch vs. Preswitch),  $F(1, 27) = 9.16, p < 0.01$ , such that the peak P300 for switch trials were larger. An Trial X Group interaction approached significance,  $F(2, 27) = 2.41, p = 0.109$ .

**Conclusions:** Despite a small sample size, the pilot study is capturing differential processing during switch and nonswitch conditions. More interestingly, the current pilot study suggests trends towards differences between early bilinguals, late bilinguals, and monolinguals. These trends in attention switching differences in bilinguals will be further elucidated with ongoing data collection and shed light on the elusive nature of EF advantages in bilingual young adults.

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**V. NUNEZ, W.R. MOORE, T. GRAETZ & M.A. GARCIA-BARRERA. A Neurophysiological Marker of Inhibition in Bilinguals: A Pilot Study.**

**Objective:** Executive functions (EFs) such as inhibiting, switching and updating working memory have become relevant targets for the bilingual advantage. In particular, inhibitory control (IC) is necessary to suppress the nontarget language during language production. Findings from studies that compare the EFs of bilingual and monolingual young adults have been inconclusive. Using ERPs, we focused on IC using a traditional go/no-go paradigm to elicit the N2, serving to determine whether a subtle bilingual advantage exists in young adults.

**Participants and Methods:** A subsample of 30 undergraduate students (Mage = 20.23; 67% female) was selected from a larger ongoing study of EF and bilingualism. There were groups: Early bilinguals, who learned a

second language before the age of six ( $n=10$ ), late bilinguals who learned a second language after the age of 12 ( $n=10$ ), and monolinguals ( $n=10$ ). Participants completed a few questionnaires and several tasks, including a modified Progressive Raven's Matrices task, a verbal fluency task, and a computerized go/no-go task. Percentage of correct no-go trials and peak N2 amplitudes were measured.

**Results:** Control and behavioural measures showed no significant differences between groups, suggesting similar nonverbal intelligence, verbal fluency, inhibition accuracy. A repeated measures ANOVA revealed a trend towards larger N2 peaks on no-go trials than go trials ( $p = 0.066$ ). Peak N2 results showed no significant difference between groups ( $p=0.680$ ).

**Conclusions:** Although mean peak N2 amplitudes for early bilinguals were largest, there may not have been enough statistical power to reveal such differences; on-going data collection will shed light on this. These results could also be related to using an N2 peak amplitude measure. As such, other ways of measuring IC, such as base-to-peak N2 and the N2/P3 complex, may be more sensitive measures of IC and will be investigated in future evaluations. Alternatively, these preliminary results may suggest evidence against the bilingual advantage for IC.

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**V. OSWALD, Y. ZEROUALI, S. LIPPÉ, A. BOULET-CRAIG, M. KRAJNOVIC, D. SINNETT, P. JOLICOEUR, C. LAVERDIERE, K. JERBI & P. ROBAEY. Fronto-Parietal and slow oscillations correlate with working memory performance: resting state MEG study.**

**Objective:** Working memory (WM) is the ability to manipulate information on items kept in short-term memory. In this study, we used resting state magnetoencephalography (MEG) oscillations to predict the performance in verbal (VWM) and visuospatial (SWM) working memory tasks.

**Participants and Methods:** We recorded resting state MEG and administered the WM Index from the Wechsler Adult Intelligence Scale – 4th edition (WAIS-IV) and the Spatial Addition subtest from the Wechsler Memory Scale – 4th edition (SA/WMS-IV) to assess WM performance in 18 participants (6 males and 12 females; mean = 26.5 years, SD = 3.98 years). We calculated means of Power Spectrum Density for different frequency bands (delta, 1-4Hz; theta, 4-8Hz; alpha, 8-13Hz; beta, 13-30-Hz; gamma1, 30-59Hz; gamma2, 61-90Hz; gamma3, 90-120Hz) and correlated MEG power normalized for the maximum in each frequency band at the sensor level with WM performance. The other WAIS-IV indexes were used to assess the specificity of the correlations. The sensors showing a significant correlation were grouped by using a cluster algorithm and corrected for multiple comparisons.

**Results:** We found positive correlations between both types of WM performance and clusters in the bilateral posterior and right fronto-temporal regions for the delta band ( $r2=0.73$ ), in the fronto-middle line and right temporal regions for the theta band ( $r2=0.63$ ) as well as in the parietal regions for the alpha band ( $r2=0.78$ ). VWM and SWM shared a common fronto-parietal cluster of sensors but also showed clusters specific to each modality. We also demonstrated that the right parietal posterior clusters for slow oscillations (delta to beta band) were specific to WM, as compared to those obtained for the other WAIS-IV indexes.

**Conclusions:** Slow frequencies (1-13Hz) especially in the delta and theta bands (1-8Hz) recorded at rest with MEG predicted WM performance. Cluster topography was consistent with the implication of a fronto-parietal network in WM.

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**G. STEFANATOS, H. ZOBEL, R. TAORMINA, B. EID & B. SARGENT. Electrophysiological Signature of Selective Auditory Attention.**

**Objective:** Many studies of auditory selective attention have demonstrated enhancement of traditional evoked responses to rare target stimulus events (oddballs) embedded in a slow-paced stream of frequent stimulus events. Few studies have examined the effects of selective attention in modulating neural responses to a continuous dynamically-changing auditory stream. We therefore used a novel steady-state auditory response (SSAR) variant of the traditional “oddball” paradigm to examine attentional modulations of neural responses to an on-going, rapidly-varying acoustic stream.

**Participants and Methods:** Responses were recorded to rapid (50 ms) pulsed frequency modulations (PFMs) of a continuous tone in 56 normal hearing adults. In an “auditory attend” condition, listeners attended to and counted the occurrence of brief intermittent epochs (oddball events) where the PFMs changed direction. In the “visual attend” condition, listeners heard the same auditory signal but were instructed to attend to targets in a concurrent visual continuous performance task.

**Results:** Multicomponent transient evoked-responses (MTER's) evident following onset of oddball events were substantially larger in the auditory compared to the visual attend condition. SSARs to PFMs and MTERs following offset of oddball events showed no condition differences.

**Conclusions:** SSARs to PFMs were not influenced by attention, suggesting they were pre-attentive in nature. By contrast, the onset MTER was highly influenced by attention. The pattern of dissociation of attentional effects on SSARs and MTERs suggests that the onset MTER is not simply attributable to the frequency deviations but is a neural marker reflecting overt target recognition. The latency, duration and scalp distribution of this response did not correspond to known traditional transient responses. Its attributes and some preliminary findings suggest it could be a clinically useful index of auditory attentional processing.

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**F. STEFFEN-ALLEN, R.P. SO & C.A. CHEN. Modulation of Neural Oscillation as a Function of Time During Successful Working Memory Performance In Schizophrenia.**

**Objective:** Working memory (WM) impairment is a core cognitive deficit in schizophrenia and has been linked to dysfunction in the gamma, alpha, and theta bands. However, successful WM performance in patients is less well characterized. This study aims to investigate modulation of the EEG signal during successful WM performance in schizophrenia and to examine how that modulation differs from controls.

**Participants and Methods:** Patients with schizophrenia ( $n=7$ ) and controls ( $n=9$ ) had scalp EEG recorded during a modified Sternberg WM task with two difficulty levels. The task was subdivided into four stages (pre-trial baseline, encoding, retention, and probe). Task-induced amplitudes were computed for the gamma, beta, alpha, theta, and delta frequency bands for three midline electrodes (Fz, Cz, and Oz). Averaged amplitudes were then computed in 14, one-second steps across the task for each participant. Repeated measures ANOVAs were conducted for each frequency band.

**Results:** Diagnosis did not predict WM performance. Additionally, patients and controls showed similar patterns of modulation in all frequency bands except delta. In delta, patients showed greater modulation in the delta band than controls, with increasing modulation when moving back across the midline axis ( $F(2.34, 32.78) = 3.26, p = .004$ ). In the beta and gamma bands, task difficulty was found to be an important factor in modulation patterns, such that greater power was associated with increased difficulty in gamma ( $F(2.51, 35.15) = 3.26, p = .040$ ) but with decreased difficulty in beta ( $F(3.51, 49.08) = 3.50, p = .017$ ).

**Conclusions:** While recent studies have suggested the importance of compensatory mechanisms to enable successful WM performance in schizophrenia, this study indicates that such strategies may not always be necessary for successful performance. Additionally, modulation of

the neural signal over time may be affected by the difficulty of the task involved, indicating the need to consider difficulty when studying WM performance in schizophrenia.

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**E. STOLZ, L.S. KEGELES, J.J. CHROBAK & C.A. CHEN. Ketamine Induced Neurophysiological and Neurochemical Changes in Healthy Controls: A Translational Model Using Simultaneous Imaging Modalities.**

**Objective:** Evidence from animal models supports the role of GABA and glutamate/glutamine (Glx) in coordinating neural oscillations, both of which are disrupted in schizophrenia and are thought to underlie higher order cognitive functions. The present study used magnetic resonance spectroscopy (MRS) and EEG modalities simultaneously during acute ketamine, an NMDAR antagonist, injection in healthy participants to analyze the temporal relationship between neurochemical pathways (GABA and Glx measures via MRS) and neural oscillations (power measures via EEG).

**Participants and Methods:** MRS measurements and MR-compatible EEG recordings were collected simultaneously before, during, and following the ketamine (0.5 mg/kg) intravenous infusion (i.e., six 15-minute blocks). GABA and Glx levels of the medial prefrontal cortex and neural oscillatory powers of different frequency bands (i.e., delta: 0.5-4 Hz, theta: 4-8 Hz, alpha: 8-12 Hz, beta: 14-28 Hz, and gamma: 30-58 Hz) were obtained at rest in healthy participants (N = 11, aged 18-55).

**Results:** GABA and Glx increased to a maximum from baseline 15-30 minutes following ketamine infusion. This increase was significant for GABA (paired-samples t-test,  $p = 0.039$ ). As hypothesized, average gamma power significantly increased following ketamine injection, peaking within 15 minutes (repeated-measures ANOVAs,  $p$  values < 0.05 for both left and right frontal electrodes, F3 and F4). Additionally, average delta power of left frontal electrode decreased in a linear fashion following infusion (repeated-measures ANOVA,  $p = 0.011$ ; polynomial of degree 1,  $p = 0.003$ ).

**Conclusions:** In the absence of a cognitive task, elevations in gamma power might represent the physiological correlate of the symptoms of schizophrenia. Increases in gamma power preceded increases in GABA and Glx, which provides preliminary support for a feedback mechanism. Our results are consistent with animal studies, supporting the translation of animal findings to humans.

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## Epilepsy/Seizures

**L.E. BARRETT, A. VEENSTRA, A. ALPERN, G. MUCCI, J. ROMAIN, M. ZUPANC & J. LIN. Age of Diagnosis Impacts Lateralization Profile in Pediatric Focal Epilepsy.**

**Objective:** Epilepsy surgery has significantly increased in recent years. More research is needed to investigate neuropsychological implications for surgery. Pediatric patients demonstrate a more generalized pattern of impairments, instead of hemisphere-specific deficits found more commonly among adults. Additional research is needed to determine the age-related factors that impact lateralization, which will assist with interpretation of neuropsychological profiles for surgery.

**Participants and Methods:** Participants between the ages of 4-20 years-old ( $m=12.19$ ,  $SD=4$ , 42.9% male) with a diagnosis of focal epilepsy completed a neuropsychological evaluation for clinical care. Participants had temporal (N=34) or frontal lobe (N=32) epilepsy or lateralization in the left (N=45) or right (N=33) hemisphere. Stepwise regression was conducted to examine the following outcomes: motor and language dominance. Z transformations of difference scores were calculated. Predictors were age at diagnosis and evaluation. Separate

regression analyses were run based on localization of seizure focus and lateralization of hemisphere.

**Results:** Left motor dominance in frontal lobe epilepsy was predicted by age of diagnosis ( $B=.19$ ,  $p<.05$ ), but not age at evaluation ( $B=.02$ , ns). For those with left hemisphere epilepsy, age of diagnosis was a significant predictor of stronger nonverbal IQ lateralization ( $B=-.07$ ,  $p<.05$ ), accounting for approximately 11% of the variance. Stronger lateralization was evident as age of diagnosis increased. For temporal and right hemisphere epilepsy, however, predictors were nonsignificant. **Conclusions:** Results indicate that focal findings on neuropsychological testing may be best predicted by age of diagnosis rather than age at evaluation. Older age at diagnosis predicts stronger lateralization findings, an important factor for presurgical evaluations. Further evidence is provided for sensitive periods of development, particularly for motor and language skills, and the impact of specific types of epilepsy on such development.

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**R.C. BREWSTER, T.Z. KING, K. HORTMAN & D.L. DRANE. White Matter Correlates of Verbal Memory Explored with DTI in Temporal Lobe Epilepsy.**

**Objective:** The structure-function relationships between memory processing and underlying white matter circuitry remain unclear. We used a presumed measure of white matter integrity, fractional anisotropy (FA), to explore verbal memory correlates in participants with left temporal lobe epilepsy (LTLE), right TLE (RTLE), and controls. We hypothesized that the LTLE group would have the lowest FA of the three groups in the left TL along the fornix (FX), uncinate fasciculus (UF), and parahippocampal cingulum (PHC), and predicted relationships between these diffusion measures and memory performance.

**Participants and Methods:** Probabilistic tractography was applied to diffusion-weighted images of 29 participants with LTLE (mean age=37.82,  $SD=13.26$ ; 65% female), 24 with RTLE (mean age=40.53,  $SD=11.44$ ; 60% female) and 20 controls (mean age=37.82,  $SD=13.26$ ; 65% female) along the FX, UF, PHC, and corticospinal tract (CST; control tract). RAVLT (word list/episodic recall), Boston Naming (confrontation naming/semantic recall), and Grooved Pegboard (control task) were obtained from the TLE groups. Bivariate correlations examined the relationships between measures.

**Results:** Tractography defined tracts for all participants. PHC FA in the LTLE group ( $M=0.34$ ,  $SD=0.10$ ) did not differ significantly from the RTLE group ( $M=0.32$ ,  $SD=0.09$ ), but was lower compared to controls ( $M=0.38$ ,  $SD=0.04$ ),  $t(40) = 4.75$ ,  $p=.035$ . The RTLE group also had lower PHC FA than controls,  $t(36) = 9.12$ ,  $p=.005$ . There was a positive correlation between PHC FA and episodic recall in the LTLE group,  $r(21)=.44$ ,  $p=.047$ . There was no relationship between PHC FA and the control task.

**Conclusions:** Consistent with literature suggesting white matter differences in TLE, both TLE groups demonstrated lower FA in a major left temporal tract (PHC) compared to controls. Unexpectedly, the LTLE group did not demonstrate lower FA than the RTLE group. PHC FA was related to episodic memory performance in LTLE groups.

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**M. DEKHTYAR, A.K. MORGAN, K. MCLAUGHLIN & E. THIELE. Aicardi Syndrome: A Case Report of a Well Developing 15 Year Old.**

**Objective:** Aicardi Syndrome is a rare neurologic disorder characterized by infantile spasms, complete or partial agenesis of the corpus callosum, and chorioretinal lacunae. The syndrome occurs almost exclusively in females and manifests with profound developmental delays in cognitive and motor skills. The objective is to share clinical data of Aicardi Syndrome collected over 14 years at Massachusetts General Hospital.

**Participants and Methods:** This is a 15-year old girl with Aicardi Syndrome who initially presented with infantile spasms at 3 months and treated with Vigabatrin since that time. She has agenesis of the corpus callosum with a small area of the genu intact, and small, scattered chorioretinal lacunae in the peripapillary area. She has been followed clinically for 14 years with neurological and neuropsychological exams and received intensive applied behavior analysis (ABA) since she was 4 years old.

**Results:** Up to age 3, the patient presented as social, interacting with others, smiling and engaged. By age 4, she developed self-injurious behaviors, became perseverative and received a diagnosis of Autism. Periodic neuropsychological exams revealed consistent developmental delays. At her most recent evaluation (age 15) she had vocabulary skills of an 8-year old and fluid reasoning of a 5-year old. Her adaptive self-care skills were equivalent to an 8 year old. Her motor skills were equivalent to a 7-year-old level

**Conclusions:** While our patient continues to have partial complex seizures, developmental delays with autism and behavioral difficulties, her skill level reflects unusually good development in contrast to others with Aicardi Syndrome. This may be due to one or more factors including her early and intensive ABA treatment, early intervention with Vigabatrin, or small chorioretinal lacunae not often seen in Aicardi Syndrome. Exploring these factors may improve our understanding of behavioral outcomes in Aicardi Syndrome.

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**J. FACELLA-ERVOLINI, L. SEPETA, A. MARTIN, S. STEWART, W. GAILLARD & M. BERL. Functional Significance of Hippocampal Abnormalities in Pediatric Focal Epilepsy.**

**Objective:** Hippocampal pathology occurs in children with epilepsy, including mesial temporal sclerosis (MTS) and hippocampal shape/position abnormalities. To our knowledge, the functional significance of various hippocampal abnormalities (HA) has not been studied in pediatric focal epilepsy. We examined memory functioning in children with focal epilepsy with and without HA, as well as typically developing controls.

**Participants and Methods:** Forty children with focal epilepsy and 20 controls (Age=11.5±3.8) underwent neuropsychological testing. Twenty children with focal epilepsy had HA (10 L, 9 R, 1 B; Age=11.6±4.3); 20 had normal hippocampi (10 L, 9 R, 1 B; Age=11.5±4.0). Twelve children with HA had MTS; eight had abnormalities such as globular or malrotated hippocampi. Measures included Children's Memory Scale Dot Location (CMS-DL) and California Verbal Learning Test (CVLT-C). Measures were transformed to normative z-scores. Group differences were examined with two multivariate analyses of covariance (MANCOVA) models with 1) overall memory score (CVLT-C List A Total Trials, CMS-DL Total) or 2) long delay free recall score (CVLT-C Long Delay Free Recall (LDFR), CMS-DL Long Delay) as between-group factors. IQ was used as a covariate due to group differences ( $p=0.001$ ).

**Results:** No main effect of group across memory measures for overall memory scores was found. However, for long delay free recall, we found a main effect of group across memory measures ( $p<0.05$ ). Posthoc analyses revealed group differences for CMS-DL long delay ( $p<0.05$ ) and a trend on CVLT-C LDFR ( $p=0.06$ ). Specifically, for CMS-DL long delay, patients with HA performed lower than patients without ( $p<0.05$ ); there was a trend on CVLT-C LDFR for patients with HA to perform lower than controls ( $p=0.06$ ).

**Conclusions:** Our results suggest that HA in pediatric focal epilepsy affects memory performance, particularly long delay free recall. These results demonstrate the functional significance of HA, which is particularly important in presurgical epilepsy evaluation.

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**H. FERNANDO & M.J. HAMBERGER. Medication and Executive Function in Temporal Lobe Epilepsy.**

**Objective:** Temporal lobe epilepsy (TLE) is often associated with impairment in functions mediated by extratemporal brain regions, presumably, due to remote effects of temporal lobe abnormalities. Antiepileptic drugs (AEDs) have also been shown to reduce cognitive functioning, with polytherapy associated with greater dysfunction, particularly in executive functioning. However, this work has failed to consistently control for other potential contributors such as disease severity and level of intelligence. We aimed to examine the effect of both of these factors on a broad range of executive functions.

**Participants and Methods:** Participants were 78 adults with TLE, (mean age=41.6, SD=14.0). 61 patients were on monotherapy (78.2%) while 17 patients took  $\geq 3$  AEDs (21.8%). Tests included Wisconsin Card Sorting Test (WCST), Trail Making (TMT), Digits Forward (DSF) & Backward (DSB), Boston Naming Test (BNT), Controlled Oral Word Association Test (COWAT), DKEFS Color-Word Interference and Wechsler scale IQ. Seizure frequency served as a marker of disease severity. T tests, Pearson correlations and regression analyses assessed the relation between AEDs and cognitive performance.

**Results:** Seizure frequency was unrelated to test performance. The polytherapy group performed significantly lower than monotherapy patients on DSF [ $t(76)=-4.29$ ,  $p<0.01$ ], DSB [ $t(76)=-3.81$ ,  $p<0.01$ ], COWAT [ $t(74)=-2.33$ ,  $p<0.05$ ], Trails B [ $t(76)=-2.62$ ,  $p<0.05$ ], DKEFS color naming [ $t(53)=-2.59$ ,  $p<0.01$ ], word naming [ $t(53)=-3.55$ ,  $p<0.01$ ], inhibition [ $t(53)=-2.02$ ,  $p<0.05$ ], and switching [ $t(53)=-2.02$ ,  $p<0.05$ ]. However, when controlling for IQ, number of AEDS predicted only lower DSF [ $F(1, 72) = 6.63$ ,  $p<0.05$ ], DSB [ $F(1, 72) = 5.56$ ,  $p<0.05$ ], and DKEFS word naming [ $F(1, 51) = 5.15$ ,  $p<0.05$ ].

**Conclusions:** When controlling for IQ, the effect of AEDs was limited to select measures of attention and working memory. Results suggest some increased risk for cognitive dysfunction with AED polytherapy, yet emphasize the importance of controlling for relevant variables.

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**M. FISCHER, S. JACOB, M.M. FIUMEDORA, C. BIGRAS & P. SHEAR. Everyday Working Memory Function in Temporal Lobe Epilepsy.**

**Objective:** Memory deficits are the most common subjective complaint in patients with temporal lobe epilepsy (TLE). In addition to their memory dysfunction, these patients are often found to exhibit executive functioning (EF) deficits. To date, EF studies have focused on laboratory measures of working memory (WM) and have rarely included self-report measures of EF in everyday functioning. This study was designed to address the degree to which adults with TLE endorse WM deficits and how this self-report corresponds to laboratory measures of WM and declarative memory.

**Participants and Methods:** Participants were 25 unilateral (19 left TLE; 6 right TLE) patients with refractory epilepsy seen for presurgical evaluations. They had a mean age of 34.8 (SD = 12.4) and had completed a mean of 13.8 years of education (SD = 2.2). All participants completed a self-report measure of EF (BRIEF-A) and laboratory measures of verbal and nonverbal learning and memory (CVLT-II, BVMT-R) and working memory (WAIS-IV WMI subtests).

**Results:** The patients on average endorsed WM deficits that were significantly more severe than any other aspect of EF measured by the BRIEF-A ( $p<0.05$  for all comparisons); 60% of patients had clinically elevated WM scores. Poorer BRIEF-A WM was significantly associated with greater deficits in verbal (but not nonverbal) immediate and delayed recall ( $p<0.05$ ). BRIEF-A WM reductions were associated with performance decrements on the WAIS-IV Digit Span but not other WMI subtests. Multiple regression showed that Digit Span and CVLT total learning made significant ( $p<0.05$ ) and near-significant ( $p<0.06$ ) independent contributions to the prediction of BRIEF-A WM.



**Conclusions:** Patients with TLE reported clinically significant and disproportionately severe WM deficits relative to other aspects of EF, a pattern consistent with data in the BRIEF-A manual from a small heterogeneous sample of epilepsy patients. The data also suggest that verbal list learning predicts aspects of BRIEF-A WM that are independent of attention and concentration.

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**Y. GRANADER, A. RATTO, L. SEPETA, J. FACELLA-ERVOLINI, M. BERL & L. KENWORTHY. Parent-Reported Comorbidities in Youth with ASD and Epilepsy without Intellectual Disability.**

**Objective:** Individuals with autism spectrum disorders (ASD) have higher rates of epilepsy than the general population. Some studies report that seizures in youth with ASD are related to intellectual disability (ID) rather than ASD. There is no previous research studying youth with ASD and epilepsy without ID. The purpose of this study was to assess comorbidities of youth with ASD and epilepsy without ID (group AE) and compare them to: youth with epilepsy (group E) and youth with ASD (group A).

**Participants and Methods:** Variables were compared across groups using chi-square analyses for categorical variables and one-way Analysis of Variance (ANOVA) for continuous variables. Participants received a measure of overall cognitive functioning. Parents completed the Child Behavior Checklist (CBCL) and Attention Deficit Hyperactivity Disorder (ADHD) Rating Scale-IV.

**Results:** 42 parents completed questionnaires and there were 14 participants in each group who were matched for age ( $M=11.4$ ,  $SD=3.5$  in AE group), sex (11 males, 3 females), and IQ ( $M=89.1$ ,  $SD=19.8$  in AE group). ANOVA results found significant findings for the CBCL ADH and Oppositional Defiant (OD) Problems. Post-hoc tests revealed that group A had greater ADH and OD Problems than group E. In addition, group AE had greater OD Problems than group E. There was also a significant finding on the ADHD Rating Scale-IV Hyperactivity Score. Post-hoc tests revealed that group AE had greater hyperactivity than group E. Comparison of the percentages from each group with elevated scores on measures found significant differences on the CBCL ADH and OD Problems.

**Conclusions:** Although we thought the burden of ASD and epilepsy would yield greater comorbidities, group A had the highest scores and was not different from group AE, but both had more hyperactivity and oppositional behavior than group E. One possibility for this finding is the behavioral regulatory effects of some antiepileptic medications. Further exploration of comorbidities is warranted to better understand this population.

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**J.P. HARP & A.J. ANDERSON. Neuropsychological Differential Diagnosis of Posterior Periventricular Nodular Heterotopia: A Case Study.**

**Objective:** Periventricular nodular heterotopia (PNH) is a neurodevelopmental disorder often related to Filamin A gene mutation (FLNA). This results in poor neural migration, manifesting in epilepsy with mild cognitive impairment in females and spontaneous abortion or early death in males. Recent research identified some PNH patients without FLNA mutation, dubbed posterior PNH. Typical presentation includes asymmetric ventricular nodules and cerebellar, hippocampal, and colpocephalic malformations (Mandelstam et al., 2013). Unlike PNH-FLNA, posterior PNH exhibits no sex-based differences, but is often accompanied by cognitive impairment and epilepsy. This presentation discusses the pathophysiology of PNH and illustrates a typical case of posterior PNH condition seen in clinic.

**Participants and Methods:** A 22-year-old, left-handed, Ukrainian-American male university student presented with refractory epilepsy and practical cognitive difficulties. Seizures appeared with fever at age 9 and persisted, usually absence with occasional falls. Imaging revealed bilateral PNH, cerebellar dysgenesis, reduced cortical volume, and possible mesial temporal sclerosis.

**Results:** Examination revealed forward-tilting posture; tremulous upper face; vague, slowed speech; and spatial disorientation. Data revealed borderline impaired IQ and deficits often observed with periventricular lesions, such as generalized slowing and significantly weaker visuospatial than verbal performances. Additional impairments included encoding and retrieval, naming, verbal fluency, mental flexibility, and construction. Close examination of imaging revealed primarily posterior, asymmetric nodules accompanied by multiple pathognomonic abnormalities.

**Conclusions:** Imaging and neuropsychological testing led to diagnosis of posterior PNH. Patient was deemed a poor surgical candidate due to non-localized seizure focus. This rather typical presentation of an unusual disorder provides differential diagnostic value with implications for treatment planning in posterior PNH.

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**E. HERMANS, M. HENDRIKS, P. OSSENBLOK, S. DASELAAR, P. HOFMAN, A. COLON & N. FRANKENMOLEN. Memory and fMRI Activation in Temporal Lobe Epilepsy: Towards Predicting Surgery Outcome.**

**Objective:** Surgical treatment in patients with temporal lobe epilepsy (TLE) involves the risk of post-surgical memory decline. Lateralization or even localization of memory networks preoperatively, may minimize postoperative risk. We developed a fMRI face-name memory task and performed a feasibility study. We investigated three aims. First, the task should provoke hippocampal activation. Second, this hippocampal activation should demonstrate memory reallocation in TLE patients. Third, this hippocampal activation should associate with performance on standard pre-surgical memory tests.

**Participants and Methods:** 31 Epilepsy surgery candidates with TLE and 10 control subjects performed the task. They were instructed to memorize combinations of faces and names during MRI scanning. Individual Lateralization Indices (LI), defined as the relative difference in the number of activated voxels in the left and right hippocampus, were calculated. These results were correlated with patients' performances on classical neuropsychological memory tests as part of their pre-surgical evaluation.

**Results:** The fMRI face-name task provoked hippocampal activation in both epilepsy patients and control subjects. Left TLE patients with hippocampal sclerosis (LI:  $M=-0.19$ ,  $SD=0.28$ ) showed more right over left hippocampal activation and right TLE patients with hippocampal sclerosis (LI:  $M=0.14$ ,  $SD=0.26$ ) showed more left over right hippocampal activation ( $t(7)=1.91$ ,  $p<.05$ , 1-tailed). There were strong and significant associations between the LI and non-verbal memory performance ( $r=.89$ ,  $p<.01$ ) in right TLE patients. More right over left hippocampal activation in right TLE patients corresponds to better non-verbal memory.

**Conclusions:** There are multiple indications that the fMRI face-name task we used may be a valuable tool in the pre-surgical evaluation of epilepsy patients. A final evaluation and validation should include more patients and data on actual post-surgical memory outcome.

**A. HINNEBUSCH, L.L. JORDAN, V. RAMOS & C.F. SALORIO. Symptoms of Inattention and Hyperactivity/Impulsivity in Pediatric Epilepsy.**

**Objective:** Previous research demonstrates that approximately 30% of children with epilepsy meet criteria for Attention-Deficit Hyperactivity Disorder (ADHD), most commonly the inattentive subtype. The specific

manifestations of ADHD symptomatology and their etiology in pediatric epilepsy are not well delineated. The current study examined ratings of inattention and hyperactivity for children with epilepsy.

**Participants and Methods:** Neuropsychological and demographic data for 131 children with epilepsy (mean age: 10.1 years; 57% male) were extracted from a large clinical database. For comparison, data were also extracted for 131 age/gender matched children with ADHD. Overall parent ratings and specific item endorsements on the ADHD Rating Scale-IV were analyzed within and between groups.

**Results:** Parents of the Epilepsy group (EPI) endorsed more items on the inattention (IA) than the hyperactivity/impulsivity (HI) subscale. Overall, the EPI group was rated at the 70th percentile on the HI and the 84th on the IA subscales. The most frequently endorsed IA items were attention to detail (62%), easily distracted (60%), and difficulty organizing (58%).

In comparison, children in the ADHD group were rated at the 83rd percentile on the HI and the 90th on the IA subscales, which was significantly higher than the EPI group on both subscales ( $p < .05$ ). More specifically, the mean ratings for the ADHD group were significantly higher across all 9 HI and 4 of 9 IA items ( $p < .05$ ). There were 5 specific HI and 3 IA items that were statistically more likely to be elevated in the ADHD group ( $p < .05$ ).

**Conclusions:** Consistent with prior research, children with epilepsy were more likely to demonstrate symptoms of inattention than hyperactivity/impulsivity. While children with ADHD had higher symptom ratings on both inattention and hyperactivity/impulsivity, specific items were differentially endorsed across groups. The ADHD Rating Scale-IV may help characterize specific symptoms of inattention and inform treatment planning in children with epilepsy.

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**S.N. JACOB, A. REEDY, S. HASLON, Q. MANO, D.M. FICKER & P. SHEAR. Memory and Coping in Patients with Epilepsy.**

**Objective:** The goal of this study was to investigate the relationship between cognitive functioning and the strategies that individuals with epilepsy use to cope with stress. We hypothesized that the memory dysfunction many of these patients experience would predict decreased use of problem focused engagement and increased use of disengagement coping approaches.

**Participants and Methods:** Participants were 37 individuals (mean age = 39.95) who had EEG-confirmed diagnosis of epilepsy. Exclusionary criteria included history of a current and progressive neurologic disorder other than epilepsy; bipolar or psychotic disorder; current substance use disorder; serious developmental disability; or verified non-epileptic seizures. Participants completed neuropsychological measures of verbal (CVLT-2) and visual (BVRT-R) memory, as well as a self-report measure of coping strategies in response to life stressors (Coping Strategies Inventory – Short Form).

**Results:** Multiple regression analyses revealed that poorer visual and verbal learning and memory each predicted significantly increased use of emotion focused engagement (EFE) and problem focused disengagement (PFD) coping ( $p < .05$ ), even after controlling for common demographic predictors of coping (age and gender), as well as disease duration. Memory did not predict problem focused engagement or emotion focused disengagement coping.

**Conclusions:** The present study demonstrates that those with poorer verbal and visual memory functioning are significantly more likely to cope with life stressors by employing EFE coping strategies, such as relying on social support and expressing their feelings, and PFD strategies, such as avoiding thinking about the stressful situation or using wishful thinking. The findings are consistent with a small literature demonstrating that cognitive ability is related to coping across multiple clinical populations and have implications for treatment interventions that aim to help patients employ effective coping strategies.

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**B.C. KAVANAUGH, B.A. JERSKEY, A. GERBER & .. RI-CART. Distinct Patterns of Younger versus Older Seizure Onset in Individuals with Autism Spectrum Disorders.**

**Objective:** Seizures frequently occur within a bimodal distribution in autism spectrum disorders (ASDs), yet limited information is available regarding the clinical profile of older versus younger onset and the association of seizure-related variables to adaptive functioning.

**Participants and Methods:** 30 children, adolescents, and adults with an ASD and a history of seizures were recruited through a large statewide ASD research registry. Participants had a community diagnosis of ASD or meet criteria for autism on the Autism Diagnostic Observation Schedule – 2nd edition (ADOS-2). Seizure-related variables were obtained from a parent-report epilepsy questionnaire. Adaptive functioning was assessed with the Vineland Adaptive Behavior Scales-2nd Edition Survey (VABS-II).

**Results:** A series of multiple regression analyses examined the influence of epilepsy-related variables on adaptive functioning. Older age of onset and greater amount of anti-epileptic drugs (AEDs) were associated with poorer adaptive functioning. A greater amount of failed AED's was associated with poorer adaptive functioning in a younger seizure onset group (< 8 years), yet a more severe lifetime seizure status and older age at onset were associated with poorer adaptive functioning in an older seizure onset group. The older seizure onset group showed significantly poorer social skills and a higher rate of generalized tonic-clonic seizures, while the younger group showed a higher rate of other generalized seizures and lifetime daily seizures.

**Conclusions:** Later age at seizure onset and amount of failed AEDs were strong predictors of adaptive functioning. Seizure onset is known to have a bimodal distribution in ASD and current findings identified distinct clinical patterns in early versus later onset seizures. Younger onset was characterized by more frequent and atypical seizures, while older onset was characterized by poorer social skills and greater prevalence of generalized tonic-clonic seizures.

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**B.C. KAVANAUGH, J. JONES, S. CORREIA, A. BLUM, W. LAFRANCE & J. DAVIS. Differential Relationship between Depression and White Matter Integrity in Adult versus Child Onset Temporal Lobe Epilepsy.**

**Objective:** White matter abnormalities occur in both temporal lobe epilepsy (TLE) and depression, but there is limited research examining the depression-white matter association in TLE. This study examined the relationship between white matter integrity (WMI) and depression and epilepsy-related variables in childhood vs. adult seizure onset.

**Participants and Methods:** Adults (N=20) with non-lesional TLE with and without depression (TLE+D; n=11; TLE-D, n=9) underwent diffusion tensor imaging (DTI). The sample was subdivided into childhood-onset seizures (COS; < 13 years; 4/11 with TLE+D) and adolescent/adult-onset seizures (AOS; 5/9 with TLE+D). Depression severity was assessed with the Hamilton Rating Scale for Depression. WMI was estimated based on fractional anisotropy (FA) and mean diffusivity (MD) calculated in frontal-temporo-limbic (FTL) regions in the JHU DTI atlas.

**Results:** Compared to COS, AOS showed lower FA in right uncinate fasciculus and higher MD in left hippocampus. There were no significant group differences in seizure-related variables. Within COS, WMI correlated significantly with depression severity (i.e., negatively with FA; positively with MD) in the corpus callosum, fornix, right cingulum, and bilateral superior longitudinal fasciculus. No significant WMI-depression correlations were found in FTL regions in AOS. COS had no

associations between WMI and seizure-related variables. In the AOS group, the presence of seizures in past month was associated with lower FA in the fornix.

**Conclusions:** WMI in FTL regions are similar in COS and AOS, but are associated with depression in the COS group only. In the AOS group, WMI is associated with the presence of seizures in the past month. The results raise the possibility that COS impacts white matter development thereby increasing vulnerability to depression; whereas AOS WMI is alternatively more susceptible to current seizure severity. Epilepsy duration may also contribute to depression-WMI associations.

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**S. KIERSTEAD, W.S. MACALLISTER, M. VASSERMAN, O. DEVINSKY & K. BLACKMON. Female Protective Effects for Social Impairment in Autism and Epilepsy.**

**Objective:** This research aims to test whether females with autism spectrum disorders (ASD) and epilepsy are protected against social impairment, relative to males. The female protective factor model of ASD suggests that females require greater genetic mutational burden than males to express the ASD phenotype. However, it remains unclear whether female protective factors extend to all core symptoms of ASD. We propose that females with ASD and epilepsy will show lower social impairment, but not stereotyped behaviors, relative to males, supporting a specific female protective effect against social impairment.

**Participants and Methods:** The sample included 89 participants, 69 males (age range = 4-33; mean=16.6, SD=6.4) and 20 females (age range=3-35; mean=18.5, SD=7.7) with a DSM-IV diagnosis within the autistic spectrum and a comorbid diagnosis of epilepsy. We included individuals with this dual diagnosis so that sex differences in ASD core symptoms could be investigated in males and females matched for neurologic phenotype. The Social Communication Questionnaire (SCQ) factor scores were used to approximate ASD severity for two core symptoms of ASD: Social Impairment and Stereotyped Behavior. We performed student t-tests to compare average factor scores between males and females.

**Results:** As predicted, males scored higher than females on the Social Impairment factor [ $t(87)=2.17$ ;  $p=0.03$ ] but there were no sex differences on the Stereotyped Behaviors factor [ $t(87)=1.18$ ;  $p=0.24$ ].

**Conclusions:** These results support protective factors for social ability in females with ASD and epilepsy. Our finding of lower social impairment in females compared to males with ASD and comorbid epilepsy contributes to the literature on sex differences in ASD symptom expression and suggests the need for sex-specific treatment considerations.

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**A. LEVAN, S.D. GALE, R.B. BURR & J.B. FULTON. The Relationship between Executive Functioning and Social Skills in Children with Epilepsy.**

**Objective:** To identify the relationship between social skills and executive functioning measures in a pediatric epileptic population. It was hypothesized that executive functioning would be positively correlated with social skill scores and that executive functioning scores would predict social skill scores.

**Participants and Methods:** Participants were recruited from the epilepsy monitoring units at Phoenix Children's Hospital in Phoenix, AZ and Primary Children's Medical Center in Salt Lake City, UT. There was a total of 28 participants (50% female, M age at testing = 11.79, SD = 3.12). Both the parents and children completed The Behavior Rating Inventory of Executive Functioning (BRIEF), The Behavioral Assessment System for Children (BASC-2), and The Social Skills Improvement System Rating Scales (SSIS).

**Results:** Correlational analysis revealed a strong, negative correlation ( $r = -.55$ ,  $p = .006$ ) between the Behavioral Regulation Index (BRI) on both the BRIEF parent and self-report and the Adaptive Skills Composite (ASC) on the BASC-2 parent report, and a moderate, negative correlation ( $r = -.44$ ,  $p = .026$ ) between the BRI parent and self-report and Social Skills Scale (SS) on the SSIS parent form. A multiple regression analysis produced  $R_2 = .422$ ,  $F(3, 36) = 8.76$ ,  $p < .001$ , showing children with higher scores (worse executive functioning) on the BRI BRIEF parent form had lower ratings (worse social functioning) of SS on the SSIS parent form.

**Conclusions:** Overall results showed executive functioning scores and social skill scores were significantly correlated, and that executive functioning scores predicted social skill scores in pediatric epileptic patients. Thus, in children with epilepsy, there was an association between executive and social functioning with worse executive function associated with worse social skill scores.

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**G. LIN, W. MUHLHOFER, E. SALZMAN, N. SINGHAL & B. PAUL. Multidisciplinary Evaluation of "Subclinical Seizures" in Pediatric Parietal Lobe Epilepsy: The Value of Neuropsychological Evaluation.**

**Objective:** Parietal lobe (PL) seizures are uncommon and not well-understood. Evaluation of such patients can be complicated by the lack of an obvious or consistent clinical correlate for electrographic seizures, despite that the PL houses eloquent cortex representing functions such as language, praxis and spatial attention. Using a multidisciplinary approach, this case study illustrates unique clinical aspects of PL seizures and highlights the contribution of formal neuropsychological testing (NPT) for detecting ictal cognitive/behavioral changes that may not otherwise be apparent.

**Participants and Methods:** The case involves a previously healthy 11-year-old who presented to UCSF with a six-month history of presumed focal epilepsy.

**Results:** Initial MRI had been normal. Despite medication she continued to have occasional seizures with varying semiologies. Video electroencephalogram [vEEG] at UCSF suggested numerous, daily subclinical seizures (i.e., apparent only on EEG) that had not been recognized. Beyond epilepsy protocol MRI, which revealed a left parietal lesion, UCSF workup also involved serial NPT. The first NPT uncovered rare, transient hemi-neglect, dyslexia and dysgraphia, amidst baseline but nonspecific language and verbal memory deficits. After clinical seizures had been controlled with medication adjustments, repeat NPT conducted with concomitant vEEG did not reveal any transient impairments of the type seen previously. However, persistent "subclinical" seizures were detected and found to be coincident with more subtle abnormalities, which were not reported by the patient and unlikely to have been detected with clinical observation alone.

**Conclusions:** This case provides an illustration of the subtle but detectable (with formal NPT) clinical presentation of focal PL seizures. It also raises an issue for neuropsychologists evaluating refractory epilepsy patients; specifically, variability in performance during NPT that is thought to be 'noise' may actually be related to covert seizure activity. Correspondence: *George Lin, Ph.D., Pacific Graduate school of Psychology, Palo Alto University, 301 N Whitewater Park Blvd, G303, Boise, ID 83702. E-mail: glin@paloalto.edu*

**L. VINCENT, M. SHAKERI, D. MALFAIT, F. MARTIN, V. PEKAR, L. ZAGORCHEV, F. WENZEL, S. KADOURY & S. LIPPÉ. Putamen Volume Predicts Working Memory Performance in Children with BECTS.**

**Objective:** Benign Epilepsy with Centro-Temporal Spikes (BECTS) is a childhood epileptic disorder often accompanied with cognitive difficulties involving basal ganglia functions (Lewis et al 2004). Our main

aim was to study the association between putamen volumes and working memory (WM) performance in BECTS. Brain structure segmentation accuracy is mandatory, but challenging. The second aim of this study was to determine which brain structure segmentation technique is most sensitive.

**Participants and Methods:** 16 BECTS children and 20 controls. Using a Philips Achieva X 3.0 Tesla MRI system T1-weighted structural scan. Neuropsychological evaluation including IQ, language and verbal memory testing were performed. Left putamen volumes were obtained with: 1) automatic FSL/FIRST tool based on the CMA protocol (see <http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/FIRST>), 2) manual corrections to FSL segmentations based on the CMA protocol 3) automatic segmentation with the a Model-based Brain Segmentation (MBS) approach developed by Philips Research. Putamen volumes/total brain sizes ratios were calculated. T-tests were used to verify group differences, and partial correlations to assess neuropsychological performances (IQ indexes, denomination, verbal memory) and volume associations in both groups separately.

**Results:** Left putamen is significantly smaller in BECTS vs controls ( $p < 0.05$ ). Results show a significant correlation between left putamen volumes obtained from both the manually corrected segmentations and MBS and the WM index in both groups ( $p < 0.05$ ). While the patient group showed a positive correlation, the control group showed a negative correlation.

**Conclusions:** Our results demonstrate an association between left putamen volumes and verbal WM performance. While abnormally reduced putamen volumes in BECTS predict more deficits, enlarged putamen volumes in controls indicate more deficits. The manual and the MBS approach were sensitive to volume modifications.

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**W.S. MACALLISTER, H. MURPHY, M. MAIMAN, S. POWELL & M. VASSERMAN. The Utility of the WISC-V in Child and Adolescent Epilepsy.**

**Objective:** Earlier work has demonstrated the utility of prior versions of the Wechsler Intelligence Scale for Children (WISC) in children and teens with epilepsy. However, the WISC-V has limited available data. The present investigation assesses the sensitivity of the WISC-V to cognitive impairment in this group.

**Participants and Methods:** 20 consecutively seen children and adolescents with epilepsy were administered the WISC-V as part of a neuropsychological evaluation. Means and standard deviations were calculated for composite and subtest scores. Correlational analyses assessed the relations between WISC-V composites and epilepsy severity variables.

**Results:** Participants ranged in age from 6–14 years (Mean=9.70) and had an average age of epilepsy onset of 3.53 years (range= birth–8 years). The WISC-V Full Scale IQ of the group was 88.45 (SD=17.74, range=62–118). On average, the Working Memory Index was the weakest composite (WMI; Mean=87.85, SD=17.33), followed by the Processing Speed Index (PSI; Mean=88.05, SD=19.74) and Visual Spatial Index (VSI) (Mean=89.20, SD=16.21). The Verbal Comprehension Index (VCI; Mean=96.10, SD=18.94) and Fluid Reasoning Index (FRI; Mean=90.35, SD=15.96) were the strongest indices. On average, Digit Span (Mean=7.45, SD=2.91) and Block Design (Mean=7.45, SD=2.54) were the weakest subtests for the group, whereas Vocabulary was the strongest (Mean=9.45, SD=3.94). Using a criterion of a scaled score 5 or lower as a threshold for impairment, Digit Span was the most frequently impaired subtest (35% of sample), followed by Picture Span (30%). Figure Weights was least frequently impaired (10%). Modest relations (i.e.,  $r > .30$ ) between number of epilepsy medications and FSIQ, VCI, VSI, FRI, and WMI were seen. Age of epilepsy onset and seizure frequency were not strongly related to WISC-V composites.

**Conclusions:** The WISC-V appears sensitive to cognitive status in children and teens with epilepsy, but has different psychometric properties from prior versions of the WISC.

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**E.J. MAHONEY, L.E. KORTHAUER, E.E. QUASNEY, D. SABSEVITZ, J.R. BINDER, L. GLASS UMFLEET & S.J. SWANSON. The Relationship between Perceived and Objective Cognitive Change Following Temporal Lobectomy.**

**Objective:** Previous research suggests that for individuals with epilepsy, mood is a greater predictor of perceived cognitive functioning (PCF) than is actual cognitive performance. Less research has investigated the relationship between objective cognitive change and change in PCF after patients undergo an anterior temporal lobectomy (ATL). Results have been mixed and studies often fail to control for factors such as mood. The aim of the current investigation was to determine if change in objective cognitive functioning after surgery is predictive of patients' PCF, after controlling for mood and surgical outcome.

**Participants and Methods:** As part of a routine pre- and post-surgical work-up, 107 (67 with right ATL, 40 with left ATL) patients completed neuropsychological testing. Correlational and regression analyses were conducted to investigate the relationship between objective memory change, as measured by the WMS Logical Memory II delayed recall, and change in PCF on the Quality of Life in Epilepsy-31 Cognitive Functioning subscale.

**Results:** There was a significant improvement in PCF in both left and right ATL groups following ATL ( $p < .05$ ). Left ATL patients exhibited a decline while right ATL patients showed a significant improvement in Logical Memory following surgery ( $p = .03$ ). Furthermore, in left ATL patients, objective memory change was not significantly related to change in PCF. However, for right ATL patients, objective memory change was marginally significantly related to change in PCF, even after accounting for mood and seizure outcome ( $p = .048$ ).

**Conclusions:** Our results replicated past findings that for left ATL patients, objective memory change is not a good predictor of change in PCF. However, for right ATL patients objective memory improvement was predictive of change in PCF, even after accounting for mood and seizure outcome. Therefore, the story in the current literature that objective memory performance shows little relationship with a patient's perceived cognitive functioning may be overly simplistic.

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**M. MAIMAN, S. POWELL, M. VASSERMAN & W.S. MACALLISTER. Inter-rater Reliability of the Parent versus Teacher Forms of the Behavior Rating Inventory of Executive Function in Children and Adolescence with Epilepsy.**

**Objective:** Children and adolescence with epilepsy frequently exhibit executive dysfunction. Prior work has demonstrated that the parent-report form of the Behavioral Rating Inventory of Executive Function (BRIEF) is useful in assessing executive dysfunction in children and adolescence with epilepsy. However, the teacher-report form remains less examined in this population, and the inter-rater reliability (IRR) between parent and teacher-report forms has not been established.

**Participants and Methods:** The parents and teachers of 64 clinically referred children and adolescence with epilepsy (Age: M=9.8 SD=2.42, Range=7-17; IQ: M=97.8, SD=12.88, Range= 69=130) completed the BRIEF as part of a comprehensive neuropsychological assessment. Intra-class correlation coefficients (ICC) were utilized to analyze the IRR of the parent and teacher forms of the BRIEF.

**Results:** With the exception of the organization of materials subscale of the BRIEF, all other scales demonstrated moderate to strong IRR, with ICC's ranging from .334 to .629. Even more impressive, the IRR

for the BRIEF as a whole was moderate (Global Executive Composite ICC = .524).

**Conclusions:** This study demonstrates that the parent and teacher forms for the BRIEF show moderate to strong IRR in children and adolescence with epilepsy.

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**A. MARTIN, L. SEPETA, J. FACELLA-ERVOLINI, W. GAILLARD & M. BERL. The Influence of Executive Function on Memory and Learning in Pediatric Focal Epilepsy.**

**Objective:** The pattern of memory deficits in pediatric epilepsy is not clear. Discrepant research findings may be related to methodological differences including memory test selection. Paired association (PA) learning engages memory systems maximally and is sensitive to mesial temporal lobe (MTL) damage. Thus, we compared PA to single-word list learning in relation to executive function (EF) to clarify memory profiles in pediatric focal epilepsy.

**Participants and Methods:** 175 children (96 Males; Age=10.5±3.2) with focal epilepsy had neuropsychological evaluation including Behavior Rating Index of Executive Functioning (BRIEF), Digit Span Backwards (DSB), Tower of London-DX (TOL-DX), Childhood Memory Scale (CMS), and California Verbal Learning Test for Children (CVLT-C). Normative z-scores were used with inversion of BRIEF scores such that lower scores reflect worse performance. We used repeated measures ANCOVA with memory test [CMS Word Pairs Long Delay (CMS-WPLD), CVLT-C Long Delay Free Recall (CVLT-LDFR)] as a within-group factor; BRIEF metacognitive index (BRIEF-MCI) was used as a covariate to examine EF's impact on memory. Linear regression analyses were conducted with EF predictors (DSB, TOL-DX Total Moves (TOL-DX TM), BRIEF-MCI) and CMS-WPLD and CVLT-LDFR as dependent variables.

**Results:** We found a trend for a main effect of memory test ( $F(1,26)=3.67, p=.067$ ), with better performance on CVLT-LDFR than CMS-WPLD. There was no main effect of BRIEF-MCI across memory tests nor an interaction between memory test and BRIEF-MCI. Linear regression analyses showed that BRIEF-MCI ( $R^2=.068, p<.01$ ) and DSB ( $R^2=.270, p<.01$ ) predicted performance on CVLT-LDFR. No EF variables predicted CMS-WPLD.

**Conclusions:** Gold standard single-word list learning tasks, such as CVLT-C, are aided by EF strategies more than PA learning, consistent with research showing the latter is particularly sensitive to MTL functioning. Knowledge of underlying mechanisms of poor memory performance in focal epilepsy has implications for potential cognitive intervention.

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**A.A. MULLANE, D. FLODEN, R. NAUGLE, L. FERGUSON & R.M. BUSCH. Patients with Memory Retrieval Difficulties are at Risk for Objective and Subjective Memory Declines Following Left Temporal Resection for Epilepsy.**

**Objective:** Preoperative verbal memory performance is a strong predictor of postoperative memory outcome following left temporal lobe resection (TLR) for pharmacoresistant epilepsy. Most prediction models include delayed free recall of verbal information with little consideration of recognition performance. This study examined objective and subjective postoperative memory outcome in patients with preoperative memory retrieval difficulties (impaired free recall with intact recognition).

**Participants and Methods:** Fifty-five patients (mean age 41 years; 66% female) completed objective (RAVLT) and subjective (MAC-S) memory measures prior to and following left TLR including mesial structures. Patients were categorized into 4 groups based on impaired/intact preoperative performance on Trial 7 and benefit/no benefit from

recognition cues. Changes scores on the RAVLT (Trial 7 and Recognition) and MAC-S (Ability and Frequency scales) were categorized as decline or no decline using RCIs or a 1 SD cutoff. ANOVAs and chi-squares examined demographic differences between groups and differences in memory outcomes.

**Results:** Few patients (10%) with preoperative retrieval difficulties showed postoperative declines in free recall; however, a substantial number (40%) demonstrated meaningful declines in recognition memory after left TLR. Of those with objective recognition declines, 38% endorsed subjective declines in memory ability and increased frequency of memory failures. Free recall declines among the other three patient groups were consistent with existing literature (40-47% decline in those with intact recall and 0% decline in those with impaired recall).

**Conclusions:** Results suggest that special consideration should be given to patients whose preoperative verbal memory performance suggests retrieval difficulties rather than a primary encoding deficit. These individuals appear to be at increased risk for memory decline following surgery, which may impact quality of life in a substantial proportion of patients.

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**S.M. NOBLE, D. SCHEINOST, S. BOOKHEIMER, P.D. WALSHAW, L.J. HIRSCH, D.D. SPENCER, R. CONSTABLE & C.F. BENJAMIN. Preliminary Validation of a Novel Method of Presurgical fMRI Language Localization through Functional Connectivity Analysis.**

**Objective:** Neurosurgery is potentially curative in chronic epilepsy but can only be offered to patients if the surgical risk to language is known. Clinical functional magnetic resonance imaging (fMRI) is a potentially ideal, noninvasive method for localizing language cortex yet remains to be validated for this purpose. Here connectivity analyses provide preliminary validation of a novel presurgical fMRI method relying on an expanded neurocognitive model of language.

**Participants and Methods:** fMRI data were collected from sixteen temporal lobe patients (12 left) being evaluated for epilepsy surgery at UCLA (mean age 38.9 [sd 11.4]; 6 female; per Wada 14 left language dominant, 1 right, 1 mixed). Language maps were generated using a novel clinician-based approach to analysis involving dynamic thresholding and conjunction of three language tasks to identify Broca's area, Wernicke's Area, Angular gyrus, Basal Temporal Language Area, Exner's Area, and Supplementary Speech Cortex. With activations defined as network nodes, mean network connectivity was compared via permutation tests with alternate (i) fully random and (ii) proximal random networks. Mean network connectivity was determined in independently-acquired motor fMRI datasets (9 foot, 16 hand, 14 tongue).

**Results:** 79% of clinician-derived language maps exhibited mean connectivity greater than fully random networks ( $p<0.05$ ). 71% of clinician-derived language maps exhibited mean connectivity greater than proximal random networks ( $p<0.05$ ). Most networks not passing the permutation tests (i.e., 75%-89%) contained a majority of nodes (>50%) that were weakly correlated ( $r<0.1$ ) with the network, indicating that most of these are not cohesive networks.

**Conclusions:** This study provides preliminary validity for a novel, clinician-based approach to presurgical language localization. This complements our recent work showing this method is reliable, and supports a proposed study comparing fMRI language maps using this technique with the results of direct stimulation mapping.

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**R.M. ROTH, C.L. PELLETIER, M. ABECASSIS, L. ERDODI, T.A. CALLER, F.P. ALEXANDRE & B.C. JOBST. RBANS Embedded Effort Measures in Adults with Focal Epilepsy.**

**Objective:** The Effort Index (EI) and Effort Scale (ES) have been put forth as performance validity measures (PVM) for the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). There is little data, however, on the prevalence of insufficient effort based on these indices in patients with epilepsy.

**Participants and Methods:** Participants were 55 adults with focal epilepsy (mean age=46.3, SD=10.7; 67.3% women), recruited for a research study through our comprehensive epilepsy evaluation program, who completed the RBANS. The EI is calculated by summing weighted scores for the Digit Span and List Recognition subtests, with cutoff scores of >3 and >0 recommended (Silverberg, Wertheimer, & Fichtenberg, 2007). The ES emphasizes the discrepancy between free recall and recognition memory [List Recognition – (List Recall + Story Recall + Figure Recall) + Digit Span], with a score < 12 considered invalid (Novitski, Steele, Karantzoulis, & Randolph, 2012). We also examined the relationship between the effort indices and score on a depression scale (PHQ-9).

**Results:** For the EI, 40% of patients were invalid based on a cutoff of >0 but only 1.8% using the cutoff of >3. For the ES, 72.7% of scores were in the invalid range. A total of 25% were considered invalid based on a Digit Span score of < 9, and 34.5% based on a Recognition score of < 19. Neither the EI nor ES was correlated with self-rated depression.

**Conclusions:** The prevalence rate of failures on either in EI (using a cutoff score of 0) or ES was far higher than expected based on prior studies of healthy and clinical samples, as well as studies using other PVMs in patients with epilepsy. Caution should therefore be exerted before considering RBANS performance to be invalid based on these cutoffs alone in patients with epilepsy. Further research including well-validated PVMs will be important to establish the sensitivity and specificity of cutoffs when using these RBANS indices in this patient population. Correspondence: Robert M. Roth, PhD, Psychiatry, Geisel School of Medicine at Dartmouth, DHMC, Dept. of Psychiatry, One Medical Center Drive, Lebanon, NH 03766. E-mail: robert.m.roth@dartmouth.edu

**S. POWELL, M. MAIMAN, M. VASSERMAN & W.S. MACALLISTER. The Relations Between Performance-Based Measures of Executive Dysfunction and Teacher-Reported Executive Dysfunction in Children with Epilepsy.**

**Objective:** Executive dysfunction is commonly seen in childhood onset epilepsy. Prior research has shown that children and adolescents with epilepsy have deficits on performance-based executive function measures, as well as 'real world' executive deficits as reported by parents. Unfortunately, the relations between performance based measures (such as the Tower of London-DX [TOL]) and parent report on the Behavior Rating Inventory of Executive Functions (BRIEF) are weak. The present investigation assesses whether stronger relations are seen between the TOL and teacher reported executive dysfunction, given that teachers are able to observe children in a more cognitively demanding environment.

**Participants and Methods:** 64 consecutively evaluated children (Age: M=9.8, Range=7-17) with epilepsy were administered the TOL-DX as part of a comprehensive neuropsychological battery. Their teachers completed the BRIEF. Epilepsy severity variables (e.g., age of onset, number of anti-epilepsy medications, seizure frequency) and IQ were also recorded. Correlational analyses assessed the relations between TOL-DX scores, BRIEF indices, and epilepsy severity variables.

**Results:** Of the BRIEF subscales, working memory was the most frequently teacher-reported deficit (42%), followed by deficits in task initiation (28%), and planning/organization (25%). However, there were no significant correlations between teacher reported executive dysfunction on the BRIEF and TOL variables or epilepsy severity variables. Conversely, there were modest correlations between FSIQ and working memory ( $r=-.252$ ) as well as task-initiation ( $r=-.305$ ) on the BRIEF.

**Conclusions:** Like the parent-report version of the BRIEF, the teacher-report form shows sensitivity to executive dysfunction in children and adolescents with epilepsy. However, it also fails to correlate with performance-based executive measures, despite some relations with intellectual functioning.

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**G.R. REY, C. VEGA, A.M. KANNER & G.J. REY. Verbal Memory Assessment of Spanish-Speaking Patients with Temporal Lobe Epilepsy.**

**Objective:** Developing appropriate instruments for accurate detection and characterization of memory problems in Spanish-speakers residing in the US continues to be a pressing issue. In patients with temporal lobe epilepsy (TLE), assessing memory is helpful when determining treatment options such as surgery, as a risk of verbal memory decline has been identified following temporal resection in 44% (left) and 20% (right) of adults (Sherman et al., 2011). The current study was designed to determine the clinical utility of the Verbal Learning subtest of the Miami Attention and Memory Instrument (MAMI-VLS) in identifying differences in memory function in left and right TLE Spanish-speaking patients being considered for surgery.

**Participants and Methods:** Patients were identified through archival record review. The sample consisted of 26 patients (50 % females; 12 left and 14 right). Mean age at the time of the evaluation was 47.5 (SD=11.5). Years of education was 12.3 (SD = 3.1). All patients completed a comprehensive neuropsychological battery that included the MAMI-VLS, a verbal list learning test consisting of 14 words presented over 5 trials, an interference list, and immediate, delayed and recognition trials. Independent sample t-tests were conducted for analysis.

**Results:** No group differences were found on IQ, age, or education. Analysis showed worse performance of the left TLE group on delayed recall of the word list ( $p<.05$ ). Although no statistical differences were evident on total learning following five trials, group means show better performance for the right TLE group.

**Conclusions:** Preliminary analysis indicate that the MAMI-VLS is sensitive to identifying dominant TLE memory problems in Spanish-speaking adults. Utilizing this tool as part of a presurgical battery can assist in decisions regarding risk of memory morbidity from the procedure. Our data is consistent with previous investigations that document a rapid loss of verbal memory traces over short delay periods in patients with left compared to right TLE.

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**A. REYES, T. THESEN, X. WANG, J. HAHN, D. YOO, R. KUZNIECKY, O. DEVINSKY & K. BLACKMON. The Fractional Amplitude of Low-frequency Fluctuation on Resting State fMRI Differentiates Temporal Lobe Epilepsy with and without Mesial Temporal Sclerosis.**

**Objective:** Temporal lobe epilepsy (TLE) with and without mesial temporal lobe sclerosis (MTS) are distinct neurological syndromes with unique and common features. Differentiating TLE with MTS from TLE without MTS is important for prognosis following resective epilepsy surgery. This study identifies novel functional MRI features that distinguish these two groups.

**Participants and Methods:** Thirty patients with TLE and thirty sex/age-matched controls consented to a research imaging protocol. TLE was verified in all patients with intracranial EEG. MTS status was confirmed by histological evaluation of surgical tissue (MTS=13; non-MTS=17). Fractional amplitude of low-frequency fluctuation (fALFF) of the BOLD resting-state fMRI signal was averaged at six different regions of interest in each hemisphere (hippocampus, amygdala, frontal, parietal, occipital, and temporal lobe). Regions of interest were labeled

ipsilateral or contralateral according to seizure lateralization. A paired *t* test was used to test for fALFF differences between patient groups and controls.

**Results:** The MTS group had lower fALFF in the ipsilateral hippocampus and amygdala compared to controls ( $t(12)=-2.38$ ,  $p<0.05$ ,  $t(12)=-3.26$ ,  $p<0.01$ , respectively), as well as reduced fALFF in the ipsilateral and contralateral frontal lobes ( $t(12)=-2.54$ ,  $p<0.05$ ,  $t(12)=-2.37$ ,  $p<0.05$ , respectively). In the non-MTS group, fALFF in the hippocampi or amygdalae were normal, but average fALFF values were reduced in ipsilateral and contralateral frontal lobes ( $t(16)=-3.5$ ,  $p<0.01$ ,  $t(16)=-3.57$ ,  $p<0.01$ , respectively).

**Conclusions:** We found mesial temporal fALFF abnormalities in TLE patients with MTS, but not in those without MTS. These findings provide validation for fALFF as a marker of focal reduction in functional integrity. Reduced frontal lobe fALFF in both groups suggests that fALFF is also sensitive to widespread functional abnormalities, possibly accounting for common cognitive comorbidities (e.g., executive dysfunction) observed in TLE with and without MTS.

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**R.M. ROTH, M. ABECASSIS, C.L. PELLETIER, T.A. CALLER, F.P. ALEXANDRE & B.C. JOBST. Self-Rated Executive Dysfunction in Adults with Focal Epilepsy.**

**Objective:** Adults with epilepsy commonly show deficits on performance-based tests of executive functions. The extent to which such patients report experiencing executive dysfunction in their everyday lives, however, is unknown. The present study therefore evaluated the prevalence of self-rated executive dysfunction in a sample of adults with focal epilepsy.

**Participants and Methods:** Participants included 55 adults diagnosed as having focal epilepsy (mean age = 46.3, SD = 10.7; 67.3% women), recruited through our comprehensive epilepsy evaluation program, who completed the Behavior Rating Inventory of Executive Function-Adult (BRIEF-A). The BRIEF-A assesses nine aspects of executive functions as experienced in everyday life over the past month. Participants also completed a measure of depression (PHQ-9).

**Results:** Overall, the patient sample obtained mean BRIEF-A scores in the clinical range ( $T\geq 65$ ) only for the Working Memory scale, Metacognition Index and Global Executive Composite (GEC), with subtler elevations ( $T=60-64$ ) seen for several other scales and the Behavior Regulation index. Clinical elevations were most common for Working Memory (87.3%), Shift (49.1%), Emotional Control, Task Monitoring and Planning/Organize (each 47.3%). The overall score for the BRIEF-A, the GEC, was elevated in 54.5% of participants. Greater depression was associated with poorer subjective executive function for all scales (correlations ranging from .34 to .64).

**Conclusions:** These findings indicate that a sizable subset of patients with focal epilepsy endorses executive dysfunction in their everyday lives, which is related in part to symptoms of depression. Further research examining factors that contribute to subjective executive dysfunction in patients with epilepsy will be informative.

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**R. SEVER, R. RUM, A. TABAK, R. TAVOLONI, M. BALAVAGE, K. OSBORN, S.R. BENBADIS, F.L. VALE, H. WASEEM & M.R. SCHOENBERG. Seizure Remission Status Following Surgery for Localization-related Epilepsy Associated with Differences in Postoperative WAIS-IV Performances.**

**Objective:** Epilepsy surgery has focused on advancing surgical techniques to improve seizure remission outcomes, and more data are needed regarding how seizure remission outcomes relate to other postoperative

variables, such as intellectual functioning. To these ends, we assessed whether localization-related epilepsy patients who underwent surgical resections for treatment of medication refractory seizures differed in postoperative Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV) index scores as a function of postoperative Engel class outcome.

**Participants and Methods:** Participants included 71 postoperative epilepsy patients, of which 51 achieved complete seizure remission (Engel class I), and 20 achieved suboptimal seizure remission (Engel class II-IV). Groups were similar in terms of age, years of education, and length of epilepsy (all  $p>.24$ ). Potential group differences by seizure remission status (Engel class I vs II-IV) were evaluated for each index of the WAIS-IV.

**Results:** Participants who achieved complete seizure remission had significantly better performances on Full Scale IQ ( $p=.01$ ,  $d=.72$ ), Perceptual Reasoning Index ( $p=.007$ ,  $d=.82$ ), Working Memory Index ( $p=.004$ ,  $d=.83$ ), and Processing Speed Index ( $p=.006$ ,  $d=.78$ ). No group differences were observed on Verbal Comprehension Index ( $p=.59$ ).

**Conclusions:** Results suggest that among this postoperative epilepsy sample, achievement of complete seizure remission was associated with better postoperative intellectual functioning.

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**R.S. RUM, K. OSBORN, R. SEVER, H. WASEEM, R. TAVOLONI & M.R. SCHOENBERG. Impact of seizure remission status and neuropsychological functioning on quality of life among postoperative epilepsy patients.**

**Objective:** While there is a large focus on the impact of seizures on quality of life (QOL), the impact of objectively assessed cognitive functioning on QOL has not been thoroughly addressed, and more information is needed to better understand each of these variables in the context of surgery for treatment of medication refractory localization-related epilepsy.

**Participants and Methods:** Participants included postoperative medication refractory localization-related epilepsy patients ( $n=60$ ) who underwent pre- and postoperative neuropsychological evaluations including self-ratings of health-related quality of life using the Quality of Life in Epilepsy (QOLIE-31). ANOVAs evaluated differences in QOLIE-31 total and cognitive functioning index scores by seizure remission status (Engel class I versus II-IV). Pearson's *r* correlations were used to examine potential associations between various postoperative neuropsychological measures and the two aforementioned QOLIE-31 variables.

**Results:** Patients with complete seizure remission (Engel class I) had significantly higher total scores on the QOLIE-31 ( $p=.003$ ), but no group differences were observed for the cognitive functioning index. QOLIE-31 total scores were significantly correlated with better performances on WAIS-IV FSIQ ( $r=.27$ ,  $p=.04$ ) and PSI ( $r=.31$ ,  $p=.02$ ), and on animal fluency ( $r=.31$ ,  $p=.02$ ). QOLIE-31 cognitive functioning index scores were significantly correlated with better performances on Green's Word Memory Test Free Recall ( $r=.39$ ,  $p=.003$ ), and the WAIS-IV FSIQ ( $r=.29$ ,  $p=.03$ ) and PSI ( $r=.35$ ,  $p=.007$ ).

**Conclusions:** Results confirm earlier studies indicating seizure remission is associated with improved quality of life and also highlight the association between objective cognitive functioning and quality of life among postoperative epilepsy patients.

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**M.I. SALEH, M. MAIMAN & W.S. MACALLISTER. The Utility of Neuropsychology in Predicting Functional Reorganization in Presurgical Pediatric Epilepsy Cases.**

**Objective:** Epilepsy patients with dominant hemisphere seizures have higher rates of functional reorganization of language skills to the

contralateral hemisphere. This case series investigates the utility of neuropsychological evaluation data to predict functional reorganization in pediatric epilepsy. The authors propose that a pattern of verbal strengths and visuospatial weaknesses in children and adolescents with left-hemisphere activity is suggestive of functional reorganization as confirmed by intracranial amobarbital procedure (i.e., Wada test).

**Participants and Methods:** A systematic, retrospective review of pediatric records from 2009 through January 2015 at the NYU Epilepsy Center identified 33 pediatric cases that received Wada examination as part of presurgical work-up. Eight were excluded due to right-hemisphere seizure foci; five, due to incomplete neuropsychological records; and seven, due to intellectual disability. The remaining 13 participants had clearly lateralized left-hemisphere seizure foci on electroencephalograph (EEG), a comprehensive neuropsychological evaluation, and an Wada testing.

Expert review of blinded neuropsychological profiles determined evidence of functional reorganization, no evidence of reorganization, or indeterminate data, with the pattern of language/verbal memory versus visual-spatial skills/visual memory being the major factors considered.

**Results:** Functional reorganization versus no reorganization as determined by Wada exam was correctly predicted reorganization in 64% of cases.

**Conclusions:** The observed pattern may suggest classic “crowding” effects, in which language reorganization to the right hemisphere causes poorer development of visuospatial skills while preserving language and verbal memory. The presented pattern may have clinical utility in identifying children with functional reorganization and cognitive risk factors following surgical resection. Future studies should use a larger sample size to investigate the accuracy of this method.

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**W.A. SCHRAEGLE, N. NUSSBAUM, A.K. STEFANATOS & J. TITUS. Pattern of Memory Performance in Children with Frontal or Temporal Lobe Epilepsy.**

**Objective:** To examine the differences between frontal and temporal memory systems in pediatric epilepsy, we tested the relationship between CVLT-C recall profiles and interference variables [proactive (PI) and retroactive (RI)] by seizure classification [temporal (TLE) vs. frontal (FLE)]. Hypotheses: greater RI and lower PI in the TLE group and vice versa for the FLE group; and a weaker verbal memory profile in the TLE group.

**Participants and Methods:** Forty-one epileptic children treated at DCMC’s completed the CVLT-C. Epileptic focus and lateralization were classified for each child based on electroencephalogram (EEG), semiology, and neurologist diagnosis; resulting in TLE (n=21, 14 males) and FLE (n=20, 16 males) groups. Cases with multiple epilepsy types were not included. No between group differences seen across several clinical and neuropsychological variables. Interference types were operationalized based on Donders (2006). CVLT recall variables correlating with classification ( $p < .05$ ) were included in the primary analysis.

**Results:** Our findings revealed significant differences in RI [ $F(2,27)$ ,  $p = .01$ ] implicating the TLE group (TLE, 91.4; FLE, 107.12); non-significant findings for PI [ $F(2,27)$ ,  $p = .37$ ] with mean differences trending towards worse PI in the FLE (TLE, 98.9; FLE, 96.3). Additionally, the FLE group showed significant differences in the pattern of RI and PI [ $t(19)$ ,  $p = .03$ ] emphasizing a stronger PI effect (PI, 96.3; RI, 107.1). Despite non significant findings between RI and PI within the TLE group [ $t(20)$ ,  $p = .15$ ]; mean differences trended towards worse RI (RI, 91.4; PI, 98.9). Finally, Immediate Recall [ $F(1,40)$ ,  $p = .05$ ] and Immediate Cued Recall [ $F(1,40)$ ,  $p = .03$ ] were worse in the TLE group.

**Conclusions:** Results highlight the interplay between frontal and temporal memory systems and how seizure foci differentially impact these processes in meaningful ways.

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**B. SHIELDS & S. HUNTER. The Relation between Executive Functioning and Psychological Disturbance in Youth with Pediatric Generalized Epilepsy.**

**Objective:** Pediatric epilepsy puts children at risk for a number of neurocognitive and behavioral difficulties compared to children without epilepsy. Previous work has shown deficits in executive functions (EF) in up to 30-40% of children with epilepsy (Dunn & Kronenberger, 2005). Additionally, children with epilepsy have higher rates of both internalizing (Ettinger et al., 1998) and externalizing problems (Pliplys et al., 2007). However, few studies have examined the link between EF and psychological adjustment in children with epilepsy. To address this gap, we examined the relation between EF and internalizing and externalizing problems in a sample of children with generalized epilepsy.

**Participants and Methods:** Participants were maternal caregivers of 46 children (64% male;  $M = 10.63 \pm 4.73$ , 64% Caucasian) with a primary diagnosis of pediatric generalized epilepsy presenting at the University of Chicago for neuropsychological evaluation. Caregivers reported on (a) youth global EF using the Behavior Rating Inventory of Executive Functioning (Gioia et al., 2000), and (b) youth internalizing and externalizing problems using the Behavior Assessment System for Children (Reynolds & Kamphaus, 2004). Linear regression analyses were used to examine the relation between EF and psychological disturbances.

**Results:** Youth EF significantly predicted internalizing problems ( $B = .45$ ,  $t[43] = 2.58$ ,  $p = .01$ ), and explained a significant proportion of variance in externalizing scores ( $R^2 = .13$ ,  $F(1, 45) = 12.31$ ,  $p = .001$ ). EF also significantly predicted youth externalizing problems ( $B = .59$ ,  $t[44] = 3.65$ ,  $p = .001$ ), and explained a significant proportion of variance in externalizing scores ( $R^2 = .23$ ,  $F(1, 45) = 12.31$ ,  $p = .001$ ).

**Conclusions:** Poor EF may play an important role in influencing psychological functioning in youth with generalized epilepsy. Prevention and intervention efforts that focus on both psychosocial functioning as well as improving EF may benefit youth with generalized epilepsy.

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**T. SOMBOON, K. UNNWONGSE, T. SRIKIJVILAİKUL & P. SRISARAKORN. Lateralizing Value of Memory Function Test (Translated) in Thai Patient with Temporal Lobe Epilepsy due to Hippocampal Sclerosis.**

**Objective:** To use the memory subtest scores (Wechsler Memory Scale-Third Edition: WMS-III) in lateralizing epileptogenic temporal lobe in patient with temporal lobe epilepsy (TLE)

**Participants and Methods:** We retrospective adult patients with unilateral TLE defined by unilateral MRI lesions and unilateral EEG seizure onset who underwent a resection of the temporal lobe at Prasat Neurological Institute between 1st January 2011-31st January 2014. All patients received presurgical assessments including MRI, interictal and ictal video EEG monitoring and memory testing by Wechsler Memory Scale-Third Edition. Demographic data and memory scores were compared, using simple t-test, Chi-square test, and Mann-Whitney U-test accordingly.

**Results:** 44 consecutive patients were included. 24 patients with L-TLE and 20 patients with R-TLE. There are no statistically significant difference in age, handedness, age of onset, and duration of epilepsy between two groups. The patients with R-TLE have a slightly higher scores in all subtests. We only found a statistical difference in auditory delayed score between L-TLE and R-TLE ( $p = 0.03$ ). We compared between auditory delayed score and visual delayed score in both groups, the auditory delayed score and visual delayed score in L-TLE is not much difference between two subtests score, while it is look like that majority of patients of R-TLE have worsen in visual delayed score.



**Conclusions:** In our retrospective study show the Wechsler-Memory Scale-Third Edition (WMS-III) is not be able to precise interpretation of memory function in the patients with temporal lobe epilepsy due to hippocampal sclerosis.

**A.K. STEFANATOS & N. NUSSBAUM. Neurocognitive Sequelae of Frontal and Temporal Lobe Epilepsy in Children: Support for Network Impairment.**

**Objective:** There is strong evidence that epilepsy results in significant neurodevelopmental sequelae that is greater with earlier onset of seizure activity. While this has been separately observed in children with frontal and temporal lobe epilepsy, few studies have directly compared these epilepsy syndromes utilizing broad assessments spanning multiple domains. We therefore evaluated the degree and selectivity of patterns of cognitive dysfunction in children with frontal (FLE) and temporal (TLE) lobe epilepsy.

**Participants and Methods:** Participants included 51 children between the ages of 6 and 16 years with intractable epilepsy who were seen for a neuropsychological evaluation through a comprehensive epilepsy program. Participants were administered measures of memory, executive, motor and intellectual functioning.

**Results:** Contrary to the selective patterns of deficits typically described in adults, both the FLE and TLE groups demonstrated significant impairments relative to normative values on each of the neuropsychological domains assessed. Moreover, no significant differences were found between the two patient groups on any of the measures.

**Conclusions:** The results from the current study suggest that individuals with childhood-onset epilepsy exhibit broad patterns of cognitive compromise, regardless of seizure localization. These findings support emerging models which conceptualize seizures as impacting the development of distributed brain networks, such that seizures affecting any part of a functional neural network can result in a similar pattern of cognitive impairment. The findings provide important insights into the organization of cognitive and behavioral functions following early neurological insults associated with epilepsy and challenge long-held assumptions about the neuropsychology of “localization-related” or “focal” epilepsies.

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**M. BERL, V. TERWILLIGER, M. SMITH & C. BULTEAU. Survey Results of Neuropsychological Evaluation in Presurgical Pediatric Epilepsy.**

**Objective:** Understanding the different outcomes of pediatric epilepsy surgery requires large datasets because of the numerous factors that contribute to such differences. A barrier has traditionally been the lack of consistency in measures used. An ILAE survey of neuropsychologists (NPs) was conducted to determine where there is commonality and divergence in current practices.

**Participants and Methods:** An online survey using REDCap was distributed via individual emails of pediatric NPs who conduct presurgical epilepsy evaluations, or other members of a surgical team if the neuropsychologist was unknown, and by posting on the International Mail List for Pediatric Neuropsychology. The survey was open from June 2014 to July 2015. Question format differed depending on the information being acquired. Descriptive analyses were reported.

**Results:** 74 responses from 16 countries were received. The majority of responses were from the USA (61%). NPs had an average of 14.7 years of experience. 90% conduct presurgical evaluations for most of their surgical patients while 56.9% conduct postsurgical evaluations. There was high consistency (>90%) in the domains assessed but consistency of specific measures and from non-USA responders were lower. WISC-IV had the highest usage for USA (97%) and other countries (71%). For USA NPs, consistency of use was high for the BNT(80%), NEPSYII(82%), DKEFS(84%), VMI(93%), Rey-O(80%), Grooved Pegboard(93%),

Conners CPT(75%), BRIEF(91%), WCST(80%), WRAML2(71%), CVLT-C(80%), BASC (77%); ABAS-II (73%).

**Conclusions:** For USA sites, there is at least one measure used by more than 75% of practitioners within each domain. This result is a basis for a recommendation of measures to use based on the consensus of NPs conducting presurgical evaluations and could serve as a starting point from which to develop multi-site collaboration through a common data repository. Points for practice development include lower frequency of post-surgical evaluation and low consistency of use of similar measures in non-USA countries.

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## Memory Functions

**M. BERL, X. YOU, L. SEPETA & J. FACELLA-ERVOLINI. Profiles of Memory and Learning of the CVLT-C using Graph Theory.**

**Objective:** The California Verbal Learning Test for Children (CVLT-C) is a powerful measure of learning and memory because it not only quantifies what, but also how, a child remembers. We used novel data-driven statistical methods that apply graph theory with the aim of categorizing different profiles within a large population of children with and without epilepsy.

**Participants and Methods:** 260 children ranging from 5-16 years old (137 males) were included if they had completed a CVLT-C and IQ. 127 children were typically developing (TD) and 133 had focal epilepsy (EPI). 21 normative z-scores were used from the CVLT-C to create correlation matrices (260x260) between subjects, which provided distance information between any given subject pair. Community detection was applied to this matrix using a Walk Trap algorithm in the igraph package in R. Community structure reveals subgroups of participants that share similar behavioral phenotypic features.

**Results:** We found three communities that significantly differed in terms of their memory performance and strategies used. Subgroup1 performed best (mean z on recall trials > 0), used a serial strategy, and had good recall consistency. Subgroup2 performed poorly ( $z < -1$ ) recalled items from the end of the list, and had more intrusion errors. Subgroup3 performed within the average range but not as well as Subgroup1, used semantic clustering and had the most perseverative errors. All subgroups were comprised of TD and EPI children; however, a majority (52%) of TD fell in Subgroup1 while the EPI children were distributed across the subgroups (31%, 40%, 29%). Children in the best performing group had higher IQ and EPI in Subgroup2 were taking more antiepileptic medication.

**Conclusions:** We delineated three learning profiles within the CVLT-C. The best performing group tended to use a serial strategy. However, recall that was limited to the end of the list was associated with worse performance. Applying this novel approach across other populations may reveal other learning profiles.

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**D.M. ANDERSON, Q. YU, A. HEITZER, J. PIERCY, S. RAZ & N. OFEN. Assessing the Relationship Between Episodic Memory and the Volume of the Hippocampus in Young Children Born Prematurely.**

**Objective:** The hippocampus is essential for episodic memory. Preterm birth is associated both with deficits in episodic memory and with alteration on hippocampal structure; however, the effect of term status on the relation between episodic memory and hippocampal volume (HCV) is unclear. We studied the relation between episodic memory and HCV in young children born prematurely.

**Participants and Methods:** Thirty-four children ages 5-6 (15 born preterm, PT; 19 born at term, FT) completed MRI scan and 3 episodic memory tasks: NIH Picture Sequencing (PS), WPPSI-IV Picture Memory (PicMem), and a picture-pair recognition task. In the PS task, participants recalled the order and location of a set of images. In the PicMem task, participants identified target images from a larger set of images. In the picture-pair task, participants identified single (item test) or accurate pairings (pair-associate test) of studied picture-pairs. Accuracy was calculated in all tasks. HCV was estimated from manual tracing on high-resolution whole-brain structural images and volumes were adjusted for total intracranial volume via ANOVA.

**Results:** In this sample, we found that the PT group performed significantly better on both the item and pair-associate tests of the picture-pair task. There were no group differences for PS or PicMem. Moreover, there were no group differences in IQ or demographic characteristics. HCV was significantly larger in the PT compared to the FT group. HCV was positively correlated with accuracy on the PS task in FT but not PT group. In contrast, there was a trend for a negative correlation between HCV and accuracy in the item test of the picture-pair task in PT but not FT group.

**Conclusions:** Taken together, our findings suggest that there is a differential relationship between HCV and performance on tasks that assess episodic memory. Moreover, our findings suggest that relationship between HCV and performance in tasks that assess episodic memory may be different in children that were born preterm compared to those born at term.

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**J.R. ANDERSON, R. GALIOTO, J. GUNSTAD & M. SPITZNAGEL. Effects of Sleep Quality and Glucoregulation on Sustained Attention, Working Memory, and Inhibitory Control in Healthy Young Adults.**

**Objective:** Recent work shows poor sleep may lead to reduced glucoregulation. Poor sleep quality and glucoregulation, even when subclinical, are both associated with reduced attention and executive functioning. We hypothesized that sleep quality and glucoregulation would interact, such that those demonstrating subclinical deficits in both areas would show greater cognitive impairment than those with either burden alone.

**Participants and Methods:** 79 healthy young adults (age  $M=20.99$ ,  $SD=2.36$ ) participated. Glucose was taken via fingerstick at 8-hr fasted baseline, followed by cognitive testing and questionnaires. Cognitive tasks were ANAM4 Go/No-Go (GNG), Running Memory Continuous Performance Test (RMCPT) and Standard Continuous Performance Test (SCPT).

**Results:** 2x2 MANOVAs examined sleep quality by glucoregulation for each test given (GNG, RMCPT, SCPT). A main effect of glucoregulation group [ $\lambda=0.88$ ,  $F(3,70)=3.30$ ;  $p=.03$ ] was observed on the GNG, such that greater mean reaction time [ $F(1,72)=6.62$ ;  $p=.01$ ] and reaction time variability [ $F(1,72)=4.72$ ;  $p=.03$ ] emerged in the better glucoregulation group. A main effect of sleep quality group [ $\lambda=0.99$ ,  $F(2,71)=3.10$ ;  $p=.05$ ] was observed on the RMCPT, with greater mean reaction time [ $F(1,72)=5.38$ ;  $p=.02$ ] in the good sleep quality group. No effects emerged on the SCPT, and no interactions were observed.

**Conclusions:** Contrary to our hypothesis, no interaction was observed, though individuals with better sleep quality and glucoregulation showed slower and more variable reaction times. Considering our relatively healthy sample, it is possible that those with subclinical sleep or glucoregulation problems were more focused in order to counteract these health deficits. Future research would benefit from the use of clinical samples and prospective design to determine whether subclinical health insults lead to this compensatory mechanism.

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**R. ÁVILA, M.A. BICALHO, L. MALLOY-DINIZ & B. SATLER. Working Memory Mediates the Relationship Between Aging and Memory Performance in Older Adults with Heterogeneous Cognitive Background.**

**Objective:** The objective of the current study is to investigate whether working memory mediates the relationship between age and memory recall in a heterogeneous sample of older adults.

**Participants and Methods:** We evaluated 261 older adults (145 female) that were divided into three groups: control group ( $n=73$ ) composed by older adults with no evidence of cognitive impairment, patients with mild cognitive impairment (MCI;  $n=88$ ), and patients with mild Alzheimer's disease (AD;  $n=88$ ). The participants underwent a comprehensive neuropsychological evaluation that included also the Rey Auditory Learning Test (RAVLT) and the Digit Span Test. The A1 score from the RAVLT was used as measure of short-term memory, the A7 as measure of episodic memory, and the backward order of the Digit span as measure of verbal working memory. We normalized the sociodemographic and neuropsychological scores with a log-transformation, once they did not follow a normal distribution, to conduct the analyses. We evaluated the mediation effect of working memory on short-term and episodic memory through simple mediation models using the macro PROCESS to estimate the direct and indirect effect of age on memory. In the model A, the outcome variable was the A1 score from RAVLT and in model B we used the A7 score from RAVLT as the outcome measure. These analyses were conducted with the whole sample.

**Results:** All variables correlated significantly. The mediation analyses showed a partial mediation effect of working memory in the relationship between age and short-term memory (model A: point estimate = -0.0012, 95% bias corrected CI = -0.0027 to -0.0004) and also in the relationship between age and episodic memory (model B: point estimate = -0.016, 95% bias corrected CI = -0.0035 to -0.0004).

**Conclusions:** The present results indicate that the performance on memory function is partially mediated by working memory. Interventions focusing on improvement of working memory performance may be beneficial in older adults with varying degrees of memory impairment.

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**K.M. BAIN, C.J. RUGGERO, J.L. CALLAHAN & R. KOTOV. Longitudinal Assessment of Verbal Learning in Patients with Psychotic Disorders.**

**Objective:** The goal of the current study was to compare the verbal learning ability of patients with psychotic bipolar disorder to patients with schizophrenia spectrum disorders and patients with psychotic major depressive disorder (MDD).

**Participants and Methods:** Data was drawn from the Suffolk County Mental Health Project (SCMHP), a large-scale epidemiological study of patients with first episode psychosis. Verbal learning was assessed with the Verbal Paired Associates I subtest of the WMS-R 2 years following the index episode of psychosis, and was assessed again with the CVLT 10 years after the index episode. T-scores were calculated for each participant that completed both assessments to allow for longitudinal investigation of verbal learning ability, in addition to cross-sectional comparison of verbal learning ability between groups at the 10-year follow-up.

**Results:** A decade after onset of psychosis, individuals with psychotic bipolar disorder ( $N = 47$ ) performed significantly better on a verbal learning test than individuals with schizophrenia ( $N = 99$ ). Their performance was not significantly different from that of individuals with psychotic MDD ( $N = 19$ ). There were no group differences in trajectory of change over time when controlling for covariates (age, gender, education, race, and general intelligence). All groups demonstrated decline over time, but this decline was not significantly different from 0. The average performance of each group on the CVLT was significantly below population norms.

**Conclusions:** In a group of patients with first-episode psychosis, relative differences in verbal learning ability among patients with schizophrenia and psychotic affective disorders were maintained over the course of 8 years (Mojtabai, 2000), with no patient group showing greater decline in performance than another. These results suggest that verbal learning deficits may be related to transdiagnostic processes, rather than being specific to particular disorders.

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**K. DHIMA, H. WADSWORTH & L.H. LACRITZ. Processing Speed as a Predictor of Memory Performance in Multiple Sclerosis, Parkinson's Disease, and Alzheimer's Disease.**

**Objective:** To examine the differential contribution of processing speed to memory performance in multiple sclerosis (MS), Parkinson's disease (PD), and Alzheimer's disease (AD).

**Participants and Methods:** Individuals with MS [ $n=115$ ,  $M_{age}=45.70(9.90)$ ,  $Medu=14.73(2.53)$ ], PD [ $n=128$ ,  $M_{age}=65.08(10.66)$ ,  $Medu=13.14(3.07)$ ], and AD [ $n=208$ ,  $M_{age}=72.62(8.94)$ ,  $Medu=13.34(3.31)$ ] were administered the WAIS-III Digit Symbol (DSym) and California Verbal Learning Test (CVLT) as part of a larger neuropsychological evaluation for clinical purposes. Linear regressions were performed to examine the role processing speed (DSym standard score) plays in learning (CVLT Total Trials 1-5 T-score) and memory (CVLT Long Delay Free Recall Z-score) across groups.

**Results:** Regression analyses were significant across groups. DSym accounted for 37% of the variance in total learning in the MS sample [ $F(1, 113)=65.58$ ,  $p<.001$ ], 26% of the variance in PD [ $F(1, 126)=45.00$ ,  $p<.001$ ], and 18% of the variance in AD [ $F(1, 206)=45.67$ ,  $p<.001$ ]. Regarding memory, DSym performance accounted for 25% of the variance in the MS sample [ $F(1, 113)=36.71$ ,  $p<.001$ ], 18% of the variance in PD [ $F(1, 126)=28.50$ ,  $p<.001$ ], and 5% of the variance in AD [ $F(1, 206)=9.88$ ,  $p<.01$ ].

**Conclusions:** DSym performance significantly predicted CVLT total learning and memory performance in all three samples, accounting for more variance in learning than in memory. In addition, the association was greatest in MS, followed by PD, and then AD. This study provides further support that processing speed contributes to verbal learning and memory, particularly in subcortical disorders. Further investigation is warranted to understand the specific mechanisms at work.

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**J.H. FEINBERG, J. MOSES, R. GOMEZ & B. BONGAR. Visual Memory Errors and Language Functioning: A Factorial Analysis of BVRT Memory Errors, WAIS-III, and MAE Subtests.**

**Objective:** The objective was to examine the relationship between Benton Visual Retention Test errors and the four spoken language subtests of the Multilingual Aphasia Examination and a four-factor solution of intelligence from the WAIS-III.

**Participants and Methods:** Subjects included ( $N = 507$ ) are male veterans from a mixed neuropsychiatric population at the VA Palo Alto. The method utilized is a series of principal component analyses (PCA) with Equimax rotation.

**Results:** The first PCA included raw score of all BVRT errors, which had a 2 component structure. The first included Distortions, Misplacements, Rotations, Perseverations and Size Errors, primarily of misperception (i.e. distorting the objects). The second included Omissions, Size Errors, and Misplacements, primarily errors of omission (i.e. forgetting all or details of the design). Factor scales were created from this analysis using the regression method. The second PCA included the two factor scores of BVRT errors with the spoken language subtests of the MAE (Sentence Repetition, COWA, Token Test, and Visual Naming). The errors

of misperception loaded with Sentence Repetition, Token Test, and Visual Naming, while the errors of omission loaded with COWA. A final analysis examined the BVRT error factors with a four factor solution of the WAIS-III using raw scores (Verbal Comprehension, Perceptual Organization, Working Memory, and Processing Speed), with age and level of education included. This found that BVRT errors of omission loaded most strongly with Perceptual Organization and Processing Speed, while errors of misperception loaded with verbal comprehension.

**Conclusions:** We found that BVRT errors load on to two factors, one which is primarily errors of misperception and the other is errors of omission. The misperception error factor loaded most strongly with measures of language, indicating these errors or more likely due to a breakdown in verbal mediation. The omission error factor loaded more strongly with processing speed and executive functioning.

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**L. GRAVES, H.M. HOLDEN, K.L. DOYLE, L. DELANO-WOOD, M.W. BONDI, S. WOODS, J. COREY-BLOOM, D.P. SALMON, D.C. DELIS & P. GILBERT. Recognition Discriminability in Huntington's and Alzheimer's Disease.**

**Objective:** Huntington's disease (HD) and Alzheimer's disease (AD) are associated with distinct memory profiles that are partly reflected by differences in recognition memory function. The first and second editions of the California Verbal Learning Test (CVLT) provide an index of total recognition discriminability (TRD) using nonparametric and parametric formulas, respectively. Our objective was to examine the degree to which these formulas similarly characterize TRD within and between HD and AD patients.

**Participants and Methods:** The CVLT-Second Edition (CVLT-II) was administered to 66 HD patients, 33 AD patients, 68 healthy middle-aged adults, and 35 healthy older adults. Raw TRD scores were calculated using nonparametric and parametric formulas. Raw and standardized false positive (FP) rates also were calculated.

**Results:** Analysis of variance and covariance tests revealed that the HD and AD groups had significantly lower TRD scores with both formulas and higher raw and standardized FP rates than the healthy adult groups ( $ps<.05$ ). In the comparison of HD to healthy middle-aged adults, the effect size associated with the parametric formula was 24% larger than the effect size associated with the nonparametric formula. The two formulas yielded comparable effect sizes in the comparison of AD to healthy older adults. The AD group had significantly lower TRD scores using both formulas and higher raw and standardized FP rates than the HD group ( $ps<.05$ ). However, standardized parametric TRD scores were comparable between the HD and AD groups.

**Conclusions:** The parametric formula for TRD used in the CVLT-II may capture certain group differences to a larger degree than the nonparametric formula without yielding different conclusions regarding TRD within and between HD and AD populations. Additionally, interpreting TRD scores in the context of FP rates may yield a more thorough assessment of recognition memory, particularly in individuals with suspected AD.

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**L. HIZEL, E. WARNER, S.C. EVANS, C. CATANIA, S.J. CROWLEY, N. SCHWAB, S. LEVY, J.J. TANNER & C. PRICE. Contribution of Organization to ROCF Recall in Idiopathic Parkinson's Disease Beyond Processing Speed and Motor Abilities.**

**Objective:** The Rey-Osterrieth Complex Figure (ROCF) is administered clinically to assess learning and memory for complex visual information. Yet the task requires organization, in that better organization contributes to better delay recall. For Parkinson's disease (PD), it is unknown if organizational ability is unique from that of the motor and processing speed components. After controlling for age and education, we examined

the relative contribution of motor performance, processing speed, and ROCF copy organizational ability on delay recall.

**Participants and Methods:** Non-demented individuals with idiopathic PD (N=58), Hoehn and Yahr of 1-3, and controls (N=42) completed the ROCF as well as measures of processing speed (WAIS-III Processing Speed Index) and motor measures [Unified Parkinson's disease Rating Scale (UPDRS); Finger Tapping]. The ROCF was assessed for organization from the copy condition flowchart using Savage (1999) criteria.

**Results:** Individuals with PD scored an average of 10 points lower for the ROCF Delay ( $p < 0.01$ ) relative to their non-PD peers. Mean UPDRS- Motor score for the PD sample was approximately 19. Hierarchical linear regression models controlling for age and education were used to predict ROCF Delay. Significant predictors for the PD sample included education ( $p < .05$ ), PSI ( $p < .05$ ), and organization ( $p < .01$ ). Overall model explained 29% of the variance. The model predicting non-PD peers found only organization ( $p < .01$ ) to be a significant predictor of ROCF recall.

**Conclusions:** ROCF copy organization, while important for recall in PD and non-PD samples, is particularly predictive beyond previously found predictors such as processing speed and motor abilities. Future research might investigate other top-down processes similar to organization as they may have significant unique association to recall of individuals with PD.

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**E.J. KELLOGG, D. HERGERT, P.L. JOHNSON & C. CIMINO. Associations Among a Task of Prospective Memory, Executive Functions, and Impulsivity within a Non-Clinical Sample.**

**Objective:** Prospective memory (PM) or "remembering to remember" has previously been studied within the context of Executive Functioning (EF). Deficits in PM are associated with impaired executive functioning in clinical populations (e.g., HIV, substance users). More recently, the relationship between PM and Impulsivity has been investigated in non-clinical samples. This study builds upon previous research and investigates the relationships among PM, EF, and Impulsivity in a non-clinical sample.

**Participants and Methods:** Undergraduates (N = 109; Females = 79) completed a Complex Prospective Memory Task including Time and Event based cues, three tasks of EF: Mazes (planning), Stroop (inhibition), and Trail Making Task (switching), and the Impulsivity scale UPPS-P (i.e., Negative Urgency, Perseverance, Premeditation, Sensation Seeking, and Positive Urgency). Correlational analyses were used to examine the associations among constructs.

**Results:** One notable significant correlation was found between PM and EF, which was between the composite Time-based cue and Mazes ( $r = .210$ ,  $p = .028$ ). Significant correlations between the subscales of the UPPS-P and PM included, Negative Urgency and Time-based cue ( $r = .197$ ,  $p = .040$ ) and Positive Urgency and Time-based cue ( $r = .232$ ,  $p = .016$ ). The correlation between Positive Urgency and Event-based cue was negatively trending ( $r = -.194$ ,  $p = .060$ ). Lastly, Perseverance (Impulsivity) was significantly negatively correlated with Stroop (EF) ( $r = -.216$ ,  $p = .026$ ).

**Conclusions:** Negative and Positive Urgency were the two subscales of the UPPS-P found to be correlated with the PM task. Of the three EF tasks, only the planning measure, Mazes, was significantly correlated with PM. Perseverance, a component of Impulsivity was negatively associated with the Stroop task. Results suggest that even within a non-clinical sample, associations are found among the three variables.

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**L.E. KORTHAUER, N.T. NOWAK, M. FRAHMAND & I. DRISCOLL. Contributions of Executive Functioning to Spatial Navigation Performance.**

**Objective:** To identify associations between executive functioning and performance on a spatial navigation task.

**Participants and Methods:** Fifty-six college-aged adults (9 males, 47 females; M age = 22.9) completed a spatial navigation task and brief neuropsychological battery. The virtual Morris Water Task (vMWT), a computerized, translational version of the classic paradigm used to investigate place learning and memory in rodents, was used to assess spatial navigation abilities. The vMWT requires participants to search a large pool to find a hidden escape platform; proximal and distal environmental cues are available to aid navigation. Lower time to find the hidden platform, fewer path intersections, and lower percentage of search path that was retraced are measures of more effective navigation. Neuropsychological tests included the Mental Rotations Task (MRT) and the Delis-Kaplan Executive Function System (D-KEFS) Tower, Verbal Fluency, and Color-Word Interference subtests.

**Results:** Worse performance on vMWT was associated with worse executive function: 1) longer latency to locate the platform was associated with lower performance on tests of category switching and color-word interference ( $p$ 's  $< .05$ ); 2) higher path retrace was associated with lower category fluency and category switching ( $p$ 's  $< .05$ ). There was a non-significant trend for an association between more vMWT path intersections and a higher percentage of errors on the MRT ( $p = .1$ ).

**Conclusions:** Prior research has focused on associations between spatial navigation performance and neuropsychological tests of memory and visuospatial abilities. This study highlights the role of executive resources (e.g., planning, monitoring, set switching) in preparing, selecting, and employing effective search strategies to efficiently navigate a virtual environment. Given that executive functioning declines during aging, these findings may inform future investigations of age-related differences in spatial navigation.

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**S.W. LARSON, J.M. CONSTANCE & M.Y. KIBBY. How does having Comorbid ADHD affect Memory Deficits in Children with Reading Disorders?**

**Objective:** Prior research suggests children with Reading Disorders (RD) have poor verbal STM, intact visual STM (when material cannot be verbally coded), and intact LTM for both modalities (when controlling for initial encoding). Children with ADHD have poor visual-spatial STM, but the rest of STM and LTM may be intact.

**Participants and Methods:** Data were collected as part of larger, NIH/NICHD-funded studies (R03 HD048752, R15 HD065627). Children, ages 8 to 12 years, with RD (N=38), RD/ADHD (N=40) or typically developing controls (N=70) were administered select subtests from the Children's Memory Scale (CMS) including Dot Locations, Stories, and Word Lists. Children with auditory processing, language, or other psychiatric or neurological disorders were excluded.

**Results:** Transformations were performed on Dot Locations-Immediate Recall and Word Lists-Delayed Recognition to remove skewed distributions. MANOVA was used to test STM and LTM performance as a function of diagnostic group. Results were significant for all three modalities: STM – Wilks'  $\Lambda = .717$ ,  $F(6,280) = 8.453$ ,  $p < .001$ ; LTM – Wilks'  $\Lambda = .754$ ,  $F(6,278) = 7.011$ ,  $p < .001$ ; Recognition – Wilks'  $\Lambda = .764$ ,  $F(4,278) = 9.996$ ,  $p < .001$ . In all cases the RD and RD/ADHD groups performed worse than controls but comparably to each other. Nonetheless, scores on semantic and visual measures were Average.

Linear regressions were run predicting delayed recall performance from STM scores, and then a MANOVA was utilized on the residuals. When controlling for initial encoding, there was no difference in delayed recall between groups, Wilks'  $\Lambda = .999$ ,  $F(5,268) = .013$ ,  $p = 1.00$ . Univariate analyses revealed similar findings ( $ps > .980$ ).

**Conclusions:** Our findings support previous work noting worse rote verbal STM in RD and RD/ADHD, however, this deficit appears specific to RD. LTM was intact when controlling for initial encoding. Further research is needed to determine why some children with ADHD have visual-spatial STM deficits and some with RD/ADHD do not.

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**S. MARKOWSKI, A. ALKOZEI & W.D. KILLGORE. Greater Neuroticism Predicts Higher Performance in Immediate Memory, Language, and Attention in Healthy Individuals.**

**Objective:** Individuals high in the trait of neuroticism tend to experience high levels of anxiety and negative emotion. Recent studies have suggested that self-report measures of traits like neuroticism are associated with some aspects of neurocognitive performance but not others, but their specificity is still poorly understood. Here we examined the association between the trait of neuroticism and performance on a widely used measure of neuropsychological functioning, the Repeatable Battery for the Assessment of Neuropsychological Status Update (RBANS), in a healthy sample.

**Participants and Methods:** Forty-six healthy individuals (females=23, M age = 25, range = 20-43) completed the NEO Personality Inventory, Revised (NEO PI-R), and the RBANS. Stepwise and backward multiple regression analyses were used to examine the relationships between neuroticism and neurocognitive performance on the RBANS.

**Results:** Neuroticism showed a positive association with total RBANS scores, accounted for 23% of the variance ( $R^2 = .231$ ,  $p = .001$ ). Furthermore, higher levels of neuroticism were found to be significantly positively correlated with Immediate memory ( $R^2 = .274$ ,  $p < .001$ ), Language ( $R^2 = .179$ ,  $p = .004$ ), and Attention ( $R^2 = .093$ ,  $p = .042$ ), but not Visuospatial/Constructional or delayed memory performances.

**Conclusions:** Higher scores on the trait of neuroticism were found to predict better cognitive performance on neuropsychological capacities requiring working memory, attention, and language skills. Prior work has suggested that neuroticism may correlate with some aspects of executive functioning, raising the possibility that this trait may be linked with systems regulated by the prefrontal cortex. Future work will need to examine how these associations may differ between healthy and clinical populations.

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**C.E. MUNRO, B. HANSEEUW, R.E. AMARIGLIO, A. SCHULTZ, G. MARSHALL, A. PASCUAL-LEONE, D.M. RENTZ, K.A. JOHNSON, R.A. SPERLING & P. VANNINI. Mapping the Metabolic Correlates of Subjective Memory Concerns in Cognitively Normal Elderly Individuals.**

**Objective:** Subjective memory concerns (SMC) are common in older adults (Jonker et al. 2000), despite performing well on objective memory tests. Whereas the pathophysiological correlates of objective memory impairment has been investigated in the clinical stages of Alzheimer's disease (AD), little is known about the pathological underpinnings of SMC. Here, we used resting state FDG-PET to map the metabolic correlates of SMC in a group of cognitively normal elderly subjects.

**Participants and Methods:** 283 elderly individuals (165 female; mean age 73.4 years; CDR=0) participated in the Harvard Aging Brain Study (Dagley et al. 2015). SMC were measured using the Memory Functioning Questionnaire (Gilewski et al., 1990), where a lower score reflects increased complaints. Whole-brain FDG-PET images were analyzed as standard uptake volume ratios, using cerebellum (gray matter only) as reference. Voxel-wise correlations between FDG-PET, SMC, and objective memory performance (Logical memory, Wechsler Memory scale (Wechsler, 1981)) were conducted controlling for age. A statistical

threshold of  $p < 0.005$  correcting for multiple comparisons using a cluster extent of  $k > 426$  voxels (FWE-correction) was applied.

**Results:** The exploratory analysis revealed that SMC correlated with decreased FDG metabolism in bilateral precuneus (PC), bilateral inferior parietal lobes, right inferior temporal lobe, right medial frontal gyrus, and the right orbitofrontal gyrus (OFG). No regional hypometabolism was observed when correlating objective memory performance with FDG-PET.

**Conclusions:** These results provide further evidence that increased memory concerns in older adults are related to functional changes within cortical regions involved in self-referential processes (e.g PC, OFG). In contrast, no changes were observed with objective memory performance, indicating that SMC may be an important early indicator of pathophysiological changes occurring before observable memory decline.

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**D.A. NATION, M.W. BONDI, E. GAYLES & D.C. DELIS. Cognitive Effects of High Altitude Exposure in Military Pilots and Aircrew.**

**Objective:** Cognitive dysfunction resulting from high altitude exposure is a major cause of civilian and military air disasters. Pilot training programs are designed to improve the recognition of signs and symptoms of moderate-to-high altitude exposure (8,000-20,000 ft) prior to the induction of severe cognitive and motor deficits that may result in the loss of aircraft control. Little is known regarding the nature of cognitive impairments manifesting within this critical altitude window where lifesaving measures may still be taken.

**Participants and Methods:** In a series of experiments, 9 to 17 military aircrew and pilots underwent neuropsychological testing before, during, and after exposure to high altitude environment in a pressure-controlled chamber. A modified version of the CVLT-2 was used to adapt testing to a pressure-controlled environment. The test consisted of two learning trials and delayed recall with written responses, followed by recognition testing. Paired t-tests were used to compare performance across experimental conditions.

**Results:** In our experiments, brief (~15 min) exposure to high altitude environment (20,000 ft) caused a rapid reduction in verbal learning (Trial 2,  $p < .001$ ) and memory ability (delayed recall,  $p < .001$ ) with relative preservation of auditory attention (Trial 1,  $p > .20$ ). Memory for the word list learned during exposure did not improve after a washout period at sea level conditions. Retrieval of word list memory learned shortly before exposure was also impaired during altitude exposure,  $p < .001$ .

**Conclusions:** These findings suggest that memory encoding and retrieval deficits may be rapidly induced upon high altitude exposure, despite relative preservation of basic auditory attention. Memory deficits could greatly impact lifesaving situational awareness and response, and may represent a major factor in determining survival of military aircrew and pilots.

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**J. NOVITSKI & M. SEIDENBERG. Relationship between Contextual Recall and Semantic Fluency Performance in Healthy Older Adults and Mild Cognitive Impairment.**

**Objective:** It is increasingly evident that the distinction between episodic and semantic memory is more aptly described as a continuum rather than a binary construct. The availability of specific personal contextual information in a memory recollection is considered to reflect the extent of engagement of episodic memory processes. We compared contextual recall for the first and last word produced by healthy control (HC) and Mild Cognitive Impairment (MCI) groups for three semantic categories: autobiographical, spatial, and non-episodic.

**Participants and Methods:** Forty-four participants, 27 healthy controls (mean age = 78, education = 15 years) and 17 individuals with MCI or mild Alzheimer's disease (mean age = 81, education = 15 years) were recruited for this study. Participants were given 60 seconds to generate items for each fluency, after which they were asked to provide personal contextual information for the first and last fluency item (e.g., "when/where/with whom were you when you last saw this animal?").

**Results:** The MCI group produced less contextual information than the HC group for all three semantic categories ( $p < 0.05$ ). However, both groups provided more contextual information for the first word than the last word. Increased number of items generated in the first, but not the last, 15-second fluency interval was associated with better performance on episodic memory measures. Also, increased contextual recall was associated with better performance on episodic memory measures (all  $p$ 's  $< 0.05$ ).

**Conclusions:** Contextual recall for items generated on semantic fluency measures is impaired in MCIs compared to cognitively intact healthy controls. The first fluency item elicited more contextual information than the last item, and fluency performance in the first 15-seconds correlated with episodic memory performance. These findings suggest that episodic memory processes may be more engaged in the initial search and retrieval involved in generating words for semantic fluency measures.

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**C. QUINN, M. TOLEA, S. KARANTZOULIS & J. GALVIN. Association of motor function and cognitive performance in a sample of older adults with and without Parkinson's disease.**

**Objective:** Although motor impairment is associated with cognitive decline, it is unclear whether extrapyramidal motor movements or pyramidal motor movements are a better predictor of such decline. This study assessed the cross-sectional association of motor function (extrapyramidal vs. pyramidal) to cognitive performance.

**Participants and Methods:** This study focused on the characterization of memory impairment in older adults (aged 60 and above) with and without Parkinson's disease (PD). Participants were recruited from NYU Langone Medical Center registries and the community. The sample included 10 individuals with mild cognitive impairment, 20 with PD and no cognitive impairment, 18 with PD and cognitive impairment, 30 healthy controls. Extrapyramidal functioning was assessed using the Unified Parkinson's Disease Rating Scale (UPDRS) and pyramidal motor functioning was assessed using a timed walk of 50 feet. The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) was used to assess cognition. A general linear model was conducted adjusting for age, gender, race, education, PD diagnosis, health, depression.

**Results:** Results revealed an inverse relationship between the RBANS list total raw score and both UPDRS score ( $p .029$ ) and walking time ( $p .018$ ), with a larger effect size for the UPDRS ( $-.856$  vs.  $-.520$ ). An inverse relationship was observed between walking time and RBANS immediate memory index score ( $p .037$ ).

**Conclusions:** Extrapyramidal and pyramidal motor impairment are associated with verbal memory decline, with a larger association for extrapyramidal motor movements. This may indicate that involuntary motor impairment associated with basal ganglia function is a stronger indicator of future cognitive impairment than voluntary motor movement associated with corticospinal tract function. Findings may aid researchers to better understand the relationship between subcortical nuclei and cognitive-motor functioning and assist clinicians to better identify patients in the early or presymptomatic stage.

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**S. RASKIN, M. RACE & E. AISENBERG. Psychometric Properties of the Memory for Intentions Test-Short Form.**

**Objective:** The Memory for Intentions Screening Test (MIST) has proven to be a useful clinical tool in a wide variety of populations as a measure of prospective memory (PM). However, it can be too lengthy for many standard clinical assessments. Therefore, the MIST-SF was created to allow for a briefer screening measure.

**Participants and Methods:** A total of 25 individuals were administered the MIST-SF. They were 14 female and 11 male. Ages ranged from 18 to 70 (mean=33.56, s.d.=18.53). Education ranged in years from 11-25 years (mean=16.16, s.d.=3.06). All participants agreed to participate with a consent form approved by the Trinity Institutional Review Board. All participants were administered the MIST-SF with a background questionnaire as the ongoing task. Total testing time for the MIST-SF was 18 minutes. The MIST-SF has a total of four items. Two are time-based and two are event-based. Two have a delay period of 2 minutes and two have a delay period of 15 minutes. There are also two 24 hour delay items, one time-based and one event-based. Each of the items is taken from the original MIST.

**Results:** The MIST-SF was successfully administered to a group of healthy participants with no floor or ceiling effects. Mean total score was 22.20 (s.d.=2.27) out of a possible 24. The reliability of the MIST-SF in terms of internal consistency was sufficient when analyzing the individual MIST-SF trials (Chronbach's alpha= 0.90), as was split-half reliability (split-half reliability = 0.86). Given that the items are taken directly from the MIST, which has already shown high validity, this was not evaluated.

**Conclusions:** A variety of potential neuropsychological measures were tried in the delay period but only self-report questionnaires proved to be useable. Using a background information questionnaire or a prospective memory questionnaire in the delay period were both effective. The MIST-SF appears to be a valid and reliable measure of PM. Further testing with people who have neurological disorders will help to determine its specificity.

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**C. PEDRO, E. AISENBERG, T. BLOOMQUIST, N. KAUR & S. RASKIN. Use of Electrophysiological and Clinical Measures of Prospective Memory in individuals with Mild and Severe Brain Injury.**

**Objective:** Prospective memory (PM) is a frequent sequelae of brain injury (BI) and can have significant impact on daily living. This study tested the hypothesis that individuals with severe and mild BI would demonstrate deficits in PM on a clinical measure and would show reduction in amplitude of markers of PM on an ERP task.

**Participants and Methods:** All participants were undergraduate students. Ten healthy adults (HA), 5 severe BI (SBI) and 14 mild BI (MBI) still experiencing symptoms. All were between 18-23 years of age and 12-18 years of education. All participants were given the Memory for Intentions Screening Test (MIST) and ERP paradigm patterned after West and Munroe (2002). This was an ongoing semantic category judgment with PM trials interspersed. Electrophysiological recording took place with a 32 channel Electro-cap and a Synamps amplifier.

**Results:** MIST total score demonstrated a significant difference between the HA and the SBI group such that the SBI group performed significantly more poorly. The group with MBI did not differ from the other two groups. The same pattern was demonstrated on MIST PM errors. On the computerized measure PM accuracy the MBI group was significantly different from the other groups with a score that fell in between them. On the electrophysiological measures there were significant differences between all three groups on the N300 waveform with the MBI group showing the greatest negative amplitude. The LPC showed significant differences between the groups only for ongoing trials and realized intentions but not for unrealized intentions. There were no differences between the groups for formation slow wave.

**Conclusions:** The MIST was designed as a clinical measure of PM and may not be sensitive enough to deficits after MBI, as indicated by the computerized measure. It is interesting that the MBI group showed deficits in successful PM remembering but also greater activation of N300. This may suggest that greater activation is required to form an intention. Correspondence: Sarah Raskin, Ph.D., Psychology, Trinity College, 300 Summit Street, Hartford, CT 06119. E-mail: sarah.raskin@trincoll.edu

**K.S. TALBOT, U. MÜLLER & K.A. KERN. Investigating General Time-Based Prospective Memory in Children Using a Novel Naturalistic Paradigm.**

**Objective:** Prospective memory (PM) is essential for successful daily functioning, yet few researchers have examined PM in a naturalistic way especially in children. The current study aimed to understand a particular form of PM, general time-based prospective memory (TBPM), in children using a novel naturalistic paradigm. General TBPM is a memory for action that is carried out within a general time frame (e.g. sometime Monday). The study also aimed to add to the current PM literature by including an analysis of the circumstances surrounding prospective remembering.

**Participants and Methods:** Twenty-nine children (aged 7-13) completed the two part study. First, children completed the WASI-II, a lab-based PM measure (MISTY), and two working memory (WM) measures. Parents also completed a parent-report questionnaire of their child's everyday PM and RM failures (PRMQC). Next, children completed a novel TBPM task with their parents on 6 'target days'.

**Results:** General TBPM did not significantly relate to the PRMQC, the overall scores on the MISTY, or MISTY TBPM subscores. WM was found to significantly relate to both MISTY-PM [ $r = .614$ ,  $p < .001$ ] and MISTY-TBPM [ $r = .620$ ,  $p < .001$ ], but not to general TBPM [ $r = -.142$ ,  $p > .05$ ], though controlling for age resulted in non-significant correlations between WM and the PM measures. Additionally, the psychometric properties of the PM measures will be discussed. Finally, when children remembered the general TBPM tasks, they often did so spontaneously (70%). However, when they forgot, most often it was because they were 'too busy' (47%).

**Conclusions:** The current findings provide preliminary support for the importance of investigating general TBPM in a naturalistic setting. More research is needed to properly evaluate the ecological validity of this novel general TBPM paradigm. Finally, it is believed that the inclusion of qualitative measures assessing the context of PM retrieval has important implications for the effective development of future interventions for children with PM difficulties.

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**M.A. TEAFORD, B. KOTOWSKI, H.E. HOUSTON & A.M. POREH. Convergent Validity of the Poreh Nonverbal Memory Test.**

**Objective:** The present study examined performance on a new measure of nonverbal memory called the Poreh Nonverbal Memory Test. The Poreh Nonverbal Memory Test is a computerized test which requires participants to click on boxes in 9 different geometric designs in search of a red square. When found the participants are supposed to try to remember the location of the red square. Participants are presented with the geometric designs 5 times and then once more after a 30 minute delay. The objective of the present study was to establish the convergent validity of the Poreh Nonverbal Memory Test by comparing results to results on the Biber Figure Learning Test using correlational analysis. It was expected that a significant negative correlation would be found.

**Participants and Methods:** 60 Participants (33 female) were recruited from the North East Ohio area. The age of participants ranged from 18-78. Participants' years of education ranged from 11-22 years. Two participants were eliminated because of lack of effort. Participants were administered the Poreh Nonverbal Memory Test and the Biber Figure Learning Test in a pseudorandom order.

**Results:** A correlational analysis was performed on all trial scores of the Poreh Nonverbal Memory Test and the Biber Figure Learning Test as well as the overall test scores. It was found that trials 2, 3 and 4 correlate at the  $p=.05$  level. Total test scores correlated significantly,  $r=-.415$ ,  $p<.001$ . It was also found that the Poreh Nonverbal Memory Test simple (symmetrical) designs learning score correlated with the Biber Figure Learning Test total score  $r=-.410$ ,  $p<.001$ .

**Conclusions:** The results of the present study suggest that the Poreh Nonverbal Memory Test is a good measure of nonverbal learning. The fact the simple design learning sub-score correlates with the Biber Figure Learning total score suggests that the simple designs are easily verbally mediated. Future studies need to compare performance on the Poreh Nonverbal Memory Test to performance on other tests of nonverbal memory.

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## HIV/AIDS/Infectious Disease

**M. GAMEZ, M. SARNO, A. ACEVEDO & R. OWNBY. Composite Scores Increase Detection of Neurocognitive Impairment in the HIV-Positive Native Spanish-Speaking Older Adult: A Pilot Study.**

**Objective:** The rate of HIV/AIDS in Hispanic elders is five times higher than that of their non-Hispanic Caucasian peers. Despite the introduction of highly active antiretroviral therapy (HAART), this overrepresentation and greater disease burden calls for examination of the combined neurocognitive effects of HIV infection plus aging in this group. This study examined whether older HIV+ native Spanish speakers exhibit lower performance than their HIV- peers on five composite scores (2-4 measures per domain): verbal fluency, learning/memory, executive functioning/working memory, psychomotor functioning, and cognitive processing speed.

**Participants and Methods:** A neuropsychological battery was administered to 52 native Spanish speakers (27 HIV+; 25 HIV-) from 12 Latin American countries, ages 50-74 ( $M=58.19\pm6.4$ ), with 2-18 years of education ( $M=12.69\pm3.7$ ). The HIV+ sample reported minimum HAART adherence of one year and 67% of the sample had an undetectable viral load. Exclusion criteria included preexisting neurological conditions and significant substance use history. ANCOVAs were conducted with age and education as covariates.

**Results:** The HIV+ group evidenced significant impairments on several composite scores as compared to controls. Psychomotor Functioning, Cognitive Processing Speed, and Executive Functioning/Working Memory domains evidenced significant group effects,  $F(1, 51)=6.79$ ,  $p=.013$ ,  $F(1, 51)=6.39$ ,  $p=.015$ , and  $F(1, 51)=5.02$ ,  $p=.031$ , respectively.

**Conclusions:** Three of five composite scores show robust evidence of neurocognitive impairment in the HIV+ sample. The findings are partially discrepant from those found in HIV+ English-speaking Caucasian older adults. This study provides implications for test sensitivity and selection in detecting subtle HIV-associated neurocognitive deficits among understudied native Spanish-speaking older HIV+ Hispanics.

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**M. SARNO, M. GAMEZ, A. ACEVEDO & R. OWNBY. Neuropsychological Profile of HIV-positive Spanish-speaking Hispanic Older Adults.**

**Objective:** The rate of HIV/AIDS in Hispanic elders is five times higher than that of their non-Hispanic Caucasian peers. Highly active antiretroviral therapy (HAART) has reduced the prevalence of HIV-associated dementia, but the occurrence of milder neurocognitive deficits remains high. This study examined whether older HIV+ Spanish-speaking Hispanics reporting HAART adherence of one year or more exhibit lower

performance than their HIV- peers on measures of attention, memory, executive functioning, psychomotor speed, and information processing speed.

**Participants and Methods:** A multi-domain neuropsychological battery was administered in Spanish to 52 Spanish-dominant Hispanics (27 HIV+, 25 HIV-), ages 50-74 ( $M=58.19\pm6.4$ ), with 2-18 years of education ( $M=12.69\pm3.7$ ), and 52% females. In the HIV+ sample, CD4 count ranged from 228-1741 ( $M=726.21\pm403.0$ ), with undetectable viral load in 67% of the sample. Exclusion criteria included preexisting neurological conditions, head injury with loss of consciousness, and significant substance use history. ANCOVAs were conducted with age and education as covariates.

**Results:** The Stroop Color Word Test (SCWT) evidenced a significant group effect on Color/Word performance  $F(1, 51)=12.72, p=.001$ . The HIV+ group evidenced significant impairments on Color, Word, and Color/Word Interference trials as compared to controls. Regarding psychomotor speed, the Finger Tapping Test (FTT) with both the Dominant and Non-Dominant hand evidenced a significant group effect,  $F(1, 51)=6.81, p=.013$  and  $F(1, 51)=14.83, p<.0001$ , respectively.

**Conclusions:** The SCWT and FTT produced the most robust evidence of neurocognitive impairment in the HIV+ sample, suggesting affected executive functioning and psychomotor speed. The findings are partially discrepant from those found in English-speaking Caucasian older adults. This study provides preliminary evidence that these brief measures may assist in detecting subtle HIV-associated neurocognitive deficits among understudied Spanish-dominant HIV+ Hispanic older adults.

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## Poster Symposium 1. Predicting Postsurgical Outcome Using Neuroimaging Markers in Temporal Lobe Epilepsy

Organizer: Karol Osipowicz

3:00–4:15 p.m.

### Epilepsy/Seizures

#### K. OSIPOWICZ & J.I. TRACY. Predicting postsurgical outcome using Neuroimaging Markers in Temporal Lobe Epilepsy.

**Symposium Description:** The proposed symposium includes three presentations that examine the ability of neuroimaging biomarkers to predict cognitive and seizure outcome following resective surgery for intractable temporal lobe epilepsy. Predicting cognitive and seizure outcomes following resective brain surgery is a critically important clinical goal. Such work also has the potential to greatly increase our understanding of brain plasticity responses, cognitive reorganization, and factors predictive of cognitive recovery after brain injury or disease. Although neuroimaging in epilepsy is heavily reliant on structural imaging, advances in multi-modal imaging techniques have opened up a wealth of biomarkers that are, as of yet, untested. Here, we discuss the use of advanced MRI analyses, including task-BOLD, resting-state, and diffusion to predict both cognitive and seizure outcomes following resective surgery, a technique which shows good short term, but much less impressive long term, outcomes. More specifically, we will present data demonstrating the use of graph-theory resting state analyses for the prediction of cognitive outcomes; volumetric analyses of gray matter used to predict seizure outcomes; and a study integrating fMRI, resting state, and DTI to predict cognitive outcome. Each presentation will cover the specific methods applied and results for each major analysis.

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#### J.I. TRACY. Frontal Gray Matter Abnormalities Predict Seizure Outcome in Refractory Temporal lobe Epilepsy Patients.

We investigated patients with refractory TLE before and after temporal resection. We explored gray matter (GM) volume change in relation with seizure outcome, using a voxel-based morphometry (VBM) approach. To do so, this study was divided in two parts. The first one involved group analysis of differences in regional GM volume between the groups (good outcome (GO), e.g. no seizures after surgery; poor outcome (PO), e.g. persistent postoperative seizures), controls,  $N=24$  in each group), pre and post-surgery. The second part of the study focused on pre-surgical data only ( $N=61$ ), determining whether the degree of GM abnormalities can predict surgical outcomes. For this second step, GM abnormalities were identified, within each lobe, in each patient when compared with an ad hoc sample of age-matched controls. For the first analysis, the results showed larger GM atrophy, mostly in the frontal lobe, in PO patients, relative to both GO patients and controls, pre-surgery. When comparing pre-to-post changes, we found relative GM gains in the GO but not in the PO patients, mostly in the non-resected hemisphere. For the second analysis, only the frontal lobe displayed reliable prediction of seizure outcome. 81% of the patients showing pre-surgical increased GM volume in the frontal lobe became seizure free, post-surgery; while 77% of the patients with pre-surgical reduced frontal GM volume had refractory seizures, post-surgery. A regression analysis revealed that the proportion of voxels with reduced frontal GM volume was a significant predictor of seizure outcome ( $p=0.014$ ). Importantly, having less than 1% of the frontal voxels with GM atrophy increased the likelihood of being seizure-free, post-surgery, by seven times. Overall, our results suggest that using pre-surgical GM abnormalities within the frontal lobe is a reliable predictor of seizure outcome post-surgery in TLE.

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#### J.I. TRACY. Pre-Surgery Resting-State local Graph-Theory measures predict Neurocognitive Outcomes after Brain Surgery in Temporal Lobe Epilepsy.

This study determined the ability of resting-state functional connectivity (rsFC) graph-theory measures to predict neurocognitive status post-surgery in temporal lobe epilepsy (TLE) patients who underwent an anterior temporal lobectomy (ATL). A pre-surgical imaging was collected in 16 left and 16 right TLE patients that underwent an ATL. Also, patients received neuropsychological testing pre- and post-surgery in verbal and non-verbal episodic memory, language, working memory, and attention domains. We investigated three graph-theory properties (local efficiency, distance, participation), measuring segregation, integration and centrality, respectively. These measures were only computed in regions of functional relevance to the ictal pathology, or the cognitive domain. Linear regression analyses were computed to predict the change in each neurocognitive domain. Our analyses revealed that cognitive outcome was successfully predicted with at least 68% of the variance explained in each model, for both TLE groups. The only model not significantly predictive involved non-verbal episodic memory outcome in right TLE. Measures involving the healthy hippocampus were the most common among the predictors, suggesting enhanced integration of this structure with the rest of the brain may improve cognitive outcomes. Regardless of TLE group, left inferior frontal regions were the best predictors of language outcome. Working memory outcome was mostly predicted by right-sided regions, in both groups. Overall, the results indicated our integration measure was the most predictive of neurocognitive outcome. In contrast, our segregation measure was the least predictive. This study provides evidence that pre-surgery rsFC measures may help determine neurocognitive outcomes following ATL. The results are encouraging



with regard to the clinical relevance of using graph-theory measures in pre-surgical algorithms in the setting of TLE.

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**K. OSIPOWICZ. fMRI, Resting State, and DTI Predict Verbal Fluency Outcome Following Resective Surgery for Temporal Lobe Epilepsy.**

Predicting cognitive function following resective surgery remains an important clinical goal. Each MRI neuroimaging techniques can potentially provide unique and distinct insight into changes that occur in the structural or functional organization of “at risk” cognitive functions. We test for the singular and combined power of three imaging techniques (functional magnetic resonance imaging, resting state functional magnetic resonance imaging, diffusion tensor imaging) to predict cognitive outcome following left (dominant) anterior temporal lobectomy for intractable epilepsy. We accomplish this by calculating the degree of deviation from normal, determine the rate of change in this measure across the pre and postsurgical imaging sessions, and then compare these measures for their ability to predict verbal fluency changes following surgery. Our data shows that the three neuroimaging techniques, in a combined model, can reliably predict cognitive outcome following anterior temporal lobectomy for medically intractable temporal lobe epilepsy. These findings suggest that these three imaging modalities can be used effectively, in an additive fashion, to predict functional reorganization and cognitive outcome following anterior temporal lobectomy. Correspondence: *Karol Osipowicz, Ph.D., 3141 Chestnut St, 204 Stratton Hall, Philadelphia, PA 19104. E-mail: kzo22@drexel.edu*

**Plenary A. The Human Brain Connectome and Cognitive and Affective Function: Normal Individual Variability, Aging, and Neurodegeneration**

**Presenter: Brad Dickerson**

**4:30–5:30 p.m.**

**B. DICKERSON. The Human Brain Connectome and Cognitive and Affective Function: Normal Individual Variability, Aging, and Neurodegeneration.**

Modern neuroimaging techniques are providing revolutionary insights into the human brain connectome. We are now able to study—in living people—large-scale brain networks predicted from non-human primate tract tracing investigations and lesion neuropsychology. I will review knowledge of the localization and function of brain networks in the healthy brain, and evidence that measures of these networks illuminate individual differences in cognition, affect, and sensorimotor function. The modulation of network connectivity in relation to task performance, pharmacologic manipulation, or brain stimulation is providing new insights into neuroplasticity. Age-related cognitive decline may be explained in part by a “compromised connectome”; older adults lucky enough to be “superagers”—with youthful cognitive function—have preserved anatomy in key nodes of large-scale cognitive-affective brain networks. Patients with neurodegenerative diseases develop disconnection, dysfunction, and atrophy within brain networks subserving cognitive, affective, and sensorimotor function related to symptoms of their illness. Neurodegenerative diseases appear to progress in part by following the pathways of the brain’s connectome.

**Learning Objectives**

As a result of attending this lecture, the participant will increase their knowledge of:

Healthy human brain networks subserving normal brain function, and impaired network connectomics in aging and neurodegenerative disease. Correspondence: *Brad Dickerson, MD, Neurology, Harvard Medical School, Gerontology Research Unit, Charlestown, MA 02129. E-mail: Brad.dickerson@mgh.harvard.edu*

**THURSDAY MORNING, FEBRUARY 4, 2016**

**CE 7. Chemical Exposures and the Nervous System: Clinical Findings and Research Evidence**

**Presenter: Roberta F. White**

**7:20–8:50 a.m.**

**R.F. WHITE. Chemical Exposures and the Nervous System: Clinical Findings and Research Evidence.**

Effects of exposures to substances with neurotoxic properties such as heavy metals, organic solvents, pesticides/insecticides, and carbon monoxide include behavioral and neuroimaging changes that can be characterized both clinically and in epidemiologic research using neuropsychological and neuroimaging methods. The field of inquiry on these effects is broadly known as behavioral toxicology and has advanced significantly in the past 30 years. This workshop will briefly review classes of known neurotoxicants and typical sources of exposure to them. It will describe the methods by which particular substances become identified as neurotoxic. Strategies for clinical assessment and for research investigations of exposure effects will be outlined. Research and clinical examples will be provided, with a focus on metals and gases. The limitations of clinical and research applications of neuropsychological

and neuroimaging methods will be explored, and current challenges and future directions in the field of behavioral toxicology will be described.

**Learning Objectives**

The workshop will allow the learner to:

Name classes of neurotoxic substances, including specific examples of them,

Understand strategies for clinical evaluation of patients with putative exposures to neurotoxicants, including a clinical diagnostic system for toxicant-induced disorders, and

Critically evaluate research literature on the neurotoxicity of chemicals in humans.

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## CE 8. Mild Cognitive Impairment and Preclinical Alzheimer's Disease: Concepts in Need of Input from Neuropsychology

Presenter: Mark W. Bondi

7:20–8:50 a.m.

### M.W. BONDI. Mild Cognitive Impairment and Preclinical Alzheimer's Disease: Concepts in Need of Input from Neuropsychology.

This workshop will present updated diagnostic criteria, with a focus on the neuropsychological features of mild cognitive impairment (MCI) and preclinical Alzheimer's disease (AD), in the context of the pathogenesis of AD. Seeking to refine diagnostic and prediction models, in a series of studies we have compared the conventional criteria, for example as operationalized by the Alzheimer's Disease Neuroimaging Initiative (ADNI), and our actuarial neuropsychological method. Results from these studies suggest that conventional criteria are susceptible to both false positive and false negative diagnostic errors, whereas MCI participants diagnosed via neuropsychological criteria yield dissociable cognitive phenotypes, significant biomarker associations, more stable diagnoses, and greater percentages who progress to dementia than conventional MCI diagnostic criteria. We further extend this actuarial method to support refinement of the research criteria for preclinical AD diagnosis. This workshop reflects the research and clinical advances in identifying MCI, examining its biomarker signatures, and offers new opportunities for diagnosis, prevention, and treatment of AD in its prodromal period.

#### Learning Objectives

As a result of participation in this course, the learner will achieve the following objectives:

Examine the relative value of biomarkers and cognitive measures to diagnosis, and

Examine their roles in prediction of progression along the aging-MCI-AD continuum.

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## Poster Session 2. ABI (Child), ADHD/Attention, Autism, and Learning Disabilities/Academic Skills

9:00–10:30 a.m.

### Acquired Brain Injury (TBI/ Cerebrovascular Injury & Disease - Child)

#### K. ARES, J. KAYLEGIAN, L. KAIS & S. HUNTER. Homeless Youths' Self-Reported Executive Functioning as Mediated by Traumatic Brain Injury Severity.

**Objective:** Traumatic brain injuries (TBI) are a frequent occurrence among homeless youths, believed to be due to their risk for impulsivity and poorer decision making (Gustafson, et al. 2013). Temperamental negative affectivity (NA) has been shown to contribute to increased risk for physical injury, including TBI (Corrigan, et al., 2010), and youths who are homeless show greater levels of NA (Ares, et al. 2014). The current study sought to examine whether severity of traumatic brain injury mediates the relationship between homeless youths' temperament and self-reported executive functioning

**Participants and Methods:** A total of 93 homeless youths (50 females, 18-22 years of age, 71% African American), residing in two shelters in Chicago, were divided into TBI severity groups.

**Results:** Analyses examined the relationship between NA, EF as assessed by BRIEF factor scores, and TBI. The overall regression for the BRIEF Behavioral Regulation Index (BRI) was significant ( $R^2=.133$ ,

$F(3, 84)=4.136$ ,  $p=.009$ ), indicating that the relationship between NA and BRI may change depending on the level of head injury severity. Levels of NA were also found to significantly predict Metacognitive Index scores, as did severity of TBI, and the interaction was significant ( $b=.157$ ,  $p=.037$ ). The overall BRIEF GEC regression was also significant ( $R^2=.147$ ,  $F(3, 84)=4.640$ ,  $p=.005$ ), with NA significantly predicting GEC scores and TBI severity. The relationship between temperament and global EF in homeless youths is strongly mediated by the severity of head injury historically experienced. For the no TBI and mild TBI groups, results revealed that higher NA scores were accompanied by greater executive dysfunction. However, for severe TBI, as NA increased, fewer difficulties with EF were reported.

**Conclusions:** Results are discussed with regard to strategies for supporting homeless youths with TBI.

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#### D.D. BOSENBARK, L. KRIVITZKY, R. ICHORD, L. JASTRZAB & L. BILLINGHURST. Attention and Executive Functioning Profiles in Children Following Perinatal Arterial Ischemic Stroke.

**Objective:** Prior research has documented a high incidence of Attention Deficit Hyperactivity Disorder (ADHD)—a disorder characterized by prominent impairments in attention and executive functioning (EF)—among children with a history of perinatal arterial ischemic stroke (PAIS), yet there has been no comprehensive investigation of the neuropsychological profile in these children. Clinical factors that may also contribute to outcomes in these domains are largely understudied in this population. We examined: 1) the neuropsychological profile of attention and EF; and 2) the influence of clinical factors on outcomes in these domains in children following PAIS.

**Participants and Methods:** Forty children born at term ( $\geq 37$  weeks) ages 3-16 (median age=7.2 years; 58% male) with PAIS underwent neuropsychological battery (WPPSI-IV/WASI-II, NEPSY-II, TEA-Ch, WMTB-C, TOL-Dx, TMT-A&B). Parents completed questionnaires (ADHD-IV, BRIEF) regarding real-world functioning. Demographic (age, sex) and clinical variables (lesion size, lesion location, presence of epilepsy) were collected.

**Results:** Although intellectual performance was in the normative range (mean = 94.38; SD = 15.90), it was statistically lower than FSIQ in the normative sample. Measures of attention, verbal fluency, inhibitory control, flexibility/shifting, planning/organizing, and processing speed were significantly lower in children with PAIS than in the normative sample (all  $p < 0.001$ ); working memory was not significantly different. The presence of comorbid epilepsy, larger lesion volume, and older age at time of testing influenced performance on several attention and EF measures, whereas sex, lesion location, and stroke laterality did not.

**Conclusions:** Children with PAIS evidenced significant attention and EF impairment in comparison to typically developing peers in the normative population. Children with comorbid epilepsy, larger stroke volume, and/or older age were at increased risk for deficits in these domains.

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#### L. KRIVITZKY, D.D. BOSENBARK, R. ICHORD, L. JASTRZAB & L. BILLINGHURST. Relationship Between Performance Testing and Parent Report of Attention and Executive Functioning Profiles in Children Following Perinatal Arterial Ischemic Stroke.

**Objective:** Children with perinatal arterial ischemic stroke (PAIS) have higher than expected rates of ADHD, a disorder characterized by weaknesses in attention and executive functioning (EF) skills. Research in other pediatric disorders has documented a low level of consistency between parent report of attention and EF skills and performance-based

measures. We aimed to compare these two data sources in children with PAIS.

**Participants and Methods:** Forty children born at term ( $\geq 37$  weeks) ages 3-16 (median age=7.2 years; 58% male) with PAIS underwent neuropsychological battery and composite scores were created for seven attention and EF domains (Processing Speed, Attention, Working Memory, Verbal Retrieval, Inhibitory Control, Flexibility/Shifting, Planning). Parents completed questionnaires (ADHD-IV, BRIEF) regarding real-world functioning. One-way ANOVAs, t-tests, and correlational analysis were used to compare parent report and performance measures.

**Results:** There were no significant differences in neuropsychological composite scores between ADHD-IV severity groups. Correlational analyses between parent report on the Global Executive Composite (GEC) Index of the BRIEF and the EF composite performance scores revealed significant negative correlations between the GEC and the Verbal Retrieval and Processing Speed composites but the remaining domains were nonsignificant.

**Conclusions:** While children with PAIS broadly have difficulties in attention and EF on both parent report and performance measures, few significant relationships were found when these two types of measures were directly compared. Reasons for the dissociation are not fully understood, but may have several explanations: measures may assess different aspects of the same underlying construct; performance-based tasks of EF may lack ecological validity; and parents may underestimate/underreport their child's deficits. Findings suggest that multiple sources of informant and performance data are needed to make more accurate conclusions about functioning in these domains.

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#### **E.M. BOUTZOUKAS, P.R. WORTS, K. STOWERS, H. MEJIA & S. BURKHART. Efficacy of Amantadine Treatment During the First Week Following Sports-Related Concussion.**

**Objective:** Amantadine is a dopaminergic NMDA Receptor Antagonist with possible N-methyl-D-aspartate effects and has been studied to address cognitive symptoms following concussion (Meythaler et al., 2002; Chew et al., 2009; Tenovuo et al., 2006; & Warden et al., 2009). Amantadine has shown efficacy as a safe and effective pharmacological treatment for specific cognitive deficits in athletes with protracted recovery over 3 weeks (Reddy et al., 2013). The purpose of the current study was to examine the safety and efficacy of Amantadine as pharmacological intervention during the first week of concussion treatment using a pilot study design.

**Participants and Methods:** The current study consisted of 20 (10 male, 10 female) adolescent participants divided into two equal groups based on gender while presenting for clinical evaluation following a confirmed sport-related concussion diagnosis. Participants ranged from 14-18 years old and were included in the current study if they presented at least one designated risk factor for potential prolonged recovery with borderline neurocognitive test performance. 10 athletes (5 male, 5 female) were randomly selected to trial Amantadine in the first week of recovery and 10 athletes (5 male, 5 female) were not provided any pharmacological intervention to serve as controls. Participants were matched on age, gender, and number of risk factors for prolonged recovery. All participants were tracked over time with total days from injury to date of return to sport, symptoms, and neurocognitive testing serving as an indicators for recovery.

**Results:** Participants administered Amantadine recovered an average of 10 days faster than matched controls and were significantly improved compared to matched controls at initial follow-up on both symptoms endorsed and neurocognitive test performance.

**Conclusions:** Results from the current pilot study suggest Amantadine may have support as a safe and effective pharmacological treatment for sports-related concussion during the first week of recovery.

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#### **E.M. BOUTZOUKAS, M. ZAYAT, G. SMITH, S. YEWALE, M.D. SADY & G.A. GIOIA. Relationship between School Concussion Policy and Symptoms, Self-Efficacy, and Supports.**

**Objective:** This study assessed how the presence/absence of a school concussion policy was related to aspects of recovery. We examined differences between those whose school did/did not have a policy for students recovering from a concussion in self-efficacy for managing concussion recovery, post-concussion concerns, and provision of academic supports.

**Participants and Methods:** Participants included 59 children (ages 6-18,  $M(SD) = 13.9(2.7)$ ; 53% male) who were evaluated in a specialty concussion clinic within 35 days of injury. Children and parents completed the Concussion Learning Assessment and School Survey (CLASS), Post-Concussion Symptom Inventory (PCSI), and Progressive Activities of Controlled Exertion Self-Efficacy (PACE-SE) scale.

**Results:** There were no significant differences between groups on symptom totals or number of school days missed ( $p > .05$ ). "Policy+" parents and students reported higher self-efficacy related to managing their concussion at school (parent  $p = .02$ , self  $p = .03$ ). Policy+ parents reported that academic performance was their primary concern (68%), while Policy- parents rated concerns with physical symptoms or sports as primary (57%), with similar findings in students' self-report ( $p < .05$ ). The policy+ group also reported receiving more post-concussion supports (e.g., extended time, reduced work; parent  $p < .001$ , self  $p = .02$ ).

**Conclusions:** Parents and students who report that their school has a policy to support students with concussion report similar injury burden at initial clinic visit (symptoms, amount of school missed), but higher self-efficacy related to recovery, more school-related concerns, and a higher number of concussion-related accommodations. While causality cannot be established, the results suggest that there is a relationship between having a school-wide policy and feeling confident/supported in one's recovery. Future research should investigate whether recovery time can be positively impacted when students are fully supported in their return to school following concussion.

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#### **A.R. BURNS, D. RANSOM, E. LONDON, B.E. STARK, C. CARTY, G.B. EPSTEIN, M.D. SADY & G.A. GIOIA. Ratings in cognitive exertion differ across neuropsychological measures following a concussion.**

**Objective:** To examine whether ratings of cognitive exertion following concussion differs across varying types of neuropsychological measures. Previous research indicates that taking neuropsychological tests generally does not increase symptoms in the absence of concussion. We posited that children with concussion who were administered the demanding Tasks of Executive Control (TEC) would report greater cognitive exertion as compared to those who were administered the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT)/Multimodal Assessment of Cognition and Symptoms (MACS) or paper and pencil measures.

**Participants and Methods:** 66 individuals (22 TEC, 22 ImPACT/MACS, 22 paper and pencil) who presented at a specialty concussion clinic (ages 5-18,  $M=12.53$ ; 61% male) were matched on age, sex, and days since injury ( $M=11.29$ ). Children rated symptoms of cognitive exertion before and after testing using the Cognitive Exertional Effects Rating Scale (CEERS), with the Exertional Effects Index (EEI) calculated as a metric of increasing symptoms.

**Results:** Individuals who were administered the TEC reported significantly higher EEIs compared to individuals administered ImPACT/MACS and paper and pencil measures ( $d=.69$ ,  $p=.03$  and  $d=.80$ ,  $p=.02$  respectively). Specifically, significantly greater increases in fatigue

and concentration problems were noted in subjects who completed the TEC, and greater increases in irritability were found in the TEC and ImPACT/MACS groups. No significant differences in headaches were found across groups.

**Conclusions:** Ratings of cognitive exertion should be interpreted within the context of a neuropsychological test, as the TEC tends to produce greater increases in symptoms following a concussion compared to other measures. Clinicians may also tailor their choice of assessment based in part on the symptom level of the individual and whether they would like to present a cognitive “challenge” to the patient.

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**A.R. BURNS, M. ZAYAT, D. SRIRAM & G.A. GIOIA. Reliability and validity of the Progressive Activities of Controlled Exertion- Self Efficacy (PACE-SE) scale: A novel measure assessing children’s self-efficacy following a concussion.**

**Objective:** To demonstrate the psychometric properties of a 17-item measure used to assess a child’s self-efficacy to maintain positive control during recovery following a concussion.

**Participants and Methods:** 50 children (ages 10-18) presenting for an initial visit at a specialty concussion clinic and 37 children returning for a follow-up visit completed the PACE-SE as part of their clinic evaluation (52% male and 43% female, mean age=14.00 and 14.11, respectively). A 17-item scale was developed to assess the child’s self-efficacy for coping with and managing their concussion (e.g., ‘I can control things in my life to allow my brain to heal’ and ‘I can find the right amount of activity that is not too little and not too much’). Items were rated on a 0-10 scale, with higher scores indicating greater confidence, and averaged to create an overall composite score.

**Results:** Composite scores ranged from 1.88 to 10, with a mean of 7.16 and a standard deviation of 1.69 at the initial visit. At the follow-up visit, mean ratings ranged from 3.71 to 10 with a mean of 7.55 and a standard deviation of 1.99. Internal consistency was strong at both time points ( $\alpha = .86$  &  $.93$ , respectively). Test-retest reliability was adequate ( $r = 0.66$ ) and change over time did not differ across gender, age, days since injury, or prior concussion history. PACE-SE scores were negatively correlated with symptom burden ( $r = -0.54$  for ages 13-18 and  $r = -0.69$  for ages 10-12) and executive functioning ( $r = -0.48$ ), demonstrating high construct validity.

**Conclusions:** Findings demonstrate adequate reliability and validity of the PACE-SE, a novel measure designed to assess the self-efficacy of children recovering from a concussion. The PACE-SE can guide clinicians in the management of concussion by targeting areas of need, e.g., providing additional supportive education, the need for further supports with school planning, or possibly the need for a referral to address difficulty coping with their recovery.

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**P. CHIU, A. TREBLE-BARNA, W. YUAN, M.M. SOHLBERG, B.E. HARN & S.L. WADE. Training-related Changes in Counting Stroop task Activation in Pediatric Traumatic Brain Injuries (TBI): an fMRI study.**

**Objective:** The present study reports pilot fMRI data in a Counting Stroop task pre- and post- attention training in participants with chronic pediatric traumatic brain injuries (TBI).

**Participants and Methods:** Children with complicated mild to severe TBI completed the Attention Improvement and Management (AIM) program, a 10-week, computerized intervention employing attention practice drills and strategy training designed to improve attention, working memory, and/or executive functions following pediatric TBI. Eight participants with TBI (age =  $12.5 \pm 2.7$  years) and ten age-matched, healthy control children (age =  $13.3 \pm 2.2$  years) were scanned with

fMRI while performing a Counting Stroop task at baseline and again at a later session. Children in the TBI group completed the AIM training between sessions whereas controls received no training.

**Results:** Accuracy of the participants with TBI generally improved in the Interference condition from baseline (mean 72%) to time 2 (86%), and numerically more so than healthy controls (from 84% to 89%). Brain activation showed predominantly a modest decrease for participants with TBI as well as for healthy controls. One cluster in the medial frontal area (BA8) showed a larger decrease from time1 to time2 in participants with TBI than that seen in healthy controls ( $p = 0.005$  uncorrected, cluster=20).

**Conclusions:** Higher level of activity in BA8 has been reported in pediatric TBI relative to healthy controls. The preliminary results in the present study suggest that the AIM training may play a normalizing role in the course of recovery.

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**S. COLLIER, C.G. VAUGHAN, R. KROMASH, R.J. KLARES, C. CHEUNG & G.A. GIOIA. The Association between Change in Post-Concussion Symptoms and Self-Efficacy over Recovery from Concussion.**

**Objective:** Examine the relations between parent and child report of changes in perceived self-efficacy (SE) and post-concussion symptoms in a sample of youth with concussion.

**Participants and Methods:** 29 youth (ages 12-18; 69% female) and 44 parents of youths (ages 6-18) with concussions were evaluated twice (min-max days since injury=10-72,  $M = 29$ ,  $SD = 13$ ) at a specialty concussion clinic. The Progressive Activities of Controlled Exertion (PACE) intervention model was used to educate patients and guide recovery. Parents and youth rated their confidence on a 0 to 10 scale in performing pro-recovery activities on the PACE-SE measure (17-item Child, 19-item Parent surveys). Symptoms were assessed using parent and age-specific self-report forms of the Post-Concussion Symptom Inventory (PCSI), adjusted for pre-injury symptomatology. Differences in self-efficacy were examined, along with the correlations between change in symptoms and change in self-efficacy ratings across two visits.

**Results:** Seventy-five percent of youth reported increased SE from V1 to V2 (mean= $14 \pm 23$ ). In contrast, 60% of parents reported decreased SE from V1 to V2 (mean= $-3 \pm 17$ ). However, parent’s PACE-SE scores were near the ceiling of the measure (mean of 170 score, with max score=190). For youth, increased SE was associated with reduced symptoms over time ( $r = -.36$ ;  $p < .05$ ). Similarly, parent SE was negatively associated with parent reported post-concussion symptoms ( $r = -.37$ ;  $p < .05$ ). There were no significant associations between age, gender, time since injury, or injury-related characteristics (LOC, amnesia, injury type) with changes in PACE-SE.

**Conclusions:** Parents and youth who reported a greater increase in self-efficacy following treatment for concussion reported a greater reduction in post-concussion symptoms. Findings highlight the potential of the PACE model for increasing self-efficacy in order to manage symptoms and promote recovery following concussion.

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**K. CROCFER, J. LENIHAN, J. PIVONKA-JONES & S. ASHWAL. Patterns of Performance on Neuropsychological Assessment in Pediatric TBI and Control Samples.**

**Objective:** Assessment of traumatic brain injury (TBI) to the developing brain continues to reveal lasting effects. Additional research continues to inform patterns of performance.

**Participants and Methods:** TBI participants were recruited from Loma Linda University Children’s Hospital Level-1 Trauma Center’s emergency department. Non-head injured controls were recruited from

pediatric routine appointments with same exclusion criteria. 85 moderate/severe pediatric TBI patients ages 6-16 (50.6% female, M age Time 1=12.03, SD=3.42; M age Time 2=13.21, SD=3.34) completed Children's Memory Scale, Test of Everyday Attention-Children, and Wechsler Abbreviated Scale of Intelligence at 3-months and 12-months post injury. Results were compared to age-matched healthy controls (n=85) assessed nine months apart.

**Results:** Paired sample t-tests were utilized to examine group trends between two time points on measures of IQ, memory and attention. Results revealed significant differences between time points in all areas: FSIQ;  $t(68)=2.76, p=.007$ ), General Memory;  $t(58)=6.05, p=.000$ ) and Attention;  $t(59)=2.35, p=.022$ ). Visual Immediate/Delayed Memory and General Memory showed the strongest recovery from 3 to 12 months in TBI patients. Compared to controls, the TBI sample at the 12-month assessment continued to fall below control scores at their initial assessment.

**Conclusions:** Similar patterns of improved scores were found among control and TBI samples. Initial scores that were higher were more likely to show a stronger improvement at Time 2, with control's performance being better across all measures. Those who performed very poorly were less likely to show larger gains at Time 2. Visual Immediate/Delayed and General Memory showed the largest gains. This study reinforces existing literature suggesting children whose initial scores are poor demonstrate less recovery over time.

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#### **G.B. EPSTEIN, D. RANSOM, M.D. SADY, C.E. LATHAN & G.A. GIOIA. Concussion-Related Cognitive Exertion Ratings in Uninjured High School Athletes.**

**Objective:** Tracking cognitive exertion effects is vital to assess and treat pediatric concussions. Previous research has established base rates of exertion change following ImpACT. We examined how symptoms changed in response to other forms of cognitive exertion, such as another neurocognitive assessment and a day of school, and across multiple administrations.

**Participants and Methods:** Twenty-seven high school athletes (52% male; 14-18 years) were administered the Defense Automated Neurobehavioral Assessment (DANA), a 20-minute computer-based cognitive test battery that measures memory, attention, and response speed, eight times - twice per day for four days over a month. Adolescents completed the Exertional Effects Rating Scale (EERS) before and after each DANA administration to measure change in individual symptoms (i.e., headaches, fatigue, concentration difficulty, and irritability) on a 0-10 Guttman scale.

**Results:** Following DANA testing, participants' fatigue (mean change = 0.50;  $p < .05, d = 0.52$ ), concentration difficulty (0.61;  $p < .01, d = 0.69$ ), and sum exertion ratings increased (1.59;  $p < .001, d = 0.77$ ). However, exertion rating change following DANA testing was not impacted by the time of day of administration (i.e., morning or afternoon; mean change difference = 0.15;  $p = .70, d = 0.07$ ), and no systematic changes in ratings over time were noted ( $p = .53, \eta^2 = 0.02$ ). Exertion ratings did not significantly change from morning to afternoon over the course of a school day ( $-0.02, p = .98, d = 0.01$ ).

**Conclusions:** Although participants' exertion ratings increased after DANA testing, increases were small in magnitude and below the clinical threshold for pediatric concussions, previously determined to be a change greater than three. There were no systematic effects of the timing of DANA administration on exertional effects, suggesting the EERS is a reliable tool and has utility in multiple settings. Further, participants' symptoms were relatively stable and uninfluenced by the demands of a typical school day.

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#### **C. GHILAIN, K.E. ONO & T.G. BURNS. Pediatric ImpACT: Detecting Age and Gender Based Differences of Baseline Functioning.**

**Objective:** Pediatric Immediate Post-Concussive Assessment and Cognitive Testing (ImpACT) is a computer-based assessment measuring neurocognitive functioning in children with suspected concussion. Using colorful graphics similar to those in video games, Pediatric ImpACT can be administered in 10-15 minutes and assesses sequencing/attention, word memory, visual memory and reaction time. Previous studies have demonstrated that age and gender significantly impact neuropsychological performance on the ImpACT used in adolescent and adult populations. Therefore, this serves as a description of age and gender differences at baseline assessment in a pediatric sample.

**Participants and Methods:** 358 children between 5-11 years (M=107.26 months, SD=19.93 months), who were identified as participants in high impact sports, completed baseline assessments from the Pediatric ImpACT battery.

**Results:** One Way Analysis of Variance (ANOVA) were conducted to assess age differences in neurocognitive performance. Significant differences were found by age on Word List Immediate (WLI)  $F(6,351)=30.26, p<.01$  and Delayed (WLD)  $F(6,351)=36.08, p<.01$  Recall, Memory Touch Number Correct (MTNC)  $F(6,351)=99.82, p<.01$ , Stop and Go Number Correct (SGNC)  $F(6,351)=9.55, p<.01$ , and Picture Memory Average Taps  $F(6,351)=195.27, p<.01$  and Completion Time (PMCT)  $F(6,351)=865.68, p<.01$ . Results of gender analyses demonstrated significant differences in performance on WLI  $F(1,356)=17.67, p<.01$  and WLD  $F(1,356)=5.83, p=.02$ , MTNC  $F(1,356)=14.40, p<.01$ , SGNC  $(1,356)=3.91, p<.05$ , and PMCT  $F(1,356)=5.58, p=.02$ .

**Conclusions:** Results, as expected, suggest significant age and gender-based differences in neurocognitive performance on the Pediatric ImpACT. These results highlight the importance of age and gender normative data as tools to facilitate appropriate return to play or school recommendations for those children without individual baseline assessments.

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#### **N.J. GOODRICH-HUNSAKER, T.J. ABILDSKOV, K.O. YEATES, H.G. TAYLOR, A. BACEVICE, D.M. COHEN, L.K. MIHALOV, B.A. BANGERT, N. ZUMBERGE & E.D. BIGLER. Altered Corpus Callosum Integrity in Children with Mild Traumatic Brain Injury (mTBI).**

**Objective:** mTBI represents a major public health concern for youth under 15 years of age. Although mTBI can result in persistent functional impairments, standard brain imaging protocols are typically negative. This discrepancy poses a dilemma for clinicians. The corpus callosum (CC) is thought particularly vulnerable in neurotrauma and therefore a candidate to assesses the predictive utility of diffusion tensor imaging (DTI) tractography in mTBI outcome. Although CC pathology is well documented in patients with moderate and severe TBI, it remains unknown (1) to what extent the CC is susceptible to damage in mTBI and (2) whether or not tract profiles are useful to evaluate associations of white matter integrity with functional outcomes.

**Participants and Methods:** Participants were children aged 8-15 years with mTBI or mild orthopedic injuries (OI). DTI scans were obtained within 10 days of injury. Using Automated Fiber-tract Quantification, the CC was reconstructed in each child's native space and segmented into 8 sections: orbital, anterior, superior frontal; motor; superior, posterior parietal; occipital; temporal. Diffusion measures were extracted along 100 segments of each section to provide tract profiles. Diffusion measures were correlated with Wechsler Abbreviated Scale of Intelligence® - Second Edition Full Scale IQ.

**Results:** CC integrity was reduced in mTBI children compared to OI. Tract profiles revealed lower fractional anisotropy and higher radial diffusivity at various points along each of the CC segmented tracts, with some differences significant after false discovery rate correction. These findings related to IQ measures in mTBI but not OI children.

**Conclusions:** CC integrity in the sub-acute phase is reduced in mTBI children. DTI of the CC may serve as a biomarker and predict mTBI outcome. Using tract profiles rather than overall mean measures of the tract appears more sensitive for detecting subtle changes following mTBI. Correspondence: *Naomi J. Goodrich-Hunsaker, PhD, Psychology, Brigham Young University, PO Box 971060, Orem, UT 84097. E-mail: njhunsaker@icloud.com*

**A.A. GRETENCORD, S. AYLWARD, J. DORFLINGER & J. HOPKINS. Self-Report of Symptoms in Sports-Related Concussions.**

**Objective:** Self-reported postconcussive symptoms (PCS) were examined in student-athletes recovering from a sports-related concussion. Current emphasis is on restricting physical/cognitive exertion until the athlete is asymptomatic, as resuming activities too soon can exacerbate PCS. However, many athletes have difficulty adjusting if this lasts an extended time. Concussion management should strive to balance these considerations. A better understanding of the PCS that concern student-athletes may provide information to guide these considerations.

**Participants and Methods:** Participants were 132 children/adolescents, (10-18 years old,  $M=14.6$ ), who were referred to a Concussion Clinic in a Midwestern medical center. Participants were 61.1% male ( $n=81$ ) and 38.9% female ( $n=51$ ).

Data were obtained from a de-identified dataset. A licensed neurologist examined participants; this included acute (time of injury) and current (time of evaluation) PCS. Current PCS were divided into four domains (cognitive, physical, emotional/behavioral, sleep).

**Results:** On average, 5.1 symptoms were reported. More physical PCS were reported compared to the other domains. Number of acute PCS significantly correlated with total and cognitive PCS ( $r=.2$   $p<.05$ ,  $r=.24$ ,  $p<.01$ ). T-tests indicated that girls reported significantly more total ( $t=-2.59$ ,  $p<.01$ ), cognitive ( $t=-2.33$ ,  $p<.05$ ), and emotional/behavioral PCS ( $t=-2.01$ ,  $p<.05$ ) when compared with boys.

Bivariate correlations and one-way analyses of variance were examined to determine if any demographic or injury-related variables (ethnicity, age, premorbid diagnosis, number of days since injury, number of prior concussions) were related to the PCS domains. Prior concussions and age were each significantly correlated with cognitive PCS ( $r=.26$ ,  $p<.01$ ,  $r=.25$ ,  $p<.01$ ).

**Conclusions:** These results indicate that student-athletes are primarily concerned with physical PCS. Female gender, age, and number of prior concussions contribute to the recovery process.

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**T. HEINKS, N.A. EGGENBERGER, K. ZIMMERMANN, M. STEINLIN & K. LEIBUNDGUT. The Influence of Age at Diagnosis for Cognitive Performance in Pediatric Brain Tumor Patients Before Treatment.**

**Objective:** Survivors of brain tumors (BT) have a high risk for a wide range of cognitive problems. These dysfunctions are caused by the lesion itself and its surgical removal, as well as subsequent treatments (chemo- and/or radiation therapy). In a recent study we found patients with BTs performed significantly worse in tests of working memory, verbal memory and attention compared to children with cancer without central nervous system involvement (CNS-) at diagnosis, i.e. before the start of any medical treatment (Margelisch et al., 2015). The aim of the present study was to investigate the influence of age at diagnosis on differences in neuropsychological profiles in children with BT and children with an oncological diagnosis not involving the CNS.

**Participants and Methods:** Thirty-two children with BT and 40 children with an oncological disease without involvement of the CNS were divided into two age-groups (young age: 6-9 yrs (BT  $n=17$ ; CNS-:  $n=19$ ); older 13-16 yrs). All children were evaluated with an extensive battery of neuropsychological tests. Patients were administered

before any therapeutic intervention such as surgery, chemotherapy or irradiation.

**Results:** Young children with brain tumors performed worse compared to older children with brain tumors in measures of attention and memory. This age difference is not found in the oncological comparison group without CNS involvement. When compared to age-matched young children with cancer without CNS involvement (CNS-), young children with BT show a significantly worse performance in measures of attention, verbal memory and working memory while other cognitive functions are at a comparable level.

**Conclusions:** Young age at diagnosis of a brain tumor negatively influences cognitive performance of these children even before the start of medical treatment. This patient group needs to be closely monitored to start cognitive interventions as early as possible.

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**L.M. KOEHL, H.L. COMBS, B.D. WALLS, D.T. BERRY & D. HAN. Validating Neurocognitive Measures in an Adolescent Sports Concussion Sample: ImPACT Computerized Testing versus Traditional Neuropsychological Measures.**

**Objective:** Documented incidence rates of sport-related concussions have increased in recent years. Concern regarding potential cognitive consequences has driven researchers, clinicians, and medical personnel to seek suitable measures to detect thinking difficulties post-concussion. As computerized measures are introduced to achieve baseline measurements and to track cognitive changes, the need to determine comparability between computerized and non-computerized measures has arisen.

**Participants and Methods:** Twenty-nine athletes ( $Mage = 14.41$ ,  $SD = 1.32$ ) experiencing persistent concussion symptoms were compared to 25 healthy athlete controls ( $Mage = 14.08$ ,  $SD = 1.32$ ). Participants were given neuropsychological screenings, including ImPACT and several traditional paper and pencil measures. Groups were matched for ethnicity, and no significant differences were found in age ( $F = .86$ ,  $p = .36$ ), sex ( $\chi^2 = .39$ ,  $p = .53$ ), or education ( $F = .22$ ,  $p = .64$ ).

**Results:** Differences between groups were examined using one-way ANOVAs. Significant differences were found between groups on four ImPACT domains (Verbal Memory  $F = 13.11$ ,  $p = .00$ ; Visual Memory  $F = 15.54$ ,  $p = .00$ ; Visuomotor Speed  $F = 16.91$ ,  $p = .00$ ; Reaction Time  $F = 23.92$ ,  $p = .00$ ) and in six paper and pencil measures: CMS Dots Delay (delayed visual memory;  $F = 6.38$ ,  $p = .02$ ), Trails Making Test B (complex visuomotor speed with executive components;  $F = 12.74$ ,  $p = .00$ ), D-KEFS Design Fluency (executive functions;  $F = 17.36$ ,  $p = .00$ ), phonemic fluency (expressive language;  $F = 9.21$ ,  $p = .00$ ), animals semantic fluency (expressive language;  $F = 7.43$ ,  $p = .01$ ), and Beery Visuomotor Index (visuomotor construction;  $F = 37.78$ ,  $p = .00$ ).

**Conclusions:** These findings suggest ImPACT may effectively detect prolonged cognitive symptoms following concussion. When compared to paper-and-pencil measures, convergent scores in most domains suggest some comparability between this computerized measure and non-computerized measures.

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**J. LAFLEUR, K. MCNALLY, M. NARAD, H.G. TAYLOR, K.O. YEATES & S.L. WADE. Attention Networks in Children with early Traumatic Brain Injuries.**

**Objective:** Children are at risk for difficulties with attention following a traumatic brain injury (TBI). The current study sought to understand the impact of an early TBI on the development of specific attention networks.

**Participants and Methods:** 70 children (mean age = 11.96,  $S.D. = 1.19$ ) who sustained an early TBI (mean age of injury = 5.11,  $SD = 1.11$ ) and 74 controls who sustained an orthopedic injury (OI, mean

age = 11.78, S.D. = 0.77) completed the Attention Network Test. Parent ratings of attention were gathered from the Child Behavior Checklist (CBCL). Regression analyses were conducted to determine the relationships between ANT scores, injury factors (injury group, age of injury), and demographic variables (age, sex, and socioeconomic status).

**Results:** Parent report measures revealed increased attention problems in children with early TBI (mean  $T = 59.40$ , S.D. = 9.89) as compared to OI (OI mean  $T = 53.65$ , SD = 5.93;  $p < .001$ ). However, the TBI groups did not differ from OI in performance on ANT network scores (alerting, orienting, or executive). Injury group ( $p = .035$ ) and SES ( $p = .003$ ) significantly predicted mean reaction time on the ANT. There was also a significant interaction between group and age of injury; in the TBI group, earlier injuries were associated with slower reaction times ( $p = .035$ ).

**Conclusions:** Although children with TBI show increased attention problems in the day to day environment, the current study does not provide evidence implicating the disruption of specific attention networks. Additional research is needed to further understand the neural mechanisms underlying attention and executive dysfunction in children with TBI.

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**E.C. MAXWELL, R.L. PETERSON, M. KIRKWOOD, H.G. TAYLOR, T. STANCIN, T. BROWN & S.L. WADE. Impact of Counselor-Assisted Problem Solving on Parental Coping in Families of Children with Traumatic Brain Injury.**

**Objective:** The present study evaluated the impact of the Counselor-Assisted Problem Solving (CAPS) program on parental coping, compared to an Internet resource comparison (IRC) group. Families in the CAPS program were hypothesized to exhibit improved parental coping skills over time (baseline to 18 months post-injury), whereas the families in the IRC condition would exhibit stable parental coping over time.

**Participants and Methods:** Participants were children (ages 12 to 17 years) hospitalized during the 6 months prior to the study for moderate to severe traumatic brain injury (TBI) and their parent(s). Participants in CAPS ( $n = 41$ ) completed 8 to 12 online modules (training in problem solving, communication skills, and self-regulation) and videoconferencing with a therapist. Participants in the IRC group ( $n = 49$ ) received links to Internet resources about pediatric TBI. Parents were asked to complete the COPE at baseline and 18 months post-injury. Analyses were evaluated utilizing repeated measures analysis of variance (ANOVA).

**Results:** There was a significant effect for time for eight of the fifteen COPE subscales ( $p < 0.05$ ), such that both groups had higher ratings at baseline compared to 18 months post-injury. For the Use of Instrumental Support subscale, there was a significant interaction between group and time  $F(1, 88) = 5.87$ ,  $p = 0.02$ , such that the ratings increased for the CAPS group and decreased for the IRC group. For the Humor subscale, there was a significant interaction between group and time  $F(1, 88) = 4.22$ ,  $p = 0.04$ , such that both groups had lower ratings over time, with a greater decrease for the IRC group.

**Conclusions:** The present study found that families in the CAPS condition had increased levels of instrumental support use over time and maintained higher levels of humor compared to the IRC condition. Thus, the current findings suggest that the CAPS program can partially help to improve parental coping.

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**J.J. MIETCHEN, T. HUFF, E.D. BIGLER, M. DENNIS, C. GERHARDT, K. RUBIN, T. STANCIN, H.G. TAYLOR, K. VANNATTA & K.O. YEATES. Frontal Volumetrics and Social Functioning in Children following Traumatic Brain Injury.**

**Objective:** Research on the role of the frontal lobes in social behavior has traditionally differentiated between traditional anatomic regions (TAR): superior and inferior-medial, orbital, and dorsolateral frontal cortical regions. This approach has been an important source for much of the current theory in neuropsychology related to frontal lobe function. While FreeSurfer (FS) methods permit examination of gyral volume derived from Brodmann's areas, these regions of interest (ROIs) do not necessarily conform to the TAR frontal classification. The current study used operator-controlled volumetric analysis of TAR ROIs compared to FS ROIs to examine social functioning in pediatric traumatic brain injury (TBI).

**Participants and Methods:** Participants were 58 children with complicated mild to severe TBI (age =  $7.80 \pm 1.88$  years; 36% female; GCS =  $10.67 \pm 5.04$ ) and 47 OI controls (age =  $7.82 \pm 1.83$ ; 36% female) who were recruited as part of the SOBIK study. T1-weighted imaging at 1.5 Tesla was acquired on average 2.61 years post injury. The frontal lobes were partitioned into four TAR ROIs in each hemisphere according to the method established by Wilde et al. (2005), as well as eight gyral FS volumes in each hemisphere. Correlational analyses were undertaken between TAR volumes and FS across the entire sample. Correlations were also conducted between frontal volumes and the Social Composite on the ABAS-II across the entire sample.

**Results:** Positive correlations were observed between FS and TAR volumes ( $r \sim 0.06$  to  $r \sim 0.51$ ,  $p < 0.001$ ). The TAR method revealed that the orbitofrontal regions were significantly correlated with the Social Composite on the ABAS-II ( $r \sim 0.19$  to  $r \sim 0.29$ ,  $p < 0.01$ ). These findings were not replicated using FS methods.

**Conclusions:** The TAR method has the advantage of using a traditional approach of differentiating frontal lobe cortical areas and, as shown herein, orbitofrontal TAR volume related to social outcome in pediatric TBI.

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**K.A. MONAHAN, K.R. WOLFE, D. BODIN, J. CASS, M. GOLDMAN, J. LUNDINE & K. MCNALLY. Feasibility and Acceptability of a Brain Injury Education Program on a Pediatric Inpatient Rehabilitation Unit.**

**Objective:** This pilot study examined the feasibility and acceptability of a semi-structured traumatic brain injury (TBI) education program for caregivers on a pediatric rehabilitation unit.

**Participants and Methods:** Participants included primary caregivers of 13 children with moderate to severe TBI admitted for inpatient rehabilitation. This program consisted of 5 educational modules covered in individual sessions and included written handouts (TBI Overview, Self-Care for Caregivers, Behavior/Emotional/Social Sequelae, Cognitive Sequelae, and Safety/Supervision). Caregivers completed pre and post-assessments of TBI knowledge and ratings of comfort level with discharge. Satisfaction ratings were also collected.

**Results:** On average, this program involved 1.73 hours of face-to-face time with each family (range = .75 – 2.75 hours). There were no significant differences between caregivers' pre and post-test of TBI knowledge. However, caregivers reported feeling significantly more comfortable going home with their child on the post-test relative to the pre-test,  $t(10) = -2.66$ ,  $p < .05$ . They also reported that they had a significantly greater understanding of their child's brain injury, including recovery and risk factors,  $t(10) = -9.8$ ,  $p < .01$ . All caregivers reported the highest possible rating of satisfaction and helpfulness of the program. Twelve caregivers reported the highest possible rating of helpfulness of handouts provided during the program; one reported the second highest rating.

**Conclusions:** Implementation of a semi-structured TBI education program on a pediatric inpatient rehabilitation unit was well-accepted by

families, and they reported finding the information provided helpful. In addition, initial data suggest caregivers felt more comfortable being discharged with their child with a TBI after completing a formal education program. These pilot data suggest this is a promising program to be further developed and researched in a more controlled fashion.

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#### **V. PLOURDE & B. BROOKS. ADHD symptoms predict quality of life following pediatric moderate-to-severe traumatic brain injury.**

**Objective:** Increasing scientific evidence suggests that youth who sustained a moderate-to-severe traumatic brain injury (TBI) are at higher risk of presenting inattention and hyperactivity symptoms and an affected quality of life. Although worse ADHD symptoms are associated with poorer quality of life in population-based and ADHD populations, less is known about these associations in children and adolescents with TBI. The objective is to look at whether ADHD symptoms predict quality of life in youth with TBI.

**Participants and Methods:** Participants ( $N = 88$ , 52 girls and 36 boys, mean age=12.79,  $SD=4.19$ , majority English speakers and Caucasian) with a moderate-to-severe TBI were recruited through a tertiary care hospital. Mean age of injury was 10.41 ( $SD=5.48$ , range=infant-18 years) and mean time between injury and assessment was 2.38 years ( $SD=3.60$ , range=8 days to 17 years). Measures included the ADHD Rating Scale-IV (parent reports) and the Pediatric Quality of Life Inventory (PedsQL – children and parent reports).

**Results:** More inattention symptoms uniquely predicted lower school functioning as reported by parents and children. Conversely, more hyperactivity symptoms uniquely predicted lower family functioning (parent-reported) on many scales: family health-related (emotional, social, and physical) quality of life; family functioning; and worries. There were not sex differences on ADHD and PedsQL scores; there were also no differences on PedsQL scores between children with or without severe ADHD symptoms except for parent-reported school functioning.

**Conclusions:** The study suggests that ADHD symptoms impact health-related quality of life in youth with moderate-to-severe TBI. Worse inattention symptoms affect children's academic life while worse hyperactivity symptoms affect family's quality of life, underlying the importance of assessing and treating both types of symptoms and their potential differential effects on health-related quality of life.

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#### **S.L. ROSENTHAL, N. BAHRAMI, E. DAVENPORT, C. VAUGHAN, G.A. GIOIA, J. URBAN, J. STITZEL, J. MALDJIAN & C. WHITLOW. Subconcussive Related Changes in High School Football Player Reaction Time.**

**Objective:** The purpose of this study was to examine the relationship between player head impact exposure and seasonal changes in cognition and symptom status using the Immediate Post-Concussive Assessment and Cognitive Test (ImPACT) and the Post-Concussion Symptom Scale (PCSS) in the absence of concussion.

**Participants and Methods:** Subconcussive impacts were recorded using the Head Impact Telemetry System and quantified as a cumulative risk weighted estimate (RWECP) of head impact exposure. 22 male subjects (Avg age: 16.96;  $SD: 0.67$ ) were evaluated for seasonal changes on ImPACT and Post-Concussion Symptom Scale (PCSS) composite scores; all subjects included had complete data and did not receive a clinically diagnosable concussion. Pre/Post-season composite scores were compared via repeated measures MANOVA. The relationship between change in composite scores (post score – pre score) and RWECP was investigated via Pearson Correlation Coefficient.

**Results:** Repeated measures MANOVA revealed no differences between pre- and post-season composite scores. A significant relationship was

found between RWECP and seasonal change in the ImPACT composite score of Reaction Time (Delta RT) ( $r=0.49$ ,  $p=0.0208$ ). No other seasonal change in ImPACT score was related to RWECP. Seasonal change in PCSS Total Symptom Score (Delta PCSS) was not significantly related to RWECP.

**Conclusions:** While no change was found in cognitive performance from the beginning to the end of the season, a significant relationship was found between cumulative impact exposure and change in reaction time, despite no concussion. The meaning of this relationship is unclear, and requires further exploration with a larger sample size, particularly in light of no significant change in post-season symptom report.

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#### **N. SANDEL, P. SCHATZ, K. GOLDBERG & M. LAZAR. Deficits in Memory and Processing Speed following Acute Sports Concussion.**

**Objective:** To identify gender differences in high school male and female lacrosse players' neurocognitive performance following acute sports-related concussion.

**Participants and Methods:** High school lacrosse players (112 males, 112 females) were matched to a control group of soccer players based on age and gender, resulting in a total sample of 448 athletes aged 13 to 17 years old ( $M=15.43$ ,  $SD=1.09$ ). Soccer players were included to control for differences in male and female versions of lacrosse. Athletes underwent baseline and post-concussion computerized-neurocognitive testing within 3 days of injury using the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT). Memory and Speed factors (Schatz & Maerlender, 2014) were calculated from ImPACT composite scores and served as dependent variables in analyses. Data were analyzed at baseline and post-injury using a mixed-factorial MANOVA with gender and sport as between-subjects factors; significant effects were further explored with univariate analyses.

**Results:** Athletes demonstrated a significantly worse performance post-injury,  $F(2,219)=9.81$ ,  $p<.001$ , on both Memory,  $F=18.0$ ,  $p<.000$ , and Speed,  $F=4.85$ ,  $p=.03$ , factors. Gender had a significant main effect,  $F(2,219)=9.18$ ,  $p<.001$ , and interaction effect with time,  $F(2,219)=6.50$ ,  $p=.002$ , on cognitive performance. Univariate analyses indicated that females' Memory performance worsened significantly after concussion compared to males,  $F=13.03$ ,  $p<.000$ . No main effect was found for sport type,  $F(2,219)=2.39$ ,  $p=.09$ , but a significant interaction effect was found between sport and time,  $F(2,219)=3.36$ ,  $p=.04$ . Soccer players demonstrated a steeper decline in Memory compared to lacrosse players after concussion,  $F=6.67$ ,  $p=.01$ .

**Conclusions:** Athletes performed worse on neurocognitive measures of memory and processing speed after concussion. Females and soccer players demonstrated a steeper decline in memory after concussion relative to males and lacrosse players, respectively.

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#### **A. TREBLE-BARNA, N. ZHANG, A. CASSEDDY, H. TAYLOR, K.O. YEATES & S.L. WADE. Profile Analysis of Long-Term Neuropsychological Functioning following Traumatic Brain Injury in Early Childhood.**

**Objective:** To conduct a profile analysis of long-term neuropsychological functioning in children who sustained early traumatic brain injury (TBI) as compared to children who sustained orthopedic injury (OI).

**Participants and Methods:** Participants included children who sustained moderate ( $n = 42$ ) and severe ( $n = 16$ ) TBI or orthopedic injuries (OI;  $n = 72$ ) between ages 3-7 years. A battery of neuropsychological tests examining verbal reasoning, nonverbal reasoning, processing speed, verbal fluency, attentional control, response inhibition, sustained attention, planning skills, and pragmatic judgment were administered at 6.8 ( $\pm 1.1$ ) years post-injury. Repeated-measures ANCOVA, controlling for SES and time since injury, with test scores as the dependent variables



and group as the independent variable was used to conduct a profile analysis.

**Results:** Analyses revealed a trend for the interaction of test by group ( $p = .072$ ), suggesting that the shape of the profiles differed by group. Simple main effects of group for each test revealed significantly poorer nonverbal intelligence, processing speed, and response inhibition in the severe TBI group relative to both the moderate TBI and OI groups; remaining test scores were comparable across groups.

**Conclusions:** Children sustaining TBI during early childhood continue to show poorer neuropsychological profiles many years post-injury. The primary differences in cognitive profiles between children with severe TBI and children with moderate TBI or OI appears to be in nonverbal reasoning, processing speed, and response inhibition.

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### G. VARGAS, H. SCHOFIELD & J. CROWLEY. Child Versus Parent Reported Recovery Post-concussion: Differences and Correlates.

**Objective:** Self report of symptoms from children can be less reliable based on limits of insight, memory, and other factors. However, parents can have limited knowledge of the child's symptoms (e.g., headache, mental fogging). With the continued focus on symptom report as a measurement of concussion severity and recovery, it is important to find reliable and valid measurements of symptoms in children.

**Participants and Methods:** Participants were a consecutive cohort presenting to a multidisciplinary Concussion Clinic during one calendar year. The Post-Concussion scale (PCS) was given before the visit and reviewed during interview. Parent and child were also asked to rate how close to 100% (baseline functioning) the child was at time of visit. The ImPACT was also administered. Participants ( $N=148$ ) ranged from 10 to 18 years old and 43% were female. Forty-nine percent of concussions were sports-related and 29% of children had a pre-existing exceptionality (e.g., ADHD). Patients were seen on average 5 weeks post-injury (range =1-18 weeks).

**Results:** Self ratings were significantly higher than parent ratings ( $t(147)=3.0, p<.01$ ) across the whole sample. However, for children seen within 1 month from injury, self and parent ratings did not significantly differ. For children seen further than 1 month from injury, self and parent ratings differed significantly ( $t(65)=2.5, p<.05$ ). PCS total was correlated with all ImPACT composite scores ( $r=-.2-.4, p<.001-.01$ ). Self ratings were correlated with 3 out of 4 ImPACT scores ( $r=-.2-.3, p<.01$ ). Parent rating was only related to 1 score ( $r=.2, p<.01$ ).

**Conclusions:** Significant differences were found between parent and child ratings of symptom recovery, particularly when assessed further from injury. Child ratings of recovery were more related to cognitive testing results. This, supports the need to obtain symptom reports from both the child and parent. A percent recovery rating is a fast way to incorporate this input from children.

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### C.G. VAUGHAN, G.A. GIOIA & P.K. ISQUITH. Examining a 3 Subtest Format of the Tasks of Executive Control (TEC) in a Concussed and Non-concussed Sample.

**Objective:** The Tasks of Executive Control (TEC) measures the effect of increasing working memory and inhibitory control on accuracy and response speed performance over six tasks. We examined whether a subset of TEC tasks could serve as an abbreviated measure.

**Participants and Methods:** Typically developing children ( $n=237$ ) and children with recent concussions ( $n=89$ ) aged 8-18 years were selected from the TEC normative and clinical datasets (mean age = 12.62  $\pm$  2.5; 67% male). Regression analysis examined the strength of association

between subtest scores on three tasks in the inhibit condition (0-back, 1-back, & 2-back) with the full 6 subtest Summary Scores. Effect sizes for the full and abbreviated TEC were compared for a subsample of 68 children (mean age = 13.41  $\pm$  2.5; 84% male) with concussions seen within 32 days of injury (mean days to visit = 6.89  $\pm$  5.0) and age-matched healthy controls (93% male).

**Results:** The 3-subtest task scores were strongly correlated with the full 6-subtest Summary Scores ( $r = .959-.991, p <.0001$ ). Concussed children had significantly different ( $p<.05$ ) scores than matched controls for accuracy, response time and variability on both full and abbreviated measures. Overall, effect sizes were similar, ranging from 6 subtest  $d = .85$  vs. 3 subtest  $d = .76$  for variability to 6 subtest  $d = .48$  vs 3 subtest  $d = .44$  for accuracy.

**Conclusions:** TEC scores derived from an abbreviated 3-subtest measure account for considerable variance in scores from the full 6-subtest battery. Differences between concussed and non-concussed children are equally evident in both versions. The abbreviated test may be a viable way to assess working memory and inhibitory control while reducing test taker burden via an abbreviated battery.

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### R. PATEL, E.A. WILDE, G. HANTEN, A. SCHMIDT, A. VASQUEZ, X. LI, B. BIEKMAN, J.V. HUNTER, Z.D. CHU & H.S. LEVIN. Relation of DTI with Reading and Language Skills in Pediatric TBI.

**Objective:** Reading and other academic skills may be adversely affected by traumatic brain injury (TBI) in children; however, the neural underpinnings of this relationship have not been thoroughly investigated.

**Participants and Methods:** Diffusion tensor imaging (DTI) was performed in children who sustained complicated-mild to severe TBI ( $n=40$ ; mean age=15.4 years) and a group of orthopedically-injured (OI) children ( $n=25$ ). Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) assessed white matter integrity in frontal, corpus callosum (CC), and inferior fronto-occipital fasciculi (IFOF) at 12 months post-injury. We examined relations between DTI metrics and performance on measures of reading (GORT-4) and language (CELF-4).

**Results:** Groups did not differ in SES, race, sex and handedness. The TBI group demonstrated decreased white matter integrity in all regions (i.e., decreased FA/increased ADC,  $p<0.01$ ). Groups did not differ on GORT-4 index scaled or CELF-4 formulated sentence scores, though age at injury contributed to performance on GORT-4 comprehension and CELF-4 formulated sentence scores, with younger age associated with worse performance. In the OI group, GORT-4 fluency was negatively correlated with FA in the right frontal ( $p<0.05$ ), CC ( $p=0.05$ ) and right IFOF ( $p=0.07$ ). Reading rate was associated with right frontal ( $p<0.05$ ), CC ( $p=0.08$ ) and right IFOF ( $p=0.09$ ) FA. In the TBI group, GORT-4 rate, fluency and comprehension were not correlated with FA, though GORT-4 accuracy correlated with right frontal FA ( $p=0.05$ ).

**Conclusions:** Our results support the contribution of age at injury to brain integrity and basic reading skills post-TBI. Contrary to expectation, DTI was largely unrelated to reading or language skills in the TBI group and only weakly related in the OI group. Reading skills may have become crystallized in these children by the time of injury, and a more complex measure of abstract reading skills may be necessary to reveal underlying brain-behavior relations.

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### M. WOJTOWICZ, M. HERCEG & G.L. IVERSON. Comparing Baseline Concussion Measures in High School Student Athletes.

**Objective:** Some high schools and colleges administer several standardized tests prior to an athletic season as part of their concussion management program. The purpose of this study was to examine the

relations between performance on sideline and computerized baseline tests (i.e., King-Devick (K-D) Test; Sideline Assessment of Concussion, SAC; and ImPACT®) in high school athletes.

**Participants and Methods:** A total of 143 high school athletes [Age M (SD)=15.4 (1.2); Boys=78, 54.5%] completed baseline pre-season testing with ImPACT®, K-D, and SAC. ImPACT® was administered in a group setting in a computer lab. The K-D and SAC were administered individually on the following day.

**Results:** There were no differences in performance between boys and girls on any of the measures ( $p > .05$ ). Age was negatively correlated with total symptoms ( $r = -.20$ ;  $p < .05$ ) and positively correlated with Visual Motor Speed scores ( $r = .34$ ;  $p < .001$ ). K-D Scores were negatively correlated with SAC ( $r = -.17$ ;  $p < .05$ ) and Visual Motor Speed scores ( $r = -.31$ ;  $p < .05$ ). SAC scores were positively correlated with Verbal Memory ( $r = .29$ ;  $p < .001$ ), Visual Memory ( $r = .24$ ;  $p < .001$ ), and Visual Motor Speed composite scores ( $r = .29$ ;  $p < .001$ ). Athletes were divided into normal SAC (i.e., total scores of  $\geq 25$ ;  $n = 109$ ) and low SAC (i.e., total scores of  $\leq 24$ ;  $n = 34$ ) subgroups. Those who performed more poorly on the SAC also had lower scores on the ImPACT® Verbal Memory ( $p < .001$ ,  $d = 0.74$ ), Visual Memory ( $p = .004$ ,  $d = 0.56$ ), and Reaction Time ( $p = .04$ ,  $d = .53$ ) composites, but not on the Visual Motor Speed ( $p = .10$ ,  $d = 0.42$ ) composite.

**Conclusions:** In high school athletes, baseline scores on the King-Devick Test were significantly correlated with reaction time and processing speed measures from ImPACT®. Poor performance on the SAC was associated with worse performance on most ImPACT® composite scores. These data suggest that there is only modest concordance between pre-season baseline measures.

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#### **M. WOJTOWICZ, M. HERCEG & G.L. IVERSON. Pre-season Concussion Testing in High School Students with Academic Difficulties or Attention Deficit Hyperactivity Disorder.**

**Objective:** Learning disabilities and attention deficit hyperactivity disorder (ADHD) are considered to be important risk factors or modifiers for concussion assessment and management. The purpose of this study was to examine cognition and symptom reporting in high school students with academic difficulties or ADHD.

**Participants and Methods:** A sample of 143 high school students [Age M (SD)=15.4 (1.2); Boys=78, 54.5%] completed baseline pre-season testing with ImPACT®, the King-Devick test, and the Sideline Assessment of Concussion (SAC). ImPACT® was administered in a group setting in a computer lab. The King-Devick test and SAC were administered individually on the following day. Students were identified as having academic difficulties (i.e., received special education, repeated a grade, or a diagnosed learning disability) or ADHD based on their self report.

**Results:** Non-parametric tests were used because of violations of normality. High school students with academic difficulties or ADHD ( $n = 21$ ) were compared to controls ( $n = 122$ ) on the King-Devick test, SAC, ImPACT® Cognitive Composite scores, and Total Symptom ratings. Students with academic difficulties or ADHD performed significantly more poorly on the King-Devick test ( $p = .003$ ;  $d = .79$ ), the Visual Motor Speed Composite of ImPACT® ( $p = 0.007$ ;  $d = .79$ ), and they reported more symptoms at baseline on the Post-Concussion Scale ( $p = .005$ ;  $d = .59$ ). There were no significant differences between groups on SAC scores ( $p = .11$ ;  $d = .36$ ) or ImPACT® Verbal Memory ( $p = .54$ ;  $d = 0.16$ ), Visual Memory ( $p = .20$ ;  $d = 0.26$ ), or Reaction Time ( $p = .14$ ;  $d = .55$ ) Composite scores.

**Conclusions:** To our knowledge this is the first study to examine performance on three different pre-season baseline measures in high school students with academic difficulties or ADHD. High school students with academic difficulties or ADHD performed more poorly on the King-Devick test, the Visual Motor Speed Composite of ImPACT®, and they reported more symptoms at baseline.

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#### **A.M. CHAMBERS, D. GARCIA, M.D. UDHINANI, C.E. TYNER & S.C. HEATON. Problems with Executive Planning are Associated with Social Withdrawal in Adolescent Traumatic Brain Injury.**

**Objective:** Adolescent traumatic brain injury (TBI) is associated with a wide variety of neurocognitive, psychosocial and behavioral problems. Across levels of severity, social dysfunction has been identified as important area for intervention after injury; social withdrawal puts tremendous strain on caregivers and can exacerbate patient's internalizing symptoms. In an attempt to better understand the manifestation of social isolation among this population, the authors explored the relative contribution of executive deficits in the area of planning and organization. **Participants and Methods:** Participants included 18 adolescents (ages 12-18), referred for neuropsychological assessment within a year of sustaining a TBI. Injury severity varied across the group, but most (~75%) had sustained a moderate to severe injuries. Parent-report of executive planning was assessed using the "Plan-Organize" subscale of the Behavior Rating Inventory of Executive Function (BRIEF). Parent report of social withdrawal was measured using the "Withdrawal" subscale of the Behavior Assessment System for Children, Second Edition (BASC-2; PRS-A).

**Results:** Pearson correlation indicated a significant association between parent-report of executive planning and social withdrawal ( $r = .513$ ,  $p < .05$ ), such that greater planning problems were associated with increases in withdrawal. Bootstrapped linear regression indicated that over 25% of the variance observed in social withdrawal was explained by executive planning ( $R^2 = .263$ ,  $p < .05$ ).

**Conclusions:** These findings suggest that deficits in planning skills may significantly contribute to the development and maintenance of social isolation among adolescents recovering from TBI. Use of validated measures of executive functioning may compliment neuropsychological testing by pointing to specific executive domains that predict social dis-engagement in this population. Future studies should examine this relationship with consideration of injury-related characteristics and developmental factors.

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#### **N.E. COOK, C. SURMAN, N. DOTY, A. DOYLE & E. BRAATEN. Processing speed in pediatric head injury: Examining the impact of psychiatric and learning comorbidities.**

**Objective:** Processing speed is negatively impacted by pediatric head injury. However, it is not clear whether head injury is associated with processing speed difficulties over and above the influence of psychiatric and learning comorbidities. Moreover, studies generally define processing speed narrowly, potentially using a single measure to characterize this domain of cognitive functioning. Our aim was to compare processing speed in head injured youth to a control group of youth matched on psychiatric and learning comorbidities by employing a more nuanced and multifaceted view of processing speed by studying a variety of neuropsychological measures. We hypothesized that head injured youth would demonstrate decreased processing speed compared to controls.

**Participants and Methods:** Participants were clinically referred youth recruited from a pediatric neuropsychological assessment clinic and enrolled in the LOGIC longitudinal study of cognition. A subgroup of 93 youth, ages 5 to 19 (M=11.2, SD=3.5), reported a history of head injury and were compared to a control group of 93 non-head injured youth, ages 3 to 19 (M=10.5, SD=3.8). The control group was matched to the head injury group on primary psychiatric diagnosis and special education status (i.e., whether or not they had an IEP). The groups were compared across several neuropsychological measures of processing

speed (e.g., Wechsler Processing Speed Index [PSI], CPT Reaction Time, DKEFS Trail Making Test).

**Results:** Preliminary analyses suggested no statistically significant differences on the individual processing speed measures. Further, the groups did not differ in terms of the percentage of participants scoring 1 standard deviation below of mean on the processing speed measures.

**Conclusions:** More work is needed to understand the impact of psychiatric and learning comorbidities on the cognitive functioning of youth who sustain head injuries. The utility of a more nuanced, multifaceted assessment of processing speed in pediatric neuropsychology will be discussed.

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## ADHD/Attentional Functions

**A.M. CHAMBERS, A.L. FRIAS, D. GARCIA & S.C. HEATON. Sustained Attention Moderates the Relationship between Sleep Schedule Variability and Verbal Memory in Children with ADHD.**

**Objective:** Attention Deficit Hyperactivity Disorder (ADHD) is characterized by impairments in sustained attention and executive functioning, as well as variety of behavioral symptoms. Sleep problems and comorbid sleep disorders are also prevalent among this population. Despite growing literature on sleep and cognition in ADHD, little is known about the effects of specific sleep behaviors such as sleep schedule variability on attention and memory functioning in children with ADHD. The current study of youth with ADHD explored the relationships between sleep schedule variability and performance on tests of sustained attention and verbal memory.

**Participants and Methods:** Participants included 75 children with ADHD (6-16 years) referred for neuropsychological assessment. Parent-report of variability in child sleep schedule was assessed using the Heaton Children's Sleep Questionnaire (HCSQ). Sustained attention was assessed using the Test of Everyday Attention (TEA-Ch) sub test, "Score!" Performance on the Word Pairs Learning subtest of the Children's Memory Scale (CMS) was used to assess initial acquisition skills on a verbal memory task.

**Results:** Bootstrapped moderation analysis indicated that sustained attention significantly moderated the relationship between parent-report of sleep schedule variability and initial acquisition of information on the verbal memory task, such that presence of sustained attention difficulties strengthened the relationship between sleep schedule variability and poor verbal learning ( $R^2 = .109, p < .05$ ).

**Conclusions:** Findings suggest that inconsistent sleep schedules in childhood ADHD account for a small but significant amount of the variability in verbal learning skills, and that this relationship may be modified by a child's capacity for sustained attention. Future studies should investigate the relationships between sleep and cognition among clinical pediatric populations in an effort to identify potential intervention targets among youth with high rates of both sleep and cognitive difficulties.

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**N.E. COOK, E. BRAATEN, N. DOTY, A. DOYLE & C. SURMAN. Do sluggish cognitive tempo and slow processing speed represent the same construct? Evidence for differentiation of functional correlates in children and adolescents with ADHD.**

**Objective:** The detrimental impact of slow processing speed has been increasingly recognized; however, whether this construct maps directly onto "sluggish cognitive tempo" (SCT) that has been described within ADHD samples over the past decade remains unclear. Given that SCT is

tied more directly to ADHD symptoms, we hypothesized that variation in SCT and processing speed would predict different functional correlates within children and adolescents with ADHD.

**Participants and Methods:** Participants included 362 youth meeting DSM ADHD criteria (mean age=10 years, SD=3.1, range 3 to 20) recruited from a pediatric neuropsychology clinic and enrolled in the LOGIC study, a longitudinal investigation of genetics and cognition. The potential incremental utility of SCT (measured by the CBCL) and processing speed (measured by the Processing Speed Index from Wechsler intelligence scales) to predict adaptive (ABAS General Adaptive Composite) and academic (composite of Word Reading and Numerical Operations from the WIAT) functioning, after controlling for ADHD symptom burden (sum of parent reported symptoms on CSI-4) was assessed using two hierarchical multiple regressions, one predicting each of the functional correlates.

**Results:** Parent-report ADHD symptom ratings significantly predicted the General Adaptive Composite (accounting for 16% of variance;  $\beta = -.40, p < .001$ ) and SCT added incrementally to the model, accounting for an additional 5% of the variance ( $\beta = -.23, p = .001$ ), while processing speed did not add incrementally to this model. Processing speed did contribute to the prediction of academic skills, accounting for 6% of the variance ( $\beta = .27, p < .001$ ). Neither ADHD symptom severity nor SCT predicted academic functioning.

**Conclusions:** SCT and processing speed differentially predicted adaptive and academic functional abilities not accounted for by ADHD symptom burden. Such data support the separate measurement of processing speed and SCT in ADHD samples. Clinical and research implications will be discussed.

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**K.A. DUCKETT, T.J. ARENTSEN, E.M. CROUSE, L.K. HENNESSEY, J.D. JACKSON, B. SMITH, S.K. STERN, W.J. STUBBS & B. ROPER. The ADHD Symptom Questionnaire (ASQ): Pilot Study on a DSM-5 Specific, Self-Report Questionnaire with Embedded Validity Items.**

**Objective:** Currently, few neuropsychological assessments measure ADHD symptoms using DSM-5 criteria and none include embedded symptom validity items (Rösler et al., 2006). The current study introduces the ADHD Symptom Questionnaire (ASQ), a newly developed, 60-item, Likert-based (ranging from 1-6) measure of ADHD symptoms that includes validity indicators.

**Participants and Methods:** Participants ( $n=47$ ) were veterans referred for possible ADHD who completed neuropsychological evaluation, including the Conner's Adult Attention Deficit/Hyperactivity Rating Scale (CAARS:S-L) and the ASQ (<2 items missing) at a large VA medical center. The ASQ includes separate scores for the 9 inattention (ASQ-I) and 9 hyperactivity symptoms (ASQ-H), and 1 for non-ADHD symptoms (ASQ-N). Descriptives for and correlations among CAARS:S-L and ASQ scales are reported. ASQ-I and ASQ-H endorsement were classified into two group statuses when at least 5 symptoms were endorsed (mean score > 3.75) on either ASQ-I or ASQ-H then compared by group to CAARS:S-L DSM IV scale scores.

**Results:** Mean scores for ASQ-I and ASQ-H symptoms ranged from 3.41 to 5.03 and 2.87 to 4.69, respectively. Three ASQ-I and 6 ASQ-H symptoms were significantly correlated with their respective CAARS:S-L DSM-IV scales. ASQ-N was positively correlated with the CAARS:S-L Infrequency Index (Suhr et al., 2011;  $r = .57, p < .001$ ). Being classified positively for DSM-5 ADHD by either the ASQ-I and ASQ-H symptoms resulted in higher scores on respective CAARS:S-L DSM IV scales, with Inattention,  $F(1,39) = 21.00, p < .001, \eta^2 = .35$ , and Hyperactivity,  $F(1,39) = 7.63, p = .009, \eta^2 = .16$ .

**Conclusions:** Current results provide preliminary evidence that the ASQ may be useful in clinical assessment of ADHD per DSM-5 criteria. ASQ-N items appear to function well as embedded symptom validity

indicators. With further development planned, the ASQ holds promise for informing ADHD diagnosis.

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**F. BALDWIN, A.E. PRITCHARD, M. MAHONE & L.A. JACOBSON. Goodbye to the Processing Speed Deficit? Performance of Clinically-referred Children with and without ADHD on the WISC-V.**

**Objective:** Children with ADHD demonstrate slower processing than both typically developing and clinical comparison peers on the Wechsler Intelligence Scale for Children-IV (WISC-IV) Processing Speed Index (PSI). Similarly, the technical manual of the newest edition, WISC-V, reported a small sample of children with ADHD ( $n=48$ ) to have lower PSI scores than controls. Whether this pattern holds relative to a clinical comparison group is unknown. The present study explored differences in WISC-IV and WISC-V Index scores between children with and without ADHD in a large clinical sample.

**Participants and Methods:** Participants included a mixed clinical sample of children ( $M\ age=10.25\pm 2.81$  years) assessed using either the WISC-IV ( $n=1443$ ) or WISC-V ( $n=445$ ) in a large outpatient neuropsychology clinic. Children who met DSM-5 ADHD criteria, per parent ratings, were included in the ADHD group ( $n=1217$ ), while all others ( $n=671$ ) comprised the clinical comparison group.

**Results:** Performance across indices shared by WISC-IV and WISC-V [PSI, Working Memory (WMI), and Verbal Comprehension Index (VCI)] was compared between WISC editions. Children with ADHD had significantly lower mean PSI scores than the clinical comparison group on the WISC-IV ( $p<.001$ ,  $\eta^2=.009$ ), but not the WISC-V ( $p=0.540$ ,  $\eta^2=.000$ ). Within the ADHD group, PSI score means were significantly higher on WISC-V (91.6) than WISC-IV (87.9; mean difference=3.76,  $p=.001$ ,  $\eta^2=.01$ ); whereas, there were no significant differences between WISC versions on WMI ( $p=0.11$ ,  $\eta^2=.003$ ) or VCI ( $p=.41$ ,  $\eta^2=.001$ ).

**Conclusions:** While children with ADHD show a relative disadvantage on the WISC-IV PSI compared to other clinical groups, this deficit does not appear to extend to the WISC-V. Moreover, it may be that children with ADHD actually perform better on the WISC-V than on the WISC-IV, especially on the PSI.

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**D.W. BEEBE & M. DIFRANCESCO. fMRI Correlates of Diminished Sustained Attention among Sleep-Restricted Adolescents.**

**Objective:** Adolescents often get much less sleep on school nights than is recommended, which can impair attention. Little is known about how the adolescent brain responds to sleep restriction (SR). This neuroimaging study compared brain response to a vigilance task under healthy sleep (HS) vs. SR.

**Participants and Methods:** Thirty-three typically-developing 14-16 year-olds underwent a 3-week within-subject randomized cross-over protocol: a baseline week followed by 2 experimental weeks with 5 nights of 6.5 hours (SR) vs. 10 hours (HS) in bed. Protocol adherence was verified via actigraphy. Teens underwent fMRI on the mornings at the end of HS and SR while performing a version of the psychomotor vigilance task that measured reaction time (RT) in response to stimuli presented at random interstimulus intervals. Slow RT is suggestive of inattention. Imaging data were analyzed using an event-related general linear model, comparing the events with the slowest 20% vs. the fastest 20% of RT. We also examined event onset times 4 seconds preceding the stimuli to capture anticipatory brain state.

**Results:** During SR, faster RT were linked to greater activation in striatum, motor cortex, and bilateral parietal areas, and less activation in the medial frontal region, anterior cingulate, left insula, and precuneus. The HS condition, however, resulted only in striatal activation for fast>slow RT. Slow reactions were preceded by stronger activation in posterior

cingulate and fusiform/temporal regions during SR, and by stronger activation in the hippocampus during HS.

**Conclusions:** During SR, episodes of inattention were preceded by “default-mode” brain states, followed by a presumably reactive increase in activation of motor and attention regions. When well-rested, the same teens showed less variation in activation between slow and fast RT. The same brain circuits that underlie daydreaming appear to be particularly relevant to inattention among chronically sleep-deprived teens.

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**A.P. BORSCHUK, C. RODWELLER & C.F. SALORIO. The Influence of Comorbid Asthma on the Severity of Symptoms in Children with Attention Deficit Hyperactivity Disorder.**

**Objective:** Attention-deficit hyperactivity disorder (ADHD) and asthma are often comorbid diagnoses in childhood. Research indicates that children with asthma are more likely to develop ADHD symptomatology than children without asthma. Children with either condition display higher rates of problem behaviors and worse performance on measures of executive functioning. It is unclear whether a comorbid diagnosis of asthma significantly influences the expression of behavior, attention, and executive functioning in children with ADHD. The current study examines the association between asthma and ADHD symptoms in a clinical sample.

**Participants and Methods:** Demographic and neuropsychological data for children with a billing diagnosis of ADHD (mean age=10; 75% male) were extracted from a clinical database. Families completed standard rating scales as part of a neuropsychological assessment. Sixty patients with a co-morbid asthma diagnosis were identified and matched by age to a group of 60 patients with only ADHD.

**Results:** No differences were found between groups in any aspect of executive functioning on the BRIEF. In contrast, analyses revealed higher parent report of behavioral symptoms ( $p<.05$ ), anxiety ( $p<.01$ ), and internalizing ( $p<.01$ ) on the BASC-2 in children with both asthma and ADHD compared to those with ADHD alone. Additionally, 37% of children with asthma and ADHD displayed clinically elevated hyperactivity, while only 15% of children with ADHD alone had clinically elevated scores.

**Conclusions:** Results suggest that in children with ADHD, co-morbid asthma is associated with increased behavioral and internalizing symptoms. Increased behavioral and internalizing symptoms seen in children with both asthma and ADHD may be due to their medical condition (e.g., anxiety due to medical regimen or recurrent asthma attacks). No difference was found on cognitive variables, suggesting chronic hypoxia may be less influential in explaining these differences. More research is needed to determine specific mechanisms of these differences.

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**M. CAIRNCROSS & C.J. MILLER. The Efficacy of Mindfulness-Based Therapies for Attention-Deficit/Hyperactivity Disorder: A Meta-analytic Review.**

**Objective:** Attention-deficit/hyperactivity disorder (ADHD) is a highly prevalent neurobehavioral disorder, which manifests as developmentally inappropriate pervasive and persistent inattention, and hyperactivity-impulsivity. Given that the symptoms of ADHD result in significant impairment in multiple areas of functioning, developing new treatments has important implications for the quality of life of individuals who suffer from ADHD. In recent years, mindfulness-based therapies (MBT) have been introduced as a potential treatment for individuals with ADHD. Although research has demonstrated MBT to be a moderately effective treatment for internally-focused disorders, it is still unclear whether MBT can provide improved functioning for individuals with externalizing disorders such as ADHD. In order to clarify the literature

on the efficacy of MBT in treating ADHD an effect size analysis was conducted.

**Participants and Methods:** A systematic review of studies published in PsycINFO, PubMed, and Google Scholar was completed from the earliest available date until December 2014. Following the collection of all data that met the inclusion criteria, the data were synthesized to estimate the overall effect size of MBT on core ADHD symptoms (i.e. attention and hyperactivity-impulsivity).

**Results:** A total of eight studies were included in the analysis of inattention and the overall effect size was  $d = -.72$ . A total of seven studies were included in the analysis of hyperactivity-impulsivity and the overall effect was calculated at  $d = -.60$ . Thus, results demonstrated that MBT significantly reduced inattention and hyperactivity-impulsivity in individuals diagnosed with ADHD.

**Conclusions:** This study highlights the possible benefits of MBT in reducing symptoms of ADHD by providing preliminary evidence for the efficacy of MBT for ADHD. The present study can help to guide future research, by bringing attention to the need for more methodologically rigorous experimental studies to provide more evidence for the use of MBT in individuals with ADHD.

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### **J.B. DYKSTRA, E.Y. LEE & J. SUHR. Self-Handicapping Strategies in Emerging Adults Concerned about ADHD.**

**Objective:** When faced with an evaluative task, some individuals engage in self-handicapping, which consists of reporting on the presence of impediments or actively creating barriers to success in order to preserve self-esteem in the event of failure. The present study objectives were to examine the impact of evaluative threat on self-handicapping efforts and evaluate the impact of self-handicapping on subsequent neuropsychological task performance among emerging adults with a concern for ADHD.

**Participants and Methods:** 103 emerging adults (ages 18 to 24) completed a working memory task. Participants were randomly assigned to either be told that the task was a measure of intelligence ( $N = 51$ ) or that the task was a prototype for a Smartphone application ( $N = 52$ ). All participants then completed self-report measures of ADHD symptoms as well as a self-handicapping checklist. They were then introduced to a computerized task of working memory (Dual 2-Back) and allowed to practice the task as many times as they wished before starting the test trial.

**Results:** Independent *t*-tests and chi-square analyses showed that evaluative threat groups did not differ in self-handicapping efforts (all  $ps > .05$ ). Regression analyses highlighted a role for individual differences in self-reported symptoms, such that individuals with higher trait self-handicapping, neuroticism, and depressive symptoms were more likely to report more general barriers to performance and higher ADHD symptoms, regardless of evaluative threat group ( $ps = .001-.04$ ). Further, within the evaluative threat group, those with higher risk factors who engaged in self-handicapping demonstrated worse performance on the Dual 2-Back ( $ps = .005-.05$ ).

**Conclusions:** The present study highlights the interplay of factors that may contribute to somatization tendencies and non-credible responding. In addition, the present study found evidence to suggest that high risk factors and self-handicapping behavior can have a negative influence on task performance in an evaluative threat context.

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### **S.A. CHEN, J.B. HALE, H.A. KUBAS, J.W. WITZKE, K. MURPHY & J. MCKEE. Research Domain Criteria for Deciphering ADHD Executive Heterogeneity.**

**Objective:** ADHD is a neurodevelopmental disorder traditionally defined using behavioral criteria. We applied a research domain criteria (RDoC) approach to define dimensional symptoms instead of focusing on behavioral subtyping to decipher the neuropsychological heterogeneity that is often observed.

**Participants and Methods:** Participants ( $N = 55$ ;  $M$  age=121.07 months,  $SD=15.99$ ) enrolled in an ADHD RCT methylphenidate study were administered consent, baseline testing, and parent ratings by neuropsychologist-supervised RAs in a secure laboratory setting.

**Results:** A relaxed-eigenvalue principal components analysis with Kaiser-normalized varimax rotation of BASC-II subscales converged in 6 iterations (eigenvalues .54 to 4.98), revealing 4 main dimensions of Conduct-Aggression (CA), Inattention-Hyperactivity (AH), Anxiety-Depression (AD), and Depression-Withdrawal (DW) symptoms, explaining 87.81% of the variance. Dimensions were differentially related to BRIEF Behavioral Regulation (significant CA and AD  $r$  range .28 to .60) and Metacognition (significant AH and DW  $r$  range .32 to .69) indices, thought to be consistent with frontal-subcortical circuit (FSC) studies and circuit balance theory. Conners' CPT-II variables were correlated with the CA and AH (significant CA and AD  $r$  range .27 to .36), but not with AD or DW (NS). PCA  $z$ -scores ( $>0$ ) and forced-entry discriminant function analyses were used to create RDoC-determined externalizing (CA-AH) and internalizing (AD-DW) subtypes. Seven out of the 12 CPT-II variables (Wilks'  $\lambda$  range .72 to .83,  $p$  range .008 to .048) discriminated between groups, with an overall 92% classification accuracy. **Conclusions:** Children with AD or DW attention problems do not appear to have the FSC circuit or executive patterns associated with AH or CA. Those with externalizing AH/CA ADHD may be more likely to show robust ADHD treatment response. Implications for ADHD research, diagnosis, and treatment will be addressed.

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### **A. KANDASAMY. Eye-Tracking as a Behavioural Measure of Impulsivity.**

**Objective:** Impulsivity is a multifaceted construct that is primarily measured using self-report questionnaires and behavioural tasks. However, often, behavioural measures of impulsivity do not align well with self-report measures, such as the Barratt Impulsiveness Scale - Eleventh Edition (BIS-11; Stanford, et al., 2009). One proposed mechanism for this phenomenon is that both modalities capture different dimensions of impulsivity (Vigil-Colet, 2011). Eye-tracking and reaction time are behavioural measures that may provide insight into the same features found using self-reported impulsive behaviours.

**Participants and Methods:** Eye-tracking and reaction time were recorded during the Peabody Picture Vocabulary Test - Fourth Edition digital stimulus book administration, and output (saccadic speed, pupillary dilation, and fixation duration), was used to predict impulsivity, as measured by the BIS-11. In addition, demographic factors, including ADHD diagnosis, age, gender, and SES, were considered. Participants were 64 undergraduate students (50 women, 14 men) at a medium-sized, ethnically diverse, university in southwestern Ontario.

**Results:** Hierarchical regressions showed slower reaction time and smaller pupil dilation predicted greater impulsivity, consistent with previous research regarding working memory and time-use in individuals with high impulsivity. Impulsivity was related to ADHD diagnosis and gender.

**Conclusions:** Findings lend insight into the disparity between self-report and behavioural measures of impulsivity and provide the foundation for developing behavioural instruments that measure the same dimensions of impulsivity captured by self-report measures.

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**J. KIM, C. LEE, T. GREIF, H. LUU, A. LEON, D.L. COOL, J. JANECEK & N. PLISKIN. Attention-Deficit/Hyperactivity Disorder (ADHD) in Adults: Neuropsychological Referrals in an Academic Medical Center.**

**Objective:** It is estimated that 4.4% of adults in the United States and 3.4% worldwide suffer from ADHD (Kessler et al., 2006; Fayyad et al., 2007). With increased use of objective tests for diagnostic clarification, neuropsychology has seen increased referrals for adult ADHD. However, clinicians' accurate knowledge of ADHD diagnostic criteria is necessary to make appropriate referrals (Gordon et al., 2006). This study examined clinical characteristics of patients referred to an academic medical center for a neuropsychological evaluation related to suspected ADHD, and examined the relationships between self-report measures, and test performance.

**Participants and Methods:** Archival records included referral sources, previous histories, and diagnoses for 77 adult patients referred to an academic medical center with concerns of ADHD. A subset (n=44) had been administered the Clinical Assessment of Attention Deficit-Adult (CAT-A), Beck Depression Inventory (BDI-II), Pittsburgh Sleep Quality Index (PSQI), and Conners' Continuous Performance Test (CPT II).

**Results:** 39% of patients were diagnosed with ADHD after an evaluation; ADHD was ruled out for 45.5% of the sample. For the remaining 15.5%, other variables (e.g., sleep disturbance, significant mood symptoms) prevented accurate determination of ADHD diagnosis. A logistic regression demonstrated a significant relationship between previous and current ADHD diagnosis ( $B=1.31$ ,  $p=.01$ ). Linear regressions indicated that self-reported symptoms on the CAT-A were significantly associated with PSQI,  $R^2=.16$ ,  $F(42,1)=$ ,  $p<.01$ , and BDI-II,  $R^2=.10$ ,  $F(42,1)=$ ,  $p<.05$ , but not with CPT scores.

**Conclusions:** Fewer than 40% of referrals received a diagnosis after a comprehensive neuropsychological evaluation. Self-reported ADHD symptoms were significantly associated with self-reported depressive symptoms and sleep difficulties. Healthcare providers and patients would benefit from increased education regarding ADHD in adults and improved interdisciplinary communication regarding diagnostic guidelines.

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**J.C. LARSON, K.L. SWEENEY, L. FERENC, M. DENCKLA, S.H. MOSTOFSKY & M. MAHONE. Can a 75-Second Motor Persistence Test Predict ADHD in School-Aged Children?**

**Objective:** The current study sought to examine the clinical utility of a brief measure of motor persistence for identifying attentional impairment in a large pediatric sample of children with and without attention deficit/hyperactivity disorder (ADHD).

**Participants and Methods:** A total of 624 children (n=362 typically developing—TD, 64% male; n=262 ADHD, 67% male), ages 6-12 years, completed a task of motor persistence and inhibition (NEPSY-II Statue) during which they were asked to maintain a fixed body position with eyes closed for 75 seconds while the examiner made a series of distracting noises. Observations were made every 5 seconds to track errors (i.e., body movements, eye opening, or talking). Total raw score (range: 1-30) was the dependent variable. For analyses, participants were grouped into the following age bands: 6-8 years (n=173); 9-10 years (n=297); 11-12 years (n=154).

**Results:** Across each age band, performance on the task improved in both groups; however, TD children demonstrated better motor persistence than did children with ADHD ( $p<0.001$ ). Additionally, the proportion of TD children reaching scores at or near ceiling (i.e.,  $\geq 27$ ) was significantly greater (66%, 74%, and 90%) than children with

ADHD (30%, 38%, and 51%) in the three bands (6-8, 9-10, 11-12) respectively ( $\chi^2<0.001$ ). Sensitivity, specificity, and receiver operating characteristic (ROC) curves were examined for predicting ADHD diagnosis across each age band for the Statue Total. Statue Total was a fair predictor of ADHD across all age bands (AUC range=0.73-0.76) and optimal cut-scores of 11, 18, and 21 were identified for age bands 6-8, 9-10, and 11-12 respectively, that maximized both sensitivity (95-98%) and specificity (77-84%).

**Conclusions:** The NEPSY-II Statue task represents a very brief, easy-to-administer measure of motor persistence that demonstrates excellent sensitivity and specificity for classifying children with ADHD. Normative data from a large TD reference sample are included for each age (year) between 6 and 12 years.

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**E.Y. LEE, S. RACINE & J. SUHR. Self-Reported Impulsivity and Self-Regulation in Relation to ADHD and Executive Function Tasks.**

**Objective:** Hyperactive/impulsive symptoms in individuals with Attention-Deficit Hyperactivity Disorder (ADHD) are more strongly related to executive dysfunction than inattention symptoms. Growing research suggests that self-regulation deficits in individuals with ADHD may be related to impulsive symptoms, but little research has examined the association of self-regulation difficulties and executive functioning. The present study examined the relationship of self-reported impulsivity and self-regulation problems to performance on a behavioral measure of inhibition in a healthy undergraduate sample.

**Participants and Methods:** As part of a larger study, self-report measures of psychopathology, including the Conners Adult ADHD Rating Scales (CAARS) and the Urgency, Premeditation, Perseverance and Sensation-seeking Scale (UPPS) and the Color-Word Interference Test (CWIT) of the Delis-Kaplan Executive Function System were administered to 60 healthy undergraduates (13 males, age range=18-27). Scale C of the CAARS was divided into separate impulsivity and self-regulation subscales (as in Mitchell et al., 2012).

**Results:** Self-reported impulsivity and poor self-regulation of CAARS scale C were related to responses on the Urgency subscale in the UPPS, both  $r=.60$ ,  $p<.001$ . Urgency was negatively correlated with CAARS DSM Inattention,  $r=-.53$ ,  $p<.001$ , and Hyperactivity/Impulsivity symptoms  $r=-.29$ ,  $p=.03$ . CAARS DSM Inattention symptoms,  $r=.02$ ,  $p=.91$ , and Hyperactivity/Impulsivity symptoms,  $r=.08$ ,  $p=.58$ , were not related to behavioral inhibition on the CWIT. Self-reported impulsivity was not related to task performance,  $r=.03$ ,  $p=.57$ , but high self-reported self-regulation was related to better behavioral inhibition on the CWIT,  $r=-.30$ ,  $p=.027$ .

**Conclusions:** These findings suggest that self-regulation is important in executive function tasks that require inhibitory control. Future studies should examine these relationships in samples of individuals who meet diagnostic criteria for ADHD, as well as include additional executive function measures.

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**J.M. NELSON & S.W. LIEBEL. ADHD Symptoms among College Students: Cross-Informant Agreement, Intra-Informant Agreement and Relationships with Neuropsychological Functioning.**

**Objective:** The purpose of this study was to investigate cross-informant agreement of current ADHD symptoms among college students, intra-informant agreement of these symptoms across time (current and retrospective childhood symptoms), and the relationships between these symptoms with scores from neuropsychological instruments used to measure attention and related abilities.

**Participants and Methods:** A large sample ( $N = 434$ ) of college students referred for potential attention and/or learning disorders received a comprehensive neuropsychological evaluation at a university-based clinic. Participants and their parents also completed measures of past and current symptoms of ADHD. These measures included the Conners Adult ADHD Rating Scale and the College ADHD Response Evaluation.

**Results:** Low cross-informant agreement was found between parent and self-reports of current inattentive symptoms, although correlations between these reports were statistically significant ( $r_s = .22 - .37$ ,  $p_s < .001$ ). Moderate cross-informant agreement was found for current hyperactive-impulsive symptoms ( $r_s = .46 - .50$ ,  $p_s < .001$ ). Low intra-informant agreement for parent reported childhood and current inattentive symptoms was found ( $r_s = .35 - .41$ ,  $p_s < .001$ ), whereas low to moderate intra-informant agreement was found for hyperactive-impulsive symptoms ( $r_s = .47 - .68$ ,  $p_s < .001$ ). Correlations between current ADHD symptoms and scores on the Integrated Visual and Auditory continuous performance test and relevant WAIS-IV (working memory and processing speed) and WMS-IV (immediate memory) subtests were either not significant or significant but in the small range (most  $r_s$  in the  $-.10$  range).

**Conclusions:** Results illustrate the inconsistent data that are often derived from adult ADHD evaluations. Evaluation data were particularly inconsistent when comparing reported ADHD symptomatology and performance on neuropsychological measures. Recommendations for valid identification of ADHD among college students will be discussed. Correspondence: *Jason M. Nelson, Ph.D., Regents' Center for Learning Disorders, University of Georgia, 337 Milledge Hall, Athens, GA 30602. E-mail: jmnelson@uga.edu*

#### **S.W. LIEBEL & J.M. NELSON. Auditory and Visual Working Memory in College Students with ADHD.**

**Objective:** Children with attention-deficit/hyperactivity disorder (ADHD) have been shown to have weaker auditory and visual working memory (WM) compared to non-ADHD children, and these differences are greatest in VWM (Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005). While it is known that ADHD persists into adulthood, little research has investigated WM deficits in college-aged adults specifically. The present study examined potential differences in AWM and VWM in a large sample of college-aged adults.

**Participants and Methods:** One hundred and thirty-seven college students with ADHD received a comprehensive neuropsychological evaluation at a university-based clinic. All participants were administered selected portions of the WAIS-IV, WMS-IV, and WI-III. A paired samples  $t$ -test analyzed overall differences in AWM and VWM ability. Hierarchical multiple regression models analyzed the unique contributions of AWM and VWM in predicting general math calculation skills.

**Results:** In this sample and contrary to previous findings, participants' AWM was worse than VWM ( $t[136] = -2.827$ ,  $p = .005$ ). Additionally, after controlling for general ability and cognitive processing speed, AWM was a significant contributor to math calculation skills ( $\Delta R^2 = .234$ ,  $p < .001$ ) but VWM was not ( $\Delta R^2 = .004$ ,  $p = .39$ ). Overall, general ability, cognitive processing speed, and AWM significantly predicted math calculation skills ( $R^2 = .524$ ,  $F[3, 84] = 29.756$ ,  $p < .001$ ).

**Conclusions:** The pattern of stronger AWM compared to VWM found in children with ADHD was not found in this adult sample. AWM appears to be more important than VWM for college students with ADHD. Correspondence: *Spencer W. Liebel, Psychology, University of Georgia, 144 Jolly Lane, Athens, GA 30606. E-mail: swliebel@uga.edu*

#### **K.S. MAZZOLA, M.A. PIEVSKY, L. ABUEHIGA, B. FREER & L. TIERSKY. The Effect of Comorbid Depression in Adult ADHD on the CAARS.**

**Objective:** Both ADHD and depression affect cognitive functioning, and there is a high rate of comorbidity between the two. However, little research has specifically looked at comorbid depression in ADHD, despite a possible additive effect on cognitive functioning. It is hypothesized

that those with comorbid depression will have higher self- and observer ratings on the Conner's Adult ADHD Rating Scale (CAARS).

**Participants and Methods:** 90 participants completed the CAARS as part of a larger neuropsychological battery. Clinicians assigned clinical diagnoses based on information from clinical interviews and test data from a full neuropsychological assessment. Three groups were created: ADHD only, depression only, and comorbid ADHD and depression.

**Results:** A MANOVA was conducted to test the effect of participants' diagnoses on the factors of the CAARS. The comorbid group rated higher than the ADHD group on both self- and observer-rated self-concept problems,  $p = .023$  and  $p = .027$ . The comorbid group scored higher than the depression group on observer ratings for DSM-inattention symptoms,  $p = .028$ , and DSM-ADHD symptoms,  $p = .012$ . Finally, the comorbid group scored higher than the depression group on observer-rated inattention and memory symptoms,  $p = .043$ .

**Conclusions:** This study shows that those with comorbid depression and ADHD differ from ADHD on self-concept, both self- and observer-rated, indicating a possible lower self-esteem and self-efficacy in the comorbid group. In addition, it was found that observers reported more problems with inattention and memory symptoms for those with comorbid depression and ADHD compared to those with depression, despite self-rated measures not showing these differences. There was no difference between the ADHD group and the comorbid group on self-reported inattention and memory symptoms. These findings suggest that clinicians should be aware that individuals with a comorbid depression and ADHD diagnosis might have lower self-concept that could impede treatment.

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#### **A.M. COLBERT, K. OSWALD, R. LAJINESS-O'NEILL, K. SAULES, W. HARRELL & J. BO. Working Memory Assessment and Symptoms of Attention Deficit Hyperactivity Disorder in Children.**

**Objective:** Working memory (WM) may be a core deficit of ADHD, and the WM theory of ADHD could provide increased understanding of ADHD. However, clinical and experimental measurement of WM often utilize differing tasks, which may elicit different constructs. Research examining relationships between WM and ADHD is also inconsistent, and evaluation of ADHD symptoms versus diagnosis may clarify this relationship. The first objective was to compare experimental paradigms and clinical assessment of WM. The second objective was to investigate the relationship between WM and ADHD symptoms.

**Participants and Methods:** As ADHD symptoms rather than ADHD diagnosis is being measured, we included male children with and without formal diagnosis of ADHD. In the sample ( $N = 50$ ,  $M = 9.12$ , range = 6-12 years), 20% were previously diagnosed with ADHD. Participants completed the WASI-II, WISC-IV WMI and Arithmetic subtest, Automated Working Memory Assessment-2, and change-detection tasks. Parents completed the Conners 3-P. Relationships were examined via Pearson correlation and hierarchical regression.

**Results:** Results indicated computerized change-detection tasks may not effectively elicit WM in young children, though a trend for developmental increase in WM was found ( $r = .31-.33$ ;  $p < .05$ ). The WISC-IV Arithmetic subtest was most consistently related to other WM measures ( $r = .34-.44$ ;  $p < .05$ ). The Arithmetic and Digit Span Backward subtests were most consistently related to inattentive symptoms ( $r = -.44$  &  $-.42$  respectively;  $p < .01$ ) though significant variance was still unaccounted for ( $R^2 = .19$ ;  $p = .002$ ), and no WM measure was consistently related to hyperactive/impulsive symptoms.

**Conclusions:** Arithmetic was a better measure of WM than other WM measures, and measurement of ADHD inattentive symptoms best characterized relationships between ADHD and WM. Results highlight the need for enhanced WM measurement and consistency between measures, as well as the utility of considering symptom presentation versus categorical diagnosis.

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**M.A. PIEVSKY, L.S. ABUELHIGA, K.S. MAZZOLA & L. TIERSKY. The Use of Neuropsychological Measures in ADHD Diagnosis.**

**Objective:** There is much debate about the use of neuropsychological measures to diagnose ADHD. A meta-analysis conducted by Hervey, Epstein, and Curry (2004) revealed that most neuropsychological measures are only modestly correlated with a diagnosis of ADHD in adults. The present study evaluated how well neuropsychological measures and self-report scales predict clinical diagnosis of ADHD.

**Participants and Methods:** Participants were 164 individuals tested at an outpatient clinic in the northeast US. Participants completed a neuropsychological test battery that included the PASAT, Conners' CPT-II omission errors, Conners' CPT-II commission errors, D-KEFS tower test number of moves, CVLT-II learning trials 1-5, and Conners' Adult ADHD Rating Scales Self Report inattention/memory problems, hyperactivity/restlessness, impulsivity/emotional lability, and problems with self-concept scales. Clinicians assigned a diagnosis of ADHD based on information from clinical interviews and test data.

**Results:** Binary logistic regression was used to test the prediction power of the above measures, those most highly correlated with ADHD diagnosis, on the likelihood of receiving a diagnosis of ADHD. The model was significant,  $\chi^2(10) = 38.93, p < .05$ . Sensitivity was .33, and specificity was .93. Only two of the measures uniquely predicted ADHD diagnosis: CVLT-II learning trials 1-5 ( $B = -.05, OR = .95$ ) and CAARS inattention/memory problems ( $B = .08, OR = 1.08$ ).

**Conclusions:** These neuropsychological and self-report measures were able to predict whether an individual would be diagnosed with ADHD, but with low sensitivity. The criteria clinicians used to diagnose ADHD appear to share little variance with these measures. Indeed historically, the relationships that have been found between neuropsychological measures and ADHD diagnosis are typically weak (Hervey et al., 2004). Future research may benefit from the use of alternative criteria for defining ADHD and should further explore the role of verbal memory in ADHD. Correspondence: *Michelle A. Piersky, MA, Psychology, Fairleigh Dickinson University, 55 Willow Street, Jersey City, NJ 07305. E-mail: mpievsky@student.fdu.edu*

**M. PINJALA. Component Structure of Multiple Tests of Attention in a Mixed Clinical Child Sample.**

**Objective:** The goal of this study was to examine the components of attention assessed by commonly used neuropsychological tests in children. This study employed scores obtained from a continuous performance task, span tasks, pencil and paper tests and behavioral rating scales.

**Participants and Methods:** A Principal Components Analysis was utilized to explain the variance in test scores and to reduce the data into components related to different domains of attention. Participants consisted of 235 children aged 6-16 years old ( $M = 10, SD = 2.95$ ), who were predominantly female (63%) and right handed (89%), with a mean education level of 4 years ( $SD = 2.8$ ). The participants were diagnosed with a variety of psychological and neurological disorders and comprised a mixed clinical sample.

**Results:** Results of the current study confirmed the utility of these tests to measure multiple aspects of attention by using a variety of approaches, as five components emerged. The first component explained 27.6% of the variance and was determined to measure Vigilance, the second explained 11.5% of the variance and was labelled Mental Tracking, the third accounted for 8.2% of the variance and was deemed Impulsivity, the fourth accounted for 8.2% of the variance and it was determined that the components measured Behavioral Inattention and the fifth component, which accounted for 6.1% of the variance was labelled as Attentional Fatigue.

**Conclusions:** The findings of the study provide useful information to those studying underlying mechanisms of attentional processes in a

developmental context, as well as to clinicians providing comprehensive evaluations of children with various clinical presentations. Further studies should examine attention patterns in individual subgroups of disorders to further bolster knowledge about attentional deficits in a variety of patient populations.

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**R.C. RECIO, L. AGUERREVERE, T.J. SWIFT, R.C. NICKS, C. WYKOFF & K. MELTON. Effects of One Neurofeedback Session on Verbal and Visuospatial Search.**

**Objective:** Neurofeedback (NF) training measures brain activity via electroencephalogram (EEG), and rewards specific brain patterns. NF training has been suggested as a possible brain-based supplemental therapy for patients with attention deficit disorder (Butnik, 2005). However, there is a scarcity of well-designed studies that present the actual effects of this technique on the component of attention (e.g. visual search, focusing, and distraction). The purpose of this study was to experimentally determine the beneficial effects of one NF session on attention-related visual search.

**Participants and Methods:** Healthy college students ( $N = 119$ ) were randomly assigned to one of three training protocols: a left hemisphere NF training (LH;  $N = 41$ ), a right hemisphere NF training (RH;  $N = 41$ ), or a sham protocol (Sham;  $N = 37$ ). After training, participants completed two visual search tasks: verbal (i.e. word finding) and visuospatial (i.e. animal finding). Strong fixations in these tasks were indicative of "finding" and these were measured via eye tracking technology.

**Results:** Results indicated that one session of NF had a significant effect on both verbal and visuospatial search (verbal search,  $F [2,116] = 5.24, p < .01, \text{partial } \eta^2 = .08$ ; visuospatial search,  $F [2,116] = 3.73, p < .05, \text{partial } \eta^2 = .06$ ). Those trained on the right hemisphere ( $m = 17.97, sd = 2.67$ ) found fewer words than the other protocols (LF  $m = 19.32, sd = 2.20$ ; Sham  $m = 19.54, sd = 1.97$ ). Participants trained on the left hemisphere ( $m = 6.69, sd = 1.47$ ) found fewer visual images than the other protocols (RF  $m = 7.35, sd = 1.10$ ; Sham  $m = 7.41, sd = 0.89$ ).

**Conclusions:** The current study found detrimental effects from one NF session on visual search when training occurred in the skill-specific non-dominant hemisphere. Beneficial effects of one NF session on visual search tasks were not observed. This study demonstrated that one session NF training can have measurable effects on neuropsychological performance, even if these are disruptive. Clinical implications are discussed.

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**M.M. TABAQUIM, M.F. PEREIRA & M.R. FERRO. Child attentional functions with Cleft Lip and Palate.**

**Objective:** To investigate the neuropsychological skills of the attention of children with repaired cleft lip and palate (CLP); to characterize the neuropsychological skills profile of attention in this population, including selectivity, support, and alternation; to compare attentional levels between groups of children with pre-foramen clefts, post-foramen, and incisive Trans.

**Participants and Methods:** The sample comprised 111 subjects, both genders, between 7 and 12 years, diagnosed with FLP isolated. The instruments used were Colored Progressive Matrices of Raven: Special Scale; School Performance Test (TDE); Divided Attention Test - Form 1 (TEDIF-1); Visual Attention Test (TAVIS-4); Test Wisconsin Card Sorting (WCST); and Stroop Color and Word Test. The data were categorized and described as strainers and calculation and interpretation tables contained in each instrument manual.

**Results:** Males reported a higher incidence and the predominant type was the transforame fissure. The brainpower in reasoning tasks for most



participants was within average range. Reading and writing were characterized by levels below average for their age for both reading activities (85.59%) and writing (73.87%), indicating basic learning difficulties. **Conclusions:** Children with cleft lip and palate demonstrate changes in attentional skills. Those with post-foramen fissure possess greater attentional losses in the selectivity and switching of attention, those with the transforame type require attentional support, and those with pre-foramen require commitments in the three components of attention, with statistical significance compared to Transforame.

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**M.M. THOMASON, R. CAMPBELL & A. ROWLAND. Concentration Deficit Disorder: Prevalence, Associated Impairment, and Comorbidities in a Population-Based Sample.**

**Objective:** Concentration Deficit Disorder (CDD; AKA Sluggish Cognitive Tempo) is a controversial diagnosis that has received significant research attention. Research on CDD and Attention-Deficit/Hyperactivity Disorder (ADHD) has supported the conceptualization of CDD as a distinct disorder frequently comorbid with ADHD, particularly Inattentive Type. Prevalence estimates from population based samples estimate 5.1% of adults and 5.7% of youth meet CDD criteria. This study examined prevalence and relationship of CDD symptoms with functioning and other symptomatology.

**Participants and Methods:** Parents of 951 children enrolled in 17 public elementary schools in grades 1-5 provided ratings of ADHD and related symptoms. Prevalence rates of CDD were based on five items from the Child Behavior Checklist (CBCL) previously used in other studies of CDD. Respondents had to rate each of the items as occurring "Often" or "Very often" to meet criteria. Hierarchical regressions examined the variance in global impairment (defined by the score on the Columbia Impairment Scale) and CBCL scales (Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Delinquent Behavior, and Aggressive Behavior) explained by CDD, after controlling for grade, sex, ethnicity, and family income.

**Results:** Prevalence rates appeared lower than previous estimates of 5.7%, depending on which combination of CBCL items was utilized. CDD explained a significant amount of variance in impairment and all CBCL scales after controlling for variance explained by demographic factors ( $R^2$  change values: 0.15-0.52).

**Conclusions:** Prevalence rates from the current study are lower than those found in other studies. This is likely due to reliance on parent report alone. Previous literature suggests teachers are more apt to recognize symptoms of CDD than parents. Study findings reveal increased comorbidities and increased functional impairment associated with increased CDD symptomatology.

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**M.D. UDHNANI, A.M. CHAMBERS, A.L. FRIAS, C.E. TYNER & S.C. HEATON. Not All Visual Memory Tasks Are Created Equal: Sustained Attention May Explain Pediatric Performance Differences.**

**Objective:** Childhood ADHD is characterized by prominent attentional and executive dysfunction, but not typically associated with primary memory dysfunction. However, memory tasks with high attentional demands may produce misleading memory deficits in populations with prominent attentional dysfunction, such as ADHD. The Children's Memory Scale (CMS) is a widely used test of memory functions, but one of the two visual memory tasks (Faces) is designed in a manner that we hypothesize requires stronger sustained attention skills. The current study examines performance of children with ADHD on the two core

visual attention tasks of the CMS and the relationship with sustained attention skills.

**Participants and Methods:** Participants included 228 children diagnosed with ADHD (ages 6-16) referred for neuropsychological assessment. Performance on the CMS Dot Locations (Learning score) and Faces (Immediate score) was examined, and correlations were run with sustained auditory attention skills as measured by the "Score!" subtest of the Test of Everyday Attention for Children (TEA-Ch).

**Results:** Although performance at the group level was comparable across visual memory tasks, sustained attention performance correlated significantly with performance on the CMS Faces task ( $R^2=.190$ ,  $p=.003$ ), but not with Dot Locations performance ( $R^2=.105$ ,  $p=.071$ ).

**Conclusions:** Though preliminary in nature, the current results support hypothesized differences in CMS visual memory task performance and suggest that performance on the Faces subtest is confounded with sustained attention skills. Results need to be confirmed in a mixed clinical sample, but findings suggest that clinicians and researchers should be mindful about task design when selecting a test to assess memory functions in populations with attentional deficits.

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**B. VAN MEURS, A. DAVIS, N. CRUZ, A. MCCLAUGHLIN, N. LYONS, K. SADOWSKI & J. DORFLINGER. Processing Speed, Attention and Executive Functioning in ADHD with and without Co-morbid Anxiety.**

**Objective:** ADHD and anxiety overlap in symptomatology, and are frequently co-morbid, however the nature of the overlap is not well understood. Some studies demonstrate reduced effectiveness and more adverse reactions to stimulant medications when ADHD is comorbid with anxiety. Others demonstrate differences in reaction times, working memory and inhibition in these groups. The present study aimed to investigate the relationship between several neurocognitive measures across these groups.

**Participants and Methods:** Participants included all individuals who received an extensive diagnostic assessment at a community medical center and received a diagnosis of ADHD and/or Anxiety, and those with known neurological insult were excluded. Groups (Anxiety-Only, ADHD-Only, Comorbid) were compared on several measures in the domains of: attention, executive functioning (EF), processing speed (PSI), and motor speed.

**Results:** The ADHD-Only group scored significantly below the Anxiety-Only group in every domain. Conversely the ADHD group and the co-morbid group did not differ on any measure. Post-hoc analyses revealed that co-morbid anxiety moderated the relationship between PSI and measures of attention and EF in those with ADHD. Moderately strong relationships between PSI and several measures of EF present in the ADHD-Only group were either completely abolished or significantly reduced in the comorbid group. In contrast, moderately strong relationships between PSI and verbal/auditory attention present in the comorbid group were not present in the ADHD-Only group.

**Conclusions:** The relationship between PSI and attention and EF differs across groups, suggesting different mechanisms of attention and EF deficits in individuals with comorbid anxiety. The dissociation of these measures across groups and future research into this phenomenon can help with diagnosis and treatment planning for individuals with comorbid symptom presentation in order to optimize treatment effects.

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**R. VAN PATTEN, C. KEITH, M. BERTOLIN & J.D. WRIGHT. The Effect of Premorbid Attention-Deficit/Hyperactivity Disorder on Neuropsychological Functioning in Individuals with Acute Mild Traumatic Brain Injuries.**

**Objective:** Mild traumatic brain injury (mTBI) is a frequent, yet undertreated condition that typically manifests with transient neurological and cognitive symptoms that resolve over the course of several weeks. In contrast, attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that presents initially in childhood but often persists into adulthood. MTBI and ADHD include overlapping symptomatology, making it difficult for clinicians to disentangle the sequelae of each condition when they co-occur in the same individual. We hypothesized that neuropsychological tests would be sensitive to preexisting ADHD in inpatients with acute mTBIs.

**Participants and Methods:** We retrospectively examined the medical charts of 100 18–40-year-old inpatients (96% Caucasian; 77% male) with mTBIs in an acute care setting, half of whom had self-reported the presence of premorbid ADHD, and half of whom were matched controls. We analyzed group differences across neuropsychological tests of attention, processing speed, and executive functions and examined the profile ratings of independent, blinded, board certified neuropsychologists.

**Results:** Individuals with premorbid ADHD a) performed significantly worse than their matched counterparts on several tests of attention, processing speed, and working memory, and b) were significantly more likely to produce profiles later rated as impaired by independent, board certified clinical neuropsychologists.

**Conclusions:** These findings a) argue for the utility of a brief assessment of premorbid ADHD in the acute care of individuals with mTBIs and b) provide clinicians with a barometer for gauging the relative contributions of premorbid ADHD to neuropsychological impairments in the neurocognitive profiles of individuals with mTBIs. Reported effect sizes will assist clinicians in accurately weighing the impact of premorbid ADHD when interpreting such profiles.

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**A. WEIGARD, A. HEATHCOTE, S. BROWN & C. HUANG-POLLOCK. A Model-Based Assessment of Slow vs. Variable Information Processing in ADHD.**

**Objective:** Response times (RT) of children with ADHD are more variable than those of their peers and analysis with the drift diffusion model (DDM: Ratcliff & McKoon, 2008) has suggested that slowed information processing explains this variability (Huang-Pollock et al., 2013; Karalunas et al., 2012). However, factors such as lapses of attention, lower signal-to-noise ratios, or increases in contaminant RTs (e.g., guessing) may explain RT variability better than inefficient processing speed. The current study uses a model-comparison analysis with the DDM and linear ballistic accumulator model (LBA: Brown & Heathcote, 2008) to test these possibilities.

**Participants and Methods:** Children with ADHD (80) and age- and IQ-matched typically developing controls (32) completed a numerosity discrimination paradigm in which they decided whether arrays contained many (>50) or few (<50) asterisks at two levels of difficulty. RT data was fit to the DDM and LBA models, and a model-comparison approach was used to determine the best fitting models.

**Results:** Consistent with prior research, DDM analyses indicated that children with ADHD displayed slower information processing than their typically developing peers,  $F(1,110) = 29.29, p < .001$ . The LBA model, despite fitting the behavioral data better, did not reveal significant group effects in variability in information processing, speed of correct information processing or error information processing, suggesting that there may be sub-groups with different patterns of deficits.

**Conclusions:** Heterogeneity in information processing would be consistent with work documenting the neuropsychological heterogeneity of ADHD (Fair et al., 2012). Implications of possible sub-group deficits will be discussed as they relate to etiological theories of ADHD that posit

inefficient processing (Killeen et al., 2013), poorer attentional control (Koffler et al., 2014), or reduced signal-to-noise ratios (Castellanos et al., 2009) as the cause of variable performance in the disorder.

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**R. FRIED, J. BIEDERMAN, J. CHAN, S. FARAONE, L. FEINBERG & A. POPE. Clinical Correlates of Working Memory Deficits in Youth with and without ADHD: A Controlled Study.**

**Objective:** The object of this study was to analyze whether the prevalent Working Memory deficits present in children with ADHD were the 1) primary cause of the educational deficits documented in this population; 2) whether working memory deficits caused difficulties beyond academics and 3) whether working memory affects children outside the context of ADHD.

**Participants and Methods:** Subjects were youth aged 6-18 of both sexes with (N = 280) and without (N = 242) ADHD, derived from longitudinal, case-control family studies conducted at the Massachusetts General Hospital. Assessment included measures of psychiatric, psychosocial, educational, and cognitive functioning. Working memory was assessed using the WISC-R Freedom from Distractibility (FFD) factor. We classified subjects as having WM deficits using the following rules: 1) Subjects with a full scale IQ of 120 or less were considered having a WM deficit if their Freedom from Distractibility (FFD) score was 1 SD (15 points) lower than their full scale IQ; 2) any subject with a FFD of <85 and 3) any subject with full IQ >120 with a FFD 1.5 SDs (22.5 points) below their full IQ.

**Results:** Significantly more youth with ADHD had WM deficits than controls (31.9% vs. 13.7%,  $p < 0.05$ ) and in ADHD children, their presence was significantly ( $p < 0.01$ ) associated with an increased risk for grade retention and placement in special classes as well as lower scores on reading and math achievement tests, relative to ADHD subjects without WM deficits. In contrast, no other differences were noted in other areas of functioning. Although WM deficits also had some adverse impact on educational and cognitive correlates in non-ADHD controls, these differences failed to attain statistical significance.

**Conclusions:** WM deficits significantly and selectively increase the risk for academic deficits in children with ADHD beyond those conferred by ADHD. Screening for WM deficit may help identify children with ADHD at high risk for academic problems.

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## Autism Spectrum Disorders

**R. FRIED, J. BIEDERMAN, B. REIMER & G. JOSHI. Examining Driving Behavior in Young Adults with High Functioning Autism Spectrum Disorders (HF-ASD): A Pilot Study Using a Driving Simulation Paradigm.**

**Objective:** A recent survey showed only 24 percent of adults with HF-ASD who were deemed capable of driving were independent drivers compared to close to 87 percent of the population as a whole. The main aim of this study was to examine driving performance in young adults with HF-ASD in comparison with a community sample to ascertain reasons why so few individuals with HF-ASD are independent drivers.

**Participants and Methods:** Subjects were 20 male 18–24 year olds, half HF-ASD and half who were community controls. The HF-ASD group met the DSM-IV criteria for ASD, had IQs of 85 or greater, and valid driver's license. Subjects drove a 43-mile virtual roadway that consisting of urban and highway roads. During the simulation, auditory distracter tasks were introduced. In addition to driving performance, physiological measures including measurement of eye tracking, skin conductance and heart rate were collected

**Results:** No differences in speed or lane variability was found between groups. Mean heart rate and skin conductance measures were higher in the HF-ASD group than Controls. The average vertical position of HF-ASD drivers' gaze was 44 % higher than the community controls indicating HF-ASD drivers were less oriented toward objects low in the visual field (i.e. dashboard, brake lights in front of them, and on-coming vehicles). The HF-ASD group also showed a difference in gaze positioning more to the left with distracter tasks indicating a shift away from the road with cognitive demand.

**Conclusions:** These results show differences in both vertical and horizontal gaze in drivers with HF-ASD as well as differences in physiological measures indicative of anxiety. This research provides an indication of the types of challenges that HF-ASD drivers may encounter and what technology or treatment might be helpful in alleviating the situation.

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**R. FRIED, G. JOSHI, J. BIEDERMAN, A. POPE, J. CHAN, P. BHIDE & S. FARAONE. Neuropsychological Correlates of Autism Spectrum Disorders: A Controlled Study of Adults with High Functioning ASD.**

**Objective:** The main of this study was to examine the neuropsychological underpinnings of High Functioning (IQ>80) Autism Spectrum Disorder (HF-ASD) attending to comorbidity with ADHD. ADHD is comorbid at a rate of 80% in ASD; thus, we compared the scores on a range of cognitive/neuropsychological tests of the adults with HF-ASD to adults with and without ADHD of similar age and sex.

**Participants and Methods:** Participants included 26 adults with HF-ASD, 52 adults with ADHD, and 52 Controls. All subjects were administered: the Wechsler Abbreviated Scale of Intelligence, Processing speed and Working Memory subtests from the Wechsler Adult Intelligence Scale-IV, tests of executive functioning from the Delis Kaplan Executive Functioning System, the Test of Word Reading Efficiency, and the Wide Range Achievement Test in Math. For continuous outcome variables, a linear regression model was used; for binary outcome variables, a logistic regression was used. If the overall test of equality of groups showed that some groups differed from the others, then pairwise tests were carried out using Tukey adjustments.

**Results:** Two subjects from the ADHD and Control groups were matched to each ASD subject. Since SES was lower in the ASD group, all subsequent tests corrected for SES. There were no other significant differences in socio-demographic characteristics between groups. No differences in IQ were found among the groups. HF-ASD subjects were significantly more impaired than both comparison groups in processing speed, cognitive flexibility and sight words. HF-ASD subjects were more impaired than Controls in Working Memory, but not compared to ADHD subjects.

**Conclusions:** Our findings reveal very robust neuropsychological deficits in subjects with HF-ASD in comparisons with subjects with ADHD as well as Controls. The finding of a unique neuropsychological profile within HF-ASD could have significant implications for identifying individuals at risk for ASD in clinical settings, where the tests utilized in this study are commonly administered.

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**E. BEN-AVI, H. PARDOE, X. WANG, T. THESEN, R. KUZNIECKY, O. DEVINSKY & K. BLACKMON. Elevated White Matter Abnormalities in Females with Autism Spectrum Disorder.**

**Objective:** The male:female ratio in Autism Spectrum Disorders (ASD) is 4:1, indicating increased risk factors in males and/or protective factors in females. Females with ASD are at increased risk for neurologic comorbidities, including severe, treatment-resistant epilepsy. This suggests that females may require a higher degree of "neurologic burden" to cross the ASD diagnostic threshold. We tested this hypothesis by

quantitatively comparing white matter abnormalities in males and females with ASD.

**Participants and Methods:** Our sample included 22 individuals with ASD (11 males) and 22 age-matched controls (11 males) from the ABIDE database. Our dependent measure of "neurologic burden" was derived from the 3T T1-weighted MRI scans from each subject. Scans were processed with Freesurfer 5.3 to segment the gray and white matter and calculate the volume of all voxels in the white matter with hypointense signal (WMH). A group (ASD, control) by sex (male, female) ANCOVA was performed to test for an interaction, after controlling for total supratentorial brain volume. Autism Diagnostic Observation Schedule (ADOS) scores were used to test for sex differences in ASD symptom severity.

**Results:** There was an interaction between group and sex ( $F=7.72$ ,  $p=0.008$ ): although male controls had higher WMH volumes than female controls ( $F=6.17$ ,  $p=0.02$ ), females with ASD trended towards higher WMH volumes than males with ASD ( $F=3.64$ ,  $p=0.07$ ). Within the ASD group, there were no sex differences in ADOS scores; WMH volumes and the stereotyped behaviors/restricted interests subscale were correlated ( $r=0.44$ ,  $p=0.04$ ).

**Conclusions:** Results suggest that although males and females with ASD did not differ in symptom severity, females carried a higher neurologic burden, as indicated by elevated WMH volumes. Further, WMH volumes were associated with elevated stereotyped behaviors and restricted interests, implicating an etiological role for these white matter abnormalities in a core ASD symptom domain.

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**A. BONEBAKKER. Autism spectrum disorders in dual-diagnosis patients.**

**Objective:** Objective

The objective of this study was to determine if ASD occurs often in dual-diagnosis patients. Over the course of a year and a half, all inpatients at the Palier Centrum Dubbele Problematiek in The Hague previously diagnosed with SUD and a serious mental disorder were screened for ASDs using a standardised psychological assessment tool.

**Background**

In recent years Dutch mental healthcare institutions have seen a rise in the number of cases of autism spectrum disorder (ASD) diagnosed among normally gifted patients. These patients often suffer from comorbid disorders. Currently little is known about patients with an ASD and a comorbid Substance Use Disorder (SUD).

**Participants and Methods:** Participants and method

Dual-diagnosis inpatients were screened using the Autism Spectrum Quotient and the Autism Spectrum Disorders in Adults Screening Questionnaire. If the results strongly suggested that the patient suffered from an ASD, he or she was given a (neuro)psychological assessment. A total of 212 patients were included in the study, of whom 100 were screened. Six were suspected of having an ASD and were assessed more fully. All six were found to have an ASD.

**Results:** Results

The number of ASD patients was similar to that found in another group that had not been screened but in which seven patients had been diagnosed with ASDs based on full psychological assessments. Both groups had a number of significant common characteristics.

Furthermore, the results are consistent with a number of other recent Dutch studies

**Conclusions:** Conclusion

This study shows that among dual-diagnosis patients at the Palier Centrum Dubbele Problematiek in The Hague, the proportion with an ASD is at least 5% higher than known prevalence rates. We suspect that there are still more patients with ASD that are not detected.

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**K.R. BRADBURY, D.L. ROBINS, M. BARTON & D. FEIN. Birth Order Impacts Psychometrics on M-CHAT-R with Follow-up Phone Interview (M-CHAT-R/F).**

**Objective:** The M-CHAT-R/F is a parent-completed, screening instrument to detect autism spectrum disorder (ASD) in toddlers. When a child screens positive on the initial items, the follow-up confirms responses and reduces false positives. Previous research suggests that parents report developmental concerns about their first-born child significantly later than concerns about subsequent children. The current study proposes to explore how birth order may affect performance on the M-CHAT-R/F.

**Participants and Methods:** Toddlers ( $n=148$ ) were evaluated after screening positive on the M-CHAT-R/F. Overall result and item performance at initial and follow-up screen were compared for first-born children ( $n=58$ ) and subsequent children ( $n=90$ ). Diagnostic outcome was also examined.

**Results:** Samples did not differ on demographic characteristics. Follow-up was conducted approximately 1.5 mos after the M-CHAT-R, which did not differ between samples. Despite similar diagnostic classification (ASD vs. non-ASD) between groups, first-born children had lower M-CHAT-R/F scores than subsequent children ( $p=.027$ ). Item analysis indicated that subsequent children were more likely to fail items regarding more subtle behavior, such as following a point. Subsequent children were also more likely to be evaluated earlier than first-born children ( $p=.045$ ).

**Conclusions:** Parents may complete screening measures, such as the M-CHAT-R, differently for their first-born children than for subsequent children. Given similar diagnostic outcomes, differences in performance may suggest decreased developmental concern for first-born children or decreased awareness of subtle developmental milestones. The increased delay to evaluation for first-born children provides further support for this claim. Additional analysis of evaluation data is warranted and may provide further insight regarding birth order effects.

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**P.A. CABILES, A. CHAPMAN, J. CHO, M. GOODYEAR, N. KESHAVARZIAN & K. KEE. Is Emotional Processing a Predictor of Traits of Autism Among University Students?**

**Objective:** Recent studies have demonstrated that healthy individuals with traits of autism showed impairments in identifying emotional valence. However, little is currently known about other aspects of emotional processing that are critical for adaptive functioning. The current study examined a broad scope of emotional processes (identifying emotional valence and arousal, emotional awareness, and emotional creativity) to determine specific predictors of autism traits in 101 university students.

**Participants and Methods:** Participants viewed a series of 60 positive, neutral, and negative images selected from the International Affective Picture System, and then identified emotional valence and arousal using the Self-Assessment Manikin. In addition, participants' emotional awareness was assessed using the Toronto Alexithymia Scale and emotional creativity was measured using the Emotional Creativity Inventory. Autism tendencies were assessed using the Autism-Spectrum Quotient.

**Results:** Traits of autism were regressed on eight emotional processing predictors (identifying positive emotional valence, neutral valence, and negative valence; emotional arousal for positive, neutral, and negative images; alexithymia/emotional awareness; and emotional creativity), using a simultaneous multiple linear regression procedure. The regression was significant,  $F(8, 88) = 3.99$ ,  $p = 0.0001$ ,  $R\text{-squared} = 0.266$ . Among the predictors, alexithymia/emotional awareness ( $B = 0.21$ ,  $t =$

$4.01$ ,  $p = 0.0001$ ) and displaying emotional arousal for neutral images ( $B = -1.32$ ,  $t = -2.08$ ,  $p = 0.04$ ) were the strongest determinants of traits of autism. Also, identifying positive emotional valence was a trend-level predictor ( $B = -0.57$ ,  $t = -1.79$ ,  $p = 0.077$ ).

**Conclusions:** Preliminary findings from the current study may potentially expand our understanding of the role of emotional processes that are important determinants of autism tendencies in healthy individuals. Correspondence: *Patrick A. Cables, Psychology, CSU Channel Islands, One University Drive, Camarillo, CA 93012. E-mail: patrick.cables20S@myci.csuci.edu*

**A.R. CARLEW & T.D. PARSONS. A Virtual Classroom Continuous Performance Task for Assessing Persons with Autism.**

**Objective:** Environmental distractors may impair classroom performance in students with Autism Spectrum Disorder (ASD). While some studies report unimpaired inhibition in persons with autism, studies of resistance to distractor inhibition tend to reveal difficulties. We used a Virtual Classroom Continuous Performance Task (VC-CPT; Digital Media Works) to compare performance of college age students with ASD to typically developing students in non-distraction and distraction conditions.

**Participants and Methods:** Eight college age students diagnosed with ASD and ten neurotypical college age students were administered the VC-CPT. Within the VC-CPT, participants were asked to click a mouse button after viewing the letter "K" followed by the letter "A." Ecologically valid auditory, visual, and audio-visual distractors were presented in the environment during the distraction condition.

**Results:** A 2x2 mixed ANOVA controlling for age revealed a main effect of group,  $F(1,15) = 7.79$ ,  $p = .014$ , and an interaction of group and condition,  $F(1,15) = 5.25$ ,  $p = .037$ . While there was a significant difference on an overall performance measure of speed and accuracy regardless of condition, the addition of distractions impaired performance of the ASD group significantly more than the control group.

**Conclusions:** The VR Classroom revealed differences in resistance to distractor inhibition between individuals with ASD and typically developing individuals. These results indicate individuals with ASD are more susceptible to disturbance by environmental distractions, which may impair everyday functioning.

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**A. CLAWSON, M. SOUTH & M.J. LARSON. Conflict Adaptation in Autism Spectrum Disorder: A Family Study.**

**Objective:** Autism spectrum disorder (ASD) is associated with deficits in cognitive control processes involved in flexible behavioral regulation. Relatives of ASD probands often display subthreshold cognitive deficits. Cognitive aspects of behavioral regulation can be measured using conflict adaptation (CA), modulations in cognitive control based on previous-trial conflict. We examined response time (RT) and error rate indices of CA in ASD probands and their father, mother, and non-ASD sibling relative to control youth and their parents. We hypothesized that ASD probands would display reduced CA and similar patterns of reduced CA would be observed in ASD relatives.

**Participants and Methods:** 18 ASD probands, 49 first-degree relatives, and 75 control families completed a modified Eriksen flanker task. Mean CA effects were calculated for RTs and error rates. Linear regressions were used to predict mean CA for RTs and error rates with Group (autism, control), Kinship (mother, father, sibling, proband), and Group x Kinship interactions as independent variables and families as clusters.

**Results:** Groups showed reliable CA effects. The model of mean CA for error rates was significant ( $F=2.88$ ,  $p=.02$ ). Group ( $t=1.05$ ,  $p=.30$ ), Kinship ( $|t|<1.33$ ,  $p>.19$ ), and Group x Kinship interactions ( $|t|<1.85$ ,  $p>.07$ ) did not significantly predict mean CA. The model of mean CA for RTs was not significant  $F=.82$ ,  $p=.58$ . Group ( $t=-.06$ ,  $p=0.57$ ), Kinship

( $t < 1.20$ ,  $p > .24$ ), and Group x Kinship interactions ( $t < 1.37$ ,  $p > .18$ ) were not significant.

**Conclusions:** Mean CA for RTs and error rates did not differ between groups or as a function of family status. Youth with ASD displayed similar patterns of CA relative to control youth, and siblings and parents of ASD probands did not display significant differences in CA relative to control families. Thus, deficits in cognitive control regulation seen in ASD may not reflect underlying poor adaptation to cognitive conflict among probands or first-degree relatives.

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### C. CORDEAUX, M. BARTON & D. FEIN. Profiles of Children Missed at Initial Autism Screening Compared to Early-Identified Peers.

**Objective:** This study presents data from a two-year follow-up screening with the M-CHAT and the M-CHAT-R/F examining the profiles of children first identified and diagnosed at age 48 months in comparison to earlier-identified peers.

**Participants and Methods:** Participants were screened at pediatric well-visits at 18-24 months of age. Approximately 2 years after initial screening, children were rescreened by mail. Children who screened positive at 18-24 months and/or 48 months were invited to complete an evaluation. Some children initially received a non-ASD diagnosis and later an ASD diagnosis (NA) ( $N=17$ ); others maintained an ASD diagnosis (AD) ( $N=164$ ). Some children who screened negative at 18-24 months but positive at 30-48 months received an ASD diagnosis (LD) ( $N=27$ ).

**Results:** At 48 months, groups did not differ by age, gender, or race/ethnicity. Groups significantly differed on cognitive ability, adaptive skills, and symptom severity. The LD and NA groups differed from the AD group on socialization, daily living skills, visual problem solving ability, and receptive and expressive language ability. The LD and NA groups differed from each other on adaptive communication and motor skills. The AD group had consistently weaker cognitive and adaptive skills and more severe symptoms than both the LD and NA groups.

**Conclusions:** These findings indicate that a subset of children with ASD may not present with full symptom profiles or present with lower intensity symptoms at 18-24 months. These results emphasize the importance of ASD screening at multiple time points as a single screening may miss cases, or initial diagnosis may change. Understanding profiles of children who are not diagnosed with ASD until late toddlerhood can inform best practices for screening in the community and aid in development for ASD-specific screening tools and procedures.

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### B. DOLAN, A. BARRINGTON, D. SNYDER, A. MCVEY & A. VAUGHAN VAN HECKE. Examining PEERS for Young Adults: Improvements in Social Motivation and Relations to Neural Activity.

**Objective:** Social skills deficits among adults with ASD lead to isolation and a lack of friendships. The Program for the Education and Enrichment of Relational Skills for Young Adults (Gantman et al., 2012) is an empirically based, caregiver-assisted treatment that teaches young adults with ASD how to make and keep friends. There are no published studies that have evaluated PEERS for Young Adults and its effects on brain function. Thus, this study seeks evaluate intervention influences on brain function, as assessed via EEG, and examine if neural changes relate to improvements in social functioning and mental health.

**Participants and Methods:** Analyses included 25 young adults (18-26 years old) with ASD. All participants had a verbal IQ  $> 70$  and diagnoses were confirmed with the ADOS. The intervention was the 16-session PEERS for Young Adults. Measures were taken at pre- and post-intervention and included: 1) the Social Responsiveness Scale

(caregiver report; SRS; Constantino, 2005); 2) the Beck Depression Inventory (BDI; Beck, 1987); and 3) a 3-minute continuous, resting state EEG recording.

**Results:** For the experimental group, caregivers at post-treatment reported significant improvements in social motivation on the SRS ( $F(1, 23) = 6.10$ ,  $p < .05$ ). There was a significant group by time by location interaction within the beta frequency band ( $F(1, 23) = 4.16$ ,  $p < .05$ ), with the experimental group demonstrating a significant decrease in left temporal-parietal beta power at post-treatment. This decrease in beta band activity was related to improvements in social motivation following PEERS ( $r = .49$ ,  $p < .01$ ).

**Conclusions:** Young adults receiving PEERS demonstrated a significant improvement in caregiver-reported social motivation, and this was related to a decrease in left temporal-parietal beta power, which research suggests is indicative of better neural control (Engel & Fries, 2010). The results from this study add to the minimal literature that has examined efficacious social skills interventions for adults.

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### J.M. ELOI. The Contribution of Intelligence, Empathy and Personality Traits to Adaptive Living Skills in Individuals with Autism Spectrum Disorder.

**Objective:** The prevalence of Autism Spectrum Disorder (ASD) is estimated at 1 in 68 people in the United States (Klaiman, et al., 2015) but little is known regarding factors that influence adaptive living skills. Prior investigations suggest that intelligence affects future academic and work success in ASD children. In the current study, we investigate whether intelligence, empathy or emotional state affect academic/job achievement, independent living and social success in ASD adults.

**Participants and Methods:** The sample consisted of 27 adults with ASD (9 females, 18 males) ranging from age 20 to 51 who underwent comprehensive assessments in an outpatient cognitive neurology clinic. All met DSM-V criteria for ASD. Neuropsychological and personality test data were examined in relation to the Functional Outcome Measure (FOM). Intelligence was measured with VCI and POI indices from the Wechsler Adult Intelligence (WAIS-III). Empathy was measured with the Empathy Quotient (EQ) from the Cambridge Behavioral Scale (Baron-Cohen & Wheelwright, 2004). Emotional state and personality were assessed with the Personality Assessment Inventory (PAI).

**Results:** A multiple regression analysis revealed that the POI variable of the WAIS-III and the NIM, PIM, SOM, ANX, ARD, DEP, MAN, PAR, SCZ, BOR, ALC, DRG, AGG, NON, RXR and DOM variables of the PAI were statistically significant and predicted FOM total,  $F(23,3)=10.210$ ,  $p < .0005$ ,  $R^2 = .987$ . The variables that were most predictive of FOM total, ( $p < .05$ ) were PIM, MAN, SCZ, DEP and ANX.

**Conclusions:** The results indicate that multiple subscales on the PAI and POI are predictive of FOM total to a varying degree. The SCZ variable showed a positive relationship with FOM such that as FOM total increased SCZ increased. The POI, PIM, MAN, DEP and ANX variables had a negative relationship with FOM total such that as FOM total increased the POI, PIM, MAN, DEP and ANX decreased. The DEP variable had the greatest effect on the FOM total.

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### S. FATOORECHI, J. MURRAY, L. SUMNER & A.E. SIMUN. Atypical Cerebral Lateralization for Handedness in Autism Spectrum Disorder.

**Objective:** Autism Spectrum Disorder (ASD) has been associated with atypical patterns of handedness. Other studies have correlated atypical neurological development and organization with ASD. The current study sought to examine the lateralization of handedness to determine specific handedness patterns and neurodevelopmental correlates in ASD.

**Participants and Methods:** Archival data was utilized to compare an ASD group (N=49) to the normative population (N=1,910) provided by the Wide Range Assessment of Visual Motor Abilities (WRAVMA) manual. The ASD group was administered the Pegboard Test of the WRAVMA. A Difference Score was calculated for each participant based on the relative difference in skill between hands. The subjects' Difference Score was calculated as the difference in standard scores between dominant and non-dominant hand. This score was used to determine degree of lateralization and was compared against the normative population.

**Results:** A z-test was computed to evaluate whether the relative difference in skill between hands in an ASD group was different from the normative population. The threshold for significance was set at  $p < .05$ . The ASD group demonstrated less variation in skill between hands when compared to the normative population. Specifically, 53% of the ASD group demonstrated equal or near equal skill between hands suggesting a deficiency in lateralization for handedness.

**Conclusions:** The current data indicate that individuals with ASD and individuals with typical neurodevelopment demonstrate significantly different patterns of handedness. The ASD group demonstrated far less variation in skill between hands indicating reduced or unestablished lateralization for handedness. These data suggest that atypical lateralization may play a role in the development of ASD symptomatology and indicate that lateralization assessments may be beneficial as a diagnostic tool for the early detection of ASD.

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**A. FLORES, C. SWICK, T. ANDERSEN, R. GOODCASE, K. MCFARLANE, S. BOWYER, J. BRENNAN, I. KOVELMAN & R. LAJINESS-O'NEILL. Relationship Between Neural Coherence and Social Inference and Prediction in Autism Spectrum Disorder.**

**Objective:** Autism Spectrum Disorder (ASD) is characterized by atypical social functioning. Aberrant neural synchrony may underlie this phenotype, as the gamma band is associated with perceptual binding; however, it is unclear whether similar associations are seen in complex language perception. This study explored relationships between synchrony and ability to infer and predict in social scenarios.

**Participants and Methods:** 12 ASD (Age:M=9.1;SD=1.0) and 13 neurotypical (NT) children (Age:M=9.3;SD=1.3) underwent magnetoencephalography (MEG) at rest. Synchrony was quantified via coherence between cortical sites in the gamma band. Kendall Tau correlations were used to examine relationships between coherence and social inference/predicting.

**Results:** ASD: enhanced interhemispheric coherence from left middle temporal to right superior parietal and bilateral precuneus, from left precuneus and superior occipital to right fronto-temporo-parietal regions, and intrahemispheric coherence from right angular to fronto-parietal regions was related to poor social inference ( $\tau = -0.51$  -  $-0.60$ ). NT: enhanced interhemispheric coherence between left middle/superior temporal and right middle/superior fronto-temporal regions, and between left inferior/middle frontal gyri and right middle temporal and angular regions, was related to poor prediction in social scenarios ( $\tau = -0.52$  -  $-0.68$ ).

**Conclusions:** Results suggest atypical hemispheric specialization for social inference and prediction in ASD. Increased gamma synchrony between bilateral parietal and right fronto-temporo-parietal regions conferred risk for poor social inference. Gamma synchrony appeared unrelated to prediction. Conversely, in NT, increased interhemispheric gamma synchrony (temporal to temporo-frontal) conferred risk for poor prediction, while synchrony was unrelated to social inference. Overall, enhanced gamma activity in anterior fronto-temporal regions was related to poor prediction in NT and enhanced gamma activity in posterior parietal regions was related to poor inference in ASD.

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**J.W. GRIFFIN, B.E. GAVETT & J. SAURMAN. Moderation Analysis of Episodic Memory in Autism Spectrum Disorders: A Meta-Analytic Review.**

**Objective:** Episodic memory is often reduced in individuals with autism. The goal of the current analysis was to examine potential moderating variables across multiple samples examining episodic memory in autism spectrum disorders. By examining possible moderating variables across studies, a better understanding of what influences episodic memory in autism spectrum disorders can be found. It is hypothesized that age and type of episodic memory assessed will have the most influence on episodic memory performance in the autistic samples.

**Participants and Methods:** A search of relevant literature within 'PsyINFO' and 'Scopus' databases yielded 23 studies meeting inclusion criteria to be analyzed, for a total of 518 participants with high-functioning autism and 547 age-matched controls. A moderation analysis was conducted using three moderating variables: gender, age, and type of episodic memory assessed (source, autobiographical, or episodic) with autobiographical being very personal.

**Results:** A random-effects model was used for the meta-analysis, consistent with the significant heterogeneity in the data ( $Q = 119.58$ ,  $p < .05$ ), which indicated that some moderating variables might exist. The overall effect of autism on episodic memory was  $d = -1.00$ , 95% CI [-1.39, -0.62]. However, the moderation analysis showed no significant differences across age ( $b = 0.18$ , 95% CI [-0.18, 0.52]), gender ( $b = 7.26$ , 95% CI [-7.50, 22.02]), or type of episodic memory ( $b = -12.30$ , 95% CI [-29.21, 4.62]), suggesting that these variables do not systematically affect memory in autism spectrum disorders.

**Conclusions:** Contrary to the hypothesis, the moderation analysis showed that neither age, gender, nor type of episodic memory had a significant effect on the episodic memory deficits found in autism, indicating that the deficits are very generalizable to multiple groups of individuals with the disorder. Because the heterogeneity in effect sizes was not explained by age, gender, or memory type, it may be a function of other factors, such as genetics.

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**L. KENWORTHY, C. PUGLIESE, H. POPAL, E. WHITE, A. MARTIN & G. WALLACE. Real-World Executive Functions in Adults with Autism Spectrum Disorder: Profiles of Impairment and Associations with Adaptive Functioning and Co-morbid Anxiety and Depression.**

**Objective:** Although executive functioning (EF) difficulties are well documented among children and adolescents with autism spectrum disorder (ASD), little is known about real-world measures of EF among adults with ASD.

**Participants and Methods:** This study examined parent-reported EF problems among 35 adults with ASD without intellectual disability (31 males; 18-40 years [ $M = 21.55$ ,  $SD = 4.12$ ]; Full Scale IQ 88-133 [ $M = 112.47$ ,  $SD = 11.21$ ]), and how they correlated with adaptive functioning and co-morbid anxiety and depression symptomatology. Research reliable autism diagnosis was confirmed by expert clinical opinion; parent report was gathered on measures of: EF (Behavior Rating Inventory of Executive Functioning-Adult version [BRIEF-A]), adaptive behavior (Adaptive Behavior Assessment System-Second Edition) and internalizing psychopathology (Adult Behavior Checklist).

**Results:** One-sample t-tests indicated that adults with ASD were impaired on all nine domains measured by the BRIEF-A relative to the normative mean ( $ps < .05$ ). Repeated measures ANOVA demonstrated a variable EF profile in ASD ( $F = 10.20$ ,  $p < .001$ ) with the most prominent deficits occurring in flexibility and metacognition. Hierarchical multiple

regressions revealed that even after accounting for the influences of age and IQ, flexibility problems were associated with anxiety-related symptoms while metacognition difficulties were associated with depression symptoms and impaired adaptive functioning.

**Conclusions:** Real-world EF problems persist into adulthood and are strongly associated with both adaptive functioning and co-morbid anxiety and depression symptoms, making EF an important treatment target among adults with ASD, for whom disproportionately poor outcomes are a major area of concern.

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**R. LAJINESS-O'NEILL, K. MCFARLANE, K.W. RUSINIAK, J. BRENNAN, I. KOVELMAN & S. BOWYER. Altered P3 Neuromagnetic Evoked Response Related to Language Functioning in Children with Autism Spectrum Disorder.**

**Objective:** Deficits in *attention* to the admissible arrangement of sounds in words may contribute to language delays in children with Autism Spectrum Disorder (ASD). Neuromagnetic evoked responses were measured using magnetoencephalography (MEG) in children with ASD and matched neurotypicals (NT) to examine differences in their ability to detect plausible (phonotactically legal, e.g. vimp) and implausible (illegal, e.g. vinp) syllables. An evoked response at ~300ms after the onset of phonotactically illegal syllables reflects a P3 deflection, an automatic attention shift to speech, which we hypothesized to be delayed in ASD. **Participants and Methods:** 13 ASD (Mean Age = 9.31; Mean IQ = 92) and 13 NT (Mean Age = 9.69; Mean IQ = 114) underwent 148 channel whole head MEG and neuropsychological assessment. Evoked responses to legal and illegal syllables were measured at 200ms, 250ms, and 300ms after stimulus onset. Mann-Whitney U and Kendall Tau were used to examine group differences and relationships with psychometric data, respectively.

**Results:** No significant latency differences were noted between groups while processing legal syllables or with illegal syllables at 200ms and 250ms, although a significant difference was noted at ~300ms ( $p < .05$ ), with ASD showing either an *earlier or later response*. Right frontal activation was noted in NT, while bilateral frontal activation was noted in ASD. Longer P3 latencies were related to lower inferential language functioning ( $\tau = -.63$ ), but higher performance on general language measures ( $\tau = .50$ ).

**Conclusions:** The P3 attentional deflection was either early or late in ASD compared to NT, which may reflect poor habituation or sensitization. The fronto-parietal attention network is believed to underlie this response, which may be less strongly right lateralized in ASD. This atypical attention to language was inversely related to two types of language functions, which may suggest distinct ASD subtypes or alterations in the response that differentially impact language.

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**C. LEE & J. BO. Poor Motor Functions Relate to Visuomotor Adaptation in Children with Autism Spectrum Disorders.**

**Objective:** Children with Autism Spectrum Disorders (ASDs) often have significant motor dysfunctions and impaired motor learning. Despite growing research in ASDs, the underlying mechanisms of motor deficits remain unclear. The current study aimed to examine the possible link between motor learning ability in a visuomotor adaptation task and motor functions assessed by clinical assessments in children with ASDs.

**Participants and Methods:** Eighteen children with ASDs (age 8 to 12) and eighteen matched controls completed the Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI) and the Movement Assessment Battery for Children (MABC-2). Their parents completed the MABC Checklist and Developmental Coordination Disorder Questionnaire (DCDQ '07). All children completed a visuomotor adaptation

task for motor learning efficiency, magnitude, and adaptability on motor planning (directional error [DE]) and motor control (total movement time [MT]).

**Results:** Results revealed that children with ASDs displayed poor visual-motor integration, motor coordination, manual dexterity, and balance. Based on parents' observation, children with ASDs presented poorer motor skills across all areas compared to the controls. Nevertheless, children with ASDs demonstrated a significant improvement in motor control (MT,  $p < .001$ ) and greater control learning magnitude (MT,  $p < .05$ ), but poor learning in motor planning (DE,  $p < .05$ ). Correlations between the adaptation and assessments revealed that greater improvement on MT during adaptation related to poor motor coordination and poor classroom skills. Greater learning magnitude on DE correlated to poor performances on all areas of the VMI and MABC.

**Conclusions:** Children with ASDs demonstrated the ability to learning motor skills from the motor control perspective. Greater improvement of motor learning was correlated with poor baseline motor functions. Facilitating motor control ability may become a new revenue to accommodate poor motor functions among children with ASDs.

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**E. MOULTON, M. BARTON, D.L. ROBINS & D. FEIN. Cognitive and Language Functioning of Children Who Lose Their ASD Diagnosis.**

**Objective:** This study compares the cognitive and language functioning of toddlers who demonstrate highly positive outcomes from an early ASD diagnosis (optimal progress, OP) to peers with high functioning autism (HFA) and peers with typical development (TD).

**Participants and Methods:** Evaluations were conducted at age two years following positive screening on an autism-specific screener (MCHAT(-R)). The Mullen Scales of Early Learning, adaptive and diagnostic measures were completed. Diagnosis was based on the clinical judgment of experienced clinicians. Children were reevaluated at age four. Three groups of children were included (OP, HFA, TD; N=20 each). Group criteria is as follows. OP: children initially met criteria for an ASD, no longer meet criteria, and scored in the average range on standardized measures of cognition, language and adaptive skills. HFA: children met criteria for an ASD at both evaluations and scored in the average range cognitively. TD: children never met criteria for any clinical diagnosis and scored in the average range cognitively and adaptively. Groups did not differ in age at reevaluation, gender or ethnicity.

**Results:** ANOVAs indicated no group differences in visual receptive or receptive language abilities. The OP group demonstrated weaker expressive language skills than TD peers ( $p = .024$ ). Specifically, the OP group demonstrated comparable repetition skills and picture vocabulary knowledge, but weaker oral vocabulary abilities ( $p = .017$ ).

**Conclusions:** By age four, children in the OP group are functioning comparably to TD peers in receptive language, fine motor and visual reception. Despite demonstrating skills within the average range, these children continue to demonstrate a relative weakness in expressive language skills, particularly in the domain of oral (but not picture) vocabulary. Additional research is needed to determine whether these differences reflect true differences in vocabulary knowledge, or differences in the ability to attend, formulate a verbal answer, or respond to purely oral questioning.

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**A. NADER, V. BOUCHARD, A. BERTONE & I. SOULIÈRES. An increased role of perception in learning for autistic children.**

**Objective:** Individuals with an autism spectrum disorder (ASD) may differ from others in how they learn and categorize new information. Not only ASD individuals perform well on a variety of low-level perceptual tasks but they also show a propensity to detect patterns and regularities.

This leads to the hypothesis that modifying the learning situation by increasing access to the regularities in the stimuli could facilitate concept acquisition for this population. Our aim is to assess how material presentation influences learning processes in autism.

**Participants and Methods:** 40 ASD and 40 typically developing (TD) children (7-13 years; IQ > 80) matched on age and IQ were exposed to two probabilistic perceptual categorization tasks where the child had to discover the rule to properly classify stimuli in two categories. The tasks differed on material presentation. In the sequential condition, 200 different stimuli were presented one at a time, with immediate feedback (200 trials). In the simultaneous condition, 200 different stimuli were presented altogether, with feedback after the child sort them into two categories. Learning was assessed in a testing phase, using the same stimuli as well as different generalization stimuli.

**Results:** While similar performance was found in TD children in both training conditions, there was a better learning rate for the ASD children when all learning material is presented as a whole (simultaneously) instead of sequentially (53% vs 65%;  $p < .05$ ). Furthermore, ASD children generalized better to similar stimuli when they learned in the simultaneous condition (58% vs 66%;  $p < .05$ ).

**Conclusions:** ASD children benefit from having access to all the information simultaneously. This suggests that these children learn differently than other children, and may rely on perceptual processes such as extracting regularities and detecting patterns among the material they are learning. The present results may modify how learning processes in autism are understood and impact teaching methods.

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**L. PAWLUK, R. LAJINESS-O'NEILL & C. SORENSEN. Initiation of Joint Attention (IJA) and Executive Functioning in School-Aged Children with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD).**

**Objective:** Children with ASD and ADHD often display symptom overlap, as well as executive and social deficits. Initiation of joint attention (IJA), a core social skill, is impaired in young children with ASD, and appears to be mediated by the frontal lobes, which are implicated in both ASD and ADHD. Whereas response to JA improves over time, little is known about the the course of IJA in ASD, and social research is generally lacking in ADHD. The current study aimed to compare aspects of social and executive functioning in these populations in order to elucidate endophenotypes that may help identify common or unique symptomatology and underlying neural substrates in these disorders.

**Participants and Methods:** Participants included 43 children (17 controls [TD], 13 ASD, 13 ADHD), 8-12 years old, who were administered the WASI, DKEFS, WCST, CPT, and ADOS. Parents completed the Connors' Parent Rating Scale (CPRS) and Vineland (VABS). The ADOS was video recorded and coded for IJA behaviors. Given the small sample size, nonparametric analyses (Kruskal-Wallis, Mann-Whitney) were conducted to evaluate for group differences.

**Results:** The ASD group was found to display significantly less IJA behaviors than the TD and ADHD groups, with no significant differences between the latter groups. Children in both the ASD and ADHD groups were rated as having more social problems than the TD group on the CPRS and VABS. There were no significant differences between groups on executive functioning measures.

**Conclusions:** While previous research focuses on IJA in early childhood, current results suggest that children with ASD continue to demonstrate IJA deficits into middle childhood. While children with ADHD were rated as experiencing more social issues than TD children, these issues do not appear to be related to IJA deficits. In fact, given significant symptom overlap in ASD and ADHD, assessing for IJA behaviors may be diagnostically beneficial in the clinical setting. Further research is required to examine neural underpinnings of IJA skills.

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**A.E. RICHARD, R. LAJINESS-O'NEILL & S. BOWYER. Neural Synchrony during Visual Attention Shifting in Autism Spectrum Disorders.**

**Objective:** Children with autism spectrum disorders (ASD) do not show greater dimension-shifting costs than neurotypicals (NT) during visual search; however, it is unknown whether dimension-shifting is achieved using abnormal neural mechanisms in ASD. This study investigated neural synchrony during a visual search task with a dimension-shifting component in ASD compared to NT, as well as relationships between neural synchrony and ASD symptomatology.

**Participants and Methods:** 6 ASD ( $Mage = 10.3$ ) and 11 NT ( $Mage = 9.8$ ) completed a visual search task with targets defined in one of two dimensions while undergoing magnetoencephalography (MEG). Parents completed a measure of ASD symptomatology. Coherence between each pair of 54 brain regions was calculated for the beta (14-30 Hz) and gamma (30-80 Hz) frequency bands.

**Results:** NT showed higher coherence than ASD in frontal-occipital and occipito-occipital pathways in both beta and gamma frequencies. ASD showed higher coherence than NT in frontal-parietal, frontal-temporal, and temporo-temporal pathways in gamma frequencies, and temporal-parietal and temporal-occipital pathways in beta and gamma frequencies. In gamma frequencies, higher coherence in temporal-parietal pathways was associated with more social communication difficulties, while higher coherence between orbitofrontal and occipital cortex was associated with fewer such difficulties. In beta frequencies, higher cingulate-occipital coherence was associated with fewer restricted and repetitive behaviors (RRB).

**Conclusions:** Results suggest that ASD rely on more widely distributed neural networks involving temporal cortex to a greater degree than NT for visual search and dimension shifting, while NT may utilize a more efficient network relying more heavily on occipital and frontal pathways. Reliance on this widely distributed network involving temporal cortex is associated with greater social communication difficulties. Greater reliance on frontal-occipital pathways is associated with fewer social communication difficulties and RRBs.

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**J. STRANG, L. KENWORTHY, L.G. ANTHONY, B. YERYS, K.K. HARDY & G. WALLACE. The Flexibility Scale: A Parent-Report Inventory of Flexibility Skills in Children With Autism Spectrum Disorders Without ID.**

**Objective:** Restricted, repetitive, behaviors and interests (RRBI) compromise one of two core symptom domains in autism spectrum disorders (ASD). Existing RRBI measures are limited in their utility to measure RRBI symptoms dimensionally. The Autism Diagnostic Interview is a widely used diagnostic evaluation of RRBI symptoms and has been inappropriately used as a quantitative measure. The Behavior Rating Inventory of Executive Function provides quantitative measurement of cognitive and behavioral flexibility, and has consistently identified flexibility deficits in ASD, but its eight items do not measure possible subcomponents of cognitive/behavioral flexibility. A novel measure, the Flexibility Scale (FS) targets broad flexibility characteristics in ASD using a larger set of items with the goal of increasing power and specificity when describing the inflexibility phenotype in ASD without ID.

**Participants and Methods:** The original 50-item FS was developed through an iterative process based on known RRBI/flexibility characteristics in ASD without ID. Parents of 227 children with ASD (age 7-14) completed the FS. Polychoric exploratory factor analysis (EFA) and assessments of internal consistency were conducted.



**Results:** Minimum Average Partial and Parallel Analysis tests indicated best fit with a 5-factor model accounting for 45% of the variance. Items with factor correlations falling below .4 were eliminated. Ten international ASD/EF experts evaluated significantly cross-loaded items for factor placement or removal, and generated descriptions of the factors based on item set and known ASD flexibility characteristics. The resulting 29-item questionnaire has 5 factors: Routine/Rituals, Transitions/Change, Special interests, Social flexibility, and Generativity.

**Conclusions:** These results suggest that RRBI/flexibility characteristics in ASD without ID are multi-dimensional. If confirmed, this factor structure has important implications for the phenotype of RRBI in ASD without ID, including intervention development and measurement.

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**A.D. VERBALIS, C. ROTHWELL, J. MARTUCCI, A. RATTO, C. PUGLIESE, C. LUONG-TRAN, M. WILLS, L. KENWORTHY & L.G. ANTHONY. Experience of Parent Burden from Cognitive Inflexibility in ASD for Poor and Rich Communities.**

**Objective:** Children with Autism Spectrum Disorders (ASD) and children from low SES families are separately reported to have greater problems with executive functioning (EF) skills (Granader et al., 2014; Sarsour et al., 2011). However, there is little research on the impact of the combination of these risk factors, the focus of this report.

**Participants and Methods:** We compared 24 students with ASD in Title 1 or priority schools (i.e., schools receiving extra funding due to academic or financial need) and 47 students with ASD in non-Title 1 schools. Age ranged from 7 to 11 ( $M = 9.47$ ;  $SD = 1.01$ ) and Verbal IQs were average ( $M = 105$ ;  $SD = 17$ ). There were no group differences in age ( $t(69) = 0.58$ ,  $p = ns$ ) or VIQ ( $t(69) = 1.85$ ,  $p = .07$ ), although the latter approached significance. Parents completed the BRIEF Shift scale and rated the degree of burden they experience from these symptoms (Interference Total).

**Results:** The two groups were not significantly different on the BRIEF Shift scale ( $t(69) = 0.16$ ,  $p = ns$ ) or the Interference Total ( $t(69) = -.44$ ,  $p = ns$ ) and both exhibited a positive relationship between these two variables (Title 1:  $r = .780$ ; non-Title 1:  $r = .614$ ). Further analysis indicated that within the Title 1 group, there was a positive relationship between greater interference and older age ( $r = .397$ ,  $p = .055$ ), but not VIQ ( $r = .013$ ). In contrast, within the non-Title 1 group there was a positive relationship between greater interference and higher VIQ ( $r = .358$ ,  $p = .014$ ), but not age ( $r = .109$ ).

**Conclusions:** Although the degree of burden caused by cognitive inflexibility is similar, the child's age has a stronger relationship with parents' experience of burden in the Title 1 communities, while VIQ is more associated with parents' experience of burden in the non-Title 1 communities. It is possible that parents' expectations of their child's abilities may mediate their experience of feeling burdened by their child's cognitive inflexibility and that these expectations are differentially affected by age and VIQ.

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## Learning Disabilities/Academic Skills

**A. CHILD & P.T. CIRINO. A Cognitive Dimensional Approach to MD, RD, ADHD Comorbidity.**

**Objective:** Reading disability (RD), math disability (MD), and ADHD are common disorders that frequently co-occur. However, it is not clear which cognitive factors contribute to comorbidity and which are unique to one disorder. Using a dimensional approach, we hypothesize that working memory and processing speed will contribute to the overlap between reading, math, and attention while phonological awareness

will contribute to the overlap between math and reading. Numerosity is expected to be solely related to math outcomes.

**Participants and Methods:** 222 2nd-grade participants from a larger sample completed phonological awareness (CTOPP Elision), numerosity (Panamath), working memory (WMTB-C), and processing speed (WJ-III Cross-Out) tasks. Reading and math abilities were assessed using untimed (WRAT-3 Reading, Arithmetic) and timed (Word Identification Fluency, Math Facts Fluency Assessment) tasks. Teachers also completed the SWAN ADHD rating scale. Analyses include partial correlations.

**Results:** Zero-order correlations of cognitive to academic/attention variables ranged from  $|r| = .20$  to  $.43$  for math,  $|r| = .11$  to  $.58$  for reading, and  $|r| = .26$  to  $.37$  for attention. Proportion of variance shared between academic and attention variables decreased between 43 and 85% after controlling for phonological awareness, 44 and 66% for working memory, 12 and 40% for processing speed, and 5 and 26% for numerosity. Proportion of shared variance decreased between 5 and 56% for untimed outcomes and 17 and 85% for timed outcomes.

**Conclusions:** Consistent with prior studies (Robinson, Menchetti, & Torgesen, 2002; Willcutt, Pennington, Olson, Chhabildas, & Hulslander, 2005), partialling phonological awareness and working memory reduced the proportion of variance shared between academic and attention outcomes. Larger reductions were found with timed versus untimed academic outcomes. No significant reductions were found after controlling for numerosity and processing speed. These results affirm and extend our knowledge of shared and unique cognitions underlying reading, math, and attention.

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**J. ELIAS, P.T. CIRINO, T.D. TOLAR, C. ALFANO & P. MASSMAN. Contributions of Executive Functions, Math Anxiety, and Parental Expectations toward Math Achievement.**

**Objective:** While executive functions (EF), math anxiety (MA), and parental expectations of math achievement (PE) have been shown to contribute to math achievement individually, no study has comprehensively examined all three factors' contributions collectively. A model was proposed which hypothesized that (1) all three factors predict math outcome, (2) of the three, EF contributes the greatest unique variance (3) EF's effect on math is moderated by MA, and (4) MA's effect on math is moderated by PE.

**Participants and Methods:** Participants were sixth graders ( $N = 96$ , 50% Male, 90% low SES) from an urban public school setting recruited for a larger algebra intervention study. Math and EF composites were derived from averaging together several standard measures, while MA and PE questionnaires were adapted from others used in previous studies (Wigfield & Meece, 1988; Hess et al., 1987). Analyses used multiple regression with age as a covariate.

**Results:** The proposed model was significant ( $R\text{-squared} = 27.0\%$ ) as was a strong EF main effect. When EF was removed, a MA main effect was also significant. Neither of the interactions was significant. Post-hoc analyses showed that certain items in the PE questionnaire correlated with math achievement, and the EFxMA interaction was significant when using only a difficult math measure (algebra posttest) as the outcome variable rather than the math composite (see Ashcraft & Kirk, 2001; Ramirez et al., 2013).

**Conclusions:** Taken together, the results provide evidence that emotional (i.e., MA) and environmental (i.e., PE) factors may influence math achievement, but comparatively, cognitive (i.e., EF) factors are much stronger predictors of math achievement. Development of interventions that target math should take into account all three factors, though interventions that provide strategies for children with low EF may offer the greatest payoff.

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**C. FRITZ, R. MORRIS, L. BRANUM-MARTIN, R. SEVCIK, D. GREENBERG, M.W. LOVETT & M. WOLF. Exploratory Factor Analyses of Neurocognitive and Reading-Related Factors in Struggling Readers At Different Ages.**

**Objective:** Research suggests that neurocognitive and reading-related variables are highly correlated and best represented by fewer factors in struggling elementary school readers compared to struggling adult readers. This study examined the degree to which core neurocognitive and reading-related indicators of Reading Comprehension (RC), Language Comprehension (LC), Word Decoding (WD), Non-Word Decoding (NWD), Phonological Awareness (PA), and Speed (S), are reflective of the same underlying constructs across different age groups of poor readers.

**Participants and Methods:** The sample included 430 elementary school students and 584 middle school students diagnosed with dyslexia, and 236 struggling adult readers. Similar measures of RC, LC, WD, NWD, PA, and S were used across the three age groups. We tested exploratory factor analysis (EFA) models with 2-6 factors for each age group to explore the relationship between the measures and identify the best fitting model.

**Results:** The best models differed across the age groups, including the 2-factor model for elementary school students:  $\chi^2(76, N = 430) = 632.78, p < .001$ ; CFI = .90; RMSEA = .13; SRMR = .05; the 4-factor model for middle school students:  $\chi^2(51, N = 532) = 126.20, p < .001$ ; CFI = .98; RMSEA = .05; SRMR = .02; and the 4-factor model for adults:  $\chi^2(51, N = 236) = 86.00, p < .001$ ; CFI = .98; RMSEA = .05; SRMR = .03.

**Conclusions:** In conclusion, different models of reading were found to best represent neurocognitive and reading-related variables across the three groups of struggling readers. The best fitting EFA was the 2-factor for the elementary readers and the 4-factor for the middle school and adult readers. Specifically, these factors appear to follow a trend of increased differentiation with age. Thus, it appears that the older poor readers do not share the less-differentiated language and written abilities of the youngest readers.

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**H.M. HASLER, S. TORRES, M.G. FULLER, J. STILES, Y.E. VAUCHER & N. AKSHOOMOFF. Moved to Learn: Movement Abilities Correlate with Cognition in Preschoolers Born Very Preterm.**

**Objective:** Children born very preterm (VPT) are at increased risk of neurodevelopmental difficulties and may have difficulties in motor functioning, even in the absence of cerebral palsy or known brain injury. Performance on the Movement ABC-Second Edition (MABC-2) was used to examine motor performance in young children and how development of motor skills is related to neuropsychological test performance.

**Participants and Methods:** As part of an ongoing longitudinal study, healthy children born VPT were selected based on gestational age at birth  $\leq 32$  weeks and no history of early brain injury. VPT and FT children were selected for the study if they obtained WPPSI-IV FSIQ scores  $\geq 85$ , had no history of serious psychiatric or neurological illness, and were entering kindergarten within the following six months. The participants did not differ on the basis of age, sex, or SES (VPT:  $n=40$ , 46.5% female, mean age 5.36 years; FT:  $n=32$ , 54.5% female, mean age 5.34 years).

**Results:** The VPT group performed significantly more poorly on the MABC-2 Balance measures that required walking on heels raised ( $t=-3.40, p=.001$ ), jumping on mats ( $t=-2.603, p=.011$ ), and one leg balance ( $t=-1.89, p=.063$ ), as well as the catching subtest ( $t=-1.98,$

$p=.063$ ). The VPT group also performed worse on the Beery Visual-Motor Integration test ( $t=-2.63, p=.011$ ). WPPSI-IV Visual Spatial and Processing Speed scores were significantly correlated with MABC-2 Balance scores ( $t=-.220, p=.058$  &  $t=.342, p=.003$ ).

**Conclusions:** In this study, we demonstrated that this group of VPT preschoolers performed worse on balance-related skills compared to FT controls. These skills are related to neuropsychological domains of visual spatial skills and processing speed, two domains important for learning complex skills necessary to succeed in formal schooling. Therefore, movement ability in preschool may help predict development of important cognitive skills as children enter kindergarten.

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**M. MARCHAND, O. MORIN-MONCET, M.H. BEAUCHAMP & G. LEONARD. Simple and Complex Motor Coordination Abilities in Children with Dyslexia and/or Attention Deficit Disorder.**

**Objective:** Dyslexia and Attention deficit disorder (ADD) are heterogeneous disorders associated with a variety of cognitive impairments and with motor skill deficits. However, findings on motor skills are highly inconsistent because of the wide variety of tools used to measure different types of motor abilities. In addition, few studies have compared these disorders on motor functioning. The purpose of this study was to examine simple to complex motor skills including sequential and coordination skills, using the Leonard Tapping Task (LTT) in children and adolescents with dyslexia, ADD or with both disorders.

**Participants and Methods:** We studied three groups ( $N=27$  each) of children with a diagnosis of dyslexia (DYS: 16 males; MAge = 13.8 SD=2.4), ADD (ADD: 20 males; MAge=12.6 SD=2.2) or both disorders (COMB: 19 males; MAge=12.6 SD=2.6). Each experimental group was matched to a control group (Respectively: C1;C2;C3) on age, gender, IQ and handedness. Reading and writing abilities (WIAT-II), behavioral questionnaires (Conners-3), dexterity (Grooved Pegboard) and simple to complex sequential motor coordination (LTT) were measured.

**Results:** Repeated measures ANOVAs revealed that the three experimental groups performed significantly worse than their matched control group on the Unimanual Sequential (DYSvs.C1:  $p=0.026$ ; ADDvs.C2:  $p<0.001$ ; COMBvs.C3:  $p=0.005$ ), Bimanual In-Phase (DYSvs.C1:  $p=0.007$ ; ADDvs.C2:  $p<0.001$ ; COMBvs.C3:  $p=0.029$ ) and Bimanual Out-of-phase (DYSvs.C1:  $p=0.002$ ; ADDvs.C2:  $p<0.001$ ; COMBvs.C3:  $p=0.018$ ) conditions on the LTT. No significant differences were shown on the Simple Rapid Repetitive condition. On the Grooved Pegboard, the ADD group was significantly slower than their matched C3 group ( $p=0.003$ ).

**Conclusions:** Children and adolescents with dyslexia and/or ADD are not as well coordinated as their typically developing peers on complex sequential motor skill measures. Early detection of motor development could be beneficial in improving the educational trajectories of children with these disorders.

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**F. COSTANZO, C. VARUZZA, S. ROSSI, S. SDOIA, P. VARVARA, M. OLIVERI, G. KOCH, S. VICARI & D. MENGHINI. Reading Improvement Following tDCS and Cognitive Treatment in Children and Adolescents with Dyslexia.**

**Objective:** Developmental dyslexia is a persistent difficulty in learning to read. There is evidence that non-invasive brain stimulation transiently modulates reading of adult expert readers and dyslexics by facilitating the neural pathways underactive in dyslexics. To date no study evaluated the efficacy of non-invasive brain stimulation in improving reading of young populations with dyslexia. However, it is critical to remediate reading problems especially during developmental ages. The study was aimed at investigating whether transcranial direct current

stimulation (tDCS) over parieto-temporal areas enhances reading abilities of children and adolescents with dyslexia and whether the effect is long-lasting.

**Participants and Methods:** Eighteen children and adolescents with dyslexia received 18 sessions of left anodal/right cathodal tDCS, set at 1 mA and lasting 20 minutes, over parieto-temporal regions combined with a cognitive training. Participants were randomly assigned to active or sham treatment; reading measures (text, high and low frequency words, non-words) were collected before (T0) and after treatment (six weeks later, T1) and in a follow-up evaluation (one month after the end of treatment, T2). The tolerability of tDCS was also evaluated.

**Results:** Active group improved low frequency words reading (reading accuracy) immediately after treatment (T1 vs T0:  $p = 0.03$ ) and one month later (T2 vs T0:  $p = 0.007$ ), and non-words reading (reading times) immediately after treatment (T1 vs T0:  $p < 0.001$ ) and one month later (T2 vs T0:  $p < 0.001$ ). In the sham group, no difference emerged in reading after treatment compared to baseline. None of participants reported any discomfort or serious adverse effect.

**Conclusions:** The study shows preliminary evidence of tDCS feasibility and efficacy in improving reading of dyslexic children and adolescents and it opens new rehabilitative perspectives for the remediation of dyslexia.

**L.S. PAO, D. SERINO, A. BONILLA, A. LEWIS & A.E. MARGOLIS. Rapid Automated Naming Speed Predicts Reading Comprehension in Impaired and Typical Readers.**

**Objective:** The double deficit hypothesis posits that reading impairment results from a deficit in either phonological awareness (PA) or rapid automatized naming speed (RAN), with the most severe impairments resulting from deficits in both, a double deficit. RAN—the ability to quickly name stimuli—predicts fluent reading. We investigated whether RAN predicts reading comprehension in impaired and non-impaired readers.

**Participants and Methods:** Participants were 20 children with reading disability (RD) and 19 healthy control (HC) children (7-13 years). RAN was assessed with Comprehensive Test of Phonological Processing digit, letter, object, and color naming subtests. PA was assessed with letter-word identification and word attack subtests of the Woodcock-Johnson Test of Achievement. Comprehension was assessed with the Gates-MacGinitie (GMRT) and Gray Oral Reading Tests (GORT). We tested first whether children with RD differed from HC children on RAN and comprehension. Next we assessed across all the children whether RAN predicted comprehension controlling for PA.

**Results:** We detected a significant main effect of group for RAN (digit naming,  $p < .005$ ; letter naming,  $p < .005$ ) and reading comprehension (GMRT,  $p < .001$ ; GORT,  $p < .001$ ), such that children with RD performed more poorly than HC children. Across all children, RAN predicted reading comprehension controlling for PA (GMRT,  $p < .001$ ; GORT,  $p < .001$ ). PA explained significant variance in comprehension (GMRT,  $p < .001$ ; GORT,  $p < .001$ ).

**Conclusions:** Children with RD performed more poorly than HCs on RAN and comprehension. Consistent with the double deficit hypothesis, RAN predicted unique variance in comprehension, above and beyond variance explained by phonological awareness, across all children. These data suggest that RAN is distinct from PA and is an essential component of fluent reading across ability levels.

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**E. RIGGALL, S. FROST, R. SEVCIK & R. MORRIS. Implicit Sequence Learning and Memory and Phonological Awareness in Developmental Dyslexia and Specific Language Impairment.**

**Objective:** The present study examined implicit sequence learning and memory, measured by the widely-used Serial Reaction Time Task (SRTT), on deficits in grammar and phonological awareness in children who met criteria for Developmental Dyslexia (DD) with or without

Specific Language Impairment (SLI). Implicit sequence learning, a type of procedural learning, is known to be a deficit in both DD and SLI (Menghini et al., 2006; Lum et al., 2010). Though impairments as measured by the SRTT remain controversial, with both positive and negative findings, implicit sequence learning is thought to be related to grammatical understanding across SLI and typically developing children (Lum, 2012). Importantly, such a relationship remains unexamined among children with DD.

**Participants and Methods:** Following Tomblin (2007), this study examined the relationship between implicit sequence learning and grammar skills in a sample of elementary school aged poor readers ( $N=50$ , ages 9-10 and 12-14) who met criteria for DD or DD+SLI. Because children also learn implicitly that words are composed of phonemic patterns much in the same way they learn about patterns underlying grammar, the study also examined whether implicit sequence learning was similarly related to deficits in phonological awareness in these two groups using the same methods.

**Results:** Growth curve analyses of learning patterns within the SRTT were used to further investigate simple group differences and to replicate previous observations of the relationship between implicit sequence learning and grammar. The same technique was also used to investigate whether phonological awareness is similarly correlated with implicit sequence learning.

**Conclusions:** Results are discussed in terms of the contribution of dimensional analyses over diagnostically categorical analyses of implicit sequence learning to enrich our understanding of aspects of language and reading impairments.

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**E.M. WESONGA, D.K. GRANGE, R.D. STEINER & D.A. WHITE. Age Moderates the Predictive Utility of Spatial Working Memory for Mathematical Achievement.**

**Objective:** The role of executive functioning and visuospatial abilities in mathematics has long been researched in school-age children, but the specificity and utility of these skills for predicting future outcomes remains uncertain. The current study adopted a longitudinal approach to investigate how working memory and visuospatial ability relate to future mathematical achievement.

**Participants and Methods:** 25 healthy children aged 7-18 years participated in cognitive and achievement testing during an initial session and at a 3-year follow-up. Standard scores from the mathematics subtest of the Wechsler Individual Achievement Test - II were used as the outcome measure. Visuospatial ability was measured by scores from the matrix reasoning subtest of the Wechsler Abbreviated Scale of Intelligence. To assess working memory, children completed modified, computerized n-back and recognition span tasks that required storage of the content or spatial location of visually presented information. Hierarchical linear regressions were used to determine the variance in math achievement at follow up predicted by initial age, visuospatial ability, working memory, and the age interactions.

**Results:** Results indicate that visuospatial ability significantly predicts future math achievement above and beyond age ( $p < 0.05$ ). There was no significant interaction between age and visuospatial ability. Although none of the working memory measures were significant, unique predictors of future achievement, there were significant interactions between age and the spatial working memory tasks ( $p < 0.05$ ), indicating that spatial working memory is more predictive of future math achievement when assessed at older ages.

**Conclusions:** Our findings suggest that while visuospatial ability may be a useful predictor of math achievement across all ages, spatial working memory skills may have more predictive utility for older children. Future studies should combine greater data collection and advanced growth curve modeling to better predict academic achievement outcomes.

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**R. WINTER, J.C. FRIJTERS, M.W. LOVETT & R. MORRIS. The Relationship between Phonological Short-Term Memory, Working Memory, and Changes in Reading Scores in Children with Dyslexia.**

**Objective:** This study aimed to understand the role of domain-general working memory (WM) in predicting post intervention reading scores in children with Developmental Dyslexia (DD). While reading research has found that phonological short term memory (STM), measured by non-word repetition (NWR), is a potential predictor of changes in reading scores from pre to post intervention in individuals with DD (Smith-Spark & Fisk, 2007), it remains unclear if a more domain-general component of WM is driving this relationship.

**Participants and Methods:** Three domain-general WM tasks, Counting Span, Digit Span Backwards and Corsi Blocks Backwards, and a test of phonological STM, NWR, were given to two groups of children with DD who participated in an empirically backed reading intervention program (Lovett et al., 2000) ( $n = 30$  for grades 3-4, mean age 8.95 ( $SD = .72$ );  $n=20$  for grades 7-8, mean age 13.13 ( $SD = .81$ )).

**Results:** A hierarchical regression showed that without domain-general tests of WM in the model, the phonological STM task (NWR) did not significantly predict reading score changes in either age group. In both age groups Digit Span and Corsi Blocks were significant predictors of reading score changes, with stronger relationships between variables seen in the younger sample.

**Conclusions:** The present results point to an important relationship between domain-general WM skills and phonological STM abilities in DD children who respond best to empirical reading intervention programs. Correspondence: *Rebecca Winter, MA, Psychology, Georgia State University, 1337 Holly Lane, Atlanta, GA 30329. E-mail: rwinter3@student.gsu.edu*

**R. WISEHEART, K. SUNG, B. JONES, S. SAMUEL & D. JOSE. How Derivational Morphology Intervention Improves Reading in Adult English Language Learners.**

**Objective:** Morphological awareness (MA) predicts reading comprehension in English language learners (ELLs), but the nature of the relationship is unclear. Previous research suggests that words are processed faster when they contain morphological units which in turn improves reading comprehension. To examine this hypothesis more closely, we explored the effects of MA intervention on reading fluency and comprehension in ELLs using a multiple baseline single subject design.

**Participants and Methods:** Twelve ELLs age 21-29 participated non-concurrently in 6 weeks of MA training. Intervention focused on structural analysis of words with derivational morphology and included a repeated timed reading component. Generalization probes for reading untrained multi-morphemic words were charted and pre- and post-test measures of reading fluency and comprehension were administered. Participants completed pre-treatment language history questionnaires and a battery of cognitive, language, and reading tests.

**Results:** All participants improved reading fluency of trained words. Generalization effects to untrained multi-morphemic words were modest ( $d=.32$ ); however, the average trend line followed a polynomial u-shaped curve ( $R^2=.83$ ) suggesting that simple processes of sound-by-sound phonemic decoding were rapidly replaced by more complex processes of morphological decoding as a direct result of MA training. There was a very large effect size of treatment on post-test measures of reading comprehension ( $d=1.86$ ). Predictors of post-treatment comprehension included bottom-up processes: reading rate, accuracy, and orthographic knowledge ( $r=.66-.73$ ); whereas associations with top-down processes such as English vocabulary and self-rated English proficiency were non-significant.

**Conclusions:** Our findings show that MA supports ELL's reading comprehension via reading fluency and demonstrates that structural analysis treatment can quickly and significantly improve MA.

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**Drug/Toxin-Related Disorders (Including Alcoholism)**

**M.J. WILSON & J. VASSILEVA. Effects of Sex and Drug Class on Neurocognitive Impulsivity Among Drug Users in Protracted Abstinence.**

**Objective:** Previous research indicates that active female drug users show more severe neurocognitive impairments than active male drug users. To evaluate whether these sex differences are present following protracted abstinence from drug use, neurocognitive tasks of impulsive choice and impulsive action were administered to male and female heroin users [HU], amphetamine users [AU], and polysubstance users [PU] with >1 year abstinence from DSM-IV substance dependence. Drug users were compared to healthy controls matched on estimated IQ (Raven's Progressive Matrices) and education.

**Participants and Methods:** Participants (male = 252; female = 85) completed tasks of impulsive action (Go/No-go Task [GNCT]; Immediate Memory Task [IMT]) and impulsive choice (Cambridge Gambling Task [CGT]; Iowa Gambling Task [IGT]). Effects of sex and drug class on neurocognitive performance were analyzed via ANCOVAs.

**Results:** Sex differences were observed across tasks of impulsive action and impulsive choice. Female HU showed selectively impaired discrimination ( $d'$ ) and low correct detections on the IMT. Collapsing across groups, females demonstrated poor  $d'$  and high omission errors on the GNCT. On tasks of impulsive choice, females engaged in risky decision-making when contingencies were ambiguous (IGT) and disadvantageously risk-averse decision-making when contingencies were explicit (CGT), with post-hoc analyses indicating that these effects were driven by female PU.

**Conclusions:** Relative to male drug users and healthy controls, female drug users in protracted abstinence demonstrated evidence of reduced sustained attention and stimulus discrimination (impulsive action), and dysregulated reward-based decision-making (impulsive choice). Different classes of prior injection drug use were associated with distinct neurocognitive impairments. Specifically, impulsive action deficits were driven by female HU, while impulsive choice deficits were observed primarily among female PU. Supported by NIDA/NIH Fogarty International Center R01DA021421 (JV).

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**Genetics/Genetic Disorders**

**Y.R. CUKIER & S. SCHAFFER. The Neuropsychological Profile of a Child with Diamond-Blackfan Anemia and the Impact of Hemoglobin Level on Aspects of Cognition.**

**Objective:** Diamond-Blackfan Anemia (DBA) is a rare ribosomopathy characterized by erythroid hypoplasia, congenital anomalies, and increased cancer risk. In some cases, regular transfusions are required in order to maintain adequate hemoglobin levels. Although research into the pathophysiology of DBA has grown in recent years, knowledge of cognitive functioning in this population is scarce. Thus, the primary aim of the current study was to report the neuropsychological profile of a child with DBA, with a secondary aim of determining the impact of hemoglobin level on aspects of cognition.

**Participants and Methods:** An 8-year old Caucasian male with a diagnosis of DBA was referred for neuropsychological evaluation due to reported inattention and academic failure. He was diagnosed with DBA at 6 weeks of age, and he has since been primarily transfusion-dependent. In addition to completing a comprehensive assessment, several measures were administered prior to and following his transfusion for the purpose of comparison.

**Results:** Results showed average intelligence with weaknesses in attention, processing speed, and executive functioning. Academic skills were deficient, with a particular weakness in decoding. Behavioral, emotional, and social difficulties were identified. Regarding changes observed between sessions, results showed that while processing speed and basic attention improved, aspects of executive functioning significantly worsened.

**Conclusions:** This is the first published case of neurocognitive functioning in DBA and the first to examine the impact of hemoglobin level on cognition in a child with DBA. Identifying patterns of cognitive development is critical in improving our understanding of this chronic illness and its impact on psychosocial well-being. Furthermore, knowledge of the cognitive patterns within this population can help guide treatment recommendations, including social, behavioral, and academic interventions, with the goal of improving overall quality of life.

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### Language and Speech Functions/Aphasia

**M. VEGA, K. RAGHUBAR, A.M. CARSON, J. OGHALAI & S. CAUDLE. Comparison of Nonverbal Skills in Children with Hearing Loss and Autism Spectrum Disorder.**

**Objective:** Measures that assess nonverbal IQ and visual processing, are useful for evaluating and monitoring patients with a high prevalence of language problems, such as Autism Spectrum Disorder (ASD) and bilateral sensorineural hearing loss (SNHL). However, it is unclear if there are differences in nonverbal processing inherent to these diagnoses. The purpose of this study is to compare the performance of children with ASD and SNHL on the Leiter International Performance Scales Revised and 3rd Edition.

**Participants and Methods:** Data was obtained via chart review for 39 patients with ASD and 38 patients with SNHL. Patients were aged 3-14 years and had nonverbal IQs of 71-129. Scores from 3 subtests (Figure Ground [FG], Form Completion [FC], and Sequential Order [SO]) were compared within and between groups to determine differences.

**Results:** Although children with ASD and SNHL performed similarly on all three subtests of the Leiter-R/Leiter-3 (all  $p$ -values  $> .077$ ), strengths and weaknesses emerged for each group. Paired  $t$ -tests revealed that children with ASD showed strength in FC compared to FG ( $p = .012$ ) and SO ( $p < .001$ ). SO emerged as an area of weakness given that decreased performance was noted relative to FG ( $p = .008$ ). In comparison, children with SNHL showed strength in FC, with higher scores compared to FG ( $p < .001$ ) and SO, ( $p < .001$ ), which did not differ from each other.

**Conclusions:** Results suggest that differences exist for development of specific nonverbal cognitive skills for these two diagnostic groups. Although both groups showed a significant strength for FC, SO (requiring sequencing ability and problem-solving skills) emerged as a significant weakness for those with ASD. Both groups showed difficulty with FG (ambiguous stimuli) in comparison to FC. These findings have implications for theories regarding cognitive development in these two groups as well as treatment approaches for language development.

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### Symposium 1. Malformations of Cortical Development and Cognition

Chair: Karen Blackmon

9:15–10:45 a.m.

**K. BLACKMON, A.M. GALABURDA, R.C. SCOTT, B. KORMAN & B.S. CHANG. Malformations of Cortical Development and Cognition.**

**Symposium Description:** "Malformations of cortical development" (MCD) is an umbrella term that covers a wide spectrum of cellular and cytoarchitectonic abnormalities. MCDs can range from large, visually apparent lesions such as Periventricular Nodular Heterotopia (PNH) to small, visually elusive lesions such as Focal Cortical Dysplasia (FCD). MCDs are associated with epilepsy, autism spectrum disorder, and learning disorders. The mechanisms by which MCDs impact functional networks underlying cognition and behavior are largely unknown but exciting advances in genetics, animal modeling, and human neuroimaging are shedding light on the complex relationship between cortical pathogenesis and neurobehavioral dysfunction. This symposium will survey such progress and introduce promising new therapies for MCD-associated cognitive disorders. Dr. Karen Blackmon will provide an overview of cortical development and discuss how failures in neuronal proliferation, migration, and maturation can lead to structural malformations. She will present data from individuals with genetic mutations in the 16p11.2 region to introduce a novel neuroimaging method for mapping neurobehavioral symptoms to focal morphometric abnormalities. Dr. Albert M. Galaburda will present rodent work showing a range of cortical anomalies that could explain learning deficits. Dr. Rod C. Scott will discuss data from animal models to show that FCD lesions have a direct impact on cognitive dysfunction, independent from seizures, and that early enrichment might rescue cognitive deficits. Dr. Brandon Korman will present human data from a pediatric epilepsy sample to demonstrate the relationship between FCD lesion extent, type, and location on cognitive functions and introduce an fMRI method for studying language network reorganization in FCD. Finally, Dr. Bernard Chang will discuss an intriguing new therapeutic approach to modulating aberrant network activity in PNH.

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**K. BLACKMON. Focal cortical anomalies and neuropsychological phenotypes in 16p11.2 syndrome.**

**OBJECTIVE:** Individuals with genetic mutations in the 16p11.2 region are at increased risk for intellectual disability, autism spectrum disorder (ASD), and epilepsy. 16p11.2 deletions are associated with overproliferation of neuronal progenitor cells and macrocephaly. It is unknown whether focal cortical anomalies are also present. This study will present a novel neuroimaging method for detecting focal morphometric anomalies in 16p11.2 deletion syndrome and determine whether they are associated with decreased cognitive ability and increased ASD traits.

**PARTICIPANTS AND METHODS:** Individuals with 16p11.2 deletions from the Simons VIP database were compared to an age-matched normative sample using a case-control approach. High-resolution T1-weighted MRI scans from each subject were processed with Freesurfer 5.3 and customized scripts. Cortical surface maps from each case were compared to the normative sample, resulting in a  $z$ -score for cortical thickness (CT) at every vertex. The surface area of all abnormal clusters ( $z$ -score  $> 2$ ) was summed for each individual and compared between the 16p11.2 and control group. Rank-order correlations were performed to determine the relationship between abnormal cluster extent, Full-Scale IQ, and ASD symptoms.

**RESULTS:** Individuals with 16p11.2 deletions showed a larger extent of abnormal CT clusters than controls. A greater extent of focal CT abnormalities was associated with lower Full-Scale IQ and higher ASD traits.

**CONCLUSIONS:** Results demonstrate that focal cortical anomalies are present in 16p11.2 deletion syndrome and associated with increased risk of intellectual disability or ASD. Given the neuroanatomical heterogeneity of abnormal clusters in the 16p11.2 group, whole-brain averaging of morphologic measures such as CT might mask group differences; therefore, case-control approaches should be utilized in syndromes where focal cortical anomalies are suspected.

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**A.M. GALABURDA. Do minor cortical anomalies need to look like minor cortical anomalies to produce learning problems? Lessons from rodent studies.**

**OBJECTIVE:** Based on findings in dyslexic brains at autopsy, various rodent models have been developed to look at items such as cortical architecture and connectivity, as well as cortical physiology and behavior. Depending on the type of rodent model a range of minor cortical malformations can be seen, with and without visible anatomical changes in cortical and subcortical structures. The main objective of this presentation is to make researchers and clinicians aware of the range of cortical changes associated with learning deficits.

**PARTICIPANTS AND METHODS:** During our research, we have looked at strains of mice with spontaneous cortical malformations, rats with freezing neonatal cortical lesions, rats exposed to in utero electroporation of shRNA plasmid directed at dyslexia risk genes, and mice knocked-out for dyslexia risk genes. Anatomical, cellular, physiological, and behavioral observations are made.

**RESULTS:** We have observed small layer 1 heterotopias, microgyria, subcortical heterotopias with cell autonomous and non-cell autonomous changes, neurons subtly displaced in cortical layers, cortical hyperexcitability, and secondary changes in thalamus and brainstem, and, in one case, frank hydrocephaly.

**CONCLUSIONS:** The developing cerebral cortex has a limited range of responses to early insults, whether genetically or epigenetically acquired. Where along this range a response will occur in an individual case can be explained in some situations but not in others.

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**R.C. SCOTT. Can early environmental enrichment improve cognitive functions in MCD?**

**OBJECTIVE:** To discuss animal models of MCD, mechanisms of cognitive impairment and improvements as a function of behavioral intervention.

**PARTICIPANTS AND METHODS:** There are several animal models of MCD described. These include models of both focal and generalized malformations. Most models are either genetic (e.g. DCX, LIS1) or a result of an intrauterine environmental insult (e.g. methylazoxymethanol (MAM), x-ray irradiation). Behavioral testing using the Morris Water maze, place avoidance task and DNMS task was performed in the MAM model. In addition, in-vivo electrophysiology in awake behaving animals was performed. Postweaning environmental enrichment and overlearning strategies were used to establish whether behavioral performance can be improved even in the context of markedly abnormal brain structure.

**RESULTS:** MAM exposed rats have impairments in spatial cognition and in attention. These are associated with changes in hippocampal oscillatory activity in the theta and high gamma frequencies. They also have abnormalities in place cell parameters in that the cells are of lower fidelity and less likely to be modulated by background theta oscillations. Enrichment and overtraining dramatically improve cognitive behavior. Enrichment is associated with enlargement of posterior hippocampus as well as partial restoration of oscillatory and single neuron firing activity.

**CONCLUSIONS:** Malformations of cortical development unsurprisingly are associated with cognitive impairments. The system-level impact of the MCD on neural firing activity is increasingly being understood.

Modification of cognition with environmental and educational interventions is possible even in the context of a fixed abnormal structural network.

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**B. KORMAN. Factors that influence neuropsychological performance in children with FCD-associated intractable epilepsy.**

**OBJECTIVE:** Presentation of factors that influence neuropsychological performance in children with intractable epilepsy due to FCD.

**PARTICIPANTS AND METHODS:** Subjects were pediatric epilepsy patients who underwent surgical resection and had histologically verified FCD. Neuropsychological evaluation and fMRI language mapping were done prior to surgery. The effects of histopathology and various clinical factors on general cognitive functioning, IQ, and language were evaluated. Language networks were mapped to determine the effects of histology on activation patterns. Memory processes were compared between temporal FCD with and without concomitant hippocampal sclerosis.

**RESULTS:** Poor cognitive outcomes were significantly associated with early age at onset of epilepsy and more widespread involvement of dysplastic cortex. Atypical organization of eloquent language areas was more likely for receptive than expressive networks, and particularly influenced by lesions in the dominant temporal lobe. There was no direct relationship to histopathology of FCD or other clinical factors. Despite no gross memory differences between temporal neocortical FCD and pathology involving both mesial temporal and neocortex, the additional hippocampal pathology is associated with worse encoding than solitary FCD of the neocortex.

**CONCLUSIONS:** FCD histopathology is not a significant influence on cognition. However, critical periods of development are disrupted linearly in relation to onset age, while multilobar dysplasias are likely to have diminished cognitive skills regardless of onset age, without significant interaction effects. Atypical language activation in epileptic children with FCD suggests proximity of pathology to dominant hemisphere critical cortex as the primary determinant of functional reorganization. Memory skills encompass multiple processes that may be disrupted at various points along the larger network and may provide clues regarding the location of temporal pathology.

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**B.S. CHANG. Modulation of brain networks in gray matter heterotopia using connectivity-guided transcranial magnetic stimulation.**

**OBJECTIVE:** Periventricular nodular heterotopia (PNH) is a malformation of cortical development characterized by misplaced nodules of gray matter lining the lateral ventricles of the brain. Classic bilateral PNH often presents with seizures and reading disability. Past studies suggest that aberrant connectivity between the heterotopic nodules and cerebral cortex is associated with the epileptic state in PNH. We sought to determine whether transcranial magnetic stimulation (TMS), when applied to cortical targets identified by connectivity imaging, could modulate brain function and reduce seizures in PNH.

**PARTICIPANTS AND METHODS:** Patients with epilepsy from PNH were studied using TMS and simultaneous electroencephalography (EEG) recordings. Single-pulse TMS was used to probe the local excitability of cortical regions shown to have resting-state functional connectivity to heterotopia. Repetitive TMS was applied to determine if cortical excitability and clinical seizure frequency could be reduced using low-frequency stimulation.

**RESULTS:** As previously described, heterotopia patients with active epilepsy demonstrated an augmented late cortical response to single-pulse TMS, and this abnormality was specific to regions with aberrant connectivity. In one participant with refractory epilepsy, low-frequency

repetitive TMS to an aberrantly connected cortical target resulted in a delayed but notable decrease in clinical seizure frequency.

**CONCLUSIONS:** Accumulating evidence suggests that abnormalities of brain connectivity underlie the major neurological manifestations of PNH. Noninvasive brain stimulation, when guided by functional connectivity imaging findings, can both probe and modulate cortical function in a directed manner. Our work demonstrates that such stimulation methods may be a useful investigative tool and raises the possibility of potential therapeutic intervention in patients with cortical malformations and brain connectivity defects.

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## **Symposium 2. Neuropsychology and Neuroimaging in Alcohol Use Disorders: A Better Understanding for a Better Treatment**

**Chair: Anne Lise Pitel**

**9:15–10:45 a.m.**

**A. PITEL, E.V. SULLIVAN, H. BEAUNIEUX, P. MAURAGE, M.E. BATES & A. PITEL. Neuropsychology and Neuroimaging in Alcohol Use Disorders: a Better Understanding for a Better Treatment.**

**Symposium Description:** Alcohol Use Disorders (AUD) are major worldwide health and socioeconomic concerns. The goal of the symposium is to highlight how the recent advances in our understanding of alcohol-related neuropsychological impairments and brain damage improved the treatment of patients with AUD.

There are four keynote speakers. Prof. Edith V. Sullivan from Stanford University (US) will address the problematic of brain structural and functional compromise associated with AUD as well as to identify factors that contribute to compromise, and assess the potential for recovery. Prof. Hélène Beaunieux from Inserm-Université de Caen Normandie (France) will speak to the validation of a cognitive screening tool especially designed to detect AUD patients with neuropsychological deficits that could limit the benefit of treatment and the patients' ability to respect their therapeutic contract. Prof. Pierre Maurage from Université Catholique de Louvain (Belgium) will present data on the emotional and social abilities that are largely impaired in patients with AUD and how, potentially, they result in interpersonal difficulties as well as the development and persistence of the addictive state. Finally, Prof. Marsha E. Bates from Center of Alcohol Studies, Rutgers University (US), will overview the development of novel AUD interventions (which involve cognitive remediation) that match individual trajectories of cognitive recovery.

As a chair and discussant, I will emphasize the significance of neuropsychological and neuroimaging approaches to patients with AUD. I will propose adjustments of treatment timing and procedures that could favor a decrease in alcohol consumption and even abstinence. Given the number of remaining unknowns, I will conclude by pointing out avenues to be explored in priority in order to enrich our knowledge of the pathophysiology and treatment of AUD to ameliorate outcome.

**E.V. SULLIVAN & A. PFEFFERBAUM. Brain Structure and Function in Alcohol Use Disorder.**

Chronic, excessive alcohol consumption can affect brain structure and function in enduring ways. Our study objectives were to quantify patterns of brain structural and functional compromise associated with Alcohol Use Disorder (AUD), identify factors that contribute to compromise, and assess the potential for recovery. Men and women with and without AUD participated in clinical evaluation and neuropsychological testing and underwent structural magnetic resonance imaging (MRI), diffusion tensor imaging (DTI), or functional MRI (fMRI). Cross-sectional

study revealed selective deficits in working memory and balance that in longitudinal study showed some recovery with sustained sobriety. MRI revealed that neural substrates of deficits involved frontocerebellar and limbic circuits. DTI showed degradation of anterior, superior white matter fiber systems with relative sparing of posterior, inferior systems that may underlie recovery or escape of function. Longitudinal study with DTI showed graded improvement with sobriety in men and women with AUD and confirmation of focal fiber degradation and recovery with an animal model of binge drinking. Factors associated with compromise and recovery of brain structure and function included amount drunk between imaging sessions and nutritional status, notably, of thiamine levels and macrocytic anemia. Brain structure and function are marked by substantial heterogeneity in their response to chronic alcohol consumption and in recovery with sobriety. Recognition of the constellation of factors marking the untoward effects of AUD and those contributing to improvement could help in treatment by enhancing and perhaps accelerating recovery. (Support: AA010723, AA017168, AA017923, AA12388, AA021697)

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**H. BEAUNIEUX, L. RITZ, C. LANNUZEL, C. BOUDEHENT, F. EUSTACHE, F. VABRET & A. PITEL. Cognitive Screening for a Better Treatment.**

Alcohol-related neuropsychological impairments affect episodic memory, working memory and visuospatial abilities, as well as executive and motor functioning. These impairments can prevent patients with alcohol use disorders (AUD) from benefiting fully from treatment, and reduce their ability to remain abstinent. A neuropsychological assessment seems essential for making the relevant clinical decisions. However, few alcohol treatment departments have the resources needed to conduct an extensive neuropsychological examination of each alcoholic patient. Brief screening tools can provide a cognitive and motor profile that can guide the adjustment of alcohol treatment and further cognitive assessments. However, current screening tools do not have a satisfactory level of content validity for AUD because they were initially designed to detect cognitive impairments in other diseases. Our goal was therefore to assess the validity and the psychometric properties of the Brief Evaluation of Alcohol-Related Neuropsychological Impairments (BEARNI), a new screening tool especially designed to assess alcohol-related neuropsychological impairments.

254 healthy controls completed the BEARNI, and 58 also performed an extensive neuropsychological battery. 73 patients with AUD underwent both the BEARNI and the neuropsychological battery served as gold standard for determining the patients' cognitive status.

An exploratory factor analysis validated the BEARNI's underlying structure, highlighting five factors that reflected visuospatial abilities, executive functions, ataxia, verbal episodic memory and verbal working memory. The standardization of each BEARNI subtest and the two total scores revealed that this test has sufficient diagnostic accuracy for the detection of patients with cognitive and motor impairments. The present study indicates that the BEARNI is a useful screening tool in clinical settings for detecting AUD's motor and cognitive impairments and adjusting alcohol treatment.

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**P. MAURAGE. Social Neurosciences in Alcohol-Use Disorders.**

The cerebral impairments related to alcohol-dependence have been largely described for the last decades, but most earlier works have focused on cognitive functions. More recently, it has been suggested that beyond these well-known memory, attentional or executive disorders, emotional and social abilities are also largely impaired in alcohol-related disorders, these later deficits playing a crucial role in the development and persistence of this addictive state. This talk will offer an overview of the currently available literature on this emerging research field,

showing how the blooming of social and affective neurosciences in psychiatry and neurology offers new perspectives for exploring the brain correlates of interpersonal difficulties in alcohol-related disorders. While developed very recently, these neuropsychological and neuroimaging studies have already clearly shown that alcohol-dependent individuals are impaired in a wide range of social abilities, including the decoding of negative facial emotions, affective empathy, theory of mind or social exclusion sensitivity. The experimental and clinical implications of these results will also be discussed, particularly by showing that innovative neuropsychological programs are currently being developed to rehabilitate these social abilities, offering promising therapeutic perspectives. Correspondence: *Pierre Maurage, Ph.D., Faculty of Psychology, 10, Place C. Mercier, Louvain-la-Neuve B-1348, Belgium. E-mail: pierre.maurage@uclouvain.be*

**M.E. BATES & J.F. BUCKMAN. Cognitive Remediation and Different Trajectories of Cognitive Recovery in Persons with Alcohol Use Disorders.**

Neuropsychological and cognitive deficits are prevalent in persons seeking treatment for alcohol use disorders (AUDs). Cognitive impairments are often overlooked both within and outside of treatment, although they may vary from mild to quite severe across persons with AUDs. The impact of cognitive problems on mental and physical health, and social and work-related functioning can be pervasive. As well, these problems may present roadblocks to successful AUD treatment process and outcomes. On average, the brain and cognition improve over time with abstinence or markedly reduced alcohol use, yet the rate and extent of recovery is variable across cognitive domains and individuals. An important question raised by these observations is whether it is possible to facilitate treatment process and improve AUD treatment outcomes by directly promoting cognitive recovery through cognitive remediation. A related question concerns how such remediations might be effectively staged in the treatment process to accommodate different prototypical trajectories of cognitive recovery. This presentation will overview the development of novel AUD interventions that involve cognitive remediation and how such approaches may map onto individual differences in trajectories of cognitive recovery in persons with AUD. Emerging evidence suggests that such interventions can be effective in promoting cognitive recovery in persons with AUD and other substance use disorders, and potentially increasing treatment efficacy. Translational approaches based on cognitive science, neurophysiology, and neuroscience research may be promising directions for effective treatment development that includes cognitive rehabilitation.

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**Paper Session 1. Acquired Brain Injury (ABI),  
Adult**

**Moderator: Eli Vakil**

**9:15–10:45 a.m.**

**E.M. JOHNSON, D.J. EBLE, Y. LIU, M. HUANG, C. DECARLI, R. AU, B.A. SILVER, M. MCCLEAN, J. GRAFMAN & A. RASKIN. Long-Term Effects of Traumatic Brain Injury in the Framingham Study.**

**Objective:** The long-term effects of traumatic Brain Injury (TBI) on cognition and brain morphology is documented in high TBI risk populations. There is, however, a paucity of research in community-based samples. This study determined whether self-reported history of TBI validated by medical records was related to cognitive and neuroimaging measures associated with brain aging.

**Participants and Methods:** Between 2009-2013, 2,517 Generation 3 and Omni Generation 2 participants from the Framingham Heart Study

were administered a neuropsychological test battery that included a question on previous history of TBI. 521 participants responded that they had previously sustained a TBI, but only 37 (7.1%) had medical records that confirmed a TBI diagnosis by American Congress of Rehabilitation Medicine standards. We compared these participants to 177 participants, a subset of respondents, who responded “no” to history of TBI and whose medical records indicated no history of TBI.

**Results:** The TBI group performed significantly poorer on tests of visual memory, attention, abstract reasoning, and psychomotor function ( $p < 0.05$ ) compared to the no TBI group. Further the TBI group had significantly greater white matter hyperintensity volume than the no TBI group ( $p = 0.039$ ), whereas there was no difference in total and lobar volumes ( $p < 0.05$ ) between the two groups.

**Conclusions:** Within a community-based population, self-reported TBI history, corroborated by medical records, was related to cognitive and neuroimaging phenotypes associated with vascular brain aging. These findings suggest that a TBI earlier in life may place people at greater risk for a neurodegenerative disorder later in life.

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**B. BIEKMAN, R.A. BERNIER, E.A. WILDE, A. ROY & F.G. HILLARY. Early and Late Neurodegenerative Changes in White Matter Integrity following TBI.**

**Objective:** While recent research on traumatic brain injury (TBI) has yielded important findings concerning short-term recovery, less is known about late effects of injury and factors predicting long-term brain structural and functional change. We examined whether white matter (WM) structural integrity measured via diffusion tensor imaging (DTI) differed between subjects earlier vs. later in their post-TBI recovery, and how DTI metrics relate to cognition.

**Participants and Methods:** Fourteen individuals with Early TBI (<1 year post-injury) and nine individuals with Chronic TBI (range: 5-28 years post-injury), who had sustained moderate-severe TBI (i.e., Glasgow Coma Scale of 3-12 or positive neuroimaging), and 12 healthy controls were recruited. Each subject underwent DTI and cognitive testing. Quantitative tractography was used to measure fractional anisotropy (FA) in the cingulum bundle (CB) and the corpus callosum genu.

**Results:** While FA in the CB differed marginally between the Early TBI and comparison groups ( $p = 0.058$ ), FA in the genu and CB differed significantly between the Chronic TBI and control groups ( $p < 0.05$ ). Even after controlling for age, time post-injury tended to predict FA of the CB ( $r = -0.41$ ,  $p = 0.16$ ) and the genu ( $r = -0.49$ ,  $p = 0.09$ ), such that decreased FA indicative of reduced WM integrity was associated with a longer interval in the combined TBI sample. CB FA was also associated with performance on the Visual Search and Attention Task, a test of information processing speed ( $r = 0.63$ ), where higher FA was associated with better performance.

**Conclusions:** While cross-sectional, these data suggest that TBI-induced neurodegenerative change detectable via DTI may continue over time, even after accounting for effects of normal aging. Moreover, structural integrity of the CB is associated with measures of information processing speed. Additional longitudinal research is needed to further characterize the progression of post-TBI WM structural change and additional factors influencing the rate and pattern of change.

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**D. KRCH, G. WYLIE & N.D. CHIARAVALLI. The Sagittal Stratum as a Candidate Biomarker for Degree of Neuropathology after Chronic TBI.**

**Objective:** Diffuse axonal injury (DAI) is a key pathology after TBI, disrupting white matter pathways and causing cognitive impairments. Studies investigating white matter integrity after TBI have identified specific fiber tracts related to cognitive performance. However, there is



little consensus regarding the relative importance of particular tracts to predict domain-specific functioning. The goal of this study was to investigate whether reduced integrity of specific tracts differentially predicted poorer memory, executive function, and processing speed. Time since injury in this relationship was also evaluated.

**Participants and Methods:** Thirty individuals with moderate to severe TBI were evaluated. Diffusion tensor imaging fractional anisotropy values were derived for major white matter tracts. Dependent variables included composites for verbal memory, visual memory, executive function, and processing speed. Stepwise multiple regressions were performed for each dependent variable, with select white matter tracts entered as the independent variables in step one and time since injury in step two.

**Results:** The left sagittal stratum was a unique and significant predictor of verbal memory; the right sagittal stratum was a unique and significant predictor of visual memory, executive function, and processing speed. A significant relationship between time since injury and white matter integrity emerged only for verbal memory.

**Conclusions:** The sagittal stratum is a major subcortical fiber system linking fibers from the parietal, occipital, cingulate, and temporal regions to the thalamus and other brainstem structures. The significant predictive relationship between this tract and performance in all cognitive domains suggests that it may rival the corpus callosum in vulnerability to DAI after TBI, thus serving as a possible biomarker for neuropathology in chronic TBI.

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**A.L. CLARK, K.J. BANGEN, S. SORC, D.M. SCHIEHSER, N. LUC, M. SANDERSON-CIMINO, M.L. WERHANE, M.W. BONDI & L. DELANO-WOOD. Links Between Perfusion, White Matter Integrity, and Cognition in Veterans with History of Mild-to-Moderate TBI.**

**Objective:** Evidence suggests cerebral blood flow (CBF) alterations contribute to white matter (WM) disruption. Given the paucity of studies investigating associations between CBF, WM integrity, and cognition in the context of traumatic brain injury (TBI), we examined (1) the association between CBF and DTI indices; (2) whether this relationship is modified by time since TBI; and (3) imaging and cognitive associations in a cohort of Veterans with mild-to-moderate TBI (mmTBI). The cingulate cortex and cingulum bundle were selected as a priori regions of interest given links to thalamic and entorhinal areas important for cognition coupled with known vulnerability of these regions to TBI.

**Participants and Methods:** 32 Veterans with mmTBI underwent neuroimaging and cognitive assessment. Resting CBF was measured with Multiphase Pseudocontinuous Arterial Spin Labeling (MPPCASL) and averaged across Freesurfer-derived parcellations of the cingulate bilaterally. WM integrity was measured with DTI and tractography quantified mean fractional anisotropy (FA) of the cingulum bilaterally.

**Results:** Regression analyses controlling for age and PTSD symptoms revealed a significant Time Since Injury x Resting CBF interaction for the left cingulum ( $p < .005$ ). Decreased CBF was significantly associated with reduced cingulum FA in the chronic phase; however, no such association was observed for participants whose TBI was less remote. Finally, decreased cingulum FA was significantly associated with poorer verbal memory performance in those with reduced CBF.

**Conclusions:** Preliminary results show that reduced perfusion of the cingulate cortex predicted poorer WM integrity in our sample of Veterans with mmTBI who were further removed from their TBI events. In addition, in those with lower CBF, reduced WM integrity was associated with poorer memory performance. Findings suggest altered CBF may represent a useful biomarker for poor WM integrity and cognitive outcomes in the chronic phase of mmTBI.

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**J. SANDRY, K.S. CHIOU, J. DELUCA & N.D. CHIARAVALLOTTI. Pre-treatment differences in clinical estimates of working memory capacity determine memory rehabilitation efficacy in TBI.**

**Objective:** Memory-impairment is common following traumatic brain injury (TBI). Due to the heterogeneous nature of memory-impairment following TBI, the success of cognitive rehabilitation is mixed. Presently, we explored how individual differences impact rehabilitation outcomes. Specifically, we investigated whether working memory capacity (WMC) can be used as a cognitive-marker to identify who will and will not improve from memory rehabilitation.

**Participants and Methods:** Post-hoc analysis on complete data from 65 moderate to severe TBI participants enrolled in the TBI-MEM randomized clinical trial. The treatment group completed 10 sessions of the modified Story Memory Technique in which subjects were taught a memory strategy focusing on the use of context and imagery to remember information. The placebo-control group engaged in active therapy sessions that did not involve learning the memory strategy. The main outcome variable was long-term memory percent retention change scores for an unorganized list of words from the California Verbal Learning Test.

**Results:** There was an interaction between Group and WMC ( $p = .008$ ,  $\eta^2 = .12$ ) whereby individuals with higher WMC showed a benefit from treatment compared to their low capacity peers. Individual differences in WMC accounted for 45% of the variance in whether or not TBI participants in the treatment group benefited from applying the modified Story Memory Technique to unorganized information.

**Conclusions:** Individuals with higher WMC showed a significantly greater benefit when applying the modified Story Memory Technique compensatory strategy to unorganized information as compared to those with low WMC. WMC is a useful cognitive-marker for identifying TBI participants' response to memory rehabilitation.

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**T. DAVIS, B.D. HILL, K. FIELDS, K. RUSS, S. TIFFIN, N. STANLEY, S. GORDON-HICKEY & K. EVANS. Utility of Auditory ERPs to Evaluate Linguistic Processing in TBI.**

**Objective:** This study evaluated auditory ERPs in the cognitive domains (N1-P2, N400, and P300) as a TBI biomarker focusing on atypical amplitude and latency on a semantic categorization task.

**Participants and Methods:** Participants (N=8; mean age 42.4 years SD=10.1; mean education 14.8 years SD=3.4; 75% white, 25% African American; 62.5% male) with a history of TBI (mean time since injury 16.3 years SD=8.2) and healthy control participants (N=8; mean age 41.3 years SD=9.8; mean education 17.0 years SD=1.1; 100% white; 62.5% male). ERPs were recorded with a 64 channel Neuroscan system while participants responded "YES" or "NO" for word pairs being a semantic match. Mean amplitudes and peak latencies were analyzed for N1-P2, N4, and P300 components using a mixed design ANOVA. Participants also completed the RBANS.

**Results:** P2 and P300 components showed significant group differences. Controls exhibited greater P2 amplitude than the TBI group [ $F(1,14) = 4.711$ ,  $p = .048$ ] at the Cz electrode. A significant interaction between midline electrode sites and group was noted for P300 amplitude [ $F(5,70) = 3.451$ ,  $p = .008$ ]. Controls showed maximum P300 amplitude at parietal electrodes while the TBI group had a broader parietal to frontal activation pattern. A clear P300 pattern emerged where 4 of the TBI participants had similar P300 morphology to controls (high ERP performance group) and recruitment of frontal areas and the remaining 4 TBI participants had a reduced or delayed P300 (low ERP performance group) and no frontal activity. The high ERP performance TBI

group performed better on the RBANS (RBANS total score mean=106.3 SD=22.9) than the low ERP performance group (RBANS total score mean=78.5 SD=22.7), though this difference was not significant due to low power.

**Conclusions:** We believe this is the first study to demonstrate an equipotential distribution of activity in TBI. Frontal P300 activity was seen primarily in those who had successfully compensated for their brain injury. This relationship requires further exploration.

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## Paper Session 2. Medical/Neurological Disorders, Adult

Moderator: **Margaret G. O'Connor**

9:15–10:45 a.m.

**K.L. POSSIN, H. KIM, E.T. JOHNSON, S. SHA, A. APPLE, B. MILLER, D. XU, S. FINKBEINER, C. HESS, M. GESCHWIND & J.H. KRAMER. Egocentric and Allocentric Working Memory in Premanifest Huntington's Disease: A Double Dissociation with Caudate and Hippocampus Volumes.**

**Objective:** Spatial information can be coded in egocentric (self-based) or allocentric (landmark-based) coordinates. Rodent studies show a critical role for the caudate in egocentric processing and the hippocampus in allocentric processing. We hypothesized that gene positive individuals with premanifest HD (pmHD), which causes caudate atrophy, would show greater impairment on egocentric than allocentric working memory. Further, egocentric performance would correlate with dorsolateral caudate volumes, whereas allocentric would correlate with hippocampal volumes.

**Participants and Methods:** Egocentric and allocentric spatial working memory tasks were administered to 16 pmHD individuals and 17 age and sex matched controls. Each task had 80 trials to remember 2 locations over 1-sec delays. There was one difference between these otherwise identical tasks: locations could only be coded in either egocentric or allocentric coordinates. Accuracy was analyzed using a mixed model ANOVA and correlated with caudate and hippocampal regional volumes. The volumes were measured using a multiatlas-based labeling algorithm and deformation-based morphometry, with significances adjusted for multiple comparisons using the false discovery rate.

**Results:** The test by group interaction was significant,  $p=.02$ . The pmHD individuals were impaired on both tasks, but they were significantly more impaired on the egocentric,  $d=1.68$ , than the allocentric,  $d=.75$ . Only egocentric performance correlated with caudate regional volumes, and specifically it correlated with the dorsolateral head, right more than left, a region that receives inputs from dorsolateral prefrontal cortex ( $p<.001$ ). In contrast, only allocentric performance correlated with regional hippocampal volumes, specifically with right dentate gyrus and left CA3 ( $p<.001$ ).

**Conclusions:** The dorsolateral caudate is important for egocentric working memory, which can explain the severe impairment in pmHD. Allocentric working memory, in contrast, appears to rely on the hippocampus.

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**M. KOPELMAN & J. MORTON. Amnesia In An Actor.**

**Objective:** Marr (1971) and McClelland et al (1995) argued that slow semantic learning might be possible by a direct cortical route in the presence of severe hippocampal damage (or within the 'extended hippocampal' circuitry). Subsequently, new semantic learning has been

demonstrated in amnesic patients, but generally using very simple material. Our aim was to examine learning of more complex material in neurological amnesia.

**Participants and Methods:** We examined a profoundly amnesic professional actor of international status, and we required him to learn passages from plays he had performed across 5 decades and 'control' passages from plays he had not performed. Autobiographical memories and background contextual information were also examined. Comparison was made with the learning curves of non-amnesic professional actors on passages from plays they had or had not performed in.

**Results:** From a lower baseline at trial 1, our actor was able to learn the passages with a normal slope to his learning curve (incremental learning) across 5 learning trials. He also showed a significant advantage for passages from plays he had performed in, despite not being able to identify the plays, nor to recall the fact that he had performed in some of them. He showed severe autobiographical amnesia for the past time-periods in which he had performed these plays.

**Conclusions:** New semantic learning of complex material can occur in amnesia, possibly by slow cortical circuits, and our actor employed long-established semantic/procedural schemas, in the form of his professional skills, to help learn the passages.

**M. GONZALES, O. AJLORE, R. CHARLTON, J. COHEN, E. SIEG, A. KARSTENS, S. YANG, A. ZHANG, A. KUMAR & M. LAMAR. Divergent Influences of Multiple Cardiovascular Risk Factors on Cognition, Grey and White Matter Morphology.**

**Objective:** Hypertension, diabetes, dyslipidemia, and obesity have each been associated with increased risk of late-onset dementia as well as preclinical alterations in cognition and brain structure; however, this information often comes from studies of individual risk factors. Our study aim was to examine the association between multiple cardiovascular risk factors, cognition and brain structure.

**Participants and Methods:** A diverse sample of 124 adults (age $\sim$ 59.8 $\pm$ 13.1; 41% African American) underwent neuropsychological and cardiovascular assessments and structural MRI. Nine cardiovascular risk factors were subjected to principal component analysis resulting in a four-component solution representing 1-cholesterol, 2-glucose dysregulation, 3-metabolic dysregulation, and 4-blood pressure. Freesurfer assessed whole-brain cortical thickness. FSL determined tract-based fractional anisotropy (FA).

**Results:** Higher blood pressure component scores predicted lower learning, memory, and executive functioning, as well as cortical thinning within the right lateral occipital lobe. Elevated glucose dysregulation predicted poorer attention/information processing and associated with reductions in FA within the right sagittal striatum and bilateral superior longitudinal fasciculi. Cholesterol and metabolic component scores did not predict cognition; cholesterol did associate with increased cortical thickness within left caudal middle frontal cortex while metabolic dysfunction associated with right superior parietal lobe, left inferior parietal lobe, and left precuneus cortical thickness.

**Conclusions:** Results suggest that blood pressure and glucose dysregulation associated with distinct cognitive alterations and both grey and white matter vulnerability. Greater understanding of the distinct and overlapping underpinnings of cardiovascular risk factors on the brain may assist in identifying specific vulnerability profiles that can be monitored for change in future longitudinal studies of affected individuals.

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**R.P. KESSELS, W. EIKELBOOM & F. DE LEEUW. The effect of cognitive reserve on vascular cognitive impairment after stroke.**

**Objective:** The extent of vascular cognitive impairment (VCI) in stroke patients varies greatly across individuals, even when the same amount of brain damage is present. Cognitive reserve, as indexed by education level, might explain these differences, but results on the effects

of cognitive reserve on are inconclusive and possibly confounded by age-cohort effects.

**Participants and Methods:** First, we performed a meta-analysis of the existing literature on cognitive reserve after stroke, identifying 11 studies (total  $N=2,698$ ). Second, we examined the effect of formal education level on VCI in patients who had experienced an ischemic stroke between the ages of 18 and 50 and were cognitively assessed on average 11.0 (SD=8.2) years post-onset (the FUTURE Study cohort). The total sample consisted of 277 young-stroke patients (mean age at follow-up 50.9 (SD=10.3)). Age- and education-adjusted expected scores were computed using 146 matched stroke-free controls.

**Results:** The meta-analysis showed an overall effect size ( $z'$ ) of 0.31 (95%CI 0.20-0.42), indicating that cognitive reserve had a small to medium effect on the extent of VCI. Analyses of the FUTURE data showed that the effect of education on post-stroke executive dysfunction was mediated by age ( $\beta$  age -0.015,  $p < .05$ ). Below-average performance in the attention domain was more frequent for the low-education patients ( $\chi^2(2) = 9.77$ ,  $p < .05$ ).

**Conclusions:** Cognitive reserve as indexed by education level is related to post-stroke VCI, but effects are small and largely mediated by age-cohort effect. Possibly, other estimates for cognitive reserve may be more valid, but these have not been studied in relation to VCI.

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#### S.N. VILLARD & S. KIRAN. Between-Session and Within-Session Intra-Individual Variability in Attention in Aphasia.

**Objective:** Patients with aphasia (PWA) have been found to exhibit increased between-session intra-individual variability (BS-IIV) in performance on non-linguistic attention tasks relative to controls. The current study examined both BS-IIV and within-session IIV (WS-IIV) in performance on a series of attention tasks of varying complexity. PWA were expected to exhibit increased BS-IIV and WS-IIV relative to controls, as well as increased BS-IIV and increased WS-IIV with higher task complexity.

**Participants and Methods:** Data was collected from 17 PWA and 17 controls. Each participant completed a series of five computerized experimental tasks of incrementally increasing complexity. This series of five tasks was administered four times, on four different days

**Results:** To examine BS-IIV and WS-IIV in reaction time (RT), coefficients of variation (COVs, or the standard deviation over the mean) were calculated for each participant, on each task. Specifically, a COV representing BS-IIV in RT (BS-COV) was calculated for each participant, each task, using data collected across the four sessions. Similarly, a COV representing WS-IIV in RT (WS-COV) was calculated for each participant, each task, using data collected within a single session. A 2 (Group)  $\times$  5 (Task) R-ANOVA showed that BS-COVs were higher for PWA than controls ( $F(1, 32) = 4.79$ ,  $p < .05$ ). WS-COVs were also found to be higher for PWA than for controls ( $F(1, 32) = 7.61$ ,  $p < .01$ ). A significant effect of Task on WS-COV within PWA was also observed ( $F(4, 64) = 9.47$ ,  $p < .001$ ), such that the most complex task elicited higher WS-COVs than any other.

**Conclusions:** PWA showed increased BS-IIV and WS-IIV in attention relative to controls; also, increased task complexity elicited increased WS-IIV in PWA. Findings have important implications for assessment and treatment in aphasia, as both testing and therapy require consistent attention to complex stimuli both from moment to moment and from day to day.

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#### T.S. PATERSON, R. SHAPIRO & W.L. THORNTON. Self-efficacy Mediates the Relationship Between Traditionally Measured Intelligence, but not Everyday Problem Solving Ability, and Medication Adherence, in Renal Transplant Recipients.

**Objective:** Our laboratory has previously shown that everyday problem solving (EPS) ability predicts medication adherence in renal transplant recipients (RTR; Gelb et al., 2010); that EPS provides a better predictor of adherence than traditionally measured intelligence (TIQ; Paterson et al., 2015); and that self-efficacy (SE) is positively associated with adherence in RTR (Demian et al., 2015). To further understand adherence in RTR, we examine whether SE mediates the relationships between (1) TIQ & adherence, and (2) EPS & adherence, respectively.

**Participants and Methods:** RTR had undergone successful transplant ( $N=179$ ) at least 6 months prior to participation. Medication adherence was measured with the Transplant Effects Questionnaire (TxEQ), TIQ was determined via the KBIT-II, and EPS ability was determined by number of safe/effective solutions generated for real-world scenarios (EPS Test). SE was measured via the Self-Efficacy Scale (SES) and Medication Adherence Self-Efficacy Scale (MASES). Multiple mediation analyses (Preacher and Hayes, 2008) were used to examine two models. Model 1 included the KBIT-II as the IV, SES and MASES as mediators, and the TxEQ as the DV; model 2 included the EPS Test as the IV, SES and MASES as mediators, and the TxEQ as the DV.

**Results:** Demographic variables related to the TxEQ (gender & ESL status) were entered as covariates. In the first model (TIQ as the IV), the SE variables completely mediated the effect of TIQ on adherence, 95% CI [.0025, .0277]. By contrast, in model 2 (EPS as the IV), SE did not mediate the relationship between EPS and adherence.

**Conclusions:** These results indicate the importance of general and medication adherence specific SE in understanding adherence behaviours. These findings also highlight differences between TIQ and EPS ability, and emphasize the potential utility of EPS measures in predicting adherence in RTR. More research is necessary to better understand the predictive utility of self-efficacy and EPS for predicting medication adherence in this group.

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#### K.A. WALKER, R. VENEZIA, K. HAPPER, A. KAUR, S. BRICE, A. HIRALALL & S. SCHAFFER. Low Mean Arterial Pressure in Critically Ill ICU Patients is Associated With Poorer Memory and MMSE at Discharge and Follow-Up.

**Objective:** Approximately 30-80% of patients admitted to the intensive care unit (ICU) for non-neurological conditions experience significant cognitive impairment at follow-up. Although delirium and hypoxia in the ICU have been associated with worse cognitive outcome, these variables do not fully account for cognitive declines. The current analysis was conducted to determine whether systemic perfusion, as measured by mean arterial pressure (MAP), predicted cognitive status at ICU discharge and at follow-up.

**Participants and Methods:** 34 individuals without pre-existing neurological or cognitive impairment admitted to the ICU for greater than 72 hours and diagnosed with septic shock and/or respiratory failure were enrolled. General cognitive (MMSE) and memory (RBANS List Learning) functioning were assessed at the time of ICU discharge and at 3-month follow-up. MAP, delirium, sedation level, and serum oxygenation (SpO<sub>2</sub>) were continuously monitored during the ICU stay.

**Results:** A total of 241 ICU days were used for this analysis. Bivariate correlation indicated that low MAP was associated with poorer MMSE ( $r = .38$ ;  $p < .05$ ) and memory ( $r = .45$ ;  $p < .05$ ) functioning at time of discharge, and poorer memory at 3-month follow-up ( $r = .62$ ;  $p < .10$ ). After covarying for total days of delirium, cumulative sedation, and total hypoxia (SpO<sub>2</sub>), MAP predicted memory ( $\beta = .55$ ;  $p < .05$ ;  $R^2 \Delta = .25$ ) and MMSE ( $\beta = .65$ ;  $p < .01$ ;  $R^2 \Delta = .23$ ) at discharge, and memory functioning at 3-month follow-up ( $\beta = .86$ ;  $p < .10$ ;  $R^2 \Delta = .27$ ). Despite a large effect size, the latter finding did not reach statistical significance.

**Conclusions:** Abnormally low arterial perfusion in critically ill patients on the ICU, as measured by MAP, is related to poorer cognitive functioning at the time of ICU discharge and at 3-month follow-up. Although preliminary, these findings suggest that reduced arterial perfusion in the context of critical illness may be linked to prolonged cognitive impairment.

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### Plenary B. There's More There: Extracting New Information From the Functional MRI Signal Using Novel Acquisition and Processing Methods

**Presenter: Peter A. Bandettini**

**11:00 a.m.–12:00 p.m.**

#### **P.A. BANDETTINI. There's More There: Extracting New Information From the Functional MRI Signal Using Novel Acquisition and Processing Methods.**

Our group has been focusing for the past several years on developing methods for detecting and characterizing ever more subtle and elusive fMRI changes in task-based and resting-state fMRI. Using methods that incorporate novel acquisition methods, novel activation paradigms, and novel post-processing methods, we have generated some surprising

findings. In this lecture, I will be discussing three primary approaches and findings. The first will be our approach to reducing artifactual time series noise and artifactual fluctuations. This approach involves the use of a multi-echo echo planar imaging (ME-EPI) acquisition. The principle we use is that blood oxygen level dependent (BOLD) shows echo time dependence while noise and artifact does not. Using this basic principle we are able to identify and remove non-BOLD signal changes. The second approach is massive averaging (9 hours of scanning) of a single subject's activation data and perform model-free analysis to determine that, in fact, all gray matter is active with even a simple task. Lastly, our third approach is to use windowed correlation analysis on time series to determine what ongoing task each subject is performing. This dynamic connectivity-based brain reading demonstrated to be more sensitive than magnitude assessment in determining ongoing tasks, and the informative connections extend well outside of the regions shown to change in magnitude with the task

**Learning Objectives**

After this lecture, the student should be able to:

1. State the principle by which multi-echo EPI separates BOLD from non-BOLD fluctuations,
2. Describe the advantages and disadvantages of a model-free approach in fMRI activation-based analysis, and
3. State the steps involved with performing sliding window correlation analysis for ongoing cognition assessment.

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## THURSDAY AFTERNOON, FEBRUARY 4, 2016

### Poster Session 3. Assessment (Adult) and Cognitive Neuroscience

**12:45–2:15 p.m.**

#### Assessment/Psychometrics/Methods (Adult)

#### **M.C. ADLER, T.J. ARENTSEN, S.K. STERN, W.J. STUBBS, K.A. DUCKETT, E.M. CROUSE & B. ROPER. Demoralization and the Metacognitive Index: A MMPI-2-RF and BRIEF-A Study.**

**Objective:** The Behavioral Rating Inventory of Executive Function, Adult Version (BRIEF-A) was designed to assess perceived executive function in daily life. The BRIEF-A Metacognition Index (MI) aims to measure working memory, initiation, planning, monitoring task performance, and organizing one's physical environment. However, the extent to which MI specifically measures perceived cognitive ability versus other psychological factors remains unclear. The current study examined the association between MI and relevant MMPI-2-RF scales to help clarify this issue.

**Participants and Methods:** Valid MMPI-2-RF and BRIEF-A profiles according to manual cutoffs were collected from veterans evaluated at a VA neuropsychology clinic (N=72). Correlations and a series of hierarchical regression models were performed to evaluate the unique contributions of MMPI-2-RF restructured clinical (RC) scales and somatic/cognitive scales to BRIEF-A MI.

**Results:** BRIEF-A MI correlated significantly with all RC scales except RC3. It was most strongly correlated with RCd ( $r=.61$ ) and RC7 ( $r=.44$ ). Regarding MMPI-2-RF somatic/cognitive scales, BRIEF-A MI correlated significantly with MLS ( $r=.42$ ), NUC ( $r=.27$ ), and COG ( $r=.43$ ). Hierarchical regression models were used to predict BRIEF-MI, beginning with RCd and adding the other scales that correlated significantly with

MI. Only RCd accounted for significant variance ( $ps<.001$ ), and other scales failed to uniquely predict BRIEF-MI scores.

**Conclusions:** MI is not specific to complaints about executive function. Furthermore, RCd best predicted MI, suggesting that MI is saturated with general unhappiness and dissatisfaction, which is commonly seen in self-report scales of psychiatric symptoms. Other, more specific, scales of psychiatric, cognitive, or somatic symptoms offer no additional contribution to MI. Findings raise questions regarding the specificity of MI to metacognitive complaints.

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#### **S.S. AHN, S. MACKALA, C. HIDIRO LU, L. YATHAM & I. TORRES. Social Desirability and the Relationship between Subjective Ratings on Cognition and Actual Performance.**

**Objective:** Social desirability (SD) refers to the inclination to present oneself in a positive manner. SD bias may influence cognitive self-report measures, which are frequently obtained in neuropsychology. The purpose of this study was to determine the relationship between SD bias and subjective cognitive ratings of general cognitive functioning and ratings of performance on a specific task.

**Participants and Methods:** Fifty-seven euthymic outpatients with Bipolar Disorder (BD) and 41 healthy community volunteers completed self-report measures of SD bias (Marlowe-Crowne Social Desirability Scale-SDS), as well as subjective ratings of either general cognitive functioning (Cognitive Failures Questionnaire-CFQ) or task-specific cognitive functioning (prediction and post-diction ratings of verbal and nonverbal memory performance on the Extended Complex Figure Test (ECFT) and the Rey Auditory Verbal Learning Test (RAVLT)). Pearson correlations were used to assess group-level associations between SDS and subjective ratings. Partial correlations examined the relationships

between subjective and objective cognitive performance before and after controlling for SDS.

**Results:** SDS scores were negatively correlated with the CFQ in both BD patients ( $r = -.52$ ,  $p < .01$ ) and healthy volunteers ( $r = -.34$ ,  $p < .05$ ), but did not significantly correlate with any of the remaining subjective ratings. Correlations between subjective cognitive ratings and objective cognitive performance before and after controlling for SD revealed a minor influence on CFQ (before  $r = -.22$ , after  $r = -.28$  in patients; before  $r = .14$ , after  $r = .07$ ) but not on task-specific ratings.

**Conclusions:** These data suggest that although SD bias has the potential to influence general cognitive self-ratings (e.g., CFQ), it does not appear to influence task-specific cognitive self-ratings. Assessment of SDS bias may therefore be a useful way to augment the validity of subjective cognitive measures, particularly when they involve self-ratings of general cognitive functioning.

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**S.L. AITA, B.D. HILL, A. BOETTCHER, C. SOFKO, E. CORLEY, B. SLAGEL & E. ELLIOTT. Revisiting the Biber Cognitive Estimation Test: A Novel IQ-Criterion Based Approach to Scoring.**

**Objective:** The Biber Cognitive Estimation Test (BCET) is a 20-item task that requires estimation of answers in five categories: time/duration, quantity, weight, and distance. The objective of this study was to compare the original distribution-based method of scoring the BCET to a new criterion-derived scoring method.

**Participants and Methods:** The present study consisted of 280 healthy participants (mean age=21 years SD=4.3; 56% female; mean education=13 years SD=1; 72% white, 21% African American, 4% Asian, 2% Latino, 1% other; mean WAIS-IV FSIQ=102 SD=11) who completed the BCET and a larger neuropsychological battery. The BCET was scored two ways: the original norms from Bullard et al. (2004) that defined scores as correct if they fell within the middle 90% of their normative sample and a new method of scoring the most frequent responses given by individuals with a FSIQ of >119 as correct.

**Results:** In this sample, the mean of the Bullard scoring method was 17.1 SD=1.9 and the mean of the new IQ-criterion approach was 13.2 SD=2.3. There was a significant difference between these scoring methods [ $t(279)=36.3$ ,  $p < .001$ ]. Both scoring methods were significantly correlated with WAIS-IV FSIQ and index scores as well as Raven's Advanced Progressive Matrices, but the new criterion-derived scoring method had higher correlations with all measures except WAIS-IV PSI. The highest correlations for the criterion-derived scoring method were  $r = .33$  for FSIQ and  $r = .32$  for WMI.

**Conclusions:** Compared to the Bullard BCET scoring method, the new method of scoring the BCET based on an IQ criterion appears to improve the utility of the BCET as demonstrated by stronger relations with multiple other measures of fluid cognition, suggesting improved construct validity. We believe this is due to the new scoring method resulting in increased variability in score allowing for greater individual differences in performance. Future studies on measuring cognitive estimation should work to improve item content, answer formatting, and scoring methodologies.

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**M.R. ALBUQUERQUE, L. MALLOY-DINIZ, M. ROMANO-SILVA, J. DE PAULA, M. NEVES & G.M. LAGE. Fixation duration predicts performance in the Grooved Pegboard Test: An analysis of two different tasks using the preferred and non-preferred hands.**

**Objective:** The aim of this study was to investigate whether the duration of fixation can predict the performance in different task conditions (Place and Remove) with the preferred and non-preferred hands

**Participants and Methods:** Fifty-two right-handed undergraduate students (33 male and 19 female), with a mean age of 22.22 ( $\pm 3.57$ ) years, performed the Grooved Pegboard Test. SMI Eye-Tracking Glasses were used during the task, with a binocular time resolution of 30 Hz. The videos were recorded in iView software, and data were analyzed using BeGaze software. The Kolmogorov-Smirnov test revealed that movement time, fixation duration, and number of fixations measured during the Place and Remove tasks and with preferred and non-preferred hands did not violate the assumption of normal distribution. Therefore, we conducted Linear Regression [19] and General Linear Model repeated measures analyses. Bonferroni's test was used as post hoc analysis, and the significance level of 0.05 was adopted for all statistical analyses.

**Results:** A significant main effect of hands and tasks were found in Number of fixations [ $F(2,021; 104.119) = 297.350$ ,  $p < 0.001$ ], Fixation durations [ $F(1,577; 83.567) = 77.567$ ,  $p < 0.001$ ] and Movement time [ $F(2,041; 108.186) = 547.826$ ,  $p < 0.001$ ]. In addition, simple linear regression using fixation duration was the predictor variable and movement time was the dependent variable in the Place task with the preferred hand ( $R = 31\%$ ) and the non-preferred hand ( $R = 41\%$ ), as well as in the Remove task with the preferred hand ( $R = 11\%$ ) and the non-preferred hand ( $R = 25\%$ ).

**Conclusions:** In conclusion, our results show that the duration of fixation differentially predicted the performance in the Grooved Pegboard Test when preferred and non-preferred hands were used, as well as when different subtests were applied.

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**T.J. ARENTSEN, B. ROPER, S.K. STERN, M.C. ADLER, W.J. STUBBS, K.A. DUCKETT, J.D. JACKSON & E.M. CROUSE. MMPI-2-RF Content Validity Indicators and BDI-II / BAI Responding.**

**Objective:** Face valid symptom inventories (e.g., Beck Depression Inventory, BDI-II; Beck Anxiety Inventory, BAI) are popular screening measures for psychological functioning. The relationship between symptom validity tests (SVTs) and similar measures of psychopathology has received attention (e.g., Forbey et al., 2013; Garcia et al., 2010); the current study aims to examine the impact of MMPI-2-RF content validity and neuropsychological performance validity tests (PVTs) on BDI-II and BAI responding.

**Participants and Methods:** Participants completed general neuropsychological assessments at a large VA Medical Center that included BDI-II and/or BAI. Some completed the MMPI-2, which was converted to the MMPI-2-RF, along with the BDI-II ( $n=88$ ) and the BAI ( $n=50$ ). BDI-II/BAI responding was compared according to valid vs. non-valid MMPI-2-RF profiles; validity criteria included F-r, Fp-r, Fs-r, FBS-r, and RBS<100 vs. any >100. Another subset completed PVTs (e.g., TOMM, RDS) as well as the BDI-II ( $n=169$ ) and BAI ( $n=122$ ). Self-report scores were examined according to credible vs. noncredible status (>2 or >3 PVT failures depending on number administered).

**Results:** BDI-II and BAI scores were significantly higher with SVT failure,  $F(1,86)=41.24$ ,  $p < .001$ ,  $\eta^2=.32$ , and  $F(1,48)=43.32$ ,  $p < .001$ ,  $\eta^2=.47$ , respectively, but not with PVT failure. In this sample, a score of BDI-II>36 and BAI>31 could differentiate validity status at 90% specificity with 36.4% and 43.8% sensitivity, respectively. Of all severe-ranged scores, 15 BDI-II (75%) and 14 BAI scores (78%) were invalid.

**Conclusions:** These results build upon growing literature defining the need to interpret all self-report inventories in light of SVTs. Psychological screening measures, while popular for brevity and face validity, are affected by over-reporting response patterns, to the point where a large majority of scores in the highly elevated range were associated with symptom invalidity. Further, these results highlight differences between constructs assessed by SVTs and PVTs.

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**D. ASHISH, J.R. SOBLE, J. MARCEAUX & K. MCCOY. Wechsler Adult Intelligence Scale-4th Edition (WAIS-IV) Performance in a Mixed Clinical Sample of Monolingual and Bilingual Veterans.**

**Objective:** Intelligence tests strive to overcome biases due to language and culture with partial success. This study's objective was to examine the effect of English as a second language (ESL) on Wechsler Adult Intelligence Scale-IV (WAIS-IV) performance in a veteran sample.

**Participants and Methods:** Data were collected from a mixed outpatient clinical sample of 117 veterans (M-age=58.54, SD=12.15; 88% men; 29% bilingual English/Spanish [ESL]) who were administered the WAIS-IV. Thirty-eight percent (N=44) did not have cognitive impairment (nCI), whereas 62% were cognitively impaired (CI; mild-CI, N=56; major-CI/dementia N=17). Multivariate analysis of covariance (MANCOVA) compared language group performance (ESL vs. English-only [EO]) on the WAIS-IV indices and subtests while controlling for education and cognitive impairment severity.

**Results:** MANCOVA was significant, Wilks's  $\Lambda= .77$ ,  $F(14, 100)=2.12$ ,  $p<.05$ , partial- $\eta^2=.23$ . Follow-up univariate tests revealed the EO group (M=97.77, SD=12.74) scored higher than the ESL group (M=87.41, SD=11.43) on the Verbal Comprehension Index (VCI),  $F(1,113)=11.33$ ,  $p<.01$ , partial- $\eta^2=.09$ , and all three VCI subtests. EO (M=93.71, SD=12.63) scored higher than ESL (M=87.00, SD=10.41) on the Perceptual Reasoning Index (PRI),  $F(1,113)=4.41$ ,  $p<.05$ , partial- $\eta^2=.04$ , though none of the PRI subtests differed significantly. EO (M=91.58, SD=13.48) also scored higher than ESL (M=82.74, SD=10.92) on the Working Memory Index (WMI),  $F(1,113)=7.69$ ,  $p<.01$ , partial- $\eta^2=.06$ , with significant differences on Digit Span,  $F(1,113)=11.55$ ,  $p<.01$ , partial- $\eta^2=.09$ , but not Arithmetic. Groups did not differ significantly on the Processing Speed Index (PSI),  $F(1,113)=0.64$ ,  $p>.05$ .

**Conclusions:** The ESL group performed significantly lower on several WAIS-IV indices including both verbal and some nonverbal tasks after controlling for education and impairment severity. Thus, a possible overlay of primary language on nonverbal and working memory performances is suggested.

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**I. BABAKHANYAN, B.S. MCKENNA, K.B. CASALETTO & R.K. HEATON. NIH Toolbox Emotion Domain: Creation of Census Stratified Normative Data, Summary Scales and Base Rates for Distressed Emotional Functioning.**

**Objective:** We examined the influence of demographic variables on the NIH Toolbox Emotion Battery (EB), developed census stratified norms, as well as summary indices. Base rates of "distressed" emotional functioning are provided to inform indicators of problematic emotions.

**Participants and Methods:** The EB, comprised of 17 scales for ages 18-85, was administered to 1036 English-speaking adults as part of the NIH Toolbox norming project. Exploratory Factor Analysis (EFA) was conducted to examine the underlying factor structures. Confirmatory Factor Analysis (CFA) was conducted to confirm the model identified from the EFA. Model fit was evaluated with CFI, TLI, SRMR, and RMSEA. Summary scores were created based on factor weights from CFA results. Emotional distress was defined by 1 standard deviation towards the problematic direction on each scale.

**Results:** Age, gender and education accounted for only small portions of variance on the unadjusted 17 scales ( $R^2<.09$  for age,  $<.03$  education,  $<.02$  gender). Given the small associations, demographically-corrected scores are not recommended. We created uncorrected scores weighted to the 2010 Census demographics. EFA resulted in a three-factor solution with 15 of the 17 scales: (1) Negative Affect (NA) (2) Social Satisfaction (SS) (3) Psychological Well-Being (PW). CFA supported this factor

structure; CFI = 0.91, RMSEA = 0.085, and SRMR = 0.052. These values fall within the acceptable-good range for model fit indices and our final solution was the best compared to other solutions. Consistent with use of a 1 SD cutoff, base rates for emotional distress in the normative sample revealed 14.3% distress for NA, 16.6% for SS, and 15.0% for PW.

**Conclusions:** This study provided census corrected norms for the EB, established 3 summary scores, and confirmed expected base rates for emotional distress in a population-based survey. Summary scores should be applied to clinical samples to further validate the factor structures and investigate emotional distress rates in medical and psychiatric populations.

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**K.M. BAERRESEN, R. ROSTAMI, O. HEMMY-ASAMSAMA, J. BROFFMAN, X. CHEN, D. PYO, M. SOUZA, M.M. DUGUAY, J.S. MILLER, D. HAN & V. ZIZAK. Screening for Cognitive Decline in a Veteran Population with the Montreal Cognitive Assessment (MoCA) and the Benson Figure.**

**Objective:** As managed healthcare increasingly requires rapid evaluation of a burgeoning geriatric patient population, brief and effective assessment tools are ever more in demand. The MoCA is the most widely used screening instrument for Mild Cognitive Impairment (MCI) and dementia worldwide. Research has acknowledged the instrument's limited utility for detecting visual memory deficits; this may limit the measure's ability to identify related impairments in cognitive decliners. Thus, the addition of neuropsychological instruments may improve diagnostic accuracy. These investigators sought to improve diagnostic accuracy of the MoCA by adding a brief nonverbal memory task (Benson Figure).

**Participants and Methods:** Some patients were only administered a cognitive screener due to the severity of impairment; these individuals were inherently less cognitively intact [MoCA: M=21.93, SD=3.78, n=47 (included); M=17.93, SD=5.62, n=33 (excluded)]. Final sample consisted of older Veterans with normal cognition (N=8), MCI (N=27), and dementia (N=12) who completed a neuropsychological battery. Majority of the sample consisted of males (96%) and Caucasians (62%). No significant differences in age, gender, ethnicity, and education were found. Regression analyses were used to determine the variance accounted for by the MoCA and Benson Figure (10' delay) within cognitive diagnosis (normal, MCI, dementia).

**Results:** Regression analyses yielded moderate association ( $R^2 = 0.19$ ) between the MoCA and cognitive diagnosis  $F(1,45) = 10.63$ ,  $p<0.01$ , and strong association ( $R^2 = 0.41$ ) between the Benson 10' Delay and cognitive diagnosis  $F(1,45) = 31.81$ ,  $p<0.001$ . Hierarchical linear regression revealed the Benson 10' Delay accounted for an additional 22.7% of variance with a significant change in  $R^2$ , [ $F(1,44) = 17.18$ ,  $p<0.001$ ]. Together they account for 41.8% of the total variance within cognitive diagnosis [ $F(2,44) = 15.82$ ,  $p<0.001$ ].

**Conclusions:** Results suggest the addition of a nonverbal memory test to the MoCA improves detection of cognitive decline.

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**J. BERNSTEIN, J. LANGFITT, L. MITCHELL, J. BAZARIAN & M. CALAMIA. Validity of the King-Devick Test in Post-Acute Concussion and Chronic Partial Sleep Restriction Populations.**

**Objective:** The King-Devick (K-D) test is a brief, timed test of eye scanning and number-naming that has been shown to be sensitive to the immediate effects of concussion and short-term sleep deprivation. We assessed whether the K-D is sensitive to longer-term effects associated with post-acute concussion and chronic partial sleep restriction (SR).

**Participants and Methods:** Participants were recruited for one of two studies: 13 recently concussed participants and 17 non-concussed

controls were recruited to assess the effects of post-acute concussion ( $m=2.5$  weeks post-injury), and 26 healthy participants were recruited to assess the effects of SR on K-D performance in a within-subjects design. All participants completed the K-D as well as tests of convergent validity (e.g., Brief Test of Attention) and divergent validity (e.g., Hopkins Adult Reading Test).

**Results:** Consistent with hypotheses, recently concussed participants took longer to complete the K-D than non-concussed participants (56.2 vs. 46.4 seconds,  $t(28)=2.72$ ,  $p<.01$ ), and participants in SR performed worse on the K-D relative to their normal sleep quantity baselines (47.6 vs. 42.8,  $t(24)=2.64$ ,  $p<.05$ ). Recently concussed participants and participants in SR also performed worse on tests of working memory relative to their comparison groups. In the concussion study, changes in performance on the K-D was associated with changes in working memory and processing speed (e.g., Brief Test of Attention,  $r(28)=-.47$ ,  $p<.01$ ). Changes in K-D performance from baseline to SR were of half the effect size to that observed between the concussion and control groups (4.8 vs. 9.8 seconds).

**Conclusions:** These findings suggest that the K-D may be sensitive to the residual effects of post-acute concussion and to SR, and that concussion and SR may affect similar cognitive domains. Larger comparative studies are needed to better assess the validity of the K-D in these populations, as well as to assess differences in effect sizes between them. Correspondence: *John Bernstein, University of Rochester, 10 Ingheside Road, Lexington, MA 02420. E-mail: jberns16@u.rochester.edu*

#### **M. CALAMIA. Self-Reported vs. Informant-Reported Depressive Symptoms in an Outpatient Neuropsychology Clinic Sample.**

**Objective:** Previous studies have shown discrepancies in self-reported vs. informant reported depressive symptoms for specific patient groups (e.g., dementia: Snow et al., 2005; Parkinson's disease: Cimino et al., 2011). We explored the relationship between self-reported and informant-reported depressive symptoms in an outpatient neuropsychology clinic sample.

**Participants and Methods:** 62 patients with a variety of diagnoses (e.g., vascular dementia, epilepsy, depression, traumatic brain injury) were seen in an outpatient neuropsychology clinic and completed the Beck Depression Inventory (BDI-II) as part of their evaluation. Informants (i.e., the patients' spouses, parents, or other individuals who knew them well) completed the General Depression Scale from the Inventory of Depression and Anxiety Symptoms (IDAS-II). Informants also reported on their own caregiver distress (i.e., Zarit Caregiver Burden Inventory).

**Results:** BDI-II and IDAS-II scores were only moderately correlated ( $r(60) = .42$ ,  $p<.05$ ). Higher discrepancies between informant-reported and self-reported depressive symptoms were associated with worse patient verbal memory performance (AVLT Delayed Recall,  $r(60) = -.47$ ,  $p<.05$ ). Discrepancies for ratings of depressive symptoms were not associated with caregiver distress ( $p>.05$ ).

**Conclusions:** Findings suggest that self-report and informant-report may yield different information about a patient's level of depressive symptoms. The moderate correlation found between self-reported and informant-reported depressive symptoms is in line with meta-analytic findings of self-other agreement for internalizing problems in adults (Achenbach et al., 2005).

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#### **J. CARSTENS & A. BAIRD. Concurrent Validity of the Goal Management Training Questionnaire – Self in Undergraduates.**

**Objective:** The Goal Management Training Questionnaire – Self (GMTQ-S) is a self-report questionnaire that was designed to assess individuals' difficulties when attempting to achieve goals in their lives. In particular, it was designed to evaluate the effectiveness of a cognitive intervention called Goal Management Training, created to alleviate

executive functioning (EF) difficulties in a variety of populations. To this date, this intervention, and thus the GMTQ-S, has not been used with an undergraduate student population. That being said, undergraduates often experience EF difficulties, albeit at a subclinical level, and thus we examined the validity of the GMTQ-S with this population.

**Participants and Methods:** 50 participants with self-reported EF difficulties (that is, difficulties focusing attention, controlling and regulating distractions, or working towards goals) completed the GMTQ-S and two measures that have often been used in the literature to assess EF difficulties (namely, the Robert Morris Attention Scale [RMAS] and the Behavioral Rating Inventory of Executive Functions – Adult Version [BRIEF-A]). In addition, participants completed an academic self-efficacy measure (Self Efficacy for Learning Form – Abbreviated Version [SELF-A]) and reported their previous semester's GPA.

**Results:** Several two-tailed Pearson  $r$  correlational analyses were performed to investigate the relationship between the GMTQ-S and these measures. Results indicate significant correlations ( $p < .05$ ) between the GMTQ-S and the BRIEF-A (that is, for the Global Executive Composite score [ $r = .61$ ], the Behavioral Regulation Index [ $r = .41$ ], as well as the Metacognitive Index [ $r = .65$ ]), the SELF-A ( $r = -.33$ ), and the RMAS ( $r = .57$ ). No significant correlation was found between the GMTQ-S and students' GPA.

**Conclusions:** These results suggest that the GMTQ-S is a valid measure to use with an undergraduate population when assessing self-reported executive functioning difficulties.

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#### **K.R. CARTER, J. SCOTT, R. ADAMS & J. LINCK. Base Rate Comparison of Failed RBANS Effort Scale and Effort Index in Parkinson's Disease.**

**Objective:** The Effort index (EI) and the Effort scale (ES) are commonly used embedded effort indicators on the Repeated Battery for the Assessment of Neuropsychological Status (RBANS). The ES may have better sensitivity in detecting suboptimal effort in traumatic brain injury and amnesic disorders; however, differential findings revealed higher base rate failures of the EI relative to the ES in Alzheimer's disease though not other dementias. The purpose of this study is to examine the failure rates in a Parkinson's disease sample.

**Participants and Methods:** This study included 163 participants who have been diagnosed with Parkinson's disease by a board certified neurologist. Twenty of these participants were evaluated for deep brain stimulation candidacy. Participants completed the RBANS and the Mini Mental State Examination (MMSE) as part of a comprehensive neuropsychological evaluation. The EI and ES were calculated in accordance with the published guidelines. The base rate of EI and ES failure was calculated for the group.

**Results:** On average, participants were 66.81 year of age ( $SD=9.5$ ) and had a mean education of 13.49 years ( $SD=2.79$ ). The mean for MMSE scores was 26.97 ( $SD=3.1$ ). Overall, 62.8% of participants failed the ES and 8% failed the EI.

**Conclusions:** The utility of the EI and the ES in Parkinson's disease populations warrants further examination. Additionally, these results demonstrate the need for validation of embedded RBANS effort measures in various disease populations.

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#### **M.V. COSTA. Diagnostic accuracy of GDS-15, PHQ-9 and HAMD-17 in a community sample of elderly with late life depression.**

**Objective:** The objective is to evaluate the accuracy, determine cutoffs and reliability for the GDS-15, PHQ-9 and HDRS-17 scales for a community sample of elderly with late life depression

**Participants and Methods:** Patients (N=129, 88.4% women) were invited for participation. They were patients from a secondary/tertiary public health unit for elderly. Participants range 60 to 92 years of age (M=71.47, SD= 7.85) and 0 to 26 years of formal education (M=6.71, SD=4.92). Criterion validity for the GDS-15, PHQ-9 and HAMD-17 was explored with late life depression treated as the criterion, exploring sensitivity and specificity of different cutscores using receiver operating characteristic (ROC) curve analysis. Presence and absence of depression was determined using patient responses to the Mini-International Neuropsychiatric Interview. Also the accuracy for diagnostic was compared through the differences between the area under the curves of the three scale. Internal consistency reliability of the scales was assessed using Cronbach alpha coefficient and corrected item-total correlation coefficients.

**Results:** The area under the curve of the PHQ-9 (0.951, SE = 0.023,  $p < 0.001$ ) show high accuracy. For the HDRS-17, the area under the curve was also high in magnitude (0.966, SE = 0.018,  $p < 0.001$ ) as well for GDS-15 (0.946, SE = 0.020,  $p < 0.001$ ). When the areas under the curve of these three independent analyses were compared no significant difference was found between PHQ-9 and HDRS-17 ( $Z = 1.239$ ,  $p = 0.2154$ ), PHQ-9 and GDS-15 ( $Z = 0.265$ ,  $p = 0.7913$ ) or -17 and GDS-15 ( $Z = 1.202$ ,  $p = 0.2294$ ) suggesting the same accuracy. According to the ROC curve analysis, the cutoff close to 6 to GDS-15, to 9 to PHQ-9 and to 9 to HDRS-17 increase specificity and sensitivity in diagnostic confirmation.

**Conclusions:** The GDS-15, PHQ-9 and HDRS-17 scales show good accuracy and reliability for elderly people with late life depression.

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#### **C.C. CRANSTON & P.D. BLANTON. Alternate Form of the Trail Making Test Parts A & B: Preliminary Validation.**

**Objective:** The Trail Making Test (TMT) is one of the most frequently given tasks in neuropsychological evaluations. Studies have demonstrated clinically significant practice effects as a result of serial administration in- and outside of NP clinics (e.g., speech pathology). A call has been made for alternate forms. The purpose of the present study is to provide preliminary pilot data for the validation of alternate forms of TMT Parts A and B.

**Participants and Methods:** Data were collected from a clinical sample of 10 veterans presenting for neuropsychological evaluation. The TMT and TMT- were administered using counterbalancing to control for order effects.

**Results:** Results revealed no significant differences in completion time and number of errors for either TMT or TMT-R administrations based on order so all participants' data were aggregated for subsequent analyses. Correlations were conducted on the total completion time, T-scores, and number of errors between TMT and TMT-R revealing strong coefficients of equivalence.

**Conclusions:** Based on findings from this preliminary validation study, there is a strong degree of equivalence between the original TMT and the TMT-R. Taken with caution, given the small pilot sample size, results provide promising evidence for the use of the TMT-R as an alternate form. Findings are meaningful in that data were gathered on a purely clinical outpatient sample without exclusion or recruitment criteria and provide preliminary clinical utility for TMT-R. Findings necessitate a call for further research in a controlled study using a longer interval between administrations of TMT-R and TMT.

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#### **C.H. STRONG, R. JAROH, H. SMITH & J. DONDERS. D-KEFS Color-Word and Verbal Fluency Performance after Traumatic Brain Injury.**

**Objective:** To determine the sensitivity of the various D-KEFS Color Word and Verbal Fluency subtests to traumatic brain injury and to examine latent constructs.

**Participants and Methods:** 128 persons with traumatic brain injury were evaluated within 30-360 days after injury. The sample included 74 men and 54 women with a median age of 39 years and a median level of education of 13 years. Individuals who failed performance validity tests had been excluded. Spearman correlations and regression analysis were used to evaluate the influence of various demographic and injury variables on D-KEFS performance. Factor analysis was used to evaluate latent constructs of those subtests that demonstrated convincing evidence for sensitivity to injury severity.

**Results:** The Color-Word Inhibition/Switching subtest and the Verbal Fluency Category Switching subtest demonstrated statistically significant sensitivity to injury severity (specifically, longer duration of coma and presence of diffuse lesions on neuroimaging) even after controlling for lower-level subtest performance (i.e., respectively, Color Naming and Category Fluency). Maximum-likelihood factor analysis with oblique rotation of these two subtests in conjunction with the 4 factor indices of the WAIS-IV yielded 2 factors: one was defined by Color-Word Inhibition Switching, Verbal Fluency Category Switching and WAIS-IV Processing Speed, whereas WAIS-IV Verbal Comprehension, Perceptual Reasoning and Working Memory comprised the other factor.

**Conclusions:** The D-KEFS Color-Word Inhibition/Switching and Verbal Fluency Category Switching subtests demonstrate promising sensitivity to injury severity after traumatic brain injury. Demands on speed of processing are of relatively greater relevance in this regard than crystallized skills that are less sensitive to brain injury.

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#### **H. DUNCANSON, A. HOLLIS & M.G. O'CONNOR. Errors versus Speed on the Trail Making Test: Relevance to Driving Safety and Cognitive Impairment.**

**Objective:** Many studies have examined the efficacy of the Trail Making Test (TMT) in the prediction of driving safety. There is a lack of consensus across studies regarding the usefulness of this test which may have to do with diagnostic heterogeneity. In a prior study we demonstrated that a diagnosis of dementia modified the relationship between MMSE and driving outcome (Hollis et al., 2015). In the current study we examine the influence of diagnosis on the relationship between TMT and road test outcome. A novel error rate calculation is used.

**Participants and Methods:** 465 participants underwent a driving assessment including a road test. Participants were divided into: those with Cognitive Impairment (CI; N = 188) and those with No Cognitive Impairment (NCI; N = 277). CI was based on a diagnosis of dementia and/or an MMSE score < 25. TMT metrics were speed of completion and errors calculated according to number of completed items.

**Results:** In the CI group ROC analyses revealed that TMT- A speed was more predictive of driving outcome than was TMT- B (AUC = 0.71,  $p < 0.0001$ ). In contrast, TMT- B error rate predicted driving competence whereas TMT-A error rate was not useful (AUC = 0.67,  $p < 0.0001$ ). In the NCI group, TMT- A & B speeds were marginally predictive of driving. Error-rate was not predictive in the NCI group for either TMT- A or TMT- B.

**Conclusions:** The TMT is more sensitive in the prediction of driving in individuals with CI than in those who do not have CI. In contrast with prior research, error rate was calculated based on total items completed rather than total number of errors. Results indicate that number of items completed is a sensitive index of driving in the CI group. TMT-A and B speed and errors were not sensitive to driving outcome in the NCI group.



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**N.A. EMMERT, J.D. GFELLER, L. SCHWARZ, J.S. VANDER WAL & K.L. ZANE. The RBANS Factor Structure in Older Adults with Suspected Cognitive Impairment: Evidence of a 5-Factor Structure.**

**Objective:** The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a brief battery of cognitive tests designed to detect cognitive impairment in older adults. Previous research has not reproduced the conceptually derived five-factor structure of the RBANS and has typically yielded two- or three-factor solutions. The present study investigated the factor structure of the RBANS and hypothesized that a more complex factor structure could be modeled using more refined analytical approaches to the data, with a more diagnostically diverse clinical sample.

**Participants and Methods:** The present study utilized archival data from a heterogeneous clinical sample of older adults ( $N = 150$ ) who were administered the RBANS as part of a larger neuropsychological evaluation at an outpatient service. Clinical diagnoses for the sample included participants with various types of dementia (e.g., Alzheimer's type), cognitive impairment without dementia (e.g., mild cognitive impairment), and subjective cognitive impairment (i.e., normal cognitive functioning).

**Results:** Four RBANS models were specified using confirmatory factor analysis. Results of the five-factor model showed excellent fit ( $GFI = 0.93$ ,  $AGFI = 0.86$ ,  $NFI = 0.91$ ,  $IFI = 0.96$ ,  $TLI = 0.93$ ,  $CFI = 0.96$ , and  $RMSEA = 0.07$ ), following modifications to the model. Overall, results of the chi-square difference test demonstrated that a five-factor model, consistent to test developer's five-index structure, was statistically superior to two- and three-factor models ( $p < .001$ ).

**Conclusions:** In summary, results from the current study provide support for the theoretically derived five-factor structure of the RBANS in a heterogeneous clinical sample of older adults, which is in contrast to previous research. Additionally, our findings indicate that interpretation of the RBANS at the index level can be clinically meaningful, particularly when there is little discrepancy across subtest scores of an index. Correspondence: *Natalie A. Emmert, M.S., Psychology, Saint Louis University, 3359 Summerset Court, North Tonawanda, NY 14120. E-mail: emmertna@slu.edu*

**M.E. ENG, J. MOSES & D.A. THOMPSON. Verbal and Nonverbal Mediation Strategies of the Boston Naming Test.**

**Objective:** Previous research demonstrated that the two-factor model of the Boston Naming Test (BNT) components are orthogonal and independent (Young, Moses, & Lum, 2014). One of them mediates verbal information processing, while the other one mediates nonverbal information processing.

The current study aimed to investigate: (1) How the two independent factorial components of BNT relate to performance level variables of age and education; (2) How demographically-related components of visual naming on BNT are related to modular performance pattern components of intelligence on the Wechsler Adult Intelligence Scale-III (WAIS-III).

**Participants and Methods:** Archival data of 131 Veterans at the Palo Alto Veterans' Affairs Hospital were analyzed with exploratory factor analyses. A two-factor model of BNT with patient age and education was used (Young, Moses, & Lum, 2014) showing that performance on early trials of the BNT loaded with age, while late items loaded with education. These two factors were reanalyzed with the raw score factorial components of the WAIS-III.

**Results:** The overall solution explained 86.77% of the shared variance. The early BNT item\_age factor loaded with Verbal Comprehension (VC). The late BNT item\_education factor loaded with Processing Speed (PS) and Perceptual Organization (PO).

**Conclusions:** These results show that an education-related component of visual naming ability verbally mediates nonverbal comprehension, while an age-related component of visual naming mediates verbal comprehension. Attention and working memory were not shown to be relationally-related to naming ability. These results provide support for a model that links specific independent components of visual naming to verbal and nonverbal conceptual reasoning strategies with demographic variables of age and education.

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**B. FAUSTO, B. MCINTOSH, C. BONNER & A. MCBRIDE. The utility of neuropsychological tests and measurement of comorbidity in predicting driving competence among memory clinic patients.**

**Objective:** The predictive ability of specific neuropsychological measures and the contribution of medical comorbidity to driving competence are unclear. The aims of this study were to identify which traditional neuropsychological measures best predict driving competence and whether a measurement of comorbid medical conditions improves predictability.

**Participants and Methods:** Neuropsychological test (NPT) raw scores, DriveABLE assessment (DA) performance, and medical history data were obtained retrospectively from 89 patients who underwent routine clinical care at a memory disorders clinic from July 2008 to July 2013 (mean age = 74.67,  $SD = 8.44$ ; mean years of education = 14.12,  $SD = 2.82$ ; 50 females). The DA, a computer-based tool of driving competence, has been found to be highly predictive of on-road driving test performance with higher DA performance scores indicating greater likelihood of on-road test failure.

**Results:** Bivariate correlations revealed that poorer NPT performance, with the exception of Boston Naming Test-60 total score, was significantly associated with higher DA scores. The linear combination of all NPT predictors, adjusting for age, education and time elapsed between NPT and DA, significantly predicted DA score ( $R^2 = .623$ ,  $p < .0005$ ). Comorbidity did not add significantly to the prediction of DA performance. After backward elimination, Coding and Visual Reproduction Delayed Recall performance remained significant predictors in the prediction model.

**Conclusions:** These data suggest that cognitive tests measuring memory and processing speed inform clinical decision-making regarding driving competence in a cognitively impaired population. The contribution of comorbidity to driving competence should be explored in more heterogeneous samples.

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**R.P. FELLOWS, J. DAHMEN, D. COOK & M. SCHMITTER-EDGECOMBE. Multicomponent Analysis of a Novel Digital Trail Making Task.**

**Objective:** The purpose of this study was to determine the construct validity of a digital version of the trail making test and to examine the association of digital component scores with traditional neuropsychological tests.

**Participants and Methods:** Participants were 60 community-dwelling older adults who completed a comprehensive neuropsychological evaluation, including a newly developed digital trail making test (dTMT). Digital component scores were created to identify and isolate specific cognitive processes involved in trail making test performance. These component scores included average time inside circle, rate between circles, lifts, and pauses. Construct validity was established by assessing the correlation of dTMT component scores with other neuropsychological tests. Exploratory stepwise regression analyses were used to determine the unique contribution of dTMT components, beyond the effects of total time and errors, to other neuropsychological measures.

**Results:** Results revealed significant correlations of total time to completion for the paper and digital versions of Part A ( $\rho = .601$ ,  $p < .001$ ) and Part B ( $\rho = .807$ ,  $p < .001$ ). Component scores correlated with measures of psychomotor speed and executive functioning but not delayed memory recall. After controlling for age, sex, and education, average time inside circles on Part B was a significant predictor of Design Fluency Total Score ( $\beta = -.498$ ,  $p < .001$ ), Category Fluency-Switching ( $\beta = -.389$ ,  $p = .002$ ) and Digit Span Total Score ( $\beta = -.333$ ,  $p = .015$ ). Whereas, dTMT Part A total time was a significant predictor of performance on the Symbol Digit Modalities Test-Oral ( $\beta = -.563$ ,  $p < .001$ ) and condition 1 of the DKEFS Color-Word Interference Test ( $\beta = .589$ ,  $p < .001$ ).

**Conclusions:** These findings provide initial validation for the construct validity of a digital trail making task. Moreover, these results further suggest that the component of average time inside circle captured by the dTMT may be useful for isolating cognitive switching processes in older adults.

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**J.S. FULLER, T.P. COTHRAN, J. SWEET & L. GUIDOTTI BRETING. Gender Differences in Item Function on a Common Clock Drawing Test.**

**Objective:** Clock drawings are commonly used measures of executive functioning in neuropsychology clinics and research. Performance on this task may also be influenced by visuospatial skills. Sex differences have previously been found in visuospatial functioning and on a clock-drawing test. Item and scale-level sex differences have not yet been investigated on a popular clock drawing task (CLOX; Royal, 1995).

**Participants and Methods:** Archival data was collected from 578 (303 female) patients who completed the spontaneous clock-drawing task (CLOX 1) at an adult neuropsychology service. Clock drawings were scored using the Royal scoring criteria (1995). Sex differences on total score were examined using independent-samples t-tests. Differences on item performance were evaluated using logistic regression and likelihood-ratio chi-square tests for uniform and non-uniform differential item functioning (DIF).

**Results:** No sex differences were found in total score ( $t=0.550$ ,  $p=0.582$ ); however, likelihood-ratio tests determined that sex differences existed on 7/15 items. Specifically, uniform DIF was found on 5 items (e.g. "Sequence 1-12 Intact?",  $p=.008$ ), and non-uniform DIF was present on an additional 2 items (e.g. "Does the figure resemble a clock?",  $p=.019$ ). Men performed better on 5 of these items and women performed better on the remaining 2.

**Conclusions:** The present study investigated scale and item-level sex differences on a commonly-used clock drawing task. Although men and women perform similarly in terms of overall score, men perform significantly better on 1/3 of items. On 2 items, the degree of difference depended on level of impairment. These results support the use of CLOX with men and women, but suggest that further work is needed to elucidate the relationships between sex, visuospatial skills, and CLOX performance.

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**J.M. GALUSHA-GLASSCOCK, C. LOBUE, L.H. LACRITZ, L.S. HYNAN & M. CULLUM. Comparison of the Texas Assessment of Processing Speed (TAPS) with Common Neuropsychological Tests among Older Individuals With and Without Cognitive Impairment.**

**Objective:** To determine how a brief (60 sec) newly developed digit-symbol transcription task, the Texas Assessment of Processing Speed (TAPS), correlates with standard measures of global cognition, attention, executive function, verbal fluency, and processing speed.

**Participants and Methods:** 378 community-dwelling subjects with and without cognitive impairment [normal cognition (NC):  $n=177$ ; mild cognitive impairment (MCI):  $n=102$ ; Alzheimer Disease (AD):  $n=99$ ] were administered the TAPS as part of the Texas Alzheimer's Research and Care Consortium protocol. Age ranged from 50 to 93 ( $M=70.06$ ;  $SD=9.60$ ) and mean education was 13.05 years ( $SD=4.58$ ). Pearson correlations were examined between the TAPS and MMSE, Clinical Dementia Rating (CDR) Sum of Boxes, WAIS-3 Digit Span, Trail Making Test, Consortium to Establish a Registry for Alzheimer's Disease (CERAD) list learning, verbal fluency measures (FAS and Animals), and Boston Naming Test. ANOVA was used to compare TAPS scores across diagnostic groups.

**Results:** TAPS scores were significantly related to all standard neuropsychological measures ( $p < .001$ ). Strong correlations were seen with the MMSE ( $r = .70$ ), Trails A ( $r = -.70$ ), Trails B ( $r = -.68$ ), CERAD List Learning ( $r = .68$ ), Animal fluency ( $r = .64$ ), and CDR Sum of Boxes ( $r = -.61$ ). Significant correlations were also seen with the Boston Naming Test ( $r = .56$ ), FAS ( $r = .51$ ), and Digit Span ( $r = .41$ ). TAPS scores significantly differed across diagnostic groups [NC  $M = 31.32$  ( $SD=7.87$ ), MCI  $M = 23.77$  ( $SD=7.44$ ), AD  $M = 16.66$  ( $SD=8.04$ );  $F(2,377) = 115.36$ ,  $p < .0001$ ].

**Conclusions:** The TAPS showed significant correlations with standard neuropsychological tests and was able to discriminate diagnostic groups. Results provides preliminary support for the validity of this new, brief measure of processing speed in the assessment of cognitive function among older individuals with and without cognitive impairment.

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**C.S. GASS & L. GUTIERREZ. Psychological Variables in WAIS-IV (Intelligence Test) Performance.**

**Objective:** The WAIS-IV and MMPI-2 are widely used together in neuropsychological evaluations, yet little is known about their interrelationships. This study explores the potential role of diverse psychopathology characteristics in WAIS-IV performance.

**Participants and Methods:** Referrals for testing ( $N=114$ ) completed the WAIS-IV, MMPI-2, Test Anxiety Profile, and Medical Symptom Validity Test (MSVT) as part of a larger battery. They were screened for suboptimal effort and self-report invalidity on the MMPI-2. Correlational methods and mean comparisons (MANCOVA) were performed.

**Results:** A principal components analysis yielded three MMPI-2 higher-order content scale dimensions: Emotional Internalizing Dysfunction (EID), Emotional Externalizing Dysfunction (EED), and Fright (Fears, Bizarre Mentation, Health Concerns). Controlling for education effects, Fright was significantly correlated with WAIS-IV FSIQ ( $-.298$ ), Verbal Comprehension ( $-.297$ ), and Processing Speed ( $-.257$ ),  $ps < .001$ . Mean WAIS-IV score comparisons between low and high Fright scorers revealed an effect size of about 1.0 on FSIQ, VCI, PRI, and PSI,  $ps < .001$ . The effect was unrelated to a measure of test anxiety. EID and EED scores were independent of WAIS FSIQ and Index scores.

**Conclusions:** Two implications of these findings: First, as a general rule, when examinees are screened for suboptimal effort and self-report exaggeration, psychological symptoms related to depression, anxiety, and acting-out tendencies do not appear to have a significant effect on WAIS-IV performance. Second, psychological symptoms related to fearfulness, bizarre thoughts, and somatic complaints appear to have a mild though statistically significant relationship with level of WAIS-IV performance.

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**B.E. GAVETT, R. ZHAO, S.E. JOHN, D. SIX, C.A. BUSSELL, S. KARAS, J. ROBERTS, J.W. ADAMS & C. YUE. Using Item Response Theory to Evaluate and Improve the Ecological Validity of Neuropsychological Tests: An Example of Phishing Susceptibility.**

**Objective:** Item response theory can estimate latent abilities based on observed responses to test items. We demonstrate how the Neuropsychological Assessment Battery (NAB) Judgment test can be used to estimate the ability level necessary to avoid falling victim to an experimental phishing attempt.

**Participants and Methods:** A sample of 122 cognitively intact participants, including older (n=65) and younger (n=57) adults, was recruited from the local community and university, respectively. Participants were administered the NAB Judgment test and exposed to an experimental phishing attempt while using a computer; the 10 Judgment items were scored on a 3-point scale and the 1 phishing item was coded as binary. Samejima's graded response model was used to estimate a judgment ability z-score for each participant as well as difficulty and threshold parameters for each item.

**Results:** The 11 items fit a unidimensional model well (RMSEA = 0.000). The threshold parameter for the phishing susceptibility item was -3.08, 95% CI [-6.05, -0.12], indicating that those with judgment abilities approximately 3 standard deviations below average have a 50% chance of becoming vulnerable to phishing attempts. However, this estimate is extremely imprecise, which indicates a need for higher-quality items for the estimation of judgment ability. The maximum amount of information provided by NAB Judgment was approximately 2.60, which corresponds to an internal consistency reliability of 0.62.

**Conclusions:** Item response theory can be useful in identifying the necessary ability level needed to complete real-world tasks. However, good test information, which is obtained through quality test items, is needed to accurately estimate item parameters with sufficient precision to be clinically useful. The NAB Judgment test may need to be supplemented with additional items in order to increase its ecological validity for phishing susceptibility. More data are needed to evaluate the NAB Judgment test as a predictor of other real-world health and safety behaviors.

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**D.A. GONZÁLEZ, J.R. SOBLE, J. HIGHSMITH, J. MARCEAUX & K. MCCOY. Auditory and Visual Naming Tests: Psychometric Properties and Performance Patterns among Veterans with and without Cognitive Impairment.**

**Objective:** Confrontation naming involves word-finding in response to visual stimuli and requires a complex integration of perceptual, semantic, lexical, and phonologic abilities that can be affected by myriad neurologic conditions. Some naming tasks use infrequent stimuli heavily influenced by educational/cultural factors and have been criticized as not reflecting day-to-day word-finding. The Columbia Visual and Auditory Naming Tests (VNT & ANT) were created to address these issues. However, the measures' psychometric properties have been evaluated in a single study. The aim of this study was to evaluate their psychometric properties in an outpatient clinical sample.

**Participants and Methods:** This archival sample included neuropsychological data for a mixed clinical sample (53% White, 34% Hispanic, 11% Black; 88% male) of 47 veterans without cognitive impairment (nCI) and 74 with cognitive impairment (CI), with a mean age of 59 (SD = 12) and mean education of 13 (SD = 3). We analyzed scale descriptives, reliability, and convergent and discriminant validity for the VNT/ANT. Other measures included the Boston Naming Test-2, verbal fluency, California Verbal Learning Test-II, Trail Making Test, and Wechsler Adult Intelligence Scale-IV.

**Results:** Results are detailed in tables. Briefly, central tendency and variance were similar to that in the original study. Several items had no variance (i.e., everyone obtained a correct score) such that reliability analysis was limited; the VNT had poor reliability in the nCI sample

(<.60), which impacted validity. Generally, scales demonstrated adequate convergent and discriminant validity. All reliability and validity coefficients were more robust in the CI sample compared to the nCI sample.

**Conclusions:** The VNT and ANT are generally valid and reliable measures, although caution should be exercised when using the VNT in non-impaired samples. Limitations include sample characteristics (e.g., sample size, gender ratio).

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**M.A. GONÇALVES, M.R. SIMÕES & A. CASTRO-CALDAS. WAIS-III's Vocabulary holds as a good measure of pre-morbid functioning after brain injury.**

**Objective:** To explore the Portuguese version of the Wechsler Adult Intelligence Scale 3rd edition (WAIS-III) in a series of patients with brain injury.

**Participants and Methods:** A mixed neurological sample of 81 brain injured patients (23 brain tumor, 30 refractory epilepsy pre/post-surgery, 20 subarachnoid hemorrhage, 4 stroke, and 4 traumatic brain injury) and 81 demographically matched healthy individuals performed the Portuguese WAIS-III (Wechsler, 2008). T-test for independent samples and ROC curves were used for data analyses.

**Results:** The mean scaled scores of Vocabulary (p=.402) and Comprehension (p=.427) were similar between groups. On the remaining 11 subtests, the healthy control group had significantly better scaled scores than the neurological group (p<.05). The neurological and the healthy control groups' percentages of scaled scores above six were respectively 94% and 91% for Vocabulary and 85% and 94% for Comprehension. For the remaining subtests, the percentage of scaled scores above six ranged from 63% to 81% for the neurological group and from 86% to 96% for the control group. ROC curves showed the lowest score for Comprehension (AUC=.527), followed by Vocabulary (AUC=.554). The remaining AUC scores ranged from .610 to .755.

**Conclusions:** The results support a long tradition of using Vocabulary as a measure of pre-morbid intelligence that started with Yates (1956) and is still in use with WAIS-III (Schoenberg et al, 2011). It also reinforces the cross-cultural interest of this measure.

**A. GURNANI, S.E. JOHN, J. SAURMAN, J.W. GRIFFIN, K. GRAJZEL, C.A. BUSSELL & B.E. GAVETT. Measurement Invariance of the Latent Dementia Phenotype in the ADNI Dataset.**

**Objective:** Royall and colleagues identified the latent dementia phenotype,  $\delta$ , which represents the concomitant cognitive and functional changes of dementia. Given that  $\delta$  has been validated cross-sectionally and longitudinally using clinical and neuropathological outcomes in the Alzheimer's Disease Neuroimaging Initiative (ADNI) dataset, it is important to examine whether  $\delta$  measures dementia severity equally across diagnostic groups. This study examines measurement invariance (MI) of  $\delta$  in baseline ADNI data.

**Participants and Methods:** From 1721 participants with baseline ADNI data, overall model fit for  $\delta$  was examined in each clinical diagnostic category: healthy controls (n=521), mild cognitive impairment (MCI; n=864), and Alzheimer's disease (AD; n=336). MI was assessed by examining the fit of a model for  $\delta$  after imposing increasingly rigid structural constraints across the three diagnostic groups.

**Results:**  $\delta$  fit the data well overall (CFI=0.971, RMSEA=0.049) and achieved configural (factor structure) invariance (CFI = 0.957, RMSEA = 0.041). Significant reductions in fit were observed when comparing weak invariance (factor loadings) to configural invariance ( $\chi^2 = 276.98$ ,  $p < .01$ ). However, model fit was not found to be significantly different when strong invariance (factor loadings and intercepts) was compared to weak invariance ( $\chi^2 = 284.98$ ,  $p=.98$ ), and "strong-plus" invariance (factor loadings, intercepts, and means) was compared to strong invariance ( $\chi^2 = 289.17$ ,  $p=.38$ ). The weak invariance model did not

fit the data well (CFI=0.931, RMSEA=0.043), with continued poor fit in the strong and “strong-plus” models (CFI=0.936, RMSEA=0.039).

**Conclusions:** Results indicate that  $\delta$  only possesses configural invariance across the three clinical diagnostic groups. The addition of constraints significantly reduced model fit, suggesting that  $\delta$  may not be measuring the same construct across samples of patients diagnosed as cognitively normal and with MCI and AD in the ADNI dataset.

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**J.A. HOLDNACK, D. TULSKY & A.W. HEINEMANN. Estimating Premorbid Cognitive Functioning Using the NIH Toolbox Oral Reading Test.**

**Objective:** Reading tests have been used to estimate expected cognitive performance due to their relative resistance to the effects of brain injury and cognitive decline and due to their high correlation with intellectual functioning.

**Participants and Methods:** Participants included 855 healthy adults, ages 18-85 from the NIH Toolbox standardization, additionally, 159 individuals with mild to severe TBI, participating in a large multi-center research study, were included in this study. All participants completed the NIH Toolbox Oral Reading Test and fluid subtests.

**Results:** Reading scores correlated from .65 (Vocabulary) to .21 (Pattern Comparison) for age-adjusted scores. Multiple regression analysis was used to develop prediction equations for the Fluid Reasoning index using a combination of reading, education, gender, and ethnicity as predictors. The prediction equation for age-adjusted scores yielded an  $R^2=.21$  and a prediction range of 76.04 to 120.18. Most scores (> 55%) were within + 10 points of the actual Fluid Index score and differences of 14 and 17 points for predicted greater than actual scores occurred in 15% and 10% of the normative sample. In a sample of participants with TBI, 45% had predicted Fluid Index scores 14 or more points higher than the actual Fluid Index scores and 37.7% had scores 17 or more points higher. These results suggest that a third or more individuals with TBI perform below expected levels considering their estimated premorbid ability.

**Conclusions:** The NIH Toolbox Oral Reading test can be used as an estimate of pre-morbid cognitive functioning. The expected rate of predicted versus actual cognitive performance based on the reading test can be used to identify atypical cognitive functioning in individuals after TBI.

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**J.A. HOLDNACK, D. TULSKY, A.W. HEINEMANN, B. BROOKS & G.L. IVERSON. Multivariate Base Rates for Interpretation of NIH Toolbox Cognition Tests and Application to Individual with TBI and Stroke.**

**Objective:** Determine the base rate of low scores on the new NIH Toolbox Cognition battery. Apply the base rates of low scores in healthy adults to differentiate typical from atypical cognitive functioning in TBI and Stroke samples.

**Participants and Methods:** Participants included 855 healthy adults, ages 18-85 from the NIH Toolbox standardization, additionally, 159 individuals with mild to severe TBI, and 174 examinees with Stroke, participating in a large multi-center research study, were included in this study. All participants completed the NIH Toolbox cognition battery verbal and fluid subtests.

**Results:** When the 7 tests were considered simultaneously, 52.4% of the standardization sample had at least one demographically adjusted t-score  $\leq$ 16th percentile and 21.4% had at least one  $\leq$ 5th percentile. For age-adjusted scores, 50.3% of the standardization sample had at least one demographically adjusted t-score  $\leq$ 16th percentile and 21.5% had at least one  $\leq$ 5th percentile. For both fully-adjusted and age-adjusted

scores, three or more scores at or below the 16th percentile was observed in only 8% of the standardization sample. In the TBI sample, 71.7% had at least one t-score at or below the 16th percentile and 24.5% had 3 or more scores at that level. Of the individuals with stroke, 81% had at least one t-score at or below the 16th percentile and 33.9% had 3 or more scores in that range.

**Conclusions:** Low scores on a battery of cognitive tests is common in healthy people and the rate of low scores varies by the cutoff that is used. The base rates of low scores in healthy adults can be applied to clinical samples to identify atypical cognitive functioning as measured by the NIH Toolbox Cognition battery.

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**L.C. HOYMAN, D. PENNINGTON, T. WONG, J. DACK, J. BIELENBERG, E. TOMLINSON, B. LASHER, E. SCHRODEK, S. YOHANNES, J. MCDONALD & S. BATKI. Preliminary Effects of Heavy Drinking and Age on Cognitive Functioning in Veterans with Posttraumatic Stress Disorder.**

**Objective:** Heavy alcohol use and age are known to have a synergistic impact on cognitive functioning beyond normal aging effects. We sought to examine age and heavy drinking effects on cognitive functioning in 52 veterans with PTSD entering a RCT of topiramate treatment.

**Participants and Methods:** Veterans completed measures of cognitive reserve, processing speed, mental flexibility, working memory, cognitive inhibition, verbal fluency, auditory-verbal learning and recall, decision-making, risk-taking, and choice inhibition. Average standard drinks per week (DPW) were calculated during the 90 days prior to cognitive testing. A four-step hierarchical regression model (HRM) was conducted for each cognitive domain. The following independent variables were entered at each step: 1) cognitive reserve; 2) DPW; 3) age; and 4) an interaction term of age-by-DPW. Cognitive reserve was trimmed from the HRMs when it was not significantly associated with cognition.

**Results:** The HRMs containing the age-by-DPW interaction term significant predicted performance on working memory [ $F(4,44) = 5.53, p<.01, R^2=.27$ ], auditory-verbal learning and recall [ $F(4,46) = 3.93, p<.01, R^2=.19$ ;  $F(4,46) = 2.96, p<.04, R^2=.12$ , respectively], and tended to predict choice impulsivity [ $F(4,41) = 2.28, p=.08, R^2=.10$ ]. Whereas, only step 2 of the HRM containing DPW significantly predicted verbal fluency [ $F(2,48) = 4.04, p<.02, R^2=.11$ ]. Multiple correlations were observed between cognitive reserve, age, DPW, and the various cognitive domains.

**Conclusions:** Evidence suggests age and heavy alcohol use has a negative synergistic impact on working memory, auditory verbal learning and recall, and choice impulsivity. These domains may be potential targets in developing cognitive training paradigms for aging veterans with PTSD entering alcohol treatment. Clinicians are encouraged to consider a standard assessment of cognitive functioning in treatment planning and delivery for heavy drinking veterans with PTSD.

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**K.M. WISNEWSKI, D. LIU, K. GIFFORD, M. GODFREY, L. LOGAN, L. SAMUELS, M. WIGGINS, D.J. LIBON & A.L. JEFFERSON. Psychometric Properties of a Visual Learning and Memory Test: The Biber Figure Learning Test.**

**Objective:** The Biber-Glosser Figure Learning Test (BFLT) is a non-verbal supraspan learning test analogous to a verbal serial list-learning test such as the California Verbal Learning Test (CVLT-II). This study assesses the psychometric properties of the BFLT and provides normative data for older adults.

**Participants and Methods:** Participants included cognitively normal older adults ( $n=166, 72\pm 7, 40\%$  female) from the Vanderbilt Memory and Aging Project who completed a comprehensive neuropsychological

protocol. A principal component analysis (PCA) with varimax rotation was completed to evaluate the BFLT structure. Partial correlations (adjusting for global cognition) between BFLT and other cognitive tests assessed convergent and discriminant validity. Bivariate correlations related BFLT to demographic factors. Normative data was presented as mean and standard deviation for key BFLT indices.

**Results:** PCA revealed a 3-component structure (recall, recognition, interference), accounting for 82% of the total variance. BFLT was negatively correlated with age ( $r>0.16$ ,  $p<0.001$ ) and reading-ability ( $r>0.18$ ,  $p<0.001$ ). Sex, education, and mood were not correlated with BFLT (all  $p$ -values  $>0.03$ ). BFLT was moderately correlated with CVLT Immediate Free Recall ( $r=0.40$ ,  $p<0.001$ ), Delayed Free Recall ( $r=0.38$ ,  $p<0.001$ ), and Recognition Discrimination ( $r=0.24$ ,  $p=0.002$ ) and visuospatial tasks ( $r>0.23$ ,  $p<0.002$ ). BFLT was modestly correlated with measures of executive function ( $r>0.21$ ,  $p<0.006$ ), language ( $r>0.22$ ,  $p<0.001$ ), and processing speed ( $r>0.29$ ,  $p<0.001$ ). Demographically-adjusted normative data was calculated for BFLT measures.

**Conclusions:** The current study suggests strong psychometric properties of the BFLT. Demographically adjusted normative data for older adults will enhance the clinical utility of this visual serial list learning test for the assessment of MCI and dementia. Greater research is needed to understand the biological relations and predictive ability of the BFLT.

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**S.M. JURICK, M. SANDERSON-CIMINO, L.D. CROCKER, C. JOHNSON, L. TRENOVA, A. KELLER, A. RAUCH & A.J. JAK. Examination of cut scores on the validity subscale of the Neurobehavioral Symptom Inventory in Iraq and Afghanistan Veterans with a history of mild to moderate traumatic brain injury.**

**Objective:** The Neurobehavioral Symptom Inventory (NSI) is a self-report measure of post-concussive symptoms widely used in Veterans with a history of mild to moderate traumatic brain injury (TBI). To identify symptom over-reporting on the NSI, Vanderploeg et al. (2014) developed the Validity-10 (V-10), an embedded measure of ten unlikely/low-frequency items. Lange et al. (2015) replicated this study in military service members with a history of mild TBI, and found varying optimal cut scores of the V-10, distinct from the cutoff recommended by Vanderploeg et al. The goal of the present study was to determine the most optimal cut score to alert clinicians to possible symptom over-reporting in Veterans with a history of mild to moderate TBI using the Minnesota Multiphasic Personality Inventory Second Edition Restructured Form (MMPI-2-RF) as a criterion measure.

**Participants and Methods:** We examined three V-10 cutoff scores in 34 Iraq/Afghanistan Veterans with a history of mild to moderate TBI who underwent a comprehensive clinical neuropsychological exam including the NSI and MMPI-2-RF.

**Results:** Using the cut scores of the F-r (Infrequent Responses), Fp-r (Infrequent Psychopathology Responses), Fs (Infrequent Somatic Responses), FBS-r (Symptom Validity), and RBS (Response Bias Scale) validity indices in the MMPI-2-RF manual, 38% of Veterans scored in the invalid range. The V-10 cutoff score of 19 had the best balance of sensitivity (85%) and specificity (38%) for a screening measure of possible symptom over-reporting. The positive predictive value was 46% and the negative predictive value was 80%.

**Conclusions:** Results indicate that 19 may be the best cutoff score for Veterans with a history of mild to moderate TBI to alert clinicians to the possibility of over-reporting post-concussive symptoms. Further assessment is warranted after a positive screen to confirm the exaggeration of neurobehavioral symptoms as this has implications for the validity of both symptom and neuropsychological measures in terms of treatment planning.

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**C.J. KREISEL, P.Z. STARK, M.J. WRIGHT & D.J. HARDY. Individual Differences in Performance on the Tower of Hanoi and NASA Task Load Index.**

**Objective:** The NASA Task Load Index (NASA-TLX) has recently been proposed as a useful assessment in neuropsychology. The present study examines the relationship between number of moves on the Tower of Hanoi (TOH) and the six subscales (Mental Demand, Physical Demand, Temporal Demand, Effort, Frustration, and Performance) of the NASA-TLX.

**Participants and Methods:** One hundred ninety-five students completed the NASA-TLX after completing each of three counter-balanced TOH conditions (3-disk, 4-disk, and 5-disk). The six NASA-TLX subscales are on a 0-100 scale.

**Results:** In all three TOH conditions, greater number of moves was positively correlated with five subscales of workload (to a lesser degree in Physical Demand), and negatively correlated with self-perceived Performance.

**Conclusions:** In general, these findings show that the NASA-TLX is sensitive to individual differences in perceived cognitive status during test performance; the greater number of moves it took to complete the TOH, the more mentally demanding, temporally demanding, greater effort, greater frustration, and worse performance one perceived. However, the finding of greater physical demand with more TOH moves, although significantly smaller relative to the other subscales, is somewhat perplexing. The NASA-TLX has primarily been used in human factors psychology, and the results of this study suggest that the usage of the NASA-TLX in neuropsychology could be useful in acquiring additional information on the cognitive status of the patient.

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**A. KRIVENKO, M.A. TEAFORD, H. HOUSTON, S.E. TOLFO & A.M. POREH. Decomposition of the Trail Making Test in a Clinical Population of Dementia.**

**Objective:** The present study describes the use of computer assisted software to decompose the Trail Making Test.

**Participants and Methods:** The study, utilizing a large clinical sample of patients suspected of dementia ( $n=105$ ), confirms previous studies with the general population indicating that particular sections require more time to complete and are more prone to errors.

**Results:** It was confirmed that patients with mild dementia would do worse towards the end of the test, patients with moderate dementia would begin and end the test well, and patients with severe dementia would begin poorly on the test. It was also confirmed that many patients, immediately after the occurrence of an error, start employing compensatory strategies which improves their performance on subsequent sections.

**Conclusions:** The present study suggests that the adaptation of computer assisted testing to clinical practice is an important evolutionary step as it provides clinicians with higher resolution for traditional measures and discerns the multiple cognitive operations within them, allowing for the identification of nonspecific error variance that impacts test performance.

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**D. LEITNER, M. LIBBEN, L. OHLHAUSER, J. UPSHAW & H. MILLER. Assessing the Efficacy of a Cognitive Model on Concurrent Functional Outcome in Acute Stroke Patients.**

**Objective:** Few studies have examined the relationship between cognition and function in stroke inpatients utilizing comprehensive methods. This study aimed to compare the efficacy of two models (cognitive and medical) predicting concurrent functional status across multiple domains in the early stages of stroke recovery.

**Participants and Methods:** Seventy-five acute stroke patients were administered a comprehensive neuropsychological assessment. Functional domains were assessed using the Mayo-Portland Adaptability Inventory - 4 (MPAI-4). Hierarchical linear regression was used to compare a medical model comprised of neuroimaging results, co-morbid factors, and demographic information with a neuropsychological model comprised of composite scores derived from neuropsychological tests of executive function, memory, visuospatial-construction skills, and language. Results were examined for the sample as a whole and after segregating the sample by stroke location based on the Oxfordshire Community Stroke Project (OCSP) Classification System.

**Results:** The neuropsychological model was a significant predictor, above and beyond the medical model, of MPAI-4 Ability, Participation, and Total scores. The degree of association varied across functional domains, and was moderated by stroke location based on the OCSP. In the medical model, anterior region lesions resulted in greater maladjustment following stroke.

**Conclusions:** Neuropsychological assessment contributes independently to the determination of functional status above and beyond medical and demographic variants of stroke patients in the early stages of recovery. There appears to be an intricate relationship between cognitive and functional domains which is moderated by stroke location. In addition, patients with anterior region strokes may benefit from a formulated intervention as part of their treatment plan due to greater difficulty with adjusting to the stroke.

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#### H. LUU, D. WHITESIDE, R. HEILBRONNER, L. RICE & N. PLISKIN. MMPI-2-RF Validity Scales in Electrical Injury, Mild Traumatic Brain Injury, and Depression.

**Objective:** Several studies have looked at performance on MMPI-2 validity scales (Silva et al., 2013) in electrical injury (EI) patients. Few studies have explored these measures with EI participants using the MMPI-2-RF. This study sought to examine similarities and differences in symptom validity performance in EI participants referred for comprehensive neuropsychological assessment compared to mild traumatic brain injury (MTBI) and depressed patients with no known neurological disorders.

**Participants and Methods:** Participants included EI (N=41; mean age=41.8, SD=9.5), MTBI (N=33; mean age=44.8, SD=12.1), and depressed (N=23; mean age=35.2, SD=11.6) patients. MANOVA was used to evaluate group differences on MMPI-RF validity scales. Invalid protocols, as defined by the MMPI-RF manual, were excluded.

**Results:** MANOVA results indicated a statistically significant difference in validity scores based on clinical diagnosis,  $F(16,194) = 2.17, p < 0.05$ . Specifically, diagnosis was significantly related to VRIN-r, TRIN-r, F-r, Fp-r, FBS-r, and K-r. Post-hoc analysis indicated that the depressed group was significantly higher than MTBI on VRIN-r, TRIN-r, and Fp-r, but was significantly lower on the FBS-r. The EI group was higher than the MTBI group on F-r but otherwise these groups were not statistically different on the validity scales. Finally, the MTBI group scored significantly higher than the other groups on K-r.

**Conclusions:** These results are generally consistent with past research indicating similar performance pattern seen in MTBI and EI groups on the MMPI-2, providing evidence that these groups have similar response sets to the MMPI-2-RF. Increased reporting of cognitive and somatic symptoms in EI patients may be a result of different and wider symptom complaints than those experienced by depressed patients.

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#### M. MALLECK, C. CONSIDINE, S. FREUND & C. ABEARE. The Brief Estimate of Seconds Test (BEST): A Pilot Study Examining Initial Psychometrics and Norms for a New Chronometric Clinical Test.

**Objective:** Distortions in timing and time perception are found in multiple neuropsychiatric populations (e.g., Parkinson's, Huntington's, ADHD, TBI, schizophrenia). Dopaminergic and acetylcholinergic action within frontotemporal-striatal and cerebellar circuits are associated with time-perception processes via attentional-monitoring, memory, and decision/motor control. While theoretically driven research is available, no widely used, easily administered, and normed chronometric clinical test currently exists.

**Participants and Methods:** Thirty-five college students (women=30) were administered a novel time-estimation test in conjunction with a post-concussive symptom questionnaire and a mood questionnaire. The novel measure requires retrospective and prospective estimates/production of two time targets (23 & 53 seconds).

**Results:** Internal reliability within subtests was adequate for all but one subtest ( $\alpha$ 's = 0.66 to 0.79). Test-retest reliability was moderate-to-high ( $r$ 's = 0.66, 0.74, 0.74, 0.80,  $p$ 's < 0.01;  $r = 0.40, p < 0.05$ ). Correlations between short and long time estimates were strongly correlated for two subtests ( $r$ 's = 0.85, 0.88,  $p$ 's < 0.01), though not correlated for the most integrative subtest, which requires participants to reproduce a time interval. Prospective verbal and production estimates were inversely related, demonstrating consistent pacing error across different subtests. Age correlated moderately with two subtests ( $r$ 's = 0.37, -0.43,  $p < 0.05$ ). No correlations were found for gender, education, or handedness. BEST subtests did not correlate with post-concussive or clinical mood sub-scales.

**Conclusions:** The BEST demonstrated acceptable psychometrics in a pilot study. Chronometric performance appeared resistant to sub-clinical cognitive, affective, and behavioral symptoms. Additional normative/psychometric data and clinical comparison group data are being collected to increase utility (measure and pilot norms available for public use).

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#### C.R. PENNINGTON, K.K. MARSHALL, C.N. BRYSON, K.E. MCCALLUM, B.E. RIDGE, R.T. CHEIFFETZ, P. STANFORD-GALLOWAY & A. SCHMIDT. The Role of Executive Functions in Externally-Valid Decision-Making Processes.

**Objective:** The current study examined the contribution of executive functions (EF) in Need for Cognition (NFC) and Need for Affect (NFA). NFC and NFA are externally-valid measures of decision-making processes often employed in forensic research. Individuals high in NFC use an information-focused approach to decision-making. Individuals high in NFA use an emotion-focused approach to decision-making. Clarifying the cognitive underpinnings of these constructs has relevance for understanding naturalistic decision-making processes. We hypothesized that NFC would be positively correlated and NFA would be negatively correlated with EF.

**Participants and Methods:** Participants included 124 ethnically diverse undergraduate students (27 males 97 females, mean age = 20 years). All participants completed measures of NFC and NFA and three tests from the Delis-Kaplan Executive Functioning System (Trail Making, Verbal Fluency, and Color-Word Interference) as part of a larger neuropsychological battery.

**Results:** Results of bivariate correlations suggest NFC ( $\alpha = .29, p = .001$ ) is positively correlated with Verbal Fluency and NFA ( $\alpha = -.28, p = .001; \alpha = -.25, p = .005; \alpha = -.20, p = .024; \alpha = -.20, p = .026$ ) to be negatively correlated with Color-Word Interference. There were no significant relationships with Trail Making performance.

**Conclusions:** Findings suggest individuals high in NFA exhibit more impulsive tendencies on EF measures suggesting an emotion-based decision-making approach may be related to problems with cognitive

inhibition. Individuals high in NFC exhibit better expressive language and verbal organizational skills. Potential implications of these findings to other studies of naturalistic decision-making are discussed.

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**T.L. MCAULEY, E. KEATLEY, H.V. ECHLIN, B. ZUCCATO, M. MALLECK & C. ABEARE. Quantifying the Qualitative Aspects of Affective Word Production on the Emotion Word Fluency Test in Somatic Anxiety.**

**Objective:** Verbal fluency tasks have largely focused on acquiring quantitative (i.e., raw number of words) and qualitative (i.e., strategic retrieval of words) data to characterize individuals. Standard scoring procedures neglect the characteristics of words produced. Utilizing an affective category of semantic fluency, qualitative aspects of words can be examined by using existing lexical norms. The present study will examine the usefulness of this technique in relation to somatic anxiety.

**Participants and Methods:** A sample of undergraduate students ( $N=74$ ,  $M$  age=20.55, 54 females) was recruited. Cognitive and somatic anxiety were measured using the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008) and affective verbal fluency was assessed using the Emotion Word Fluency Test (EWFT; Abeare et al., 2009). Arousal and Age of Acquisition (AoA) norms were used to assess characteristics of responses.

**Results:** Results demonstrated negative associations between trait and state somatic anxiety and modal arousal  $r$ 's(23)=-.427, -.424  $p=.037$ , .039, respectively, state somatic anxiety and arousal  $\ln r$ (73)=-.281  $p=.015$ , and trait somatic anxiety and AoA mean  $r$ (73)=-.245  $p=.036$ . A single negative association was also found between state cognitive anxiety and modal AoA  $r$ (14)=-.620,  $p=.014$ .

**Conclusions:** Quantifiable values attributed to the qualitative aspects of words reflected biases in affective semantic retrieval, despite no differences in the raw number of emotion words produced. Individuals with high somatic anxiety retrieved less arousing words and had a less sophisticated emotion vocabulary. Future research should utilize this type of methodology in a clinical sample, as it highlights a novel way to obtain valuable data from the EWFT.

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**D. MCCABE & B. MERKER. Centralized, Collective, Neuropsychological Databases: Perceived Value and Feasibility.**

**Objective:** Large-scale, centralized, collective, databases (CCDs)—e.g., collaboratively developed repositories of normative and clinical/research data—could substantially advance the field of neuropsychology (e.g., Jagaroo, 2009; Bilder, 2011). Practice organizations (e.g., the AACN Test Development Group; Nelson, 2014), commercial enterprises (e.g., The Meyers Neuropsychology System; <http://meyersneuropsychological.com/>), and research groups (e.g., The International Neuropsychological Normative Database Initiative; <http://inndi.org/>) have already developed neuropsychological resources and initiatives involving large-scale databases. The future manifestation of CCDs however, is unclear, as is the level of interest within the neuropsychological community to participate in such endeavors. The goal of this survey was to gauge interest and perceived feasibility, regarding the use and development of CCDs.

**Participants and Methods:** An invitation to complete a web-based survey (primarily multiple-choice) was distributed to the NPSCYH and Community-AACN email lists. Participants ( $N=105$ ) expressed their views concerning 1) desirability and feasibility of broadly accessible CCDs, and 2) features that should (and should not) be incorporated in CCDs.

**Results:** Over 90% of respondents indicated they would “probably” or “definitely” be interested in using a scoring CCD and 86.54% would “probably” or “definitely” be interested in participating in a research

CCD. Most respondents believed that scoring (85.58%) and research CCDs (89.22%) are feasible, despite concerns (e.g., potential copyright/publishing issues). Features such as restricted/regulated access were widely favored (over 90%) whereas respondents were divided on other features (e.g., requiring minimum testing datasets).

**Conclusions:** Overall, participants were optimistic about the feasibility of CCDs, eager to take advantage of these resources, but wary of the obstacles inherent to their development.

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**J.J. MIETCHEN & S.D. GALE. Factor Structure and Predictive Model of the Rey Auditory Verbal Learning Test.**

**Objective:** Investigate the factor structure of the Rey Auditory Verbal Learning Test (RAVLT) in a sample of healthy young adults. Specifically, determine whether Trial 1 is, indeed, a measure of working memory/attention, and whether this predicts overall performance on the RAVLT.

**Participants and Methods:** Participants were 66 college age adults (age=20.9±2.2 years; 56% female). The RAVLT was administered to the participants following administration protocol. Confirmatory factor analysis (CFA) was conducted to determine the factor structure of the RAVLT. Structural equation modeling (SEM) methods were used to determine the predictive value of Trial 1 on other measures of the RAVLT (e.g., learning, delayed recall).

**Results:** CFA revealed a three factor model in which Trial 1 represented a single factor (working memory/attention), total score for Trials 1-5 represented a single factor (learning), and short-delay, long-delay, recognition hits, and recognition false positives together represented a third factor (long-term memory;  $\beta\sim 0.36 - \beta\sim 0.95$ ,  $p<0.01$ ). This model demonstrated good model fit ( $\chi^2=0.46$ , RMSEA<0.001, CFI=1.0, SRMR=0.06). SEM analyses revealed that Trial 1 had a direct effect on learning ( $\beta=0.67$ ,  $p<0.001$ ), and long-term memory ( $\beta=0.31$ ,  $p<0.05$ ). However, the direct effect of working memory/attention on long-term memory is partially mediated by learning, and the direct effect between working memory and long term memory was no longer significant ( $\beta=-0.27$ ,  $p>0.05$ ).

**Conclusions:** The RAVLT appears to measure similar, but distinct facets of memory, including working memory/attention, learning, and long-term memory. Working memory seems to be an important component that contributes to learning and long-term memory performance. Understanding the factor structure of the RAVLT and appreciating the importance of working memory/attention in memory processes may have important implications for clinical interpretation of the RAVLT.

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**J. DURANT, J. BERG, S.J. BANKS & J.B. MILLER. Comparing the Test of Premorbid Functioning with the Wide Range Achievement Test, 4th Ed. Reading Subtest as Estimates of Premorbid Ability.**

**Objective:** Estimating premorbid intelligence is a common component of clinical evaluations that often relies on reading ability. Two frequently used measures include the reading subtest of the Wide Range Achievement Test, 4th Ed. (WRAT-4), which converts a raw score to an age corrected scaled score, and the Test of Premorbid Functioning (TOPF), which predicts a full scale intelligence quotient (FSIQ) based on demographic factors and raw reading score. The aim of the present study was to compare the predictive ability of each of these measures in a memory disordered sample.

**Participants and Methods:** Records from 58 consecutive referrals (Age:  $M=72.0$ ,  $SD=9.1$ ; Education:  $M=15.4$ ,  $SD=2.8$ ; 60% male) seen for neuropsychological evaluation as part of routine care in an outpatient neurodegenerative disorders clinic were reviewed. Measures of interest included the TOPF, the WRAT-4, and Montreal Cognitive Assessment.

Discrepancy scores were calculated between estimates and this was correlated with demographic factors and cognitive screening measures. Pairwise correlations were calculated between raw scores and predicted intelligence estimates.

**Results:** Discrepancies between predicted IQ estimates ranged from -22 to 24 ( $M=1.4$ ,  $SD=7.0$ ) and estimates were significantly correlated ( $r=.73$ ,  $p<.001$ ). The difference between WRAT-4 estimated IQ and TOPF predicted VIQ ranged from -21 to 23 ( $M=1.1$ ,  $SD=6.8$ ); these estimates were also significantly correlated ( $r=.75$ ,  $p<.001$ ). Correlations between the difference values, education, and cognitive screening were non-significant.

**Conclusions:** The TOPF and WRAT-4 generate highly comparable predicted intelligence values in a memory disordered sample. Given the simplicity of the WRAT-4 over the TOPF, it calls the added utility of the additional demographic information used in the TOPF algorithm into question.

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**K.N. MORGAN, B. SCOTT, M. SHEAN, G. ALVAREZ, K. SHADA & J. CONLEY. Can Luminosity Assessment Tools Provide An Accurate Snapshot of Executive Functioning? An Independent Investigation of Test-Retest Reliability and Convergent Validity.**

**Objective:** Neuropsychologists have long recognized the multifactorial nature of executive functioning (EF), with many executive measures only weakly correlated with one another. The current pilot study investigated the relationship between Trail Making Test B (TMTB), the Stroop Color Word Test (SCWT), and their relationship to EF measures in a computerized cognitive battery. Reliability of the EF subtests was also examined to further inform validity characteristics.

**Participants and Methods:** Thirty neurologically healthy participants between 18 and 35 were recruited from a private college in the Pacific Northwest. They completed the computerized battery on two occasions, with one to three weeks between sessions. Of this sample, 14 participants completed traditional TMTB and SCWT measures during the pre-test session. Spearman's rank order correlations were used to determine test-retest reliability of computerized measures, as well as the relationship between traditional and computerized measures.

**Results:** Regarding reliability, five out of ten of the computerized measures demonstrated moderate to high correlations ( $p < 0.01$ ), while two of the ten reflected moderate relationships ( $p < 0.05$ ). The traditional TMTB was moderately correlated with one parallel and one non-parallel computerized EF measure ( $p < 0.05$ ). A stronger relationship existed between conventional and computerized TMTB raw times ( $r = .685$ ,  $p < 0.01$ ). The SCWT was not significantly related to computerized EF tasks or TMTB task.

**Conclusions:** Results are consistent with previous studies of EF. Although tasks may evaluate similar factors within the EF construct, the measures are often weakly correlated. Of concern, however, is the lack of strong relationships between parallel conventional and computerized tests in this study, despite a trend toward moderate to strong reliability. A larger sample is needed to better predict the reliability and convergent validity of this battery, and ecological validity should also be explored. Correspondence: *Kelly N. Morgan, MS, Psychology, Pacific University, School of Professional Psychology, 5518 N. Haight Ave., Portland, OR 97217. E-mail: morg5891@pacificu.edu*

**C. MULLEN & A.Y. STRINGER. Problem Solving in Space: Factors Accounting for Short Category Test Performance.**

**Objective:** To better characterize patient performance, we developed Short Category Test (SCT) perceptual, mental flexibility, and reasoning indices to supplement the standard total error score.

**Participants and Methods:** Archived records yielded data on a mixed neurological sample (11 dementia, 8 epilepsy, 8 stroke, 2 encephalopathy, 5 brain injury, 4 tumor, and 3 other/mixed etiologies; mean

of 81 months since onset). A sample majority was female ( $n=25$ ) and right-handed ( $n=37$ ), with mean age 47. The proposed SCT indices were calculated, and Pearson correlations were computed with hypothetically related neuropsychological tests, followed by multiple regression analyses when several tests correlated with a single index.

**Results:** Overall SCT errors correlated negatively with design fluency accuracy ( $r=-.43$ ,  $p=.02$ ), while perseverative errors correlated negatively with verbal fluency accuracy ( $r=-.50$ ,  $p=.13$ ), confirming a relationship between the SCT and mental fluency/flexibility. SCT categorical reasoning correlated with both phonemic fluency ( $r=.432$ ,  $p=.02$ ) and verbal fluency set loss errors ( $r=.42$ ,  $p=.02$ ), with hierarchical regression confirming both variables independently accounted for significant variance in the reasoning index [ $t(29)=2.348$ ,  $p=.03$ ;  $t(29)=2.272$ ,  $p=.03$ , respectively]. While judgment of line orientation ( $r=.38$ ,  $p=.02$ ), design fluency accuracy ( $r=.414$ ,  $p=.03$ ), and Wisconsin Card Sorting Test sorts ( $r=-.32$ ,  $p=.05$ ) correlated with the ability to judge spatial orientation on the SCT, only the first two of these variables trended towards significance in subsequent regression analyses.

**Conclusions:** As predicted, SCT performance is dependent on a combination of perceptual, mental flexibility, and reasoning abilities which are not adequately captured by simply tallying overall errors. The SCT indices allow for a fine-grained analysis of results, allowing more precise characterization of patient performance.

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**C. BROADBENT, M.R. TWOMEY, L. OHLHAUSER, D. LEITNER, J. UPSHAW, A.F. PARKER, A.M. SCHUSTER, M. LIBBEN, H. MILLER & C. GODBOUT. Convergent Validity of the Functional Independence Measure and Common Neuropsychological Tests in a Stroke Population.**

**Objective:** The Functional Independence Measure (FIM) is a widely used clinical tool to assess motor and cognitive functional abilities. However, it is unclear how well the cognitive subscale of the FIM (FIMc) assesses various domains of cognition. This study aimed to assess the convergent validity of the FIMc and FIM motor subscale (FIMm) with commonly used neuropsychological (NP) tests.

**Participants and Methods:** Participants ( $N=51$ ) were inpatients admitted to a rehabilitation unit following stroke. Functional abilities were assessed with the FIM, and cognition was assessed with a battery of NP tests. Convergent validity between the FIM subscales and NP tests was assessed using Pearson  $r$  correlations.

**Results:** The FIMm significantly correlated with the Color Trails Test (CTT) 1&2, Rey-Osterrieth Complex Figure Test (RCFT) Copy, Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV) Block Design (BD), Controlled Word Association Test (COWAT) Animals, and the Grooved Peg Board (Pearson  $r$  ranged from .28 to .41,  $p<.05$ ). The FIMc significantly correlated with CTT1&2, RCFT (Copy, 3' delay, and 30' delay), BD, COWAT-Animals, and GPB (Pearson  $r$  ranged from .31 to .56,  $p<.05$ ). These tests correlated with at least 1, but up to all 5 of the FIMc items. The Consonant Trigrams, Selective Reminding Test, WAIS-IV Coding, Wisconsin Card Sorting Test, and COWAT-FAS did not significantly correlate with the FIMc items or total score.

**Conclusions:** The FIMm was correlated with most NP tests involving motor abilities. Correlations between the FIMc and NP tests were mixed. Notably, the FIMc and its items were not correlated with NP tests of memory, executive function, or verbal fluency. Results suggest that performance on NP tests measuring memory, executive function, and verbal fluency do not affect stroke patients at a functional level, or the FIMc inadequately assesses cognition and may overestimates abilities. More research is needed to determine how performance on NP tests relates to real-world functional abilities.



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**J. BARRY, J. LITTLE, C. BROADBENT, L. OHLHAUSER, J. UPSHAW, D. LEITNER & H. MILLER. Glycemic Control and Neuropsychological Test Performance in Adults With Type II Diabetes.**

**Objective:** Type II diabetes (T2D) is known to be associated with impairments in cognitive functioning, especially in the areas of memory and executive functioning. Although the mechanisms that drive this decline in cognitive functioning are multifactorial, poor glycemic control resulting in chronic hyperglycemia has been implicated as a strong contributing factor. The aim of this study was to determine a) whether the T2D patients in our sample exhibited poorer neuropsychological test performance as compared to available norms, and b) whether glycemic control variables correlated significantly with neuropsychological test performance.

**Participants and Methods:** Adults with T2D (N=43) were recruited from the community. Participants completed a neuropsychological test battery and biological tests were conducted. Data from 72-hr continuous subcutaneous glucose monitoring (CSGM) were collected, including average glucose levels, fasting glucose levels, amplitude of glycemic fluctuations, and sustained chronic hyperglycemia. Composite scores for neuropsychological testing were calculated by averaging test scores along the domains of executive function, memory, and visuospatial abilities.

**Results:** No correlations existed between glycemic control variables and neuropsychological test performance or composite scores. However, impairments in cognitive functioning were present in the domains of memory (Rey-Osterrieth Complex Figure Test, Buschke Selective Reminding Test List Total, CLTR, LDFR scores) and executive functioning (Colour Trails Test).

**Conclusions:** Our sample of adults with T2D had significant cognitive impairments in memory and executive function. No relationship between poor glycemic control and neuropsychological test performance was found. Results support previous findings of cognitive deficits in T2D, but contradictory of the link between poor glycemic control and neuropsychological test performance. Future research is needed to identify biological factors related to lowered cognition in adults with T2D. Correspondence: *Damian Leitner, BSc. (Hons) Psychology, Kelowna General Hospital, 2268 Pandosy Street, Kelowna, BC V1Y 1T2, Canada. E-mail: Canadian\_02@hotmail.com*

**E. PAOLILLO, M.M. ELBULOK-CHARCAPE, W. BARR & L. RABIN. Utilization of Instruments with Alternate/Parallel Test Forms among Clinical Neuropsychologists in the U.S. and Canada.**

**Objective:** Tracking neuropsychological change over time can pose a challenge due to practice effects that occur when the same instrument is used more than once with a given patient. Failure to account for practice effects can lead to erroneous conclusions. One approach to handling practice effects is the development of alternate/parallel test forms. As part of a larger study on test usage practices among neuropsychologists, the current study analyzed data related to neuropsychologists' reported utilization of instruments with alternate/parallel forms.

**Participants and Methods:** Respondents were 512 doctorate-level psychologists from the U.S. and Canada affiliated with the National Academy of Neuropsychology and/or the International Neuropsychological Society (25% usable response rate). Participants were asked to report the frequency with which they use tests with alternate/parallel forms and list up to four of these tests that they frequently administer.

**Results:** The overwhelming majority of respondents (95%) reported use of tests with alternate/parallel forms, however only 23% of these respondents reported frequent use of such measures. Respondents younger than 50 years as well as those who spend professional time with older adults reported using tests with alternate/parallel forms more frequently than

other respondents. The California Verbal Learning Test, Repeatable Battery for the Assessment of Neuropsychological Status, Brief Visuospatial Memory Test, Hopkins Verbal Learning Test, and Wide Range Achievement Test, were the most frequently used tests with alternate/parallel forms.

**Conclusions:** Findings are discussed in relation to the challenges associated with developing alternate test forms that effectively attenuate practice effects and produce reliable results.

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**C. PARANAWITHANA, P. DE ZOYSA, S. KATHRIARACHCHI, J. MENDIS & A. FERNANDO. Neurocognitive Impairment in First Episode Bipolar Disorder and Schizophrenia.**

**Objective:** The study aimed at utilizing the Sri Lankan validated Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) test battery in identifying the relative magnitude of cognitive deficits in first-episode schizophrenia and bipolar disorder and identify the specific cognitive domains that are mostly deficit.

**Participants and Methods:** A total of 130 individuals were evaluated. Neurocognitive functioning of age, gender education matched people with bipolar disorder (n = 41), schizophrenia (n = 51) and healthy controls (n = 51) without any history of psychiatric disorder, was compared using analysis of covariance. All participants were administered the RBANS. The RBANS is a brief, standardised, cognitive screening instrument which assesses multiple cognitive domains. Data collection took place at Colombo South Teaching Hospital and National Institute of Mental Health.

**Results:** A comparison of the three groups showed significant differences on the RBANS total score and all of the measured domains. In all of the comparisons, the schizophrenia group obtained the lowest scores, followed by the bipolar disorder group, and then the normal controls without psychiatric disorder. In the analysis of covariance of RBANS total scores with the patient samples, the difference between schizophrenia and bipolar disorder remained significant after controlling for a range of demographic and clinical variables. The bipolar disorder and schizophrenia groups were most impaired on tests of memory, attention and language. The bipolar group performed significantly better on tests of coding (speed of processing), verbal fluency and visuospatial/constructional ability.

**Conclusions:** Overall, this study demonstrates that both first-episode schizophrenia and bipolar disorder are associated with significant cognitive impairments, but those in schizophrenia are more severe.

**A.F. PARKER, A.M. SCHUSTER, L. OHLHAUSER, D. LEITNER, J. UPSHAW, M. LIBBEN & H. MILLER. Lesion Localization and Performance on the California Verbal Learning Test-II Following Stroke.**

**Objective:** Previous research has found that stroke patients with unilateral right hemisphere damage (RHD) score significantly below the normative mean on the California Verbal Learning Test (CVLT). This study aimed to (1) replicate the previous findings using the second edition of the test, the CVLT-II, and (2) determine if performance on the CVLT-II differs by stroke location.

**Participants and Methods:** Thirty-seven hospital inpatients (mean age=66.2, SD=12.1) completed the CVLT-II during a neuropsychological evaluation during stroke rehabilitation. Independent samples t-tests were used to determine if significant differences on CVLT-II performance were based on stroke location: right vs. left hemisphere stroke (RHD vs. LHD) and anterior vs. posterior stroke (AL vs. PL).

**Results:** All stroke patients exhibited deficits on the total recall portion of the CVLT-II. Those with LHD or PL performed more than 1SD below the mean (M = 50, SD = 10), while those with RHD or AL performed within 1SD below the mean. No significant differences were found for CVLT-II performance between RHD (M=44.96, SD=14.19) and LHD

( $M=39.55$ ,  $SD=14.41$ ), or between AL ( $M=44.27$ ,  $SD=14.24$ ) and PL ( $M=38.80$ ,  $SD=13.19$ ).

**Conclusions:** Previous findings of RHD stroke patients performing close to 2SD below the mean on the CVLT were not found here. This may be due to the relatively updated normative database of the CVLT-II. Results suggest that the CVLT-II is not able to differentiate stroke location based on test performance. Future research should be directed towards determining if other commonly used verbal learning tests are sensitive enough to discriminate verbal memory performance in stroke patients. Correspondence: *Ashleigh F. Parker, University of British Columbia - Okanagan, 2543 Paramount Drive, West Kelowna, BC V4T 3H5, Canada. E-mail: ashleighparker94@gmail.com*

**V.M. PATT, G.C. BROWN, M. THOMAS, S.C. ROESCH, M.J. TAYLOR & R.K. HEATON. Characterizing Heterogeneity in Normal Neurocognition.**

**Objective:** In studies where healthy individuals have been compared with patients, “normal neurocognition” has been assumed to constitute one large homogenous group and modeled using a flat neuropsychological profile. The current project tests this assumption by examining individual differences in absolute and relative neurocognitive profiles.

**Participants and Methods:** The neuropsychological profiles of neuro-medically-healthy individuals were characterized using latent profile analysis (LPA) on a normative dataset of the expanded Halstead-Reitan Battery (eHRB). The neurocognitive domains underlying performance on the eHRB were characterized and quantified using exploratory and confirmatory factor analyses. Two LPAs were conducted on composite factor scores that were corrected for demographics (absolute profiles) and for both demographics and general cognitive ability (relative profiles).

**Results:** The first LPA revealed individual differences in overall level of ability, with some individuals simply performing better than others across eHRB neurocognitive factors (i.e., working-memory, fluency, verbal memory, language, visuospatial cognition, perceptual speed, and perceptual attention). The second LPA revealed patterns of individual differences described by four pairs of latent classes with opposite relative strengths and weaknesses. Moreover, these latent classes were found to lie on a two dimensional continuum, characterized using principal component analysis by verbal-to-perceptual and analysis-to-attention/speed bipoles.

**Conclusions:** When demographic characteristics are controlled, individual differences in normal neurocognition are dominated by general cognitive ability. However, at equivalent levels of general cognitive ability, latent classes of individuals are distinguished, which can be further characterized by relative tradeoffs along two almost orthogonal bipolar dimensions: verbal-to-perceptual and analysis-to-attention/speed.

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**R.J. PIERS, B. NING, Y. LIU, S. DEVINE, B. WASSERMAN, S.H. AUERBACH, L.R. SILVA, L. FARESE, S. SESHADRI, P.A. WOLF, D.J. LIBON & R. AU. Displacement of the Minute Hand as a Preclinical Marker of Dementia: Clock Drawing in the Framingham Heart Study.**

**Objective:** The Clock Drawing Test (CDT) is a widely used, popular test because of its ease of use, low cost, and sensitivity in detecting cognitive impairment. The current research examined the clinical significance of the CDT error ‘minute hand not to correct number’.

**Participants and Methods:** 171 non-demented participants from the Framingham Heart Study were administered the CDT to command and copy with hands set for “10 after 11” (mean age= $82.33\pm 6.07$ ; MMSE= $27.47\pm 2.41$ ; 90.64% high school grad; 61.99% women). The CDT was administered between 1999 and 2003. Study participants were followed for incident dementia between 2004 and 2015. We investigated the clock drawing error ‘minute hand not to correct number’ to see if

there was a significant difference between those who did and did not develop dementia.

**Results:** Ninety participants (52.63%) developed incident dementia ( $4.93\pm 3.25$  years between test and mild date). A Cox regression was performed and, after removing stroke/PD subjects, accounting for the survival time (time until date of diagnosis), and controlling for age at NP test and education level, we found a significant difference between groups for incorrect placement of the minute hand ( $HR=1.855$ ;  $p<.05$ ). That is, those participants who eventually developed dementia were more likely to misplace the minute hand at the time in which they were deemed not to be demented.

**Conclusions:** This finding suggests that the CDT error ‘minute hand not to correct number’ could serve as a preclinical marker of dementia. Correspondence: *Ryan J. Piers, Neurology, Framingham Heart Study, 19 Harvard Avenue, Brookline, MA 02446. E-mail: rpiers@bu.edu*

**R.J. PIERS, K.N. DEVLIN, B. WASSERMAN, Y. LIU, M. LAMAR, C. PRICE, R. SWENSON, R. DAVIS, D.L. PENNEY, S. SESHADRI, P.A. WOLF, R. AU & D.J. LIBON. Percent Intra-Component Think Time: Digital Clock Drawing in the Framingham Heart Study.**

**Objective:** The Digital Clock Drawing Test (dCDT) permits objective assessment of cognitive behavior that may reflect brain integrity. The current research defines the novel metric ‘percent intra-component think time’ and its potential clinical application.

**Participants and Methods:** 726 stroke- and dementia-free participants from the Framingham Heart Study (age= $67.85\pm 9.61$ ; education= $15.52\pm 3.15$ ; MMSE= $28.84\pm 1.43$ ; 47.5% women) were administered the dCDT to command and copy with hands set for “10 after 11”. Four age groups were constructed: 50s, 60s, 70s, and 80s+. dCDT parameters included total time to completion, total drawing time or ‘ink time’, total non-drawing or ‘think time’, and four intra-component latency measures of decision-making: (1) post clock face circle latency, (2) pre 1st hand latency, (3) pre 2nd hand latency, and (4) inter-digit latency. ‘Percent intra-component think time’ was calculated as: the sum of the four intra-component latencies divided by total ‘think time’.

**Results:** In the command condition, total time to completion was longer for 80s+ than other groups (post hoc test;  $p<.01$ ). In the copy condition total time to completion was longer for 70s and 80s+ than other groups (post hoc test;  $p<.01$ ). For both command and copy, total drawing time (ink) comprised 35-40% of total time to completion, and non-drawing time (think) comprised 55-60%, with no age group differences. Total intra-component latencies accounted for approximately 30% of total ‘think time’. No group differences were observed.

**Conclusions:** The ability to measure precisely latencies during shifts in task demands affords opportunity to measure key decision-making components. Proportionally longer time spent making decisions (‘percent intra-component think time’) may reflect cognitive deficits even in normal appearing drawings. Longitudinal changes in ‘percent intra-component think time’ should be explored as a potential cognitive biomarker for emerging illness.

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**R.J. PIERS, K.N. DEVLIN, B. WASSERMAN, Y. LIU, M. LAMAR, C. PRICE, R. SWENSON, R. DAVIS, D.L. PENNEY, S. SESHADRI, P.A. WOLF, R. AU & D.J. LIBON. Digital Assessment of Speed and Graphomotor Decision Making by Age Group: Framingham Heart Study.**

**Objective:** The Digital Clock Drawing Test (dCDT) permits precise, reliable, and objective assessment of key cognitive constructs. These measures may be used to track early emerging neurocognitive decline. We determined the effect of age on drawing characteristics and a novel metric of dCDT decision-making, termed intra-component latencies.

**Participants and Methods:** 726 stroke- and dementia-free Framingham Heart Study participants (age= $67.85\pm 9.61$ ; education= $15.52\pm 3.15$ ; MMSE= $28.84\pm 1.43$ ; 47.5% women) were administered the dCDT to

command and copy with hands set for “10 after 11”. Total strokes, total time to completion, and four intra-component latency measures of decision-making were computed: (1) post clock face circle latency, (2) pre 1st hand latency, (3) pre 2nd hand latency, and (4) Inter-digit latency. Four age groups were constructed: 50s, 60s, 70s, and 80s+. Education and MMSE performance were co-varied.

**Results:** All following post hoc tests for age group comparisons were significant at  $p < 0.05$ . In the command condition, 80s+ participants required more total strokes and total time to completion compared to other groups. Inter-digit latency was longer for 70s compared to 60s; and 80s+ compared to 50s and 60s. In the copy condition, 80s+ required more total strokes than 50s and 60s; and the 70s and 80s+ groups had slower total time to completion compared to younger groups. Post clock face circle latency, and pre 1st hand latency were longer for 80s+ compared to 50s and 60s; inter-digit latency was longer in 80s+ compared to other groups.

**Conclusions:** Age group differences are detectable on a standard neuropsychological test in cognitively intact individuals. More strokes and longer decision-making latencies in copy versus command drawings may reflect greater use of working memory and/or increased self-monitoring behavior in older subjects.

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#### **A. POLEVOY, C. BREWER & M.I. OSTER. Utility of the RBANS in Detecting Cognitive Impairment in Alcohol Use Disorders: A ROC Study.**

**Objective:** The neurotoxic effects of alcohol on the brain are well established; however, substance abuse treatment facilities do not always administer neuropsychological tests to assess cognitive impairment. The study examined the diagnostic accuracy of the RBANS in predicting cognitive deficits. The researchers hypothesized participants with AST and ALT elevations would score significantly lower on measures of visuospatial skills, attention, immediate and delayed recall, and total score on the RBANS.

**Participants and Methods:** The study included 45 adult alcohol abusers receiving inpatient detoxification treatment. As part of joining the program at Keys to Recovery (Des Plaines, IL), the participants were assessed using a brief neuropsychological test battery. The researchers utilized a ROC analysis to evaluate the diagnostic utility of the RBANS.

**Results:** Scores were systematically calculated at various levels and found AST > 90 IU/L and ALT > 100 IU/L are the most accurate cutoff points. Attention, visuospatial, and total score modestly predict cognitive impairment. Further, 1 SD below the mean yields moderate predictive validity measures (SE = 0.75 SP = 0.70). Results indicate modest scores for immediate memory and attention and moderate sensitivity and specificity for total score 1 SD below the mean (SE = 0.833 and SP = 0.641). Language (AUC = 0.45) and delayed memory (AUC = 0.59) domains yielded statistically insignificant measures of predictive validity.

**Conclusions:** Findings support the clinical utility of the RBANS in detecting cognitive impairment. RBANS is modestly effective in assessing impairment related to immediate memory, attention and visuospatial skills. Total score provides a moderate tradeoff between sensitivity and specificity; it predicts global cognitive deficits associated with chronic alcohol abuse. Findings suggest a cutoff of 1 SD below the mean is most sensitive in determining cognitive impairment. Contrary to the initial hypothesis, the RBANS is not sensitive in predicting delayed recall deficits. Correspondence: *Arina Polevoy, Psy.D., Psychology, Illinois School of Professional Psychology, 3109 Pheasant Creek, Northbrook, IL 60062. E-mail: aratne2@gmail.com*

#### **E.E. QUASNEY, J.R. WIENER & M.W. HAUT. Neurobehavioral Examination Performance and Motor Intrusion Errors in Mild Cognitive Impairment versus Dementia.**

**Objective:** The Neurobehavioral Examination (NBE) was developed as a rapidly administered screening measure of broad cognitive function, with a specific focus on identifying signs of frontal lobe dysfunction. The exam combines components of the neurologic exam with procedures that assess motor, motor executive, sensory, visual, language, attention/working memory, and memory. We investigated performance on the NBE in individuals with MCI and dementia and examined the association between group membership (MCI versus dementia and Alzheimer's disease versus other dementia syndromes). We also examined a specific error type, motor intrusions, on a go/no-go task.

**Participants and Methods:** ANCOVAs controlling for age, education, and WRAT-4 Word Reading Standard Score were conducted to examine differences between groups (MCI N=60, Dementia N=47; Alzheimer's N=18) on various NBE scores. Chi-square was used to examine the association between group membership and the presence of a motor intrusion on a go/no-go task.

**Results:** Significant differences emerged in Total NBE Correct,  $F(1,101) = 48.10$ ,  $p < .001$ ,  $\eta^2 = .323$ ; Total NBE Errors,  $F(1,101) = 22.48$ ,  $p < .001$ ,  $\eta^2 = .182$ ; and Total NBE Score,  $F(1,101) = 49.41$ ,  $p < .001$ ,  $\eta^2 = .329$ , with better performance in the MCI group than the dementia group on all NBE variables. Chi-square analysis revealed that motor intrusions occurred more frequently in dementia than MCI,  $\chi^2(1) = 7.58$ ,  $p = .006$ , and more frequently in Alzheimer's disease than other types of dementia,  $\chi^2(1) = 6.43$ ,  $p = .013$ .

**Conclusions:** Results suggest that individuals with MCI perform better than individuals with dementia on the NBE overall, thus supporting its diagnostic utility. Motor intrusions occur more frequently among (1) individuals with dementia relative to MCI and (2) individuals with Alzheimer's disease relative to other dementia syndromes.

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#### **J. RAAK, R.L. SKEEL, C. ANDERSON & M.E. ELLIS-STOCKLEY. Predicting Variance in Neuropsychological Test Performance from Heart Rate and Anxiety.**

**Objective:** Neuropsychological evaluations can be high stakes situations requiring complex performance on unfamiliar tasks. This has the potential to cause elevations in anxiety, but the impact of this anxiety on neuropsychological test performance is not well understood. Few studies have included both self-report and physiological measures of anxiety. Thus the current study measured both heart rate and self-reported anxiety levels. It was hypothesized that test performance would follow a curvilinear pattern as heart rate and anxiety increased, especially for the most difficult tasks.

**Participants and Methods:** Final analyses included 48 participants split evenly into an anxiety induction and a control group to encourage a broader range of anxiety levels. All participants completed the PASAT, the Stroop Test, the Rey Auditory Verbal Learning Test, the Trail Making Test and the State/Trait Anxiety Inventory. Heart rate and blood pressure were recorded during each measure. Performance on each measure was predicted using three hierarchical regression equations; a linear and curvilinear relationship with heart rate, and one that combined curvilinear heart rate, STAI, condition, and blood pressure.

**Results:** Results varied with each measure. Working memory dependent tasks on the RAVLT and PASAT demonstrated a curvilinear relationship with heart rate following a u-shaped pattern. Performance on the Interference portion of the Stroop Test demonstrated a linear relationship. Self-report measures of anxiety were not related to performance.

**Conclusions:** Heart rate is predictive of performance on neuropsychological measures, primarily in those reliant on working memory. However, the direction of this relationship was unexpected as performance followed a u-shaped rather than hill-shaped pattern. This may capture

the meeting point of past research finding improvements in performance after both relaxation and sympathetic activation.

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**M. REYNOLDS, B. CLARK & S. HALL. A Significant Threat to Neuropsychological Test Validity.**

**Objective:** Neuropsychological test security is vital to the validity of assessment. Previous research in our lab has shown that 71% of participants use the Internet to prepare for neuropsychological evaluations. We investigated the availability of information related to neuropsychological tests on the Internet, a topic that has received little attention in the research literature.

**Participants and Methods:** First, we decided a priori that we would not reveal the terms used in this Internet search, as to not contribute to the problem of threatened test security. We used the Internet search engine "Google" to begin a search using a general question that a person with no neuropsychological expertise might use to access initial results. We obtained 899,000 results for this question. We then selected the first five search results. One link provided us with a list of 52 commonly used neuropsychological tests. This list also included information about the type of cognitive information that the test was meant to assess. Lastly, we searched for these tests on Google Images and YouTube to investigate the extent of the information available.

**Results:** The protocols for 43% of the 52 tests were available on Google Images. At least partial administration demonstrations were available on YouTube for 54% of the 52 neuropsychological tests. These demonstrations revealed the test protocols and basic strategy of the tests.

**Conclusions:** A substantial amount of information regarding neuropsychological tests is available on Google Images and YouTube, threatening the validity of these tests. Individual practitioners may want to consider this when obtaining informed consent and history taking. It is recommended that professional neuropsychological associations begin to develop guidelines regarding appropriate content for websites and identify and continuously monitor websites that contain threatening information.

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**A. ROSEN, Z. QUITTNER, C. CONABOY & R. MACHER. Neuropsychologists' Expectations are High for Poor Cognitive Performance in Recreational Cannabis Users.**

**Objective:** Empirical findings regarding the cognitive effects of cannabis are equivocal at best, and a recent meta-analysis found little or no effect of cannabis on cognition (Shreiner & Dunn, 2012). Stereotype threat, which Looby and Earleywine (2010) observed in cannabis users, is one explanation for the variable findings. Similarly, the examiner may introduce stereotype threat into the testing environment, affecting cognitive performance. The present study examined evidence for the perceived cognitive effects of medicinal and recreational cannabis use within a sample of neuropsychologists (i.e., experts on cognition).

**Participants and Methods:** We sent an online survey to members of the National Academy of Neuropsychology (NAN) and the International Neuropsychological Society (INS). Respondents (N = 261) rated vignettes according to their beliefs about the potential cognitive effects of recreational and medicinal cannabis use (e.g., in patients with insomnia, anxiety, multiple sclerosis, or cancer) across nine domains: FSIQ, attention, memory, executive functioning, language, visuospatial functioning, motor functioning, processing speed, and effort. Recreational and medicinal vignettes were matched with regard to method of ingestion (e.g., pipe, joint), frequency of use, and duration of use.

**Results:** Prior to using paired sample t-tests to compare responses on corresponding vignettes, the estimated effects of medical disorders alone were subtracted from medicinal vignettes. Recreational cannabis users

were rated as having greater cognitive impairment when compared to medicinal cannabis users ( $p < .001$ ) across all nine cognitive domains.

**Conclusions:** Results suggest that neuropsychologists estimate greater cognitive impairment in recreational cannabis users relative to medicinal cannabis users, despite a lack of empirical support to confirm the negative cognitive effects of cannabis. Thus, future research should utilize a design in which examiners are blind to user status to prevent the potential effects of stereotype threat.

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**A.S. ROSENBLATT, N.J. PASTOREK, B. MILLER, J. ROMESSER, A. SIM & J. LINCK. Evidence for Clinical Utility of Neuropsychological Data Despite Performance Validity Failures.**

**Objective:** Performance validity tests (PVTs) have been shown to explain significant variability in neuropsychological test performance. However, patients with poor PVT performances often perform in the normal range on some measures, suggesting greater nuance is needed when predicting how performance invalidity impacts individual neuropsychological tests. The purpose of this study was to examine neuropsychological test performances by both the number and the level of failure on PVTs.

**Participants and Methods:** 180 OEF/OIF/OND Veterans with a history of mTBI were seen for neuropsychological evaluation. The study sample was 95.6% male with a mean age of 31.5 years (SD=6.3) and mean education of 13.1 years (SD=1.6). Effects of number and level of PVT failures were examined on a comprehensive set of neuropsychological test scores, dichotomized as at-or-above the normal range (i.e., intact) by a cut z-score of -1.0. PVTs included WMT, TOMM, RDS, CVLT-II FC, and Rey-15, each with empirically supported cut scores. Nonparametric tests were used to examine the relation between neuropsychological tests scores and number and level of PVT failures.

**Results:** Of those failing at least one PVT, 33.9% showed intact performance on at least two-thirds of neuropsychological measures (median failed PVTs=2). Significant negative correlation was confirmed between neuropsychological performance and number of PVTs failed (Kendall's tau=-.38). Of those below recognized cut scores but above chance-levels on the WMT and TOMM, 53.6% and 51.0% showed intact performance on at least two-thirds of neuropsychological measures. Lower PVT scores were also associated with more impaired scores.

**Conclusions:** This study showed that although PVT failures relate to neuropsychological performance, intact neuropsychological performances may occur frequently depending on number or level of PVT failures. While intact performance may not accurately represent one's true cognitive potential in the context of PVT failure, testing may still help rule out frank impairment.

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**J.A. ROWLAND, H.M. MISKEY, T.W. BREARLY, S.L. MARTINDALE & R.D. SHURA. Construct Validity of Auditory Consonant Trigrams.**

**Objective:** Auditory Consonant Trigrams (ACT) was initially developed to test immediate memory decay when rehearsal is prevented by a distractor task. Subsequent studies have suggested the test measures aspects of executive functioning, though few studies have empirically evaluated the construct validity of the ACT. The purpose of this poster is to present construct validity results of the ACT using a sample of post-deployment Veterans.

**Participants and Methods:** For this study, 184 participants who completed a standardized battery of neuropsychological measures were evaluated. All participants passed the Word Memory Test and denied a history of moderate or severe traumatic brain injury (TBI). The relationship between ACT performance and demographic characteristics, history of mild TBI, and psychiatric disorders was tested with group

mean comparisons. Construct validity was explored by examining the relationship of the ACT to 12 tests of processing speed, attention, verbal memory, and executive functioning using regression analysis.

**Results:** ACT Total score reliability was adequate ( $\alpha = .79$ ). Performance on the ACT was related to education, estimated premorbid intellectual ability, and current major depressive disorder (MDD). Hierarchical linear regression suggested education ( $\beta = .17$ ), estimated intellectual functioning ( $\beta = .27$ ), and psychomotor speed ( $\beta = -.20$ ) significantly predicted ACT performance. Results from post-hoc backwards stepwise regression using the same variables suggested significant relationships among the ACT Total score and years of education ( $\beta = .14$ ), WTAR ( $\beta = .30$ ), Trails A ( $\beta = -.18$ ), WAIS-III LNS ( $\beta = .16$ ), and CPT-3 Commissions ( $\beta = -.15$ ).

**Conclusions:** This study demonstrates that the ACT has adequate psychometric properties. Education, intellectual functioning, and psychomotor speed were most salient to ACT performance. Additionally, those with MDD showed significantly lower ACT Total scores, perhaps secondary to slowed processing speed.

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**S. ROYE, M. CALAMIA, K. GREVE, K. BIANCHINI, L.E. AGUERREVERE & K.L. CURTIS. Booklet Category Test: Factor Structure and Neuropsychological Correlates in a Mixed Clinical Sample.**

**Objective:** The Booklet Category Test (BCT) is widely used to assess executive functioning (Rabin et al., 2005). Previous research has investigated the factor structure of the BCT and found three distinct factors: "Counting", "Spatial Positioning" and "Proportional Reasoning" (Johnstone, Holland, & Hewett, 1997). This study explored the relationship between BCT factors and a battery of neuropsychological measures given to a mixed patient sample.

**Participants and Methods:** 137 patients (n=77 TBI, n=30 stroke, n=30 other psychiatric or neurological diagnoses) who were classified as giving adequate effort in a previous study (Greve et al., 2007) completed the BCT and a number of neuropsychological tests.

**Results:** An exploratory factor analysis yielded a similar solution to the previous three factor model (Johnstone et al., 1997). Participants made few errors on the Counting subtests (subtests 1 and 2) reducing the degree to which that factor could correlate with other variables. Scores on the Spatial Positioning (subtests 3, 4, and 7) and Proportional Reasoning (subtests 5 and 6) factors were similar in the magnitude of their relationship to other measures of executive functioning: Wisconsin Card Sorting Test total errors ( $r(134) = .41$ ,  $r(134) = .42$ , both  $p < .05$ ); Stroop Color-Word performance,  $r(109) = -.37$ ,  $r(109) = -.30$ , both  $p < .05$ ; phonemic fluency,  $r(130) = -.36$ ,  $r(130) = -.36$ , both  $p < .05$ ). The factors were also similar in the magnitude of their relationship with other measures (e.g., WAIS-III FSIQ,  $r(136) = -.49$ ,  $r(136) = -.46$ , both  $p < .05$ ).

**Conclusions:** Findings replicate and extend previous research supporting the BCT as a multidimensional test whose factors significantly correlate with a number of other neuropsychological measures (e.g., Allen et al., 2006). Given errors are made primarily on the Spatial Positional and Proportional Reasoning factors, the similarities between those factors in the size of their correlations with other measures supports the continued use of the total error score in clinical practice.

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**S.L. SALINAS & S. PENNA. Older Patients Who Present With Comorbid Depression and Cognitive Complaints: Why Full Neuropsychological Testing Is Recommended.**

**Objective:** The current study examined performance on a screening measure for cognitive impairment as well as traditional neuropsychological

measures in older veterans with suspected cognitive impairment with and without depression.

**Participants and Methods:** All participants are veterans referred to a Mild Cognitive Impairment (MCI) clinic due to reported concerns of cognitive decline. As part of their work-up in the clinic, veterans underwent neuropsychological battery, cognitive screening measures, and medical work-up from a geriatric physician. Twenty-six of the 93 patients who completed neuropsychological testing endorsed clinically significant rates of depression on the BDI-2 (cut off score of 20). Using t-tests with Bonferroni correction, the current study evaluated whether or not veterans with depression did more poorly on neuropsychological testing than those who were not depressed.

**Results:** Scores on the Montreal Cognitive Assessment (MOCA), a screening measure of cognitive impairment, were negatively impacted by those who reported moderate to severe depression.  $t(39.35)=1.96$ ,  $p=.057$ . However, no differences were detected between depressed and non-depressed veterans on standardized neuropsychological measures assessing specific cognitive domains (e.g. memory, attention, executive functioning).

**Conclusions:** In a rapidly aging population, quick, efficient screening measures of cognitive decline are increasingly relied on when assessing for cognitive impairment. As the data here indicate, traditional neuropsychological measures do not appear to be affected by patient's emotional state. However, global screening measures such as the MOCA are more influenced by a patient's emotional functioning. Thus, patients who present with comorbid depression and cognitive complaints would be better served to undergo full neuropsychological testing to rule out depression/pseudodementia versus an actual neurodegenerative process. Correspondence: *Stephanie L. Salinas, MS, Department of Clinical Psychology, Georgia School of Professional Psychology at Argosy University, 980 Hammond Dr., Suite 100, Atlanta, GA 30328. E-mail: steph.salinas34@gmail.com*

**R. SALMON, S. FREUND, T.L. MCAULEY & C. ABEARE. Lexical Characteristics of Emotion Word Fluency Test Responses and Depression in Healthy Young Adults.**

**Objective:** The literature suggests that individuals with depression perform similarly to controls on tasks of phonemic fluency, but demonstrate deficits on tasks of semantic fluency (Henry & Crawford, 2005). Semantic fluency tasks have yet to be investigated in terms of an affective category (i.e., emotions). This type of measure may be particularly relevant to individuals with affective disorders, such as depression.

**Participants and Methods:** A sample of undergraduate students (N=102, Mage=21.9, 89 females) was administered the Beck Depression Inventory (BDI-II; Beck et al., 1996) and the Emotion Word Fluency Test (EWFT; Abeare et al., 2009), in which participants are required to generate as many emotion words as they can in one minute.

**Results:** The relationship between BDI-II scores, age of acquisition (AoA), and the arousal characteristics of words were calculated. Results demonstrated associations between BDI-II scores and AoA variables  $r(102)=-.203$ ,  $p=.04$ . There was also a negative correlation between BDI-II scores the number of words with calm arousal ratings,  $r(101)=-.197$ ,  $p=.05$ .

**Conclusions:** Regardless of depression scores, emotion semantic fluency was not disrupted in this sub-clinical sample. However, the age of acquisition and arousal characteristics of the words generated by individuals reflects the underlying differences in affective semantic retrieval. Individuals with higher levels of depression demonstrated a less sophisticated emotional vocabulary and a more highly arousing semantic memory bias, which manifested as a lack of production of low arousing, calm affective words. Future research should examine these relationships in a clinical sample.

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**A.M. SCHUSTER, A.F. PARKER, L. OHLHAUSER, D. LEITNER, J. UPSHAW, M. LIBBEN & H. MILLER. The Efficacy of Neuropsychological Assessment Composite Scores as a Predictor of Discharge Destination After Stroke.**

**Objective:** Comprehensive assessment of cognitive domains following stroke may better predict independent (IND) or dependent (DEP) discharge destination from hospital than single neuropsychological tests. This study aimed to determine (1) if composite scores for memory, visuospatial abilities, and executive functioning better predict discharge destination than individual neuropsychological tests, and (2) which cognitive domain (memory, visuospatial abilities, and executive functioning) is the strongest predictor of IND or DEP discharge from hospital.

**Participants and Methods:** Sixty-two stroke inpatients (IND=24, DEP=38) were seen for neuropsychological assessment during acute rehabilitation. Composite scores were calculated by averaging T-scores of the tests comprising the respective cognitive domains. The relationship between composite scores, individual test scores, and discharge destination was examined using logistic regression, independent samples t-tests, and ANOVAs.

**Results:** In the composite score model ( $R^2=0.50$ ), only the memory composite (MC) ( $B=-0.09$ ) was an independent predictor. In the individual test model ( $R^2=0.22$ ), the RCFT-Copy ( $B=0.06$ ), WCST-PE ( $B=0.14$ ), and WCST-Categories ( $B=-0.13$ ) were independent predictors ( $p < .05$ ). The MC, RCFT-Copy, and WCST Categories were greater in the IND group than the DEP group, while scores for the WCST-PE were greater in the DEP group.

**Conclusions:** These findings demonstrate that (1) the RCFT-Copy, WCST PE, WCST Categories, and MC can accurately predict discharge destination (IND or DEP) for stroke patients. There was no indication that composite scores better assess cognitive abilities to predict IND or DEP discharge destination. Findings do indicate that MC is a stronger predictor of discharge destination (IND or DEP) than visuospatial abilities, and executive functioning.

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**E. SEGAL, D.Z. PRESS & M.G. O'CONNOR. The Clinical Utility of the Boston Naming Test as a Measure of Semantic Memory.**

**Objective:** We examined the utility of the Boston Naming Test (BNT) as a test of semantic retrieval by comparing it to other tests designed to assess semantic access. Originally conceived to detect anomia in aphasic individuals, the BNT has been appropriated to assess loss of semantic knowledge suggestive of memory dysfunction in non-aphasic individuals as it has a semantic memory component. It has clinical application, for example, in diagnosing Mild Cognitive Impairment and Alzheimer's Disease. Forgetting the names of everyday objects is a common presenting symptom complaint in individuals with these disorders. However the suitability of using the BNT on a wider population than for which it was originally designed merits investigation.

**Participants and Methods:** Neuropsychological data from 100 subjects (45 female, 55 male; age range = 26-87, mean age = 64 yrs  $\pm$  12) were analyzed with simple linear regression. We wanted to determine whether age and education would have similar effects on BNT scores, phonetic and semantic fluency scores, and long-delay retention scores.

**Results:** (1) Age accounted for 10% of the variance in semantic fluency scores and 16% of long-delay retention percent-correct scores, but only 1.3% of BNT scores and 0.5% of phonetic fluency scores; (2) education accounted for 10% of the variance of phonetic fluency scores, 4% of the variance of percent-correct long-delay retention scores, 5% of semantic fluency scores and 4% of BNT scores.

**Conclusions:** Age was less of a factor on the BNT than expected given the known impact of age on other semantic retrieval tests. While the BNT is used widely to assess naming problems, it also serves as a proxy of semantic loss arising from medial temporal lobe degeneration, and opportunity exists to redesign the test to increase its utility as a test

of semantic loss by making sure age is a relevant variable that is accounted for.

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**M. SEIDENBERG, C. KANDAH, E. HOIDA, D.A. KELLY, K.A. NIELSON, J.L. WOODARD, J. SMITH, S. DURGERIAN, W. HOLCOMB, W. SONG, N. PLISKIN & S.M. RAO. The Relationship Between Demographic Variables and Performance on a Newly Developed Remote Memory Test of Famous Name Discrimination.**

**Objective:** We previously reported findings for a newly developed remote memory measure, the Famous Name Discrimination Test (FNDDT), which compares the discrimination of the names of well-known public individuals from remote and recent time periods. For example, a Mild Cognitive Impairment (MCI) group showed poorer performance than a healthy control (HC) group for identifying recent famous names, but not remote famous names. Baseline performance was also a significant predictor of cognitive decline 18 months later in a group of HC, and an MCI group showed further decline in discrimination performance after 18 months for both recent and remote famous names. Here, we present findings on the relationships between age, education, and gender and the performance of older adults on the FNDDT.

**Participants and Methods:** 247 cognitively-intact participants, aged 65-90 ( $M = 74.06$ ,  $SD = 5.43$ ), 70% female, with fifteen years of average education were administered the FNDDT, which is composed of 30 famous and 30 unfamiliar names. There were 10 recent (less than 10 years of public exposure) and 10 remote famous names (at least 40 years from initial fame). Names were presented on a computer screen for 4 seconds. Accuracy and response time (RT) were recorded via button press.

**Results:** Remote famous names (96.23%) were identified significantly more accurately and faster (by about 200 msec) ( $t = 3.50$ ,  $p = .004$ ) than recent famous names (84.85%;  $t = -4.84$ ,  $p < .001$ ). Age, education and gender were not significantly correlated with discrimination accuracy or RT for recent or remote famous names ( $p$ 's  $> .05$ ).

**Conclusions:** These findings indicate a minimal impact of basic demographic variables on FNDDT performance in older adults. This finding is an important consideration for the use of the FNDDT in a clinical setting. Correspondence: *Emily Hoida, Psychology, Rosalind Franklin University of Medicine and Science, 2831 N Augusta Dr, Wadsworth, IL 60083. E-mail: emily.hoida@my.rfums.org*

**A.R. SNYDER, B. ASKEN, J.R. CLUGSTON & R.M. BAUER. Confirmatory Factor Analysis on the Immediate Post-Concussion Assessment and Cognitive Testing (ImpACT) at Baseline.**

**Objective:** The purpose of this study was to examine the dimensionality of the hypothetical constructs that compose the Immediate Post-Concussion Assessment and Cognitive Testing (ImpACT), a popular, computerized assessment of neurocognitive function after concussion. The factor structure of ImpACT is hypothesized to consist of four different domains for clinical interpretation: Verbal Memory, Visual Memory, Visual Motor Speed, and Reaction Time.

**Participants and Methods:** A confirmatory factor analysis (CFA) was conducted on retrospective baseline ImpACT data from 495 collegiate student athletes at the University of Florida. The CFA was conducted using SPSS AMOS on a four factor, oblique model.

**Results:** Fit indices suggested poor model fit for the proposed four factor solution in our sample. Significant overlap was found between the Reaction Time and Visual Motor Speed factors and between the Visual Memory and Verbal Memory factors. Individual subtests varied significantly in the amount of variance explained by each of the four factors to which they were assigned. Parameter estimates, factor loadings, and correlation matrices are presented.

**Conclusions:** Our findings indicate that the existing factor structure of the ImPACT test may not be ideal according to CFA and may be improved by a different interpretive framework such as the two-factor solution proposed by Schatz and Maerlander (2013). Additionally, the structure of specific subtests within factors may benefit from further investigation and refinement.

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#### **A. SORRELL & A. BENITEZ. Construct Validity of the NIH-Toolbox Cognition Battery Fluid and Crystallized Composite Scores in Cognitively Healthy Older Adults.**

**Objective:** The NIH-Toolbox Cognition Battery (NIHTB-CB) is a new series of computerized tests yielding composite scores of fluid and crystallized intelligence. Fluid abilities are thought to reflect changes in neurobiological integrity due to aging, while crystallized intelligence remains fairly static even in old age. We sought to demonstrate the convergent and discriminant validity of these composite scores using gold standard neuropsychological tests, demographic estimates of premorbid intelligence, and MRI volumes.

**Participants and Methods:** 51 cognitively healthy older adults (Age:  $67.8 \pm 5.4$ , 64.7% female, 94.1% White) underwent neuropsychological testing and brain MRI. Fully adjusted FLU and CRY scaled scores from the NIHTB-CB, raw scores of the gold standard neuropsychological tests, and T1-MPRAGE images submitted to NeuroQuant® for volumetric analysis (volumes in cm<sup>3</sup> normalized to intracranial volume) were analyzed using Pearson's correlations and Hotelling's *t* tests.

**Results:** CRY scores, more than FLU scores, correlated with word reading tests (i.e. AmNART, WRAT Reading;  $r$ 's=0.74-0.81,  $p < 0.01$ ) and a demographic estimate of premorbid intelligence (i.e. years of education,  $r = 0.39$ ,  $p < 0.01$ ). FLU scores, more than CRY scores, correlated with gold standard neuropsychological tests (i.e. digit symbol coding, trailmaking tests;  $r$ 's=0.26-0.46,  $p < 0.05$ -0.01) and inferior and lateral ventricular volumes ( $r$ 's=0.23-0.27,  $p < 0.05$ ). Both CRY and FLU scores moderately correlated ( $r$ 's=0.26-0.43,  $p < 0.05$ -0.01) with neuropsychological tests that may comparably tap both abilities (i.e. letter and category fluency, WMS-R delayed story percent recall).

**Conclusions:** The NIHTB-CB Crystallized and Fluid Composite scores demonstrate adequate construct validity for use in cognitively healthy older adults.

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#### **S.K. STERN, T.J. ARENTSEN, B. ROPER, W.J. STUBBS, M.C. ADLER, B. SMITH & E.M. CROUSE. General Unhappiness and Dissatisfaction Impacts Elevations on the Behavior Rating Inventory of Executive Function-Adult: An Emotional, Not Cognitive, Connection.**

**Objective:** Evidence from child and adult studies demonstrate that the relationship between subjective report of executive functioning (EF) and performance on object measures is tenuous (Rabin et al., 2006; Toplak et al., 2013). This study sought to determine the extent to which self-report of EF on the Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A) is influenced by performance on EF tests and self-report of general unhappiness and dissatisfaction.

**Participants and Methods:** Thirty eight veterans completed a neuropsychological evaluation, passed performance validity tests, and completed a Minnesota Multiphasic Personality Inventory-2 (MMPI-2) and BRIEF-A in a valid manner. An EF Index was calculated using the average of normalized scores on EF measures for each participant. Correlation coefficients were calculated among BRIEF-A clinical scales and index scores, the MMPI-2 RCd scale, and the EF Index.

**Results:** BRIEF-A index scores correlated significantly with RCd (Behavior Regulation Index:  $r = .51$ , Metacognition Index:  $r = .52$ , Global Executive Composite:  $r = .60$ ,  $p \leq .001$ ). All BRIEF-A scales also significantly correlated with RCd ( $r$ s ranged from .40 to .68,  $p$ s from .01 to  $< .001$ ), with the exception of Emotion Regulation ( $r = .25$ ,  $p = .13$ ) and Organization of Materials ( $r = .25$ ,  $p = .14$ ). Correlations among BRIEF-A scales with the EF Index were all non-significant ( $r$ s ranged from .02 to .24), with the exception of Task Monitoring ( $r = .38$ ,  $p = .02$ ).

**Conclusions:** In general, BRIEF-A scales and index scores are much more strongly associated with general unhappiness and dissatisfaction than they are with actual performance on tests of executive abilities. To our knowledge, the susceptibility of the BRIEF-A to unhappiness and dissatisfaction has been under-examined. These results help answer previously raised questions (Yehyawi et al., 2011) regarding the influence of rater biases (e.g., distress) on perception of EF impairments. Implications regarding the nature of performance and metacognition are discussed.

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#### **M. TROYANSKAYA, N.J. PASTOREK, R.S. SCHEIBEL, N.J. PETERSEN, A. WALDER, H. HENSON & H.S. LEVIN. Choosing Appropriate Control Group Participants in Studies of Veterans: Characteristics of Orthopedically Injured and Uninjured OEF/OIF/OND Veterans.**

**Objective:** Research addressing deployment-related traumatic brain injury (TBI) is fairly complex due to a high prevalence of co-morbid conditions, multiple exposures, and the lack of acute medical records. Therefore, there is a need for a well-defined, matching control group. This study compared deployment-related characteristics, everyday functioning, and cognitive performance in recently deployed veterans who had not sustained any injuries with those who had orthopedic injuries during deployment, but who were without TBI.

**Participants and Methods:** Participants included 37 individuals who had been deployed and who were without injuries and a group of 24 individuals who reported at least one orthopedic injury during deployment. The Mayo-Portland Adaptability Inventory-4, Community Integration Questionnaire, Veterans RAND 36 Item Health Survey, Brief Pain Inventory, Barratt Impulsiveness Scale -11, and PTSD Checklist - Civilian were used to assess daily functioning. Cognitive performance was measured using the Controlled Oral Word Association Test, Trail Making Test, Color-Word Interference Test, and Verbal Selective Reminding Test.

**Results:** Participants with and without a history of extra-cranial injury did not differ significantly in age, gender distribution, education, post-deployment interval, level of combat exposure, or current level of intellectual functioning. Substance abuse issues were rarely reported in both groups. Participants with history of orthopedic injury were not significantly different in their current symptom reporting and did not experience more limitations in daily activities. There were no significant between-group differences in cognitive performance.

**Conclusions:** Orthopedic injuries sustained during deployment did not have any lasting effect on participants' health, cognition, and daily functioning. These results indicate the two groups are comparable and that their data could be combined to create a single control group.

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#### **D.S. TULSKY, J. HOLDNACK, N.E. CARLOZZI, A. WONG, M. COHEN & A.W. HEINEMANN. Confirmatory Factor Analysis of the NIH Toolbox Cognition Battery Among Individuals with Acquired Brain Injury.**

**Objective:** The NIH Toolbox Cognition Battery (NIHTB-CB) comprises 7 measures developed to assess the domains most relevant to cognitive

impairment in individuals with neurological insult or disease. Previous construct validation research using healthy adults supported the interpretation of the NIHTB-CB tests as measures of reading, vocabulary, episodic memory, working memory, and combined executive functioning/processing speed. Because many clinicians want to use the NIHTB-CB to measure cognition in individuals with neurocognitive deficits across a broad range of medical, neurological, and developmental conditions, the current study evaluated if the tests measure the same cognitive constructs in individuals with acquired brain injury.

**Participants and Methods:** 392 adults, diagnosed with either a traumatic brain injury or a stroke completed the NIHTB-CB as well as established neuropsychological measures (RAVLT, PPVT-R, WRAT-IV Reading, WAIS-III LNS, CD, and SS, DKEFS CWIT IN, and BVMT-R) as part of a multisite research project. Confirmatory factor analyses (CFA) was conducted using SPSS AMOS Software. Alternative models of cognition were tested and goodness of fit indices (AGFI, RMSEA, TLI, CFI, and BIC) were compared to evaluate model fit.

**Results:** The results of the CFA suggest that a 5-factor model comprised of language, episodic memory, working memory, processing speed, and executive functioning had the best fit to the data. CFA analysis of the NIHTB-CB core seven subtests alone yielded supported a three-factor structure of Language, Memory, and Executive functioning. Cross-loadings and error covariances indicated that individual NIHTB-CB measures may draw on multiple cognitive abilities.

**Conclusions:** This research marks the first evaluation of the NIHTB-CB tests in a clinical population of individuals who an acquired brain injury and are likely to have cognitive impairment. Overall the results suggest a strong model fit for the NIHTB-CB for a 5 factor solution that represents the construct domains of the NIHTB-CB tests.

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#### **B. VERMILION, L.J. RAPPORT & C.G. WONG. Can You Hear Me Now? Phonetic and Semantic Analysis of a List-Learning Task.**

**Objective:** The objective of this study was to evaluate phonetic, phonotactic, and lexical properties of the Hopkins Verbal Learning Test – Revised (HVLT-R) six alternate forms. Hearing loss is common among older adults; however, most verbal memory tests are administered with auditory stimuli. The phonetic properties of words used in verbal memory tests could disadvantage examinees with hearing loss and could cause differential equivalence of alternate forms.

**Participants and Methods:** The data consisted of 144 words from the six forms of the HVLT-R. Each form has 12 words for learning and free-recall trials, and 12 foils for recognition trials. Word frequency was determined using SUBTLEX (US) norms. Number of syllables and phonemes, neighborhood word density, and phonotactic positional probability were derived from the Irvine Phonotactic Online Dictionary (IPHOD) database.

**Results:** Kruskal-Wallis and ANOVA tests with planned contrasts using Mann-Whitney and t tests indicated significant differences across the six HVLT-R forms. For learning trial words, forms differed significantly with large effects on number of syllables and phonemes, word frequency, and neighborhood density. Phonotactic positional probability showed meaningful effect size, which was nonsignificant due to low power associated with the limited population of words per list. Recognition foil words showed a medium effect size for differences on word frequency and word density, but small effects on phonemes, syllables, and positional probability.

**Conclusions:** HVLT-R alternate forms are not equivalent for word frequency, neighborhood density, phonemic and syllabic structure. Differences in phonetic, phonotactic, and lexical properties across the six forms may pose problems of differential reliability and validity for persons with hearing impairment. Future research should directly examine the associations of these word properties with performance protocols from patients with and without hearing loss.

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#### **E. WELTON, T. RUBINSTEIN & B. FREILICH. A Brief Attention, Memory, and Frontal Abilities Screening Test (AMFAST) for Children and Adults.**

**Objective:** The present study describes the development and effectiveness of a novel, empirically-based cognitive screening measure designed to assess impairment in processing speed, attention, memory, and executive skills which are present in many neurologic and psychiatric disorders in both children and adults. To date, no other screening measure (e.g., MOCA) specifically evaluates these domains exclusively. The AMFAST requires minimal training to administer and can be effectively used by treating clinicians in 10 minutes to determine if comprehensive neuropsychological testing is needed.

**Participants and Methods:** 32 cognitively normal individuals were recruited as the normative sample. They represent a highly diverse Bronx community sample from ages 8-89. Roughly equal numbers of males/females of various ethnic backgrounds and education levels were included. A mixed clinical sample, used to classify how accurately the AMFAST identified impairment, was comprised of patients evaluated by the authors via comprehensive neuropsychological assessment with evidence of cognitive impairment.

**Results:** A scoring system was created based on the distribution of the responses in the normative sample. An overall cutoff score of  $\leq 75/100$  (96% of the normative sample scored  $>75$ ) suggests comprehensive testing is highly recommended. With this cutoff, the AMFAST accurately classified 95% of the overall sample, with 83% sensitivity and 97% specificity.

**Conclusions:** The AMFAST is a novel, empirically-based cognitive screening measure that can be administered by treating clinicians to identify the presence of attention, memory, processing speed, and executive deficits in children and adults, and to determine the need for comprehensive neuropsychological testing. The AMFAST correctly classified 95% of the overall sample using a cutoff of  $\leq 75$ .

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#### **S.C. WOLLMAN, M.G. HALL, L.A. FRAZIER & B.J. SCHROCK. Order of Test Administration Affects Verbal Fluency Performance.**

**Objective:** The order that neuropsychological measures are administered has been shown to impact an individual's performance and can lead to validity issues. Few studies have examined the impact of test order effects on tests which assess a similar cognitive ability, such as verbal fluency. The purpose of this study was to investigate whether or not there are order effects between phonemic (FAS) and semantic fluency (animals) when administered successively.

**Participants and Methods:** This pilot study utilized a random sample method, which yielded 62 healthy participants. All participants were prescreened for previous brain injuries, significant mood disturbances, and other neurological disorders such as attention-deficit disorders as well as learning disabilities. The sample was divided into two groups based upon administration order. Group 1 was administered FAS immediately followed by animals, while Group II was given reverse administration. Independent samples t-tests were conducted to assess for group differences.

**Results:** Groups were similar on gender and did not significantly differ on demographic variables such as age and education. Results indicated a significant test order effect for phonemic fluency on semantic fluency. Specifically, when compared to Group II, Group I had significantly lower T-scores on semantic fluency  $t(61) = 3.12, p = .002, r = .37$ . Results also indicated an effect for semantic fluency on phonemic fluency. Group II demonstrated significantly higher T-scores on FAS, when compared to Group I  $t(61) = -2.339, p = .022, r = .31$ .



**Conclusions:** These results indicate possible test order effects in assessing phonemic and semantic fluency when administered successively, resulting in either under and over inflation of verbal fluency scores, depending upon the order of administration. These results have implications both in terms of clinical interpretation as well as for test administration procedures. Similar research in clinical populations is in progress.

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**K.L. ZANE, N.A. EMMERT & J.D. GFELLER. Detecting Insufficient Effort in Persons with Post-Acute Traumatic Brain Injury using the Conners' Continuous Performance Test-II.**

**Objective:** The Conners' Continuous Performance Test-Second Edition (CPT-II), a measure of attentional processes, has recently been examined as a measure of insufficient effort. The present study investigated CPT-II indicators of limited effort in persons with post-acute traumatic brain injury (TBI) of varying severity. We hypothesized that persons with mild TBI who failed effort testing on the Word Memory Test (WMT) would have lower CPT-II scores compared to persons with mild or moderate to severe TBI who passed. We also hypothesized that CPT-II effort indicators would demonstrate some utility to detect insufficient effort in persons with TBI.

**Participants and Methods:** The present study utilized archival data from a clinical sample ( $N = 132$ ) of adults who sustained a TBI. All participants completed the CPT-II and WMT as part of a larger neuropsychological evaluation. Participants were divided into 3 groups based on brain injury severity and WMT performance (pass/fail): Mild TBI (MTBI)-Pass ( $n = 68$ ), MTBI-Fail ( $n = 19$ ), and moderate to severe TBI (MSTBI)-Pass ( $n = 45$ ).

**Results:** A multivariate analysis of variance revealed performance differences on four CPT-II variables (Omissions, Hit Response Time Standard Error, Variability, and Perseverations). Univariate and post hoc analyses indicated that the MTBI-Fail group exhibited impaired CPT-II scores relative to the MTBI-Pass and MSTBI-Pass groups. Moreover, the Receiving Operating Curve (ROC) area for the CPT-II Omissions variable (.72) suggested fair properties as an indicator to classify persons giving adequate versus insufficient effort ( $p < .004$ ).

**Conclusions:** Results from the current study indicate that individual CPT-II variables have some utility to identify low effort in persons with post-acute TBI. In particular the CPT-II Omission variable has some clinical utility to "rule in" or "rule out" insufficient effort. Additional research of the CPT-II as a measure of effort among persons with TBI is encouraged.

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## Cognitive Neuroscience

**A. ALKOZEI & W.D. KILLGORE. Exposure to Blue Wavelength Light Suppresses Anterior Cingulate Cortex Activation in Response to Uncertainty During Anticipation of Negative or Positive Stimuli.**

**Objective:** Blue wavelength light has been used as an effective treatment for some types of mood disorders, including depression and seasonal affective disorder. The neurobiological mechanism behind this effect, however, remains unclear. One possible explanation for this effect may be that blue light influences functioning of the emotion-regulation neurocircuitry when processing emotional stimuli. We hypothesized that acute exposure to blue wavelength light would directly affect the functioning of the ventromedial prefrontal cortex, amygdala, insula, and anterior cingulate cortex (ACC) during an emotional anticipation task.

**Participants and Methods:** Twenty-nine healthy 18-32 year olds (15 females, mean age = 21.57) were randomized to receive an acute

thirty-minute exposure to either blue (active) ( $n=14$ ) or amber (placebo) light ( $n=15$ ), immediately followed by functional magnetic resonance imaging (fMRI). During scanning, participants completed a task that involved presentation of cues that portended an upcoming positive or negative emotional stimulus of certain or uncertain valence. Participants also reported on their depressive symptoms using the Beck Depression Inventory (BDI-II).

**Results:** In contrast to placebo light, participants in the blue light group showed significantly ( $p < .003$ ) reduced activation within the rostral and dorsal ACC during uncertain anticipation (i.e., uncertainty regarding whether a positive or negative stimulus would be shown) in comparison to certain anticipation (i.e., assured exposure to a positive stimulus). Notably, within the blue, but not the placebo group, greater depressive symptoms correlated with deactivation within the rostral ACC ( $r = -.59$ ,  $p < .02$ ).

**Conclusions:** Findings suggest that blue light exposure may lead to suppression of emotional brain responses during anticipation of uncertain outcomes. As this effect was correlated with greater depressive symptoms, these findings may point to one potential neurobiological mechanism by which light exposure improves mood.

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**A. ALKOZEI & W.D. KILLGORE. Exposure to Blue Wavelength Light is Associated with Increased Dorsolateral Prefrontal Cortex Responses During a Working Memory Task.**

**Objective:** Consistent long-term exposure to blue enriched white light has been associated with increases in self-reported alertness, concentration, work performance and decreases in fatigue and sleepiness. The aim of this study was to investigate whether a short single exposure to blue light would lead to measurable changes in functional brain responses during a working memory task.

**Participants and Methods:** Twenty-nine healthy 18-32 year olds (15 females, mean age = 21.79) were randomized to receive a 30-minute exposure to either blue (active) ( $n=14$ ) or amber (placebo) light ( $n=15$ ), immediately followed by a working memory task (N-Back task) during functional magnetic resonance imaging (fMRI).

**Results:** In contrast to placebo, participants in the blue light group showed significantly greater activation within the dorsolateral prefrontal cortex (DLPFC) with increases in working memory load (two back > zero back) ( $k = 69$ ;  $x = -48$ ,  $y = 14$ ,  $z = 22$ ;  $p = .01$ , FWR corrected at the cluster level). There was a trend that participants in the blue group had faster reaction times during conditions of high cognitive load in comparison to participants in the placebo group (MBlue = 574.09ms (203.81ms); MPlacebo = 692.89ms (222.71ms),  $p = .10$ ).

**Conclusions:** The results suggest that a short single exposure to blue light is sufficient to produce measurable changes within the DLPFC, a brain area recruited during heavy cognitive load. This may explain why previous studies have reported increases in subjective alertness and performance after long-term blue light exposure. Our results point in the direction that blue light exposure may be associated with better performance, albeit the results did not reach statistical significance. It is possible that while 30 minutes of blue light exposure is sufficient to lead to increases in activation within certain brain areas, longer exposure is necessary to produce objective behavioral changes. Replication with a larger sample size and varying durations of blue light exposure is therefore necessary.

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**N. ASSAR, A. LEESEBERG, A. WEAVER, A. SERGENT, A. BECKER, H. GAGNON & R.L. SKEEL. The Effect of Self-Criticism on Working Memory Performance Following Success and Failure.**

**Objective:** Maladaptive self-criticism (SC) refers to a form of self-concept, shaped by negative self-evaluation and self-judgment that is targeted at various aspects of the self. It has been associated with various psychopathologies and health vulnerabilities, as well as diminished goal progress. Failure has been reported to engender a sense of self-punitive worthlessness, provoking intense sensitivity and fear. Given the heightened response to failure, the objective of the present study was to examine the impact of failure and success on performance on working memory measures.

**Participants and Methods:** 218 participants with varying levels of trait SC (low, moderate, and high) were randomly assigned to either a success or a failure condition. Participants completed a baseline working memory task, followed by a success/failure manipulation on a separate task, and then completed a second working memory task.

**Results:** Results demonstrated varying feedback-dependent test-retest performance as it relates to levels of SC. While low self-critics did not differ in test-retest scores, moderate and high self-critics were impacted by success and failure. Failure resulted in a decrease of performance in moderate self-critics, while high self-critics displayed an increase in retest scores. Conversely, after success, moderate self-critics displayed an increase, while high self-critics displayed a decrease in performance at retest.

**Conclusions:** Findings shed light on how high self-critics may perceive and respond to failure versus success, which has important implications for factors that impact motivation and goal-directed behavior. Findings are discussed with respect to the effects of stress on brain networks responsible for emotion processing and reward feedback, in order to clarify the neurological basis of SC and goal-directed behavior.

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**M. AZAR, E. HUEY, K. COLLINS, B. ROHL, E. LOUIS & S. COSENTINO. Awareness of Cognitive Abilities in Individuals with Essential Tremor.**

**Objective:** There is growing recognition that individuals with Essential tremor (ET) can demonstrate cognitive impairment secondary to cerebellar dysfunction and are also at increased risk for neurodegenerative disorders. As the perception of cognitive changes can vary widely across neurologic conditions, the aim of this study was to determine the extent to which individuals with ET accurately perceive specific cognitive changes.

**Participants and Methods:** 55 non-demented individuals with ET underwent cognitive testing. Using a modified Brief Anosognosia Rating Scale, participants and informants separately rated participants' cognitive abilities in the domains of multitasking, memory, and word finding. Partial correlations adjusted for age, education, and gender were used to measure the strength of the association between ratings in these 3 domains and performance on tests of these abilities including verbal fluency switching, delayed verbal memory, and confrontation naming, respectively. Fischer's z-tests were used to detect differences in the strength of the association between performance and self vs informant ratings in each domain.

**Results:** For multitasking, self-ratings were more strongly associated with performance ( $r=.46, p<.01$ ) than informant ratings ( $r=.10, p=.49$ ),  $p=.03$ . For memory, informant ratings were more strongly associated with performance ( $r=.46, p<.01$ ) than self-ratings ( $r=.01, p=.96$ ),  $p<.01$ . Similarly, informant ratings for word finding were more strongly associated with performance ( $r=.37, p=.01$ ) than self-ratings ( $r=.02, p=.92$ ),  $p=.03$ .

**Conclusions:** Participant ratings regarding multitasking were more closely related to performance than informant ratings. The opposite pattern was observed for memory and word finding. Dissociations in self-report across cognitive domains have implications for seeking

patient versus informant report when ascertaining the presence of specific cognitive symptoms in individuals with ET.

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**K.A. CARBINE, K. SLINN, J. LECHEMINANT & M.J. LARSON. The Effects of Exercise and Time of Day on Inhibitory Control towards High- and Low- Calorie Food Cues.**

**Objective:** There is an increasing interest in the role of executive and inhibitory control functions in food intake and obesity. Decreased ability to inhibit responses to food cues may be associated with eating behaviors and body weight. We examined the influence of food calorie status (high vs low), time of day (morning vs evening), and exercise (exercise vs rest) on food-related response inhibition during high- and low-calorie Go/No-Go tasks. We hypothesized faster reaction times (RTs) and greater accuracy in the morning and exercise conditions when responding to low-calorie foods, reflecting enhanced inhibitory control.

**Participants and Methods:** RT and accuracy data were collected while 61 healthy-weight participants completed two food Go/No-Go tasks between 7-10am or 7-10pm, once after resting and once after 45 minutes of treadmill walking at 3.8mph. All participants completed tasks using high-calorie foods as No-Go stimuli and low-calorie foods as No-Go stimuli and recorded food intake on days of participation.

**Results:** In a 2-calorie (high, low) x 2-exercise (rest, exercise) x 2-time (morning, night) ANOVA, RTs were faster towards low- relative to high-calorie foods ( $p<.01$ ). A calorie by exercise interaction showed high-calorie food RTs were faster after exercise relative to rest, whereas low-calorie food RTs remained constant across conditions ( $p=.05$ ). No main effects or interactions for accuracy were significant ( $ps>.12$ ). Pearson correlations relating caloric intake to accuracy and RTs showed that when inhibiting towards high-calorie foods after resting, accuracy is negatively related to caloric intake ( $r=-.35, p=.04$ ).

**Conclusions:** Exercising may be effective in managing the increased attention individuals have towards high- relative to low-calorie foods. Inhibitory control towards high-calorie foods may affect regulating food intake after periods of inactivity. Time of day does not seem to affect food-related inhibition. Other measures of cognitive control, like EEG, should be used to examine food-related inhibition.

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**J.E. COHEN-GILBERT, M.M. SILVERI & L.D. NICKERSON. Impact of Acute Alcohol and Nicotine use on Emotional Impulsivity: Associations with Resting State Perfusion in Reward Circuitry.**

**Objective:** A high percentage of individuals co-use alcohol and nicotine, which together lead to more severe substance abuse disorders compared to use of either substance alone. However, cognitive and neural mechanisms that underlie the interactive effects of these drugs to facilitate co-use are still poorly understood. The current study examined the impact of acute alcohol and nicotine challenges on emotional impulsivity and on cerebral blood flow (CBF) in key reward-processing brain regions, acquired at rest using PCASL fMRI.

**Participants and Methods:** Seven males who were light to moderate smoker/alcohol drinkers completed both placebo nicotine patch + alcohol (PA) and 14mg nicotine patch + alcohol (NA) conditions in randomized order. Emotional impulsivity was measured via an emotional Go-NoGo task that featured negative, positive, neutral or scrambled distractor images.

**Results:** A repeated-measures ANOVA examining the impact of both drugs on NoGo trial accuracy revealed an increase in impulsivity (reduced NoGo accuracy) for positive trials, in response to alcohol, across both PA and NA conditions. No main effect of nicotine was observed. Nicotine and alcohol were found to increase CBF in the nucleus accumbens. In the NA condition relative to nicotine alone, the change

in CBF in right nucleus accumbens was significantly correlated with reaction time on Go trials.

**Conclusions:** While the small sample size of this pilot study precludes firm conclusions regarding the role of emotional impulsivity in alcohol and nicotine co-use, these findings suggest that the interplay of positive emotion, reward-related circuitry and impulsivity may have important implications for understanding how alcohol and emotion interact to increase risky behavior in young adults who co-use alcohol and nicotine.

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**V. CORBO, W.P. MILBERG, R. MCGLINCHEY & D.H. SALAT. Early Life Trauma Impacts the Association between Gray Matter Integrity and Memory in Combat-Exposed Veterans.**

**Objective:** Early Life Trauma (ELT) has been shown to impact cognition well into adulthood. However, little is known about the relationship between gray matter integrity of regions affected by ELT and cognitive performance. In the current study, we used the California Verbal Learning Test (CVLT) to examine memory in Veterans with and without a history of ELT.

**Participants and Methods:** 233 Veterans from the Translational Research Center for TBI and Stress Disorders (TRACTS) were recruited in the current study. History of ELT was based on reports of sexual abuse, physical abuse or family violence before 18 years old (ELT+ N = 79; ELT- N = 154). Posttraumatic Stress Disorder Symptoms (PTSD) were measured using the Clinician-Administered PTSD scale. Cortical thickness and subcortical volumes were measured using the tools provided by the FreeSurfer suite.

**Results:** Veterans with ELT performed worse on the standardized short delay free recall, but not long delay recall, compared with Veterans without ELT. When looking at cortical thickness, Veterans with ELT showed a positive association between thickness of the right superior temporal gyrus and total number of intrusions, while Veterans without ELT showed a negative association. A similar positive association was found in ELT between the number of intrusions and the volume of the left amygdala as well as bilateral hippocampus.

**Conclusions:** Our findings suggest that ELT may influence direction of the relationship between brain integrity and behavior that is typically observed, both at a cortical and subcortical level, in areas sensitive to the impact of stress. The decreased performance in short-delay recall further indicates that Veterans with ELT may suffer more from interference compared with Veterans without ELT.

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**G. GALINDO, M.A. FRAGA & R.I. MACHINSKAYA. Effect of Emotional Valenced Stimuli on Working Memory Performance.**

**Objective:** Working memory (WM) is the ability to keep information cognitively in course for a brief period of time, but with enough duration as to complete a task. Few is known about how the different emotional valences of the perceived information provoke effect over WM, since it is known that for WM task performance, motivated behavior receives important emotional influence. The objective of the present study was to determine the possible effects of different emotionally valenced visual stimuli (i.e., pictures of scenes or facial expressions) on decision making in a working memory task in young adults.

**Participants and Methods:** A total of 27 subjects university students, randomly selected, participated in the study. Data was acquired from 23 right handed subjects (20.22 yr mean age, SD = 1.47), 52.2% male (20.09 yr old mean age, SD = 1.7), 47.8% female (20.35 yr mean age, SD = 1.3). Instruments and procedure, influence of emotional valence in

a WM task was measured using content from the International Affective Picture System (IAPS), subjects were asked to remember the first image of the pair, compare the second image with it. Accuracy of response (AR) measured by the number of correct responses, and reaction times (RT) were obtained for each subject.

**Results:** Results show that the RT is shortest for pictures with neutral valence and longest for negative valence, MANOVA statistics showed a significant main effect of emotional valence. It was found that the AR is highest for pictures with neutral valence and lowest for negative valence.

**Conclusions:** The main finding of the present study was that emotionally charged IAPS images were processed worse than neutral pictures during the WM task. We also observed an effect of emotional valence on RT, which was longer for negative pictures than for positive pictures. Correspondence: *Gilberto Galindo, Doctor, Neuroscience and Cognition Laboratory, Autonomous University of Baja California, Carr. Estatal No 3, Mexicali 21218, Mexico. E-mail: gilberto.galindo.aldana@uabc.edu.mx*

**M. RAMÍFEZ-FLORES & M.T. GARCIA. Skills of Theory of Mind in Mexican children of 3 to 5 years old.**

**Objective:** Theory of Mind (ToM) is the ability of understanding the mental states (desires, believes and thoughts) of other people and of ourselves, and its goal is to understand and predict their behavior. The aim of this study was to explore the cognitive and emotional abilities of ToM in Mexican children of 3, 4 and 5 years old, and to analyze if these abilities were influenced by age, sex or social variables such as type of school, siblings and parents' education.

**Participants and Methods:** The study was divided in two phases. In the first phase we translated, adapted and applied the test Scales of Theory of Mind given by Wellman & Liu (2004) in a population of 20 Mexican boys and girls of 3, 4 and 5 years old. In the second phase we assessed, with the same test, 60 Mexican children of the same ages from different schools (private and public).

**Results:** Results showed significant differences in the development of the abilities of ToM across ages, specifically between 3 and 4 years old, and between 3 and 5 years old ( $X^2 = 20.18, p = .000$ ). Also we observed a positive correlation between ToM and age of the children ( $r = .589, p = .000 < 0.05$ ).

In regard of the social variables, a factorial static analysis was performed to determine which kind of social aspects affect the children's performance in this test and it was found that the children's education, their age and siblings explain the 46% of variance in the test.

**Conclusions:** In conclusion there's a relation between the age and the development of ToM, nevertheless there are social variables such as siblings and children's education that could be affecting the performance in this test. Likewise it can be observed that the development of this ability is related with other cognitive process such as memory. Also the results of this investigation are similar with others that had been made in different continents, suggesting that maybe the development of ToM could be overall.

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**C.E. HARRISON & S. ROGERS. Identifying the Specific Frontal-Executive and Processing Speed Deficits in Parkinson's Disease.**

**Objective:** Studies show that cognitive decline is a sequelae of Parkinson's disease (PD), but much of this research has focused on general cognitive domains, to the exclusion of differentiating specific cognitive abilities within these domains. In the present study, the authors examined the specific executive and processing speed abilities that are involved in PD, while controlling for overall level of cognitive impairment.

**Participants and Methods:** 214 older adults (93 women, M age = 73.61, M education = 14.84) participated in neuropsychological assessment as part of outpatient neurology evaluations. All patients were

taking carbidopa-levodopa. Measures completed included MMSE, MoCA, Trails A & B, WAIS-IV Similarities, Coding, Arithmetic, and Letter-Number Sequencing, and DKEFS Color Naming, Word Reading, and Inhibition.

**Results:** Those with PD performed worse on Trails A,  $t(193) = 2.66$ ,  $p < .01$ , WAIS-IV Coding,  $t(161) = 2.09$ ,  $p < .04$ , and Letter-Number Sequencing,  $t(120) = 3.16$ ,  $p < .01$ . ANCOVAs controlling for MMSE/MoCA scores showed worse performance on Trails A,  $F(1, 190) = 9.51$ ,  $p < .01$ , WAIS-IV Coding,  $F(1, 158) = 3.98$ ,  $p < .05$ , and Letter-Number Sequencing,  $F(1, 115) = 4.31$ ,  $p < .05$  among those with PD. There were no significant differences in WAIS-IV Arithmetic or Similarities, Trails B, or DKEFS Color Naming, Word Reading, or Inhibition.

**Conclusions:** The field of neuropsychology tends to speak of processing speed deficits and a frontal-executive syndrome accompanying PD pathology, but this seems to represent an overgeneralization of each domain. Working memory and visual processing speed in particular appear to be affected by PD pathology, but the remaining frontal-executive and processing speed abilities appear to remain preserved, even when overall level of cognitive impairment is controlled. These findings aid our understanding of the diagnosis and pathophysiology of PD, as well as provide guidance for the customization of treatment and cognitive training for those suffering from PD.

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#### **M. ISHIDA & T. ARAI. Perceptual Integration of Locally Time-reversed Speech in Japanese.**

**Objective:** This study investigates how temporally inverted phonetic information of “locally time-reversed speech” can be integrated and perceived. Listeners listened to Japanese words and non-words in which every certain length of speech (e.g., 50ms) was reversed on the horizontal time axis. Previous studies suggested that the intelligibility of locally time-reversed speech gradually deteriorates as the length of flipped segments becomes longer, but showed different deterioration curves; some studies reported 70% intelligibility while the others 0% intelligibility when every 100ms was flipped along the time axis. The current study attempts to explore the relationship between the reversal time window length and the intelligibility of locally time-reversed speech, by adopting Japanese language which has CV (consonant+vowel) as a basic linguistic unit, and by considering the ratio of stop and fricative consonants in speech which presumably have different tolerance to the local time distortion.

**Participants and Methods:** Participants were 40 Japanese native speakers. Half of them was randomly assigned to the fricative-dominant stimuli group, and the other half to the stop-dominant stimuli group. They listened to a pair of a locally time-reversed word (or non-word) spoken by a male speaker, and an unreversed word (or non-word) spoken by a female speaker in a row, and judged if the first and the second speakers spoke the same or different words. There were four different stimuli pairs: word-word (same), nonword-nonword (same), word-nonword (different), nonword-word (different).

**Results:** The results suggested that fricative-dominant words were significantly more tolerant to the local time distortion than stop-dominant words; Fricative-dominant words maintained more than 80% intelligibility with 110 ms reversal window length, while stop-dominant words showed less than 60% intelligibility.

**Conclusions:** The intelligibility of locally time-reversed words is likely to be susceptible to the ratio of fricative and stop consonants in speech.

#### **W.T. MCCUDDY, S. POTTS & A. PORCELLI. Cognitive and Cardiovascular Flexibility Relates to Stress Induced Habitual Decision-Making.**

**Objective:** The goal of the current study is to examine the extent to which individual differences in cognitive and cardiovascular flexibility protect goal-directed decision-making after exposure to acute stress.

Further, the current study aims to assess the relationship between these variables and functional neuroimaging data during a decision-making paradigm designed to assess goal-directed versus habitual behavior.

**Participants and Methods:** After completing a neuropsychological test battery, which included Trails A and B, WAIS-IV Digit Span, a computerized STROOP task, and Conner’s Continuous Performance Test (CPT), we examined whether acute stress promoted expression of simple financial preferences “overtrained” to the point of habit in the face of a changing environment ( $N = 28$ ). After exposure to either an acute stressor or control procedure participants performed the same decision making task during fMRI scanning, with an added reversal phase. Cardiac flexibility is operationally defined here by the high frequency domain (HF) of heart rate variability (HRV), which provides a measure of parasympathetic activation during the stress procedure.

**Results:** During fMRI scanning, after stimuli values were altered stressed participants made significantly more habitual decisions, although these decisions were now financially detrimental. Within the stress group ( $n = 14$ ) a negative relationship between the HF measure during the acute stress procedure and number of habitual responses after stress reached significance ( $r = -.64$ ,  $p < .05$ ). Additionally, preliminary analysis of neuropsychological measures revealed a significant correlation between raw Trails B scores and number of post-stress habitual decisions ( $r = .68$ ,  $p > .01$ ).

**Conclusions:** These results suggest that greater levels of cognitive and cardiovascular flexibility might buffer the negative effects of stress on decision-making.

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#### **L.A. OLIVERA FIGUEROA, R.P. JUSTER, J.K. MORIN MAJOR, M.F. MARIN & S.J. LUPIEN. A Time to be Stressed? Time Perspectives and Cortisol Dynamics Among Healthy Adults.**

**Objective:** This study investigated whether Time Perspective (TP) profiles like Balanced Time Perspective (BTP) and Negative Time Perspective (NTP) in healthy men and women would be divergently associated with cortisol dynamics in relation to a well-validated psychosocial stressor, known as the Trier Social Stress Test (TSST).

**Participants and Methods:** Sixty-one healthy adults (Men = 32, Women = 29) from Montreal ranging in age from 18 to 35 ( $M = 22.9$ ,  $SD = 4.1$  years) participated. TP was measured according to two profiles: maladaptive Deviation from Balanced TP (DBTP) and adaptive Deviation from Negative TP (DNTP). Eight salivary cortisol samples were analyzed using area under the curve with respect to ground (AUCg) and to increase (AUCi). Statistic analyses involved partial correlations controlling for depressive symptoms.

**Results:** Results for both sexes showed that while controlling for depressive symptoms, higher DBTP scores were associated with lower cortisol AUCg scores ( $r = -.272$ ,  $p = .035$ ) but not with cortisol AUCi scores ( $r = -.124$ ,  $p = .344$ ). In contrast to DBTP, higher DNTP scores were associated with higher cortisol AUCg scores ( $r = .258$ ,  $p = .046$ ) but not with cortisol AUCi scores ( $r = .210$ ,  $p = .108$ ), while controlling for depressive symptoms.

**Conclusions:** While results are modest, correlational, and require replication among diverse populations, our results nevertheless show for the first time that cortisol systemic output (AUCg) is negatively associated with maladaptive DBTP scores and positively associated with adaptive DNTP scores. This association is exclusive to overall HPA-axis systemic output and not to stress reactive increases or decreases (AUCi). These findings may point to pervasive psychobiological modulation that must be explored further cross-culturally, as well as in clinical research. In summary, the observed cortisol dynamics are interpreted as having been influenced by each participant’s respective TP profile.

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**D.J. PALOMBO, M.M. KEANE & M. VERFAELLIE. The Effect of Semantic Future Thinking on Temporal Discounting: A Critical Role for the Medial Temporal Lobes.**

**Objective:** The capacity to envision the future plays an important role in many aspects of cognition, including our ability to make optimal, adaptive choices. Past work has shown that medial temporal lobe (MTL) structures are implicated in decisions that draw on episodic future thinking. By contrast, little is known about the role of the MTL in decisions that draw on semantic future thinking. Accordingly, the present study investigated whether the MTL contributes to one form of decision making, namely intertemporal choice, when such decisions depend on semantic consideration of the future.

**Participants and Methods:** Patients with MTL damage and healthy controls performed an intertemporal choice task that drew on semantic future thinking, such that, prior to decision, participants were required to generate specific items that they would purchase with the future reward.

**Results:** We found that, relative to a baseline condition involving standard intertemporal choice, healthy individuals were more inclined to select a larger, later reward over a smaller, present reward after engaging in semantic future thinking. By contrast, amnesic patients with MTL damage were paradoxically less inclined to wait for a future reward following semantic future thinking.

**Conclusions:** These findings suggest that the MTL is necessary for making optimal decisions that draw on semantic future thinking, and thereby broaden the role of the MTL in aspects of decision making.

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**K. REITER & K.A. NIELSON. Cognitive reserve offsets memory decline and the influence of APOE  $\epsilon 4$ .**

**Objective:** Cognitive reserve (CR) is a theoretical construct that explores lifestyle factors that influence the trajectory of cognitive changes with age and the maintenance of independent daily functioning. Most studies assess CR as “achievement”, via a composite score of education, occupation, and verbal IQ, while some also include lifestyle choices such as activities. The current study seeks to determine how CR, measured with both achievement and late life activities, influences cognitive functioning in healthy, cognitively intact older adults who vary by their genetic risk for Alzheimer’s disease by the apolipoprotein-E  $\epsilon 4$  allele.

**Participants and Methods:** Thirty-seven adults (age 51 to 84) completed neuropsychological assessment and genetic testing. A CR composite score was computed via principal components analysis (PCA) of education, occupation, estimated IQ, and current lifestyle activities. PCA was also conducted on neuropsychological measures to examine common constructs. Two (High/Low CR)  $\times$  2 ( $\epsilon 4$  + /-) ANCOVA was conducted for each cognitive factor, regressing for age.

**Results:** PCA revealed 5 cognitive components: word list memory, fluency, processing speed, narrative memory, and digit span. High CR led to better narrative memory ( $p = .05$ ). CR also interacted with  $\epsilon 4$  to produce better fluency ( $p < .05$ ) and digit span ( $p < .05$ ) in  $\epsilon 4$  carriers vs. non-carriers.

**Conclusions:** Cognition was differentially influenced by CR and  $\epsilon 4$  inheritance. CR significantly benefitted memory for contextualized material such as stories, articles, books, etc., which has relevance for everyday functioning. Moreover, CR particularly benefitted those most at risk for AD in the domains of verbal fluency and working memory, both of which rely heavily on attentional capacity. Thus CR may help to offset the trajectory of cognitive decline with advancing age in memory and attention, and this offset may be particularly notable in those at genetic risk for AD.

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**D. SMITH, C.L. ARMSTRONG, M.T. LONG, C. MURPHY, S. KNIGHT & M.J. FISHER. Development of Cognitive Tests of Cerebellar Function.**

**Objective:** The cerebellum has a long and steep developmental trajectory, potent neural stem cells, and rapid learning capacity, and it is relevant to the cognitive outcomes of many neurological disorders. Its role in human non-motor cognition is recognized, but more empirical support and understanding is needed. As the single most common site of pediatric brain tumors, more precise cognitive markers of cerebellar function are needed. We present early findings on tests of implicit cognitive function that are available by open-source.

**Participants and Methods:** Children (N=12, age 10.6y) with left, right, or mid/bilateral cerebellar tumors, and healthy controls (N=11, age=9.5y) yielded valid results on tests with empirical evidence from normal, clinical, and functional imaging studies. Tests of implicit cognition were: (1)Serial Position, (2)Timing Functions, (3)Audio-Visual Attention Shift, (4)Balls-in-a-Bottle. A test of explicit cognition was (5) Phonological Working Memory.

**Results:** The hypothesized cerebellar-specific cognitive functions were partially supported. (1)Patients’ learning effect was reduced on Serial Position ( $p < 0.005$ ). (2)Patients were less accurate than controls in their perception of longer tonal time intervals on the Timing Function test ( $p < 0.05$ ). (3)Patients were less accurate in responding to the target at shorter and longer intervals between cue and target when shifting attention from auditory to visual attention ( $p < 0.02$  to  $p < 0.0002$ ). With increasingly longer time elapsed, patients were less accurate and slower than controls ( $p < 0.0001$ ). (4)There were no differences in estimating vs. counting Balls-in-a-Bottle. (5)Patients’ accuracy in recalling words of increasing phonological length was not significantly inferior to controls, though means were lower at all lengths.

**Conclusions:** These preliminary results from our study of cognitive processes that activated the cerebellum in prior reports, suggest that cerebellar-specific cognitive tests have potential for clinical application with further validation.

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**R. SMITH, A. ALKOZEI, J. BAO & W.D. KILLGORE. Successful Goal-Directed Memory Suppression is Associated with Increased Inter-Hemispheric Coordination Between Right and Left Frontoparietal Control Networks.**

**Objective:** The neural basis of voluntarily suppressing conscious access to one’s own memories has recently received considerable attention, with several studies finding evidence that this process engages frontal and parietal cognitive control regions. However, researchers to date have not yet examined the way right and left hemisphere cognitive control networks coordinate with one another during memory suppression.

**Participants and Methods:** Forty-eight participants (25 female; 18-45 years of age) completed a Think/No Think task for memories of emotionally unpleasant visual scenes while undergoing functional magnetic resonance imaging (fMRI). We used psychophysiological interaction (PPI) analyses to examine functional connectivity between right and left hemisphere frontal-parietal control regions during memory suppression.

**Results:** Right frontal-parietal regions were activated to a greater degree by the “No Think” (NT) than “Think” (T) condition, whereas left frontal-parietal regions were activated by the reverse contrast. Participants who were better at memory suppression, as assessed by greater numbers of forgotten memories in the NT than T conditions, also had greater functional connectivity between multiple right and left hemisphere control regions. This was true of connectivity between right (Peak Voxel = 64, -34, 38) and left inferior parietal cortex (Peak Voxel = -24, -68, 46;  $T = 4.47$ ) and between right (Peak Voxel = 6, -58, 54) and left precuneus (Peak Voxel = -18, -66, 58;  $T = 5.00$ ). We also observed this pattern of connectivity between right dorsolateral prefrontal cortex (DLPFC; Peak Voxel = 30, 34, 28) and primary visual cortex bilaterally (Peak Voxel = 14, -78, -4;  $T = 4.76$ ).

**Conclusions:** This suggests that individual differences in memory suppression ability may be partially explained by underlying differences in task-specific inter-hemispheric coordination. It also suggests that right DLPFC may be more successful at suppressing visual imagery in those who are better at suppression.

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**J. SNEIDER, M.M. SILVERI & L.D. NICKERSON. Acute Alcohol and Nicotine Effects on Hippocampal-based Memory Performance and Resting State Quantitative Perfusion.**

**Objective:** A high percentage of individuals co-use alcohol and nicotine, which together lead to more severe substance abuse disorders compared to use of either substance alone. Despite established findings of alcohol-related memory alterations in animal and human studies, little is known regarding the underlying neurobiological mechanisms of co-administration. This study examined memory performance on a virtual water maze task (vWMT) and cerebral blood flow (CBF) acquired at rest using PCASL fMRI following nicotine and alcohol challenges.

**Participants and Methods:** Six males who were light/moderate smoker/alcohol drinkers were randomized into placebo nicotine patch + alcohol (PA) and 14mg nicotine patch + alcohol (NA) conditions. Offline vWMT performance and CBF data were acquired prior to (baseline) and following an oral acute alcohol challenge during scanning.

**Results:** Breath alcohol levels (BrAL) achieved prior to vWMT testing were  $0.077 \pm 0.026$  (PA) and  $0.075 \pm 0.016$  (NA). Relative to the baseline, in the PA condition, significantly worse memory retention (-11%) was observed, which correlated with higher BrALs. Significantly lower resting state hippocampal CBF also was observed in the PA condition (-15%) relative to the baseline. No significant memory or CBF decrements were observed in the NA condition.

**Conclusions:** Impaired memory retention associated with acute alcohol exposure is consistent with previous animal studies. Further, alcohol-related memory impairment was not observed when alcohol and nicotine were co-administered, suggesting that nicotine may mask some of alcohol's impairing effects, as well as minimize effects on resting state CBF. Such masking may enhance co-use of these substances, which during acute exposure may be advantageous, but under chronic co-use conditions may have more significant consequences, such as greater severity of substance abuse disorders and higher rates of relapse.

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**M. THAI, H. OKABE, J. DEGUTIS, S. LAGANIERE, M.A. HALKO & M. ESTERMAN. Intermittent Theta Burst Stimulation of the Dorsal Attention Network Cerebellar Node Improves Selective and Sustained Attention.**

**Objective:** Attention is one of the most commonly impaired domains in neuropsychological populations. The core cortical network supporting selective and sustained attention is the dorsal attention network (DAN). Although transcranial magnetic stimulation (TMS) of select cortical nodes of the DAN can impact attention, little is known about how whole-network modulation of the DAN impacts attention. Previous work has demonstrated TMS of the cerebellum can be used to upregulate whole-network DAN functional connectivity. Using this cerebellar network TMS approach, we hypothesized that increasing functional connectivity within the DAN would improve selective and sustained attention.

**Participants and Methods:** We administered intermittent theta burst TMS (iTBS, a 2 s train of TBS [3 pulses at 50Hz, repeated at 200ms intervals] is repeated every 10 s for a total of 190 s [600 pulses]) to the midline cerebellar node of the DAN and, as a control, the right cerebellar

node of the default mode network (DMN) to 10 young, healthy adults at 80% of motor threshold. These targets were localized using individual resting-state MRI scans. Participants completed the attentional blink, a measure of selective attention, and the gradual onset continuous performance task (gradCPT), go/no-go sustained attention task, immediately before and after stimulation, in two sessions (DAN and DMN) separated by 1-2 weeks.

**Results:** Stimulation to the DAN improved selective attention, increasing accuracy on the attentional blink on average by 10% ( $p < .01$ ), and trended toward improving sustained attention, decreasing commission errors for the gradCPT ( $p < .08$ ). In contrast, stimulation to the DMN did not affect performance on either task.

**Conclusions:** These results suggest that temporarily increasing functional connectivity in the DAN via cerebellar stimulation can enhance selective and sustained attention. This has important implications for the future use of iTBS to ameliorate attention deficits in neuropsychological populations.

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**A.A. WANK, M.M. KEANE & M. VERFAELLIE. Future Thinking About Self Versus Other in Patients With Medial Temporal Lobe Amnesia.**

**Objective:** Research over the last decade has provided compelling evidence that a network of midline regions play a critical role in imagining events in the future (episodic future thinking). However, the specific contribution of each region to aspects of episodic future thinking remains less clear. One such region, the medial temporal lobe (MTL), is critical for generating and/or recombining details in the service of future simulations. Another midline region, ventromedial prefrontal cortex (vmPFC), is thought to mediate representations of pre-existing knowledge, including knowledge related to the self. Previous work has demonstrated that in patients with amnesia, memory is enhanced when it can be supported by pre-existing knowledge (Kan et al., 2008). Here we examined whether pre-existing knowledge can also benefit future thinking in patients with MTL lesions by comparing generation of future events under conditions that differ in the extent to which they draw on self-knowledge.

**Participants and Methods:** Nine patients with lesions to the MTL and 18 aged- and education-matched healthy control participants imagined future events either from the perspective of the self (e.g., imagining yourself going to a national park) or that of others (e.g., imagining your doctor going apple picking). Participants' descriptions of future events were scored for number of episodic details.

**Results:** MTL patients showed an intact benefit associated with description of future events from a self-perspective, despite showing an overall reduction in the generation of episodic details. This effect remained when co-varying for familiarity in the 'other' condition.

**Conclusions:** These results suggest that integration of self-related knowledge in future simulations does not depend on the MTL. These findings extend previous research by demonstrating that patients with MTL lesions can benefit from pre-existing knowledge to support not only memory but also future thinking.

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**E. WATSON, A.J. STEPHENSON & E. EVERHART. Neurophysiological Behavioral Inhibition (BIS) and Behavioral Activation (BAS) Systems Are Related to Sleep Quality.**

**Objective:** An estimated 50-70 million U.S. adults live with a sleep-wake disorder, resulting in impaired daily functioning, increased healthcare costs, and morbidity. The Reinforcement Sensitivity Theory (RST) has previously been utilized to examine the individual differences

associated with sleep-related disorders. RST is comprised of distinct neurophysiological systems that relate to approach and withdrawal behaviors, including the Behavioral Activation System (BAS), and the Behavioral Inhibition System (BIS). BAS is associated with left frontal alpha activity (measured through EEG) and approach behavior, while BIS is associated with right frontal activity and withdrawal behavior. Previous research has suggested that elevated BIS levels are associated with emotional dysregulation and poor sleep quality.

**Participants and Methods:** Taking the next step in this study, the relationships between BIS, BAS, frontal EEG asymmetry, and self-reported sleep quality using the Pittsburgh Sleep Quality Index (PSQI) were examined in 75 university students. It was hypothesized that BIS would be positively associated with the PSQI, while the opposite relationship would be observed for BAS. It was also predicted that greater right than left baseline resting frontal asymmetry scores would be significantly related to poorer sleep quality.

**Results:** While associations were observed, they were opposite as hypothesized. BIS was weakly associated with the PSQI,  $r(75) = -.246$ ,  $p < .05$ , while no association was observed for BAS. Further, greater left activity was associated with the PSQI for FP1,  $r(52) = .408$ ,  $p < .01$ , F7,  $r(53) = .477$ ,  $p < .01$ , FT7,  $r(52) = .362$ ,  $p < .01$ , and FC3,  $r(50) = .328$ ,  $p < .05$  when compared to homologous right hemisphere scalp sites.

**Conclusions:** These results, however, do indicate that sleep quality is associated with self-reported behavioral inhibition and frontal EEG asymmetry. Implications for these findings are discussed.

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#### H. WEISS & K. LOW. Exploring the Relationships of Dissociative Experiences, Sleep and Cognition in Undergraduates.

**Objective:** Because previous studies have found both positive and negative relationships between dissociation and cognition in healthy individuals, this study aimed to clarify the relationship between dissociation as assessed by the DES and various aspects of attention, including working memory, selective, divided and sustained attention. Based on the mixed literature and recent findings connecting dissociative experiences to abnormal sleep as measured by the Iowa Sleep Experiences Scale, we hypothesized that sleep experiences might have a non-linear association with dissociation and with certain neurocognitive dimensions while controlling for mood.

**Participants and Methods:** 76 undergraduates completed a battery of questionnaires measuring dissociative experiences, sleep, and mood as well as neurocognitive tasks measuring working memory, selective, divided and sustained attention.

**Results:** Correlational analyses revealed negative relationships between the more pathological subscales, amnesia and derealization, of the Dissociative Experiences Scale and divided and selective attention. Dissociation and abnormal sleep experiences were positively related, but this relationship was non-significant when controlling for mood.

**Conclusions:** The more pathological dissociative experiences had unique relationships with cognition, which could indicate that they represent phenomena distinct from the more common absorption dimension of dissociation. The negative relationship between dissociation and selective and divided attention suggests that dissociative experiences may be due to a decreased ability to process multiple stimuli simultaneously. Last, because controlling for mood eliminated the relationship between dissociation and sleep, it is crucial that the growing body of research built upon sleep-related hypotheses consider the role of mood in these relationships.

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#### Acquired Brain Injury (TBI/ Cerebrovascular Injury & Disease - Adult)

##### P.T. KEENAN, M. EDMUNDSON & G.J. LAMBERTY. Neurobehavioral Symptom Inventory (NSI) Cognitive Items Do Not Predict Cognitive Dysfunction.

**Objective:** The Neurobehavioral Symptom Inventory (NSI), a self-report measure of postconcussive symptoms, is part of the VA's Comprehensive Traumatic Brain Injury Evaluation (CTBIE). Recent work by French et al. (2014) concluded that NSI items intended to assess cognitive dysfunction (inattention, forgetfulness, slowed thinking/disorganization) do not reliably predict impairment on objective neuropsychological measures. Rather, NSI cognitive item endorsement was better accounted for by psychiatric distress as measured by the Personality Assessment Inventory. The current study aimed to: (1) determine if similar findings would be observed on additional neuropsychological measures and the MMPI-2-RF and (2) delineate between veterans performing below, at, and above expectation on objective testing.

**Participants and Methods:** The sample included veterans who completed a valid MMPI-2-RF and a neuropsychological evaluation within one year of NSI/CTBIE administration. Cognitive functioning was examined using mean *t*-scores of relevant neuropsychological measures.

**Results:** Correlations between NSI cognitive items and relevant neuropsychological measures were generally small (inattention: 0.07-0.17; forgetfulness: 0.03-0.18) with the exception of slowed thinking/disorganization which evidenced larger correlations with Stroop subtests (0.25-0.43) and Trails B (0.28). NSI cognitive items were generally more highly correlated with MMPI-2-RF scales measuring internalizing dysfunction, somatic/cognitive concerns, and perceived helplessness (attention: 0.28-0.42; forgetfulness: 0.21-0.34; slowed thinking/disorganization: 0.18-0.42). With regard to NSI cognitive items' predictive utility, only 4-12% of veterans reporting significant cognitive dysfunction exhibited low scores on objective testing while the majority exhibited intact (70-85%) or above average (10-26%) performances.

**Conclusions:** The current results are consistent with previous findings and suggest NSI cognitive items are poor predictors of cognitive dysfunction.

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##### J.L. PRILUCK, X. BONILLA, C. EVANS & R. MOSS. Prolonged Neuropsychological Deficit Following mTBI.

**Objective:** Investigators have enthusiastically argued about the reasonability of attributing prolonged mTBI symptoms to a recently incurred mTBI. This study aimed to highlight quantifiable, clinical characteristics of mTBI that did not remit after the typical three-months post-injury recovery window.

**Participants and Methods:** This study presented Ms. S, a 40 year-old Hispanic female, and Mr. V, a 26 year-old middle-eastern man, with prolonged post-concussive complaints which continued at both four-months and 16-months post-injury. Data were obtained through clinical interviews, behavioral observations, neuropsychological measures, neuroimaging, and electroencephalogram. Symptom validity testing was done, including free standing and embedded measures.

**Results:** Data indicated severe memory and attention deficits consistent with the minority of patients whose post-concussive symptoms persist beyond three-months. Notably, patients' histories included previous head injury, and Ms. S had received documented accommodations throughout her schooling due to the severe, childhood TBI.

**Conclusions:** These case studies offer both a verifiable, quantitative glimpse at some of the minority of patients presenting with prolonged mTBI symptoms, as well as suggest a reasonable explanation for their prolonged deficits. It is therefore concluded that these case studies suggest a subset of mTBI patients whose symptoms persist due to the accumulated effects of previous TBI. These case studies will hopefully provide impetus for larger-scale neuropsychological studies of patients

with prolonged mTBI symptoms. This research may provide additional, quantifiable data that may be systematically reviewed. In turn, this will aid methodically categorizing patients with prolonged mTBI complaints by group, prognosis, and treatment recommendations.

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**M. TROYANSKAYA, N.J. PASTOREK, N.J. PETERSEN, G.S. VOGT, A. WALDER, H. HENSON, H.S. LEVIN, E.A. WILDE & R.S. SCHEIBEL. Deployment-Related and Demographic Characteristics as Predictors of Community Integration Following Combat Deployment.**

**Objective:** Problems with social functioning, family relationships, and initiation are highly prevalent among individuals who were deployed to Iraq and Afghanistan. This study investigates the influence of demographic and deployment-related characteristics on community integration and participation in recently deployed veterans.

**Participants and Methods:** Participants included 141 recently deployed veterans (Age (years): mean= 33.9, SD= 6.8; Education (years): mean= 14.3, SD= 1.8, Time since deployment (years): mean= 5.1, SD= 2.4) with a history of at least one traumatic brain injury during deployment. The Participation Index of Mayo-Portland Adaptability Inventory-4 (M2PI) and the Community Integration Questionnaire (CIQ) were used to assess current level of community functioning and participation. The Combat Exposure Scale (CES) was used to assess war zone stressors. Basic demographics and deployment-related information were also collected.

**Results:** A multivariable ordinary linear regression revealed a significant effect of the CES total score ( $p= 0.04$ ) and age ( $p= 0.002$ ) on CIQ total score and CES total score ( $p= 0.03$ ) and time since deployment ( $p= 0.002$ ) on M2PI. More severe combat exposure negatively affected integration and independence and resulted in greater functional impairment. Younger individuals and those with longer post-deployment interval reported better community integration and functioning.

**Conclusions:** Deployment-related characteristics and demographic features are important predictors of social and family functioning, initiation, and other aspects of community integration following combat deployment.

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**Invited Symposium 1. The Contributions of Neuroimaging to Understanding Autism**

**Chair: Deborah Fein**

**Discussant: Deborah Fein**

**12:45–2:15 p.m.**

**D. FEIN, R. SCHULTZ, A. DIMARTINO, V. MENON, I. EIGSTI & D. FEIN. The Contributions of Neuroimaging to Understanding Autism.**

**Symposium Description:** Dr. Schultz is a member of the Infant Brain Imaging Study group, and will present up-to-date results from infant brain imaging. Such structural imaging data from a period of development when symptoms are not yet apparent or are not yet fully developed can shed crucial light on the causes of deviations from typical social and cognitive development. Dr. Di Martino will present functional brain imaging results from prekindergarten age children, imaged during sleep. These data shed light on the organization of functional networks in early childhood and their relationships with symptomatology. Dr. Menon will

present results on whole brain intrinsic functional connectivity in ASD in later childhood; results suggest that hyperconnectivity within the several large-scale networks, and especially the salience network, can correctly classify autism cases. This network participates in attention allocation to salient stimuli and may contribute to diminished interest in social interaction. Dr. Eigsti will present data on activation of different brain areas during language processing in adolescents with high-functioning autism and those who have moved off the autism spectrum, to explore the mechanisms of this ‘optimal outcome’. Dr. Fein will present a brief discussion, considering the developmental implications of the 4 papers from infancy through adolescence, and consider ways to characterize the phenotype that may be crucial for integrating findings from disparate samples.

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**R. SCHULTZ. MRI Findings from the Collaborative Infant Brain Imaging Study (IBIS).**

The Infant Brain Imaging Study (IBIS) is a multisite prospective longitudinal study of babies and toddlers at risk for autism spectrum disorder (ASD) by virtue of having an older sibling with ASD. This talk will focus on results from the first data collection period ( $n \sim 400$  high risk ASD and  $\sim 150$  low risk), when data were collected at age 6, 12 and 24 months, with diagnostic grouping tied to the 24 month outcomes. At each time point parents completed questionnaires and interviews, and infants underwent cognitive, diagnostic and MRI assessments, including structural MRI for neuroanatomical comparisons and diffusion MRI for interferences about white matter connectivity and gray matter microstructure. Results suggest that the recurrence risk for autism is  $\sim 20\%$ . Significant cognitive and clinical symptoms of ASD emerge by 12 months of age. Gross motor differences emerged at 6 months. Key white matter fiber bundles showed less steep growth trajectories between 6 and 24 months. ‘Sticky’ visual attention was observed at 7 months, and gaze shift latencies correlated with white matter fractional anisotropy of select tracts. The corpus callosum (CC) was enlarged starting at 6 months (especially anterior portions), and CC size correlated positively with repetitive behaviors at age 24 months. Radial diffusivity inversely predicted CC thickness, suggesting myelination and axon composition differences. At 24 months, those with ASD showed significantly decreased local and global network connectivity ‘efficiency’. Overall brain size began to deviate in those with ASD at 6 months, with significantly larger brain size and cortical surface area by 24 months. Gray matter microstructure showed differences (suggestive of delayed dendritic development) at 12 and 24 months in sensory motor cortices, and cortices that have functional roles in in older children and adults in perspective taking and affective processes.

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**A. DIMARTINO. An Emerging Paradigm for Examination of Autism in Early Brain Development.**

Functional magnetic resonance (fMRI) imaging is a powerful means to non-invasively map neuronal circuits underlying cognitive and emotional processes. Yet, despite its promise to accelerate our understanding, diagnosis and treatment of mental illnesses such as autism, progress has been slow. To accelerate the fMRI translational potential in autism, we shifted focus into younger individuals, whole brain measures, and their relation with early index of outcomes. Specifically, we used resting-state fMRI (R-fMRI) in natural sleep in 32 preschoolers with autism (M age=57 $\pm$ 10 months, 28 males). We profiled the intrinsic brain functional organization using data driven R-fMRI measures amenable to full-brain examination without a priori hypotheses. These included regional homogeneity (ReHo) and Voxel Mirrored Homotopic Connectivity (VMHC) - which index local and interhemispheric connectivity, respectively - amplitude of low frequency fluctuations (fALFF), and degree centrality (DC) - a graph theory network measure used to



characterize information flow throughout the entire connectome. As a first step, we examined the relationship between each of these measures and verbal proficiency measured by the expressive language scale of the Vineland Adaptive Behavioral Scale-second edition (VABS-II). Each R-fMRI measure captured specific aspects of the brain-language relationship in preschoolers with ASD. For example, homotopic connectivity of associative occipital cortex was positively related to the verbal proficiency skills, while local connectivity of medial and lateral prefrontal cortex was negatively correlated to VABS-II scores. Finally, analyses also revealed a negative relationship between verbal proficiency and interhemispheric homotopic connectivity for sensorimotor cortex. While highlighting the role of thalamic-visual and sensorimotor networks for verbal proficiency in ASD, our approach shows the potential for natural sleep fMRI to identify neuronal signatures of autism that can eventually serve as predictive markers of later outcome.

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### **V. MENON. Functional and Structural Brain Organization in Autism: Linking Physiology and Behavior.**

An understanding of how the brain produces cognition ultimately depends on knowledge of its large-scale organization and wiring. The human brain undergoes protracted structural and functional changes during which it constructs dedicated large-scale brain networks comprised of discrete, interconnected, brain regions. Aberrations in brain connectivity have been widely reported in autism, but their relation to its three core symptoms – social communication, language and repetitive-restricted behaviors are unknown. In this talk I will describe recent progress in our understanding of large-scale brain networks in autism and demonstrate that its three core deficits can be linked to distinct features of atypical brain connectivity in affected individuals. I will also describe progress in development of connectivity based biomarkers of the disorder and predictors of symptom severity. Although under-connectivity has been posited to be a hallmark of atypical brain organization in autism, emerging findings in children with autism are painting a decidedly more complex picture, one that has thrown into sharp relief the challenges facing our understanding of brain connectivity over the lifespan in autism. At the same time, they open new possibilities for a deeper understanding of the neurobiological origins of the disorder. In this vein, I will describe findings from a computational “virtual brain” model which demonstrates that regional imbalance in excitation and inhibition (E/I imbalance) in a few key hubs can lead to altered global brain connectivity similar to those observed in individuals with autism. Our model provides novel mechanistic insights into the neurophysiology of the disorder. Implications of our findings for early detection and treatment of autism will be discussed.

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### **I. EIGSTI, B. CASTELLUCCIO, M. STEVENS & D. FEIN. Functional Brain Activation During Language Comprehension in Youth with Verbal Autism Spectrum Disorder (ASD), Typical Development, and Optimal Outcomes from ASD.**

Research has followed a group of youth with a history of autism spectrum disorder (ASD), who no longer have symptoms of the disorder and who have typical language, social, cognitive and adaptive skills (dubbed an “optimal outcome,” OO). Studies of head circumference in OO suggest enlarged brain volumes between ages one-two years, suggesting early brain differences in OO, consistent with an ASD diagnosis at that time. In this talk, we describe functional and structural brain differences in youth with OO, highlighting mechanisms of plasticity that may underlie their developmental behavioral trajectories. We present results from an fMRI study of youth with OO (n=16), ASD (n=23) and TD (n=20), as they performed a sentence comprehension task. Results across groups showed activations for sensory-motor regions; in anterior and posterior language areas; and in visual areas. There was also deactivation in the

medial default network. Group differences suggested no evidence of full “normalization” in the OO group (exemplified by OO, TD  $\pi$  ASD); there were several regions where both OO and ASD groups had significantly greater activations than the TD group, but did not differ from each other. The predominant pattern suggested neural compensation, such that the OO group showed heightened activation relative to both ASD and TD groups. We also report diffusion tensor imaging (DTI) results, which describe fractional anisotropy (FA), radial diffusivity (RD), and axial diffusivity (AD) of white matter tracts, which were broadly consistent with the fMRI data in showing that the OO group differed from ASD and TD groups in most tracts where there were group differences. We suggest that these neural patterns are markers of functional plasticity, potentially suggesting an extended period of neural reorganization. A critical question is that of causality: does behavioral change reflect the results of neural plasticity, or was the plasticity causally implicated in behavioral progress? We discuss with reference to the infant stroke, dyslexia, and cognitive aging literatures.

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## **Symposium 3. Neuropsychology’s Role in Preventing, Understanding, and Treating Alcohol and Marijuana Use in Adolescents and Young Adults**

**Chair: Lindsay M. Squeglia**

**Discussant: Staci A. Gruber**

**12:45–2:15 p.m.**

**L.M. SQUEGLIA, J. JACOBUS, L.M. SQUEGLIA, J. JACOBUS, L.C. BIDWELL, J. SCHACHT & S.A. GRUBER. Neuropsychology’s Role in Preventing, Understanding, and Treating Alcohol and Marijuana Use in Adolescents and Young Adults.**

**Symposium Description:** This symposium focuses on the role of neuropsychological functioning in emergent substance use disorders (SUDs), particularly in regards to the two most commonly used substances: alcohol and marijuana. The four presentations will progress along a developmental continuum from early adolescence (Presentations 1 & 2) to young adulthood (3 & 4) and will address the role of neuropsychology in preventing, understanding, and treating this important public health issue:

- (1) Dr. Squeglia will describe how neuropsychological test data, in combination with an innovative machine learning technique, can be used to predict which youth will initiate heavy drinking during adolescence. The ability to identify an at-risk child before heavy alcohol use is initiated could have significant public health implications.
- (2) Dr. Jacobus will discuss how neuropsychological functioning and brain development are affected after adolescents initiate heavy alcohol and marijuana use. Given the increasing prevalence of marijuana use and changing legal policies, understanding the long-term neuropsychological and behavioral effects of marijuana use is an increasingly important topic.
- (3) Dr. Bidwell will examine the role of risky decision making in SUDs, comparing risk-taking in emerging adults to older adults. These findings suggest risk-taking is more salient in emerging adults, suggesting more targeted assessment and treatment are essential during early adulthood.
- (4) Dr. Schacht will conclude by examining the interplay between neuropsychological functioning, genetics, and alcohol treatment. His findings suggest that genetic variation moderates medication effects on response inhibition, suggesting that individualized alcohol treatment that selectively targets neuropsychological functioning could hold promise.

Dr. Gruber, the discussant, will integrate the presentations and discuss the public health implications of these findings and the role of neuropsychology in helping prevent and treat SUDs.

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**L.M. SQUEGLIA, T.M. BALL, J. JACOBUS, T. BRUMBACK, B.S. MCKENNA, T.T. NGUYEN-LOUIE, S. SORG, M.P. PAULUS & S. TAPERT. Neurocognitive Predictors of Initiating Heavy Alcohol Use during Adolescence.**

**Background:** Underage drinking is a major public health and social problem for adolescents in the US. Being able to identify an at-risk child before they initiate heavy alcohol use could have immense clinical and public health implications; however, few investigations have explored individual-level precursors contributing to adolescent substance use. This investigation combined machine learning with neuropsychological (NP) data to determine whether we can predict heavy alcohol use initiation by age 18 in a group of substance-naïve adolescents.

**Methods:** Participants (N=137) were healthy alcohol-naïve adolescents (ages 12-14) who underwent NP testing and structural and functional magnetic resonance imaging (sMRI and fMRI) and were followed annually. By age 18, 71 youth (52%) initiated heavy alcohol use and 67 remained non-users. Random forest classification, a machine learning tool, generated individual-subject alcohol use outcome predictions for 41 demographic, 26 NP, 68 sMRI, and 68 fMRI variables.

**Results:** The final random forest model was 75% accurate, with good sensitivity (73%) and specificity (76%), and included 34 predictors contributing to heavy alcohol use by age 18, including demographic factors (e.g., being male, higher SES, early dating), worse NP performances (e.g., Digit Vigilance Test, Block Design, and Matrix Reasoning), thinner cortices, and less brain activation in diffusely distributed brain regions. Including the sMRI and fMRI variables increased the predictive accuracy of the model from 65 to 75%.

**Discussion:** Together, random forest models and neuropsychological data can provide individual-subject predictions of adolescent substance use with a reasonably high level of accuracy. Moreover, this study helps clarify the effects of a range of neurocognitive factors on initiating alcohol use during adolescence and suggests a mix of demographic, NP, and neuroimaging indices could be integral in identifying youth at risk for underage drinking.

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**J. JACOBUS, L.M. SQUEGLIA, N. CASTRO & S. TAPERT. The Adolescent Brain Pre- and Post Alcohol and Marijuana Initiation.**

**Background:** Marijuana use has become increasingly prevalent over the past decade and changing legal policies have aroused public concern about the potential for use to increase further among youth. The need to understand its long-term effects on developing adolescent neuropsychological (NP) functioning has become increasingly important.

**Methods:** Participants (N=46) are healthy adolescents (ages 13-14) assessed prior to the onset of any substance use and again approximately 5 years later. Half initiated alcohol use and half initiated alcohol and heavy marijuana use (i.e., minimum of 50 lifetime marijuana uses). Groups were demographically matched and given the same NP, structural magnetic resonance imaging, and psychopathology measures at the same ages.

**Results:** Increasing cognitive performance over time was observed for both groups, however marijuana initiators did not show improved performance on some measures of processing speed post-baseline ( $p < .05$ ). Adolescents who initiated alcohol and marijuana use post-baseline showed significantly increasing externalizing symptomatology that was not present at baseline ( $p < .05$ ), and increased thickness estimates in frontal brain regions by follow-up ( $p < .05$ ) compared to those who initiated alcohol only by late adolescence/early adulthood.

**Discussion:** Based on this finding and prior studies from our laboratory, it is hypothesized that ongoing analyses with larger sample sizes will continue to show worse NP functioning and increased cortical thickness

in youth who initiated alcohol and marijuana use compared to alcohol only by early adulthood. Heavy marijuana and alcohol use into young adulthood may be associated with altered neural tissue development that can have neurobehavioral consequences. Investigation pre- and post-initiation of substance use will help us understand neural changes that may be the result of problematic use versus pre-existing differences that are also likely to play a role in neural outcomes.

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**L.C. BIDWELL, S. YORKWILLIAMS, S.L. HAGGERTY, E. CLAUS & K. HUTCHISON. Neuropsychological Correlates of Risk-taking and Substance Use in Emerging Adults.**

**Introduction:** Emerging adulthood (ages 18-25) receives increasing attention as a distinct developmental stage. Heavy alcohol use is associated with neuropsychological functioning such as risky decision-making; we compare this in emerging adults (EA) and control adults (CA) using an fMRI task.

**Methods:** 159 (64 F) EA reporting a wide range of alcohol, cigarette, and cannabis use were included and compared to 101 (44 F) control adults (CA) aged 26-31, matched to EA on gender and substance use. Scan acquisition and preprocessing followed standard procedures.

**Balloon Analogue Risk Task:** Subjects may “pump” a simulated balloon, with each inflation earning money, or cash-out before the balloon bursts and winnings are lost. Subjects also pump “no-risk” control balloons that never burst.

**Behavioral results:** Groups did not differ on the number of no-risk balloon pumps, but CA averaged fewer risk balloon pumps than EA ( $t = -2.50$ ;  $p = .01$ ). Heavy drinking did not predict risk behavior (mean risk – no-risk balloon pumps) in either group, even after controlling for cannabis/cigarette use.

**fMRI results:** When analyzing EA and CA separately during risk-taking, and controlling for cannabis/cigarette use, heavy drinking was associated with increased striatal activation in EA, but not CA. When comparing EA and CA risk-related differences directly, CA showed greater activation than EA in several regions, including the superior frontal gyrus. **Discussion:** After matching on gender and substance use, CA took fewer risks and showed greater prefrontal activation than EA during risk-taking. Heavy drinking was positively correlated with risk-related striatal activation in EA but not CA. This suggests that compared to typical adults, EA recruit less executive control during risk-taking, and that their striatal response to risk-taking is more strongly related to drinking behavior, which implicates targeted neuropsychological assessment and treatment for younger adults with substance use disorders.

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**J. SCHACHT, K.E. VORONIN & R.F. ANTON. Dopaminergic Genetic Effects on the Neural Correlates of Response Inhibition Among Young Adults with Alcohol Use Disorder.**

Impairments in neuropsychological function have been reported among individuals with Alcohol Use Disorder (AUD), particularly for tasks that require inhibition of prepotent responses, and impaired function impedes successful AUD treatment. Dopamine (DA) signaling in the prefrontal cortex (PFC) is one of several neurochemical influences on neuropsychological function, and both low and high DA tone are associated with poor function. In the PFC, DA is primarily inactivated by the enzyme catechol-O-methyltransferase (COMT). The val158met single nucleotide polymorphism in the COMT gene is associated with differential COMT function, such that val-allele homozygotes, relative to heterozygotes, display increased enzymatic activity and lower PFC DA, while met-allele homozygotes display the opposite phenotype. This study examined the effects of val158met genotype on brain activation associated with response inhibition among 35 young adults with AUD. Subjects were genotyped and completed an fMRI response inhibition (stop-signal) task after 7 days of treatment with the DA partial agonist

aripiprazole or placebo. Irrespective of treatment group, COMT genotype moderated activation associated with successful response inhibition in several cortical areas, including the dorsomedial PFC and inferior frontal gyri (cluster-corrected  $p < .05$ ), such that both val- and met-allele homozygotes displayed weaker activation than heterozygotes. Although the study blind will not be broken until December 2015, analyses conducted with A/B treatment coding suggested that COMT genotype also moderated treatment effects on task-related activation. Preliminarily, these data suggest that DAergic genetic variation affects neuropsychological function in AUD, as well as pharmacological attempts to remediate such function. Consideration of genetic differences may ultimately allow the development of individualized treatments that selectively target neuropsychological function, an integral aspect of AUD. Correspondence: *Joseph Schacht, 67 President St., MSC S61, Charleston, SC 29425. E-mail: schacht@musc.edu*

### **Symposium 4. Chaotic Order, Language Connectivity, and a Generalizing Treatment of Aphasia**

**Chair: Stephen E. Nadeau**

**12:45–2:15 p.m.**

#### **S.E. NADEAU. Chaotic Order, Language Connectivity, and a Generalizing Treatment of Aphasia.**

**Symposium Description:** The predominant source of order in multicellular living organisms is chaotic order—order that emerges from the dynamic interaction of large numbers of interacting units and determines both form and function. In the brain, representations are population encoded, that is, they reflect the combined activity of large numbers of units (neurons, micro-columns) that are extensively connected with each other. Knowledge resides in the connections (synapses). Dr. Nadeau will begin this symposium with a discussion of neural mechanisms underlying phonologic and semantic function that relies heavily on the science of population encoded representations—parallel distributed processing. He will conclude with a brief introduction to neural mechanisms underlying grammatic function. These posited mechanisms make strong predictions about the connectivity of Broca's region, predictions that have been born out in high angular diffusion imaging (HARDI) studies of the neural connectivity underlying language function, to be presented by Dr. Bohsali in the second part of this symposium. Evidence from aphasia studies also suggests that there are both phonological and whole word networks that translate concept representations into word form, and that there are at least two perisylvian networks that support sublexical and word sequence knowledge, one phonologic, one involving grammatic morphology. Dr. Bohsali's work confirms both hypotheses. Finally, the comprehensive model of language presented here provides clear insight into why treatments for anomia following stroke have shown so little evidence of generalization to untrained exemplars or daily verbal communication, even as it demonstrates opportunities for the development of aphasia therapies that will generalize. Dr. Kendall will conclude the symposium with a discussion of a therapy she has developed, phonomotor, and clinical trial evidence of its efficacy and capacity for generalization.

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#### **S.E. NADEAU. Language Function Through the Lens of Population Encoding and Parallel Distributed Processing.**

Our conceptualization of the neural basis of language function still relies heavily on the Wernicke-Lichtheim model. However, this model provides no basis for understanding the nature of representations in the

various domains of the model, or the nature of the processes occurring between domains. The science of parallel distributed processing (PDP), which is predicated on population encoding of representations, has provided enormous insight into the fundamental mechanisms involved. PDP models have been subjected to extensive computer simulations and have demonstrated an enormous capacity for replicating normal human behavior. When damaged in various ways, they also replicate the behavior of individuals with brain damage. Rehabilitation studies of damaged computer simulated networks have made startling predictions that have later been born out in human subject studies. This presentation will begin with a discussion of how meaning (semantics) can be supported by population encoded representations, how this PDP conceptualization provides a logical explanation for the errors and error types exhibited by patients with aphasia, and how it can be reconciled with evidence from cognitive neuropsychology that semantics is represented in specialized forms in disparate brain regions. The second portion of the presentation will introduce the neural basis for phonology and the neural network capacity for encoding of phonologic sequence knowledge. The presentation will conclude with a brief introduction to the multicomponent representation of grammatic function in the brain and the predictions it makes for neural connectivity underlying language function.

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#### **A. BOHSALI. Neural Connectivity Underlying Language Function.**

We employed high angular diffusion imaging (HARDI) to map neural connectivity underlying language function in 18 normal young male participants, guided by hypotheses borne of the language literature. HARDI substantially transcends problems mapping fibers that take sharp bends or cross other pathways that afflict older diffusion tractography methods, thereby enabling direct mapping between cortical regions. We found extensive interconnectivity between the 3 established components of Broca's region (BR), pars orbitalis, pars triangularis, and pars opercularis, and between these components and ventral portions of area 6. All 4 regions connect extensively via a topographically organized, anterior to posterior dispersion of fibers, to middle and superior temporal gyri. Studies from aphasia suggest at least 2 major connections between BR and post-central cortices, one supporting naming from semantic representations via a phonological route and one via a whole word route. They also suggest more than one anterior to posterior network supporting sequence knowledge, one primarily instantiating phonologic sequence knowledge, the other knowledge of grammatic morphologic sequence and phrase structure rules. Our results provide strong support for these hypotheses. We discovered 2 very large pathways that plausibly support sublexical sequence knowledge, one linking pars opercularis and Wernicke's area via the extreme capsule, one linking inferior area 6 to inferior portions of the supramarginal gyrus via a supra-Sylvian pathway. We also found extensive connectivity, likely involving the arcuate fasciculus, between pars opercularis, area 6, and temporal cortices linked to semantic function, including ventral area 22, area 21, and area 20. We found very limited connections between BR, mainly pars orbitalis and pars triangularis, and cortices plausibly supporting semantic function, traveling via the uncinate fasciculus and the occipito-temporal-frontal fasciculus.

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#### **D.L. KENDALL. Phonomotor Therapy: an Intrinsically Generalizing Approach to Aphasia Therapy.**

Anomia, the most common and disabling component of aphasia after stroke, is typically remediated using whole words and tasks such as confrontation naming, repetition, phonologic cueing, and picture matching. While these traditional aphasia therapies improve naming performance, knowledge gained tends to be limited to words actually trained and there is, at best, very limited improvement in performance with untrained

words (Edmonds, Nadeau & Kiran, 2009; McNeil et al. 1997; Nickels, 2002; Wisenburn & Mahoney, 2009). The potential for generalization is doomed to be modest if treatment is focused on neural networks that link substantially orthogonal domains of knowledge (e.g., word meaning and word sound) and therefore encode few regularities. New approaches that circumvent this limitation by focusing on knowledge domains characterized by extensive regularities are being developed and show considerable promise. One treatment, called phonomotor, is inspired by a parallel distributed processing (PDP) model of lexical processing. Because of the extensive regularities in phonological sequence knowledge, training of a subset of sequences can generalize to all native sequences. Because phonologic sequence knowledge is engaged in the production of all words, such training can also generalize to untrained exemplars. Through intensive, multi-modal (auditory, motor, orthographic, tactile-kinesthetic, and conceptual) training of phonemes and 1-, 2- and 3-syllable real- and nonword phoneme sequences, the neural connectivity supporting phoneme sequence knowledge can be enhanced and word retrieval improved. Data from our open trial of 60 hours of phonomotor in 26 participants suggest that the treatment improves confrontation naming performance on trained words and generalizes to naming of untrained words at 3 months post treatment termination, to some aspects of discourse production, and to indicators of quality of life (Kendall et al. 2008, Kendall et al 2012, Kendall 2015). Correspondence: *Diane L. Kendall, 1417 NE 42d Street, Eagleson Hall Room 161, Seattle, WA 98105. E-mail: dkendall@u.washington.edu*

### Paper Session 3. Aging

Moderator: Benjamin M. Hampstead

1:00–2:20 p.m.

**E.E. SHAW, A. SCHULTZ, K.A. JOHNSON, R.A. SPERLING, R.L. BUCKNER & T. HEDDEN. The ready brain: Amyloid burden alters the longitudinal relationship of performance to neural responses during task anticipation and execution.**

**Objective:** This study tested how amyloid burden in cognitively healthy older adults alters the longitudinal relationship between performance and brain activity during anticipatory or execution phases of a rule-switching task. We predicted that individuals with higher baseline amyloid burden would exhibit an altered relationship between activity and performance over time.

**Participants and Methods:** Participants were 102 healthy older adults (baseline age 66-85) from the Harvard Aging Brain Study. Cortical amyloid burden was measured at baseline with Pittsburgh Compound B. Participants performed a rule-switching in-scanner task where they were cued to respond to the size, shape or color of each stimulus. Brain activity was measured at baseline and 3-year follow-up in a priori prefrontal and parietal regions during the anticipatory and execution phases of each task block in a 3-Tesla fMRI scan. Task accuracy and switch costs were measured behaviorally. Analyses focused on the effect of amyloid burden on associations between behavioral performance and brain activity during each task phase over time.

**Results:** Behaviorally, individuals with higher amyloid at baseline showed increasing switch costs over time. In higher amyloid individuals, lower anticipatory activity at baseline was associated with increased switch costs over time, while increased execution activity over time was associated with increased switch costs over time. In contrast, individuals with lower amyloid burden at baseline had lower switch costs, higher baseline anticipatory activity, and did not show a relationship between switch costs and activity.

**Conclusions:** These results indicate that amyloid burden alters the relationship between anticipatory versus execution-related brain activity and performance during a rule-switching task. Amyloid burden may have longitudinal effects on executive function that impact the ability

to anticipate and respond to rule switches, in addition to its well-studied relationships to episodic memory.

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**K.J. MANNING, R. KAPLAN, G. CHAN, L. WOLFSON & W. WHITE. The Effect of Blood Pressure on Processing Speed and White Matter Microstructure Abnormalities in Healthy Older Adults.**

**Objective:** Hypertension in middle age is associated with worse cognitive performance, white matter disease, and increased probability of dementia. Evidence for an association between hypertension and worse neurocognitive outcomes in late-life is mixed. Less is known about the effect of mild elevations in blood pressure on cognition and white matter disease in older healthy adults. We investigated the effect of blood pressure on cognitive and white matter microstructure change over time in sample of largely (72%) normotensive non-demented older adults.

**Participants and Methods:** Ninety-eight older adults aged 75+ free of neurological disease, unstable cardiovascular disease, and significant cognitive impairment (i.e., Mini-Mental State Examination score  $\geq 24$ ) completed measures of executive functioning / processing speed and diffusion tensor imaging (fractional anisotropy; FA) of the corpus callosum and periventricular pathways. Twenty-four hour ambulatory systolic blood pressure (ABP) was also recorded. Participant s completed all measures at baseline and two years later. A series of mixed-effects linear models were computed to analyze the effect of baseline systolic blood pressure on cognition and DTI values at baseline and two year follow-up. These models included main fixed effects for time and blood pressure, their interaction, and random intercepts using maximum likelihood estimates. Age, gender, and education were included as covariates.

**Results:** Linear modeling revealed time by blood pressure interactions for measures of processing speed (Coding;  $p = .04$ ) and sustained attention (CPT;  $p = .02$ ) as well as FA of the splenium ( $p = .01$ ) and cingulate-hippocampal tract ( $p = .01$ ). Elevated blood pressure at baseline was associated with worse neurocognitive outcome over time. Models with executive functioning measures were not significant.

**Conclusions:** Even subtle elevations in blood pressure can detrimentally impact cognition and white matter integrity in older healthy adults. Correspondence: *Kevin J. Manning, Ph.D., Psychiatry, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT 06030. E-mail: manning@uchc.edu*

**L. BERTOLA, L.B. ZAHODNE, M. ANGEVAARE, D. SANCHEZ, C.W. WATSON, N. SCHUPF, Y. STERN, R. MAYEUX & J. MANLY. Sociodemographic and cognitive predictors of memory trajectories across educational groups.**

**Objective:** Low educational attainment is a risk factor for more rapid cognitive aging, but there is substantial variability in cognitive trajectories within educational groups. The aim of this study was to determine the factors that confer resilience to memory decline within educational strata.

**Participants and Methods:** We selected 2592 initially non-demented White, Black, and Hispanic participants from the longitudinal community-based Washington Heights/Inwood Columbia Aging Project who had at least two visits. Trajectory of memory was represented as the probability of belonging to a stable-high memory class (range=0-1), extracted from a growth mixture model. Educational attainment groups were classified as Low ( $\leq 5$  years), Medium (6-11 years) and High ( $\geq 12$  years). Multiple group regression analyses determined if the relationship of sociodemographic (age, race/ethnicity and gender), cognitive (composite scores for executive, language/semantic and visuospatial tests) and reading level predictors differed across the groups.

**Results:** Predictors of memory trajectory significantly differed across educational strata. The best predictors of high and stable memory performance in the Low education group were higher reading ability, better language/semantic scores and being female; for the Medium group were

higher scores on executive and language/semantic tests, being female and younger age. Among the High group, predictors were the same as for the Medium group and being non-Hispanic White was an additional predictor.

**Conclusions:** Although people with very few years of education are at higher risk for cognitive decline and dementia, our results suggest that regardless of age and race, reading level and language skills may represent potential sources of developing cognitive resilience in people with fewer than 6 years of school. We found that cognitive resilience factors differ across educational strata, and thus potential intervention targets may be more effective if they are specifically tailored depending on educational experience.

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**L.B. ZAHODNE, J. MANLY, M. AZAR, N. SCHUPF, A.M. BRICKMAN, Y. STERN, R. MAYEUX & M. GLYMOUR. Racial Disparities in Cognitive Performance across Mid and Late Adulthood: Analyses in Two Cohort Studies.**

**Objective:** Racial disparities exist for health and cognitive outcomes across the lifespan. Many physical health disparities appear less prominent in late life, which is likely due to higher mortality rates for African Americans. This study examined whether this attenuation of racial disparities at older ages observed for physical health outcomes can be extended to cognitive outcomes in mid-life and late-life samples. Evidence of selective survival with respect to cognition would imply that conventional risk factor patterns for dementia may be distorted among older African Americans, and clinical predictions based on less selected white peers will be inaccurate.

**Participants and Methods:** Z-score composites of executive functioning and episodic memory were computed for 3,857 (10.5% African American; median age 57) participants in Midlife in the United States (MIDUS) and 2,729 (53.8% African American; median age 75) participants in the Washington Heights-Inwood Columbia Aging Project (WHICAP). Cross-sectional associations between race and cognition were examined as a function of age.

**Results:** Independent of main effects of age, birth cohort, sex, education and chronic health conditions, significant age by race interactions indicated that racial disparities in both domains were larger at younger ages than older ages in both samples. Independent associations between African American race and cognition in younger vs. older ages were -0.420 vs. -0.333 for memory and -0.855 vs. -0.673 for executive functioning in MIDUS; -0.398 vs. -0.264 for memory and -0.463 vs. -0.324 for executive functioning in WHICAP.

**Conclusions:** Attenuation of racial inequalities at older ages can be extended to cognitive outcomes, which likely reflects selective survival. Research on cognitive disparities or on race-specific causes of cognitive outcomes in old age must incorporate corrections for selective survival if the goal is to identify causal predictors of cognitive outcomes, rather than merely statistical predictors.

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**Plenary C. Modulating Brain Networks to Promote Recovery from Brain Injury**

**Presenter: Alvaro Pascual-Leone**

**2:30–3:30 p.m.**

**A. PASCUAL-LEONE. Modulating Brain Networks to Promote Recovery from Brain Injury.**

Following a brain insult (e.g. following a stroke or traumatic brain injury), or as a consequence of the alteration of function in a specific brain region (for example due to a sustained change in afferent input or efferent demand), the affected neural network adapts fluidly. This neural plasticity can confer no perceptible change in the behavioral output of the brain, lead to changes demonstrated only under special testing conditions, or cause behavioral changes that may constitute symptoms of disease or represent paradoxical functional facilitations. A consequence of such a formulation is the notion that the manifestations of focal brain dysfunction are ultimately defined by brain plasticity. Thus, disability after a brain insult, is the consequence of plasticity, just as through plasticity it might be possible to recover from the functional consequences of a brain insult.

The challenge in interventional cognitive neuroscience and rehabilitation is to guide the plastic changes across the lifespan, or following a brain insult, in order to promote the best functional outcome for a given individual. This requires modulation of neural networks. The challenge is to learn enough about the mechanisms of plasticity and the nature of dynamics of neural networks to be able to suppress changes that may lead to undesirable behaviors while accelerating or enhancing those that result in a behavioral benefit for the patient. Neurostimulation, including non-invasive brain stimulation techniques, provide an opportunity to modulate plastic brain networks in a controlled and specific manner, and a growing body of evidence supports its utility in promoting recovery of function after a brain injury.

Learning objectives:

1. Explain the brain networks.
2. Discuss the localization of dysfunction and symptoms as a consequence of network impact of a lesion
3. Demonstrate the feasibility of modulating brain networks and discuss approaches to do so.
4. Discuss implications of modulating brain networks for recovery from injury.

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**Poster Session 4. Assessment (Child), EF/Frontal, and Medical/Neurological Disorders (Child)**

**3:30–5:00 p.m.**

**Assessment/Psychometrics/Methods (Child)**

**E. MEADE, A.E. PRITCHARD & J.T. BEETAR. Comparison of Parent and Teacher Reports of Adaptive Behavior: A Diagnostic Perspective on Special Education Students.**

**Objective:** Since adaptive behavior determines the severity of an intellectual disability diagnosis in DSM-V, accurate measurement of this construct is essential. Though the ABAS-II manual reported high parent-teacher correlations among typically developing children (Harrison & Oakland, 2003), discrepancies in parent and teacher report of children with neurodevelopmental disorders are common on other adaptive

behavior measures (e.g., VABS; Hundert et al., 1997). The present study investigated if parent-teacher concordance on the ABAS-II is lower when children in special education are rated, relative to typically developing children. Lower agreement between raters in this population may complicate diagnostic formulation.

**Participants and Methods:** Subjects included 93 students with parent and teacher ABAS-II ratings archived from evaluations at 2 special education schools. The sample was 83% male, primarily Caucasian (56%) or African American (31%), and 13.6 (SD=3.5) years old on average. Autism (58%), Other Health Impairment (20%), and Emotional Disability (15%) were the most common special education classifications. Estimated cognitive functioning was in the borderline range, on average (M=76, SD=19).

**Results:** Correlations between parent and teacher reports of adaptive behavior were moderate (composite  $r$ 's ranged from .32-.46) and smaller than those reported in the test manual ( $z$ 's > 1.88,  $p$ 's < .061). At the group level, parents rated their children as having poorer overall adaptive skill than did teachers ( $t(91) = -2.31$ ,  $p < .05$ ,  $d = -0.26$ ). At the individual level, the differences between parent and teacher scores averaged about 1 standard deviation. For diagnostic purposes, using a General Adaptive Composite below 70 as a cutoff, 34% of parents and teachers disagreed on children's adaptive skills, with parents endorsing impairment more often than teachers.

**Conclusions:** These results highlight the importance of obtaining multiple perspectives in the diagnosis and educational planning of students with neurodevelopmental disorders.

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#### **K. DAVIS, A.E. MARGOLIS & J. HERBSTMAN. Development of a Self-Regulation Subscale Using Specific Items From the Behavior Rating Scale of the Bayley Scales of Infant and Toddler Development.**

**Objective:** To develop a standardized instrument to measure self-regulation in early childhood.

**Participants and Methods:** This study describes the development of a Self-Regulation Subscale using specific items from the Behavior Rating Scale of the Bayley Scales of Infant and Toddler Development. We selected items based on existing literature describing development of self-regulatory capacity in early childhood. A sample of normal subjects ( $n = 77$ ) age 36 months was used to test validity of findings.

**Results:** The Self-Regulation Subscale demonstrated good psychometric properties (mean = 40.12,  $sd = 4.11$ ). It was found to have high convergent validity, as there were significant positive associations ( $p < 0.05$ ) with Bayley Mental Development Index (MDI) scores at 12 months and sibling Child Behavior Checklist Deficient Emotional Self-Regulation (CBCL DESR) scores at 9 years.

**Conclusions:** The Subscale may be useful in assessing the development of self-regulatory capacities in early childhood. Significant positive associations with MDI and DESR scores are consistent with existing literature indicating that the development of self-regulatory capacity is continuous and does not stabilize until 9 years. Future research should investigate reliability and discriminant validity of the subscale, as well as clinical implications.

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#### **N. FEIRSEN, L. SALINAS, J. UDERMAN & S. SCHAFFER. Relationship Between Executive Function Performance and Collateral Reports in Pediatric Populations.**

**Objective:** Executive dysfunction is a core feature of many childhood neuropsychiatric disorders. The two methods that clinicians often rely on to measure executive functions (EF) include: rating scales and performance-based tests. However, the correlation between and predictive

validity of these measures is unclear, making clinical interpretation difficult. This study aims to examine whether performance on objective EF measures predict parent and teacher rated EF.

**Participants and Methods:** We examined data from 53 children (ages 8-18) referred for neuropsychological evaluation from 2008-2015. EF was assessed via Behavior Rating Inventory of Executive Function (BRIEF) parent (P) and teacher (T) ratings and objective measures that assess at least one aspect of EF measured by the BRIEF (D-KEFS subtests, CPT-II, WISC-IV subtests, Hooper Visual Organization Test (HVOT), Children's Category Test, and CVLT-C).

**Results:** BRIEF-P and -T Behavioral Regulation (BRI) and Global Executive Composite (GEC), but not Metacognition (MCI), scores were significantly correlated ( $p < .05$ ). Multiple regression analyses were used to determine factors that predict BRIEF index scores. CPT-II commissions, HVOT, and DKEFS Trail Making Test (TMT) 4 scores accounted for a significant amount of the variance of GEC scores ( $p < .05$ ). WISC-IV digit span (forward and backward) and CPT-II (commissions and block change standard errors) explained a significant amount of the variance of BRI scores ( $p < .05$ ). MCI scores were not predicted by any objective measures. However, several objective measures significantly predicted individual MCI and BRI subscales.

**Conclusions:** CPT-II, WISC-IV digit span, DKEFS TMT, and HVOT emerged as the most robust predictors of BRIEF-P and -T ratings. These findings suggest that these specific EF measures capture concepts that are generalizable to various applied academic and behavioral contexts. Implications of these findings will be discussed.

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#### **M. BONINO & A.L. FERNANDEZ. Reliability of the Test de Velocidad de Denominación for Early Detection of Dyslexia.**

**Objective:** The Test de Velocidad de Denominación (TVD) was developed in order to measure naming speed in children between 4 and 9 years old. Naming speed is an early indicator of children at risk of developing dyslexia. This study was designed to estimate the reliability of the Test de Velocidad de Denominación (TVD) with a test-retest design in a sample of children from pre-school and primary school

**Participants and Methods:** The TVD was administered twice to a sample of 93 children between 4 and 8 years old. Mean time between administrations was  $7.13 \pm 0.52$  days. All of the children attended to two public schools in Cordoba city, Argentina. The correlation coefficient was calculated in order to assess the test stability. Learning effect between test administrations was assessed with a mean differences t-test.

**Results:** The mean score for the test was  $79.19 \pm 30.47$  seconds, and  $71.8 \pm 22.4$  for the retest. Pearson's  $r$  correlation coefficient was .93. The difference between test and retest means was statistically significant ( $p = 0.000$ ).

**Conclusions:** The TVD has an excellent stability. The significant learning effect suggests that an alternative form should be developed to be used when individuals need to be assessed more than once.

#### **A.L. FERNANDEZ, L.F. LAMAS, M. GATTÁS, M. REBAK, G. CIARÍMBOLI, V. RAGESSI, G. JÁUREGUI, C. DRI, C. PRADO, C. RISELLI, K. BRACAMONTE, V. GIRAUD, V. MARIN, C. LOYOLA, A. CARDOZO & P. MARCHETTI. Normative Data and Influence of Demographic Variables on a Speed Naming Test For Spanish-Speaking Children- The "Test de Velocidad de Denominación"**

**Objective:** The Test de Velocidad de Denominación (TVD) was developed in order to measure naming speed in children between 4 and 9 years old. Naming speed is an early indicator of children at risk of developing dyslexia. Validity studies were presented previously. In this poster data are presented on the normative data and the influence of demographic variables on time to complete the test.

**Participants and Methods:** Six-hundred and seventy eight children from public (20%) and private (80%) schools of Cordoba city,

Argentina, were included. Children were from pre-school and primary (up to 3rd grade) school. Forty-eight percent were female.

**Results:** Mean time to complete the test decreased significantly as children progressed in school ( $p=0.0000$ ;  $\eta^2=0.41$ ). The most significant decrease was between the last pre-school year and 1st grade. An ANCOVA showed that children from private schools had significantly shorter times than those of public schools but only during the pre-school years. Parents' educational level had an influence on the TVD scores only if they had less than 12 years of school. No significant differences were found between male and female.

**Conclusions:** These data confirm that naming speed decreases as the children grow/progress in school. There is a feedback between naming speed and learning to read: an adequate naming speed ensures an appropriate learning to read process, but learning to read improves naming speed, in return. Socio-economic variables play an important role possibly influencing early cognitive stimulation; however, the schooling process seems to level the pre-existent differences.

**M. GEURTEN, C. CATALE, C. GEURTEN & T. MEULEMANS. Psychometric properties of the Questionnaire of Executive Self-Awareness (QESA) for Children.**

**Objective:** People with an accurate representation of their own cognitive functioning (i.e., cognitive self-awareness) are more likely to make use of appropriate strategies to regulate their behavior in day-to-day life. However, due to the lack of appropriate instruments to appraise self-awareness, few studies have examined the development of this ability among children. The aim of the present study is to test the measurement properties of the self-rating and other-rating form of the Questionnaire of Executive Self-Awareness (QESA) designed to tap children's knowledge of their executive functioning.

**Participants and Methods:** Participants were 317 typically developing children aged from 7 to 14 years old. A group of 29 children who had sustained moderate to severe TBI from closed head trauma also participated in the study.

**Results:** Confirmatory factor analyses carried out on the QESA confirmed the eight-factor structure of the two versions of the scale. Convergent validity was revealed with significant correlations between the QESA and the parent version of the BRIEF, the DEX-C, and the CHEXI. The two forms of the QESA were also shown to be able to distinguish between children who sustained a traumatic brain injury (TBI) and control participants. Finally, a self-other discrepancy score was computed to assess children's level of executive self-awareness. A statistical difference was observed between the TBI groups and the control group on the latter score, suggesting that self-awareness impairments could be a consequence of TBI in children.

**Conclusions:** Overall, the good psychometric properties of the scale were established.

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**M. MESSER, J. GREENE, P.K. ISQUITH, G.A. GIOIA, L. KENWORTHY & S. GUY. Behavior Rating Inventory of Executive Function, Second Edition (BRIEF2): Analyzing and Interpreting Ratings from Multiple Raters.**

**Objective:** We examined the correlations, mean differences, and calculated the percentage of sample obtaining various T-Score differences on the BRIEF2 among various interrater dyad samples (parent, teacher, and self-report).

**Participants and Methods:** BRIEF2 interrater reliability was assessed in subsamples of the typically developing (TD) standardization sample ( $n = 115-632$ ) and the combined clinical sample ( $n = 287-1,426$ ). This included examining the correlations between dyads of raters for a subsample of matched raters. In addition, effect size for mean differences were calculated for each BRIEF2 scale and index. Percentages of these

samples that obtained various T-Score differences on the Index scores and GEC score were calculated.

**Results:** Overall, the correlations between raters are moderate to strong for TD children and low to moderate for clinical groups. The mean differences between BRIEF2 scores are relatively small. For parent and teacher ratings, approximately 53-59% of cases reported scores within 10 T-score points. As expected the agreement of the parent-parent sample was higher, with approximately 67-76% of being within 10 T-score points. Agreement in the Teacher-Teacher sample was even higher, with approximately 70-76% of cases bring within 10 T-score points of each other. Agreement within 10 T-score points for adolescents when compared to parents and teachers ratings was approximately 58-63% and 51-59% of cases, respectively.

**Conclusions:** Pairs of raters with similar perspectives, namely, parent-parent and teacher-teacher, tend to be correlated more highly than raters who see the child from different perspectives. The lowest correlations were seen between adolescent and either parents or teachers. Gathering multiple perspectives in the assessment of a child's functioning provides a more comprehensive set of data. An interpretive strategy that includes comparison of dyads or triads of raters' views is desirable.

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**M.J. HAMBERGER, M. SMITH, W.S. MACALLISTER, A.C. WILLIAMS & W.T. SEIDEL. Auditory and Visual Naming Tests for Children.**

**Objective:** The most commonly used naming measure for children has been the Boston Naming Test (BNT). However, this test was developed for adults and its use with children is problematic due to: 1) inclusion of uncommon, low frequency items (e.g., yoke), confounding naming assessment with vocabulary, 2) use of line drawings, adding the potential confound of perceptual processing, and 3), lack of normative data for delayed or cued responses, both of which reflect naming difficulty. Further, the BNT, like most naming measures, is limited to visual naming. Considerable work has shown greater sensitivity of auditory description naming in identifying temporal lobe based naming deficits in adults. We aimed to develop complementary visual (VN) and auditory naming (AN) tests for children, ages 6-15 years, addressing these and other shortcomings in current naming tests for children.

**Participants and Methods:** Participants were 182 healthy children (106 girls) who were administered the 36-item AN and VN tests, WASI, WIAT Reading, and Digit Span. AN and VN items were comparable in word frequency and familiarity. Performance measures included accuracy, mean RT, and Tip-of-the-tongue ('TOT'=responses  $\geq 2$  sec + items requiring phonemic cue). Data were stratified by 2-year age intervals for analysis.

**Results:** Multivariate ANOVA revealed no differences among age groups in IQ or standardized reading scores ( $P > .05$ ). AN and VN accuracy scores were also comparable across groups, except for children ages 6-7 earning significantly lower scores than other groups. AN and VN RT and TOT scores were lower in age groups 6-7 and 8-9 ( $P < .05$ ); however, scores were comparable among children age 10 and older. Pearson correlations indicated naming performance was unrelated to gender, reading and digit span scores.

**Conclusions:** Naming, as assessed by both auditory and visual cues, appears to stabilize after age 9 years. Overall, preliminary results suggest that these AN and VN tests promise age appropriate naming measures for school aged children. NIHNS35140(MH)

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**D.J. HINDS, J.H. BERNSTEIN & F. YOUSSEF. Taking the (NIH) Toolbox to Trinidad and Tobago.**

**Objective:** 1. Assess the use of the Toolbox (TB) in Trinidad & Tobago (T&T). 2. Document cognitive, language and social-emotional characteristics of children entering primary school.

**Participants and Methods:** 68 children (34 M) entering primary school in 5 schools in Port-of-Spain and their parents. Age range: 4y10mo–6y7mo. Children were seen individually at school using the Kindergarten Language Screening Test, 2nd Edition (KSLT2) and the TB Cognitive Battery. Parents completed social and emotional questionnaires.

**Results:** 67.6% of children completed all 7 TB tasks, providing analyzable data; 6 tasks = 82.3%, 5 = 92.6%, 4 = 98.5%. Failures resulted from limited attention and inability to get into task set. Obtaining completed questionnaires from parents was a challenge (34% responses). Initial analyses of TB data yielded main effects for gender, age group and school community. Girls were better readers: Oral Reading F (1, 66) = 4.45,  $p < .05$ . Age group differences were found in Oral Reading F (4, 62) = 10.85,  $p < .001$ ; Flanker F (4, 61) = 3.22,  $p < .05$ ; Picture Sequence Memory F (4, 50) = 3.08,  $p < .05$ ; Picture Vocabulary F (4, 62) = 3.21,  $p < .05$ ; KLST2 F (4, 62) = 3.50,  $p < .05$ . School differences were found in List Sorting F (4, 41) = 3.02,  $p < .05$ ; Picture Sequence Memory F (4, 53) = 5.04,  $p < .01$ . TB language measures (Oral Reading -  $r(68) = .49$ ,  $p < .001$ ; Picture Vocabulary -  $r(68) = .43$ ,  $p < .001$ ) were significantly correlated with the KLST2.

**Conclusions:** These initial results indicate that the TB can be successfully used in a non-US setting. TB language scores correlate with those from the KLST2. Culture-specific factors such as school community play a role in children's performance. Lessons learned: need to adapt research requirements to local setting; impact of variable literacy levels on recruitment, consent, data collection; implications for future funding requests.

**I. HUANG, T.M. BRINKMAN, Y. CHEUNG, C. PUI, M.M. HUDSON & K.R. KRULL. Functional consequence of cognitive impairment in long-term survivors of childhood acute lymphoblastic leukemia (ALL): the role of cancer symptoms.**

**Objective:** To examine the association of cognitive impairment with cancer symptoms and daily functional status in childhood ALL survivors treated on a chemotherapy only protocol.

**Participants and Methods:** 213 survivors (mean age=14.8 years; time since diagnosis=7.7 years) were assessed at >5 years post-diagnosis. Testing included measures of executive function (Delis-Kaplan Executive Function System; Wechsler Intelligence Scale for Children-IV [WISC-IV]), processing speed (WISC-IV; Grooved Pegboard), visual-spatial processing (Wechsler Abbreviated Scale of Intelligence), memory span (WISC-IV), and attention (Conners CPT-II). Symptoms (e.g., pain, worry, cognitive, communication) and daily functional status (physical, emotional, social, school) were reported by parents using the PedsQL. Association of cognitive impairment with symptoms and functional status was tested using regression analysis. The extent to which cognitive impairment influences functional status through symptoms was tested using mediation analysis.

**Results:** Cognitive impairment (>1SD below age-adjusted norm) was identified in 18-41% of the survivors. Impaired executive function, processing speed, and memory span were associated with high cancer symptoms (all  $p$ 's<0.05), typically driven by perceived cognitive and communication problems. Impaired executive function, processing speed, visual-spatial processing, and memory span were associated with poor functional status (all  $p$ 's<0.05). In each cognitive domain impairment was associated with poor school function (all  $p$ 's<0.05). Impact of cognitive function (except attention) on overall functional status was mediated by overall cancer symptoms (all  $p$ 's<0.05).

**Conclusions:** Although the frequency of impairment in survivors treated with chemotherapy was less than that seen with radiation therapy, cognitive impairment is related to elevated cancer symptoms and decreased functional status. Mediation analyses indicate that cognitive function works through cancer symptoms to impact functional status.

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**A.M. O'BRIEN & J.E. CASEY. Test-Retest Reliability of the ImPACT with a Canadian Sample of Healthy Young Athletes.**

**Objective:** Although baseline neurocognitive assessments are highly recommended for tracking concussions in athletes who play high-risk sports, there are currently no measures available specifically for use with children. The most widely used assessment tool, the Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), was developed for adults. According to the test manual it can also be used with children as young as 11 years old. Despite this assertion, there is no published study regarding the psychometric properties of the ImPACT in children younger than high-school age. The purpose of the present study was to determine the two-week test-retest reliability of the ImPACT neurocognitive test in a healthy sample of young athletes.

**Participants and Methods:** Participants (n=34) included healthy Canadian athletes ages 11-14 (15% female) that had not sustained a concussion within the previous three months. Participants completed the baseline ImPACT neurocognitive test and then returned for a re-test approximately 14 days later (M=14.32, SD=1.55).

**Results:** Overall, the ImPACT neurocognitive test has at least fair test-retest reliability with intraclass correlation coefficients for absolute agreement ranging from 0.36 to 0.75. In addition, the standard error of measurement (SEM) was calculated and revealed that some composite scores were more accurate than others with SEMs ranging from 0.07 to 9.44. The Visual-Motor Speed composite demonstrated the highest reliability.

**Conclusions:** The study demonstrates that the ImPACT neurocognitive test may be appropriate for use with children as young as 11 years old based on test-retest reliability at a 14-day interval. The accuracy of scores, however, varies depending on the composite scores. These findings provide some psychometric support for the use of the ImPACT with athletes younger than high-school age and emphasize its use only as part of a comprehensive baseline evaluation.

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**I. O'DESKY, B. FECHTER, D. COLOGNORI & D. MARKS. Use of Executive Functioning as a Predictor of ADHD and NLD.**

**Objective:** Children with NLD are often diagnosed with ADHD. Research suggests that attention problems in NLD may result from issues distinct from those in ADHD and differences in executive functioning (EF) could help differentiate these groups. It was hypothesized that subjects meeting screening criteria for ADHD would differ significantly from subjects meeting screening criteria for NLD on four measures of EF used on the NEPSY-II (Animal Sorting, Auditory Attention and Response Set and Design Fluency) and that performance on EF tasks of visual-spatial reasoning would predict NLD while performance on measures of attention would predict ADHD.

**Participants and Methods:** Participants completed an extensive battery of cognitive functioning. NLD Screening Criteria included a VCI >PRI by at least 15 points on the WISC-IV and impaired score on the Rey-Osterrieth Complex Figure Test. ADHD-I Screening Criteria included a CPT-II score  $\geq 70$  and T-score  $\geq 60$  on the Conners 3 Inattention scale.

**Results:** 20 subjects met NLD criteria and 17 subjects met ADHD-PI criteria. In support of the first hypothesis, groups differed significantly on the Design Fluency task,  $p = .02$ . In support of the second hypothesis, a model including the four NEPSY-II subtests was significant,  $p < .01$ . When predicting ADHD, a model including the four subtests was not significant,  $p = .880$  and no individual subtests were predictors. Post-hoc analyses showed that verbal fluency semantic,  $p = .896$  and phonemic,  $p = .891$  did not predict NLD.



**Conclusions:** Children with NLD and ADHD both present with EF deficits. Results suggest that those with NLD may be more likely to show EF deficits in visual-spatial area. This distinction is important as NLD and ADHD may present similarly but the etiologies of their attention problem may be different. Design Fluency scores may be helpful for differential diagnosis of ADHD and NLD and this can help ensure that the child receives relevant interventions and accommodations.

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**T.W. OLIVIER, B. SHIEH, R. PLOTKIN, L.A. JACOBSON & J. REESMAN. Preliminary Examination of WISC-V Indices in a Clinical Sample of Children with Hearing Loss.**

**Objective:** Multiple studies have examined use of previous versions of the Wechsler Intelligence Scale for Children (WISC) with children who have hearing loss, with results suggesting it is useful within this population (Krouse & Braden, 2011). With the release of the WISC-V, additional research is needed to examine performance patterns given this population's unique concerns (Reesman et al., 2014). No studies to date have examined WISC-V performance in children with hearing loss.

**Participants and Methods:** Performance on the WISC-V was examined in a retrospective review of children with and without hearing loss referred for evaluation to a large urban neuropsychology department with a specialty clinic for hearing loss. Our sample included 10 children (7 male) ages 7 to 14 ( $M=11.29$ ,  $SD=7.51$ ), all with hearing loss (sensorineural  $n=3$ ; conductive  $n=5$ , mixed  $n=2$ ). Three children used auditory supports (hearing aid  $n=2$ , cochlear implant  $n=1$ ). An age- and gender-matched clinical sample without hearing loss was used for comparison ( $n = 10$ ). Instructions were presented using the child's language preference.

**Results:** Independent samples t-tests examined group differences on WISC-V indices between children with hearing loss and controls. Results revealed no significant differences ( $p > .05$ ) between the groups on WISC-V Full Scale IQ [ $M=89.90$ ,  $SD=15.60$ ],  $t(18) = .032$ ]; Verbal Comprehension [ $M=87.10$ ,  $SD=15.31$ ],  $t(18) = .921$ ]; Visual Spatial [ $M=94.80$ ,  $SD=22.17$ ],  $t(18) = -.013$ ]; Fluid Reasoning [ $M=91.60$ ,  $SD=18.72$ ],  $t(18) = .696$ ]; Working Memory [ $M=91.20$ ,  $SD=13.57$ ],  $t(18) = -.760$ ]; or Processing Speed [ $M=89.10$ ,  $SD=22.08$ ],  $t(18) = .230$ ] indices.

**Conclusions:** This study provides preliminary support of the hypothesis that clinically-referred children with hearing loss earn similar scores on the WISC-V when compared to clinically-referred hearing peers. Given the heterogeneous nature of hearing loss, these findings should be replicated and extended with larger, more diverse samples of children with hearing loss compared to hearing peers.

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**E.A. LIVANOS, E.C. ROSEMAN, B.K. LEBOWITZ & T. PRESTON. A Comparison of Two Prospective Memory Tests in Clinically Referred Children: Influence of Distracter Task.**

**Objective:** Prospective Memory (PM) has become an increasing focus of research with both typically developing and clinically referred children. This study is part of an effort to produce a convenient and ecologically valid measure of PM that can be incorporated into the neuropsychological examination. The Prospective Memory Screening (PROMS) and the Memory for Intentions Screening Test (CMIST) were compared in samples of clinically referred children, using different types of distracter (ongoing) tasks to determine the influence of those tasks on scores.

**Participants and Methods:** Participants in Study 1 were 75 children and adolescents (mean age 9.6 years) referred for attention and learning disorders. The CMIST was administered using a word search as the distracter task, while the PROMS was administered using academic testing as the distracter. Test administration was counterbalanced to prevent order effects.

Participants in Study 2 were 22 clinically referred children and adolescents (mean age 9.2 years). For both measures on this occasion, however, the distracter task was identical, i.e., the popular "Minecraft" game. Again, tests were counterbalanced.

**Results:** In Study 1, there was a moderately strong correlation ( $r = .64$ ,  $p < .001$ ) between the PROMS and the CMIST. PROMS scores were slightly lower overall, possibly reflecting the greater demands of academic testing as a distracter.

In Study 2, there was once again a moderately strong correlation ( $r = .62$ ,  $p < .01$ ). Here, however, CMIST scores were lower, suggesting that when the distracter task is the same, the greater cognitive demands of the CMIST make it more difficult.

**Conclusions:** Although further investigation of reliability and validity is needed with both of these measures, the fact that they are reasonably well correlated with each other indicates that one or both may ultimately be useful as indicators of PM in both typical and clinically referred children.

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**A.M. RACH, J.V. WETHE, M. HOWARD, A. STARLING & D. DODICK. Age-Based Child-SCAT3 and SCAT3 Normative Values Using a Youth Football Population.**

**Objective:** Since the release of The Standardized Concussion Assessment Tool (SCAT3) and the pediatric version for children under the age of 13 (Child-SCAT3) studies examining the normative properties of the tools in youth 12 years of age and younger have yet to be published. The relative paucity of baseline assessments within concussion management protocols has increased the need for normative data. The purpose of this study was to provide normative data for the SCAT-3/Child-SCAT3 component and domain scores in a population of youth football players.

**Participants and Methods:** Pre-season Child-SCAT3/SCAT3 data was collected from 114 youth football players. Athletes with a diagnosis of ADHD ( $n=6$ ) or LD ( $n=3$ ) were excluded. The 105 athletes were male, ranged 10-13 years of age, and seven players self-reported a previous concussion.

**Results:** Average composite scores on the Child-SCAT3 were 25.54 for the SAC Total Score, 2.60 for the BESS, and 5.21 for athlete and 4.5 for parent-report on the PCSS. Average scores on the SCAT3 were 26.5 for the SAC Total Score, 5.17 for the BESS, and athletes endorsed an average of 5.2 symptoms. One-way ANOVA revealed a main effect of age on the SAC domains of Orientation [ $F(2, 80) = 3.6$ ,  $p < .05$ ], and Delayed Recall [ $F(2, 80) = 6.1$ ,  $p < .01$ ], and the Total Score [ $F(2, 76) = 3.6$ ,  $p < .05$ ]. Younger athletes performed more poorly than older athletes. Age was not related to BESS or symptom report.

**Conclusions:** Age significantly influences performance on baseline cognitive screening measures. Athletes aged 10 years or younger achieve scores significantly lower than older peers. This age related variability supports the importance of obtaining baseline cognitive screening scores for post-injury comparison. Although age did not influence balance or pre-season symptom report, given that athletes endorsed symptomatology at baseline, obtaining a baseline symptom checklist is important for post-injury comparison before returning the athlete to play.

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**T.A. RENTERIA-VAZQUEZ & J. TURNBULL. Reading Skills in a 3 Year-Old Boy Diagnosed With Hyperlexia: Case Report.**

**Objective:** This case study describes the neuropsychological, developmental, and socioemotional functioning of a 3 year-old boy (EJ) with an obsessive interest in letters/words and superior word reading that emerged spontaneously. Whether this characterization alone should define the term Hyperlexia (Hyl) is a matter of debate. The common definition emphasizes a core discrepancy between superior word reading

ability and weaker reading comprehension ability. However, terminological confusion ensues: Is Hyl a distinct disorder, a feature of a disorder, or on a continuum inclusive of non-clinical populations? We take Grigorenko et al.'s, (2003) position that Hyl should be reserved for individuals with autism spectrum disorder and apply this to EJ's case.

**Participants and Methods:** EJ is a 3-year-old Caucasian boy. The child was administered standardized neurocognitive and academic tests and the Castelli Animation Test. Caregivers were administered normative behavior checklists.

**Results:** On the WPPSI-IV, EJ displayed very superior performance on the verbal comprehension/working memory indices, but a significantly discrepant average performance on the visual spatial index. He displayed very superior word reading abilities (SS=158-244) and strong but reduced reading comprehension abilities (SS=115-175). Qualitative data, (research test) results, and parents/teacher ASD rating scales were consistent with ASD.

**Conclusions:** Overall, EJ's profile raises ambiguities and terminological confusion, even in the context of a commonly accepted definition of Hyl. His word reading is significantly higher than expected for his age and his reading comprehension. Despite the large discrepancy, EJ was able to understand much of what he read. At the same time, EJ showed a clear bias for the explicit and concrete aspects of what he read. Such nuances are lost within Hyl definition that rest upon neurocognitive concepts, but are uniquely captured by a focus upon more global processes involved in the processing of individuals with ASD.

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#### **A.D. SCHMID, K. LINNEA & J. LICHTENSTEIN. An Examination of WAIS-IV Digit Span Sequencing in a Clinical Sample.**

**Objective:** While WAIS-IV Digit Span Sequencing (DSS) is conceptualized as a working memory measure, the construct validity of this task has been questioned. Clinical experience suggests that DSS performance is more consistent with WAIS-IV Arithmetic (AR) than with Digit Span (DSF) or Digit Span (DSB). Therefore, it was hypothesized that DSS measures an aspect of number sense above working memory. As little research has been conducted on this concept, this study explored the relationship between DSS and other tasks measuring number sense and working memory in a clinical sample.

**Participants and Methods:** The data of 27 male (55.6%) and female (44.4%) adolescents, ages 16-17 years ( $M = 16.33$ ,  $SD = .48$ ) referred for outpatient neuropsychological evaluation was retrospectively analyzed. Correlation and multiple regression analyses were conducted to examine the relationship between DSS and various potential predictors. Variables included DSF, DSB, AR, and either Trail Making Test Part A or DKEFS Trail Making Test Condition 3 (TNS).

**Results:** Using WAIS-IV FSIQ as a control variable, partial correlations revealed a significant and positive association between DSS and AR ( $r = .51$ ,  $p < .01$ ). No additional significant correlations emerged. Within multiple regression analyses, AR and TNS significantly predicted DSS in the expected direction ( $B = .59$ ,  $p < .05$  and  $B = .31$ ,  $p < .05$ ). Although DSB also emerged as a significant predictor of DSS, the association was negative ( $B = -.37$ ,  $p < .05$ ).

**Conclusions:** These results support our clinical observations that aspects of number sense significantly contribute to DSS performance. Unexpectedly, DSS was inversely correlated with DSB, suggesting that they may be measuring different constructs. This has implications for the use of the Digit Span composite score within clinical populations. Further, these findings highlight the need for a re-examination of how DSS is clinically interpreted.

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#### **M.E. SELEME, Y. ROMERO & L. ROJAS. Pilot Study to Assess the Development of Executive Functions in Cuban Preschoolers Using Two Tests Developed in Brazil.**

**Objective:** To assess the development of the executive functions in a sample of Cuban preschoolers using the Cancellation Attention Test and the Trail-making Test for Pre-schoolers developed in Brazil.

**Participants and Methods:** A total of 39 children between 5 and 6 years old, females and males, performed the tests that evaluate attention and cognitive flexibility. The results were statistically analyzed with the Mann-Whitney U Test for mean differences.

**Results:** No significant differences were found between the two age groups, 5 vs. 6 years old, in any of the variables from the Cancellation Attention Test and the Trail-making Test for Pre-schoolers.

**Conclusions:** Both 5 and 6 years old children behaved as an homogeneous group regarding the proper development of the executive functions assessed by the Cancellation Attention Test and the Trail-making test. The results show a correspondence between the mean values of the overall variables of both tests and the mean values of the Brazilian norms. The Brazilian tests were useful to assess the executive functions and cognitive flexibility in the Cuban sample studied. Our study suggests that the tasks included in both tests can be applied in the Cuban context.

#### **K. SKILLICORN, L.A. JACOBSON, T. ZABEL, E.F. JONES & A.E. PRITCHARD. Psychometric Equivalence of Online and Paper-and-Pencil Caregiver Behavior Ratings.**

**Objective:** Benefits of online versus paper-and-pencil (P&P) data collection include increased sample size, and reduced costs and errors; however, research has been mixed regarding the comparability of online measures to their P&P counterparts (Buchanon, 2003; Carlbring et al., 2007; Joinson, 1999). The study compared the psychometric properties of parent/caregiver behavior ratings completed online versus P&P, hypothesizing psychometric equivalence.

**Participants and Methods:** Participants included 4,345 caregivers of children aged 5-18 (64% male). Behavior ratings, including standardized measures such as the ADHD Rating Scale-IV (DuPaul et al., 1994) and Colorado Learning Difficulties Questionnaire (Willcutt et al., 2011), were collected as part of routine care in a neuropsychology outpatient clinic. Ratings were completed either online ( $n = 3831$ ) or via P&P ( $n = 514$ ).

**Results:** The two groups were similar on child age, sex, and behavior/symptom severity, but caregiver education was significantly lower in the P&P group ( $\chi^2 = 186.39$ ,  $p < .001$ ). Across administration formats, scale inter-item reliabilities were similar and all fell within an acceptable range (Cronbach's  $\alpha > .70$ ). Comparison of results of group-specific exploratory factor analysis suggested nearly identical factor structures for each measure across administration formats, with factor loadings correlated very highly across groups ( $r$  ranged from .977-.999 across measures). The P&P group generated significantly more missing data across measures ( $t(4031) = 5.21$ ,  $p < .001$ ).

**Conclusions:** Despite differences in caregiver education across groups, caregiver ratings of child behavior evidenced comparable psychometric properties (i.e., inter-item reliability, scale factor structure, factor loadings) across administration formats. Online ratings may offer substantial clinical and research benefits while maintaining the psychometric properties of the original P&P measures.

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#### **M. VASSERMAN, M. MAIMAN, M. JORGENSEN, G. WITKIN & W.S. MACALLISTER. WISC-V Profiles in Children with ADHD and Learning Disabilities.**

**Objective:** There are no independent studies examining WISC-V profiles of children with Attention Deficit Hyperactivity Disorder or Learning Disabilities. We aimed to evaluate sensitivity of WISC-V to presence of cognitive impairment in this group.

**Participants and Methods:** 43 clinically referred children received the WISC-V as part of a clinical neuropsychological evaluation. Means and standard deviations were computed for index and subtest scores and t-tests assessed differences between groups on WISC-V variables. **Results:** Participants ranged in age from 6–15 (Mean=9.20). Thirty-two children had ADHD, 18 had LD, 14 had co-morbid ADHD/LD. Ten children had unspecified ADHD, LD or language disorder. For the sample, the Processing Speed Index was the weakest composite (Mean=96.95;SD=17.46), followed by Working Memory Index (Mean=99.84;SD=16.3). The Verbal Comprehension Index (Mean=103.58;SD=12.55), Fluid Reasoning Index (Mean=104.49;SD=16.05) and Visual Spatial Index composites (Mean=104.79;SD=15.39) were strongest. The General Ability Index, on average, (Mean=104.42;SD=14.82) was stronger for our sample than the Cognitive Proficiency Index (97.88; SD=16.58). On a subtest level, Figure Weights was strongest (Mean=11.37; SD=2.94), while Coding was weakest for the group (Mean=9.44;SD=3.68). Using scaled score of 5 or lower as threshold for impairment, Coding was the most frequently impaired task, (11.6% of sample). Within the Digit Span subtests, Digit Span Sequencing was most commonly impaired (11.6%), followed by Digit Span Backwards (9.3%). No children were impaired on block design, similarities, figure weights, or visual puzzles. There were no group differences in any subtest or index scores between those with ADHD and/or LD and those without.

**Conclusions:** In this sample of children with ADHD/LD high rates of impairments were not seen on any of the WISC-V variables, though groups performed better on tasks of general abilities than cognitive proficiency.

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## Executive Functions/Frontal Lobes

### B.A. BAILEY, C.C. FECK, M. SCITURRO & S.C. HEATON. The Role of Executive Functioning in Youth Self-Esteem.

**Objective:** Self-esteem (SE) has been defined as the ratio of reality to ideal, such that success in areas of personal importance leads to improved SE. Low youth SE is predictive of poor outcomes such as delinquency and aggression. Executive functioning (EF) has been implicated as a predictor of success in areas important for development and maintenance of SE (e.g., academics & peer relations), but little is known about the direct relationship between EF and SE. The current study sought to explore the relationship between youth SE and EF, with particular focus on the relative contribution of parent-report and performance-based measures of EF.

**Participants and Methods:** Participants (205 youth ages 8–16 referred for neuropsychological assessment) were administered the Behavioral Rating Inventory of Executive Functioning (BRIEF) and the Creature Counting task of the Test of Everyday Attention for Children (TEA-Ch) to assess EF. SE was measured using the youth self-report version of the Behavioral Assessment Scale for Children (BASC).

**Results:** Bootstrapped step-wise regression analysis revealed that the Inhibit subscale of the BRIEF was significantly associated with SE ( $R^2=.03$ ,  $p<.05$ ) but accounted for little variance. After accounting for parent-report of inhibition skills, no significant associations remained between SE and other BRIEF scales nor performance on the Creature Counting task.

**Conclusions:** Stronger SE was seen in youth with stronger behavioral inhibition skills. This suggests a relationship between executive functioning and self-esteem, but the performance-based measure failed to exhibit this relationship, and the variance explained by parent-reported EF was small. Future studies are needed to confirm that this relationship is best captured through rating scale assessment methods. It will also be important to examine the role of EF in SE in the context of broader

youth functioning, as parent-reported EF plays only a small role in this likely complex model.

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### B.A. BAILEY, M.D. UDHANI, E.M. MELLOTT & S.C. HEATON. The Role of Parent-Reported vs. Performance-Based Executive Functioning in Youth Academic Achievement.

**Objective:** Research has indicated that executive functioning (EF) broadly predicts academic achievement. Though recent research has highlighted differences between rating scales and tests of EF, little is known about these assessment methods as they relate to academic achievement (AA). The current study sought to determine the association between youth AA and both performance-based and parent-report EF measures.

**Participants and Methods:** EF was assessed in a mixed clinical sample of 77 youth ages 8–18 with the Creature Counting subtest of the Test of Everyday Attention for Children (TEA-Ch, to age 16) and parent ratings on the Behavioral Rating Inventory of Executive Functioning (BRIEF). AA was measured using word reading, math calculation, and spelling tasks from the Woodcock Johnson Tests of Achievement (WJ-Ach) or the Wechsler's Individual Achievement Tests (WIAT).

**Results:** Results revealed significant correlations between Creature Counting performance and both reading and spelling AA ( $r=.37$  &  $r=.41$ ,  $p<.05$ ). In contrast, parent-rated problems with EF (BRIEF Shift scale) only correlated with lower reading AA ( $r=-.29$ ,  $p\leq.05$ ).

**Conclusions:** Results indicate that the performance-based task is a stronger, broader predictor of AA. Greater parent-reported attentional control (as assessed by the Shift subscale) was associated with better word reading. However, greater performance on the Creature Counting task (which also measures attentional control) was more strongly associated with word reading and was associated with higher spelling performance. This study provides support for the use of performance-based measures of EF in assessments conducted for educational recommendations. Future studies should continue to explore benefits of performance-based and parent-report methods and their ability to predict other academic indicators such as grades.

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### M. CARLIER & Y. DELEVOYE-TURRELL. Assessment of inhibition predetermines the tolerance to physical effort.

**Objective:** Objective: The tolerance to effort is defined as a trait that influences one's ability to continue exercising at an imposed level of intensity even when the activity becomes uncomfortable or unpleasant. In the present study, we hypothesized that inhibition capacities will predetermine the ability to resist to higher efforts as suggested by the strength model of self-control (Audiffren and André, 2014). The more efficient one's inhibition ability, the more one should be tolerant to physical effort and resist to the urge to stop.

**Participants and Methods:** Participants and methods: 45 healthy individuals participated in the study. The inhibition capacities were assessed using the anti-saccade task (Miyake, 2000). The tolerance threshold was assessed using the PRETIE-Q questionnaire and two groups were determined (high vs. low tolerance). Physical activity consisted in cycling for 40 minutes, at a self-set intensity defined as "somewhat difficult" on the Perceived Exertion Scale (RPE 13). Feelings were assessed every 5 minutes using the Feeling Scale. Power output was measured at the same frequency on the ergo cycle (TechnoGym).

**Results:** Results: The low tolerance group revealed an inhibition ability that was significantly weaker (i.e., less effective) than the high tolerance group: they provided fewer correct answers in the anti-saccade task especially in the incongruent condition. The low tolerance group was also characterized by slower reaction times. During physical activity,

for the same level of perceived effort, the low tolerance group produced less power output than the high tolerance group with similar levels of affective responses.

**Conclusions:** Conclusion: High tolerance individuals may have the ability to resist longer to the emergence of negative feelings, which helps them produce more physical output than low tolerance individuals. Assessment of inhibition may be a tool to predict tolerance to physical effort and thus, predict the emotional experience of Adapted Physical Activity used for rehabilitation.

**M. CLEM, A. HOLLAND, R. PEREZ & P. STAVINOHA. Parental Ratings of Executive Functioning in Pediatric Survivors of Medulloblastoma and Pilocytic Astrocytoma.**

**Objective:** The present study compared parental ratings of executive functioning (EF) in pediatric survivors of medulloblastoma (MB) and pilocytic astrocytoma (PA) and examined factors contributing to those ratings. It was hypothesized that parental ratings would reflect worse EF in MB patients due to their history of irradiation, unlike PA patients. **Participants and Methods:** 36 survivors of MB and 20 survivors of PA completed a brief neuropsychological battery including the Wechsler Abbreviated Scale of Intelligence. Parents completed the Behavior Rating Inventory of Executive Functioning (BRIEF).

**Results:** Univariate tests indicated no significant group differences with regard to socioeconomic status (SES), gender, age at testing, ethnicity, or medical variables other than history of irradiation. However, PA survivors were younger at diagnosis ( $p < .01$ ). The PA group demonstrated significantly higher FSIQ and was rated as having significantly more problems on BRIEF scales of Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor (all  $p < .05$ ). Regression analyses showed that SES, FSIQ, age at diagnosis, and medical variables did not predict parental ratings of EF.

**Conclusions:** Findings regarding FSIQ are consistent with known effects of irradiation. However, the hypothesis was not supported, as PA survivors were described as having greater problems with EF. Research has shown older age at time of diagnosis and tumor resection is associated with stronger EF for MB and PA patients. Present findings suggest that younger age at diagnosis may be an even greater risk factor than irradiation in terms of EF late effects for these groups, which may help inform treatment decisions if supported by further research. Alternatively, parental ratings of EF may more prominently reflect rater bias than actual EF. Specifically, varying parental expectations for EF based on general level of disability (related to treatment intensity; FSIQ) may result in biased reports of perceived EF deficits.

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**E. CRAUN, S. KAPLAN, C. WILLIAMS, K. WESTERHAUS & M.M. WONG. Executive Functioning Moderates the Association Between Parent-Child Relationship and Alcohol Use.**

**Objective:** Alcohol use increases in emerging adulthood (i.e., 18-25 years). This may be due to the fact that emerging adults often live outside the home, away from their parents' supervision, allowing for an increase in risky behavior. Closeness in a parent-child relationship may mitigate this risky behavior. Indeed, previous research reported that closeness of the parent-child relationship is protective against alcohol use (Petraitis et al., 1995). A risk factor for alcohol use is executive functioning (EF) ability (Wong et al., 2010), where deficits in the flexibility of behavior, inhibition of responses, and planning for the future is associated with increased alcohol use. The purpose of this study is to assess how EF ability moderates the relationship between parent-child closeness (PCC) and alcohol use in a population of emerging adults.

**Participants and Methods:** This study examined 239 college students between the ages of 18 to 25. Participants completed the Parent-Child Closeness scale, Rutgers Alcohol Problems Inventory, and the Tower

of Hanoi. A regression model was employed to evaluate the association between PCC and alcohol use, moderated by EF ability.

**Results:** Tower scores significantly moderated the relationship between PCC scores and number of alcohol problems ( $\Delta R^2 = .02$ ,  $F(1, 201) = 5.39$ ,  $p < .05$ ). Additionally, Tower scores also significantly predicted a decrease in alcohol problems ( $b = -1.74$ ,  $t = -2.82$ ,  $p < .05$ ). Subsequent probing of the interaction showed that among individuals with low ( $b = -2.09$ ,  $t = -3.83$ ,  $p < .005$ ) to average EF ( $b = -1.19$ ,  $t = -2.92$ ,  $p < .005$ ), PCC was negatively related to alcohol problems, such that participants who were close to their parents had fewer alcohol problems. Among individuals with high EF, PCC had no relationship with alcohol problems. **Conclusions:** These results suggest that high EF abilities are a robust protective factor against alcohol use. For those with low to average EF abilities, parent-child relationship may act as a protective factor to drinking problems.

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**K. CROCFER & J. REESMAN. Parent Ratings of Executive Function in Children with a History of Hearing Loss.**

**Objective:** Multiple studies have examined the clinical utility of the Behavior Rating Inventory of Executive Functioning- Parent form (BRIEF) in various clinical populations. The present study sought to examine the impact of the presence of hearing loss on parent ratings on the BRIEF in clinically referred samples of children with and without hearing loss.

**Participants and Methods:** Parent ratings were examined in groups of children with and without a history of hearing loss. Our hearing loss sample included 34 children (61.8% male) ages 8-14. Twenty-nine of the children reported past use of auditory supports (e.g. hearing aids, cochlear implant) with twenty-seven of the children presently using auditory supports. The majority ( $n = 29$ ) were diagnosed with hearing loss prior to age two years. An age and gender matched sample of children without hearing loss was used for comparison ( $n = 34$ ). Parent ratings on the BRIEF were examined for each group individually and comparisons between groups were examined via independent samples t-tests.

**Results:** Examination of scores on the BRIEF for both groups demonstrated an average group rating above the mean. Significant differences between the groups were noted only on the Monitor scale of the BRIEF demonstrating that children in the sample with hearing loss were actually rated closer to the average range ( $M = 55.91$ ;  $SD = 12.49$ ) than children without hearing loss ( $M = 62.35$ ;  $SD = 12.21$ );  $t(66) = -2.15$ ,  $p = .035$ .

**Conclusions:** Present results suggest that parents of children with or without hearing loss tend to rate their children similarly when presenting for clinical evaluation. Presence of hearing loss within the context of additional concerns of neurocognitive impact that prompt referral for neuropsychological evaluation may not contraindicate use of parent rating scales designed for parents of children with typical hearing status. Additional study of parent ratings and relationship to child's performance on performance based measures is still necessary, particularly for children with hearing loss.

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**N. DOTY, J. NIELSEN, M. LEVITT, E. O'DONNELL, H. WILSON, B. WILLOUGHBY, H. DITMARS, J. BLAIS, A. DOYLE & E. BRAATEN. Executive Dysfunction as a Moderator of the Link Between Depression and Externalizing Behavior in Children and Adolescents.**

**Objective:** Children and adolescents with depression are at increased risk for externalizing problems, such as aggression and delinquency. However, the mechanisms underlying this comorbidity remain poorly understood. This study examines executive dysfunction as a potential moderator of the relationship between depressive symptoms and externalizing behaviors in youth.

**Participants and Methods:** 170 participants aged 8-17 were recruited as part of an ongoing investigation of youth presenting for psychological assessment at a general hospital. Parents rated executive dysfunction on the Behavior Rating of Executive Function (BRIEF) and externalizing problems on the Behavior Assessment System for Children (BASC-2). Youth rated their own depressive symptoms on the self-report BASC-2.

**Results:** In a hierarchical regression model, youth externalizing problems were predicted by the interaction between depressive symptoms and executive dysfunction. The association between depressive symptoms and increased externalizing problems was strongest for youth with greater executive dysfunction.

**Conclusions:** Results suggest that depressed youth with executive dysfunction may be at particular risk for externalizing problems. This study highlights executive dysfunction as a risk factor for future investigation, as well as a potential target for intervention among depressed youth.

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**L.M. MCGRATH, E. BRAATEN, N. DOTY, B. WILLOUGHBY, H. WILSON, E. O'DONNELL, M. COLVIN, H. DITMARS, J. BLAIS, A. METZGER, R. PERLIS, E. WILLCUTT, J. SMOLLER, I. WALDMAN, S. FARAONE, L.J. SEIDMAN & A. DOYLE. Extending the “cross-disorder” relevance of executive functions to dimensional neuropsychiatric traits in youth.**

**Objective:** Executive functions (EFs) are promising mediators of the underlying genetic risk that is now known to be shared across different neuropsychiatric conditions; yet, evidence that the same cognitive functions are impaired across different forms of psychopathology comes primarily from separate studies of individual categorical diagnoses versus controls. Given growing support for dimensional models that cut across traditional diagnostic boundaries, we aimed to determine, within a single cohort, whether performance on measures of EFs predicted variation in symptoms of different psychopathological conditions known to share genetic liability.

**Participants and Methods:** Data include 393 youth, ages 8 to 17, enrolled in the Longitudinal Study of Genetic Influences on Cognition (LOGIC). This project ascertains DNA and dimensional cognitive and psychiatric phenotypes on consecutive referrals to a pediatric assessment clinic within the Psychiatry Department at Mass General. First, we used MPlus to model three cognitive factors (working memory, shifting, and executive processing speed) that loaded on a second-order EF factor. Then, we related this EF factor to variation in symptom dimensions of autism, mania and psychosis.

**Results:** The EF factor predicted variation in our three target traits but not in a negative control (somatization). Moreover, this EF factor was primarily associated with the overlapping (rather than unique) variance across the three outcome measures, suggesting it related to a general increase in psychopathology symptoms across those dimensions.

**Conclusions:** Findings extend support for the relevance of EFs to neuropsychiatric conditions that share underlying genetic risk. They suggest that EFs relate to the dimensional spectrum of these disorders and not just the clinical diagnoses. Moreover, results have implications for bottom-up models linking genes, cognition, and a general psychopathology liability.

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**A. FEDER, J. RAAK, R. GOLDSWORTHY, A. DUDLEY & R. SKEEL. Working Memory Load Negatively Impacts Moral Acceptability Judgments.**

**Objective:** Working memory plays a prominent role in dual process theories of decision-making (Evans & Stanovich, 2013). These theories examine the role of effortful, controlled processes and automatic,

intuitive processes in decision-making. However, the moral reasoning literature has emphasized higher order concepts, such as agency, utilitarian distinction, etc. with less research conducted on basic processes such as working memory.

**Participants and Methods:** Participants (N = 102) were presented with vignettes describing unpleasant moral decisions, with outcomes early in passages to minimize working memory demands. Participants rated how appropriate they found the vignette outcome. Outcomes were categorized as positive, neutral or negative valence. It was hypothesized that under greater working memory load participants would be less successful in overcoming automatic reactions or coming to counter-intuitive conclusions.

**Results:** A significant main effect was observed with positive vignettes rated most acceptable, negative vignettes least acceptable, and neutral vignettes falling in-between. A significant interaction effect was also found between vignette valence and working memory load. Those in working memory load conditions rated vignette acceptability less positively than those in non-working memory load conditions. This difference was greatest when participants were presented with vignettes with incongruent outcomes such as a positive vignette in which participants are presented with an unpleasant moral situation (i.e. – cannibalism) that results in a positive outcome (i.e. – refusing to engage in cannibalism).

**Conclusions:** The interaction effect observed in this study supports findings that working memory plays an important role in moral decision making. Notably, it illustrates working memory was necessary in overcoming automatic responses and forming counter-intuitive conclusions. Furthermore, dual process theories are applicable in moral reasoning research and shed light on the underlying cognitive processes.

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**E.I. FRANCHOW, M. NIERMEYER, J. BALL & Y. SUCHY. Expressive Suppression in Older Adulthood Differentially Depletes Executive Functioning.**

**Objective:** Higher-than-usual burden of regulation of affective responses known as expressive suppression (ES) is associated with acutely-compromised executive functioning (known as “executive depletion”), but not working memory or processing speed, in young adults (Franchow & Suchy, 2015). We have also demonstrated this executive depletion effect in a pilot sample of older adults (Franchow, Rhodewalt, Rigby, & Suchy, 2014). However, it is unclear whether the depletion effect remains specific to executive functioning in older adulthood.

**Participants and Methods:** 98 adults (M=69 years old; 66.3% female; M=15.75 years of education) completed four subtests from the Delis Kaplan Executive Functioning System, with scores reflecting response generation, maintenance, and switching (Exec-Pre) and processing speed (PS-Pre) combined into composite scores. Participants were then pseudo-randomly assigned to undergo experimental manipulation of ES (viewing 5 minutes of disgusting and amusing videos) under one of two conditions: 1) Suppress (maintaining neutral affect), or 2) Free Expression (responding naturally). Participants then repeated cognitive testing (Exec-Post, PS-Post). Groups were comparable in age, sex, and years of education.

**Results:** Repeated measures analysis of variance with executive and processing speed composites as dependent variables, time (Pre v. Post) as the within-subjects factor, experimental condition as the between-subjects factor, and age and sex as covariates showed a main effect of time ( $F(1, 91) = 4.063, p = .047$ ) and an interaction between time, condition, and domain ( $F(1, 91) = 6.039, p = .016$ ); both groups showed a significant practice effect on processing speed, but only Free Expression Participants also showed a significant practice effect on executive scores.

**Conclusions:** These results suggest that the depleting effect of ES continues to be specific to executive functioning in older adulthood, as it is in younger adulthood.

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**C. GESSNER, D. MOORE, I. PIRYATINSKY, S. GRANT, A.B. WATERS & A. MACKAY-BRANDT. D-KEFS Normative Data from the Nathan Kline Institute – Rockland Sample (NKI-RS) Open-Access Data Resource.**

**Objective:** Despite an era of great enthusiasm for brain science and the growth of fields that examine brain – behavioral relationships, there is a wide gap in the ability to map brain structure and function to associated variations in behavior as measured by cognitive, health, or psychodiagnostic assessment. In order to close this gap, we need large-scale normative data with extensive characterization across modalities.

**Participants and Methods:** The Nathan Kline Institute-Rockland Sample (NKI-RS) is a large-scale, cross-sectional sample of brain development (aged 6 – 85 years), with the aim to characterize 1000 community-ascertained participants using multimodal neuroimaging, genetics, health and extensive behavioral assessments. Participants were recruited from the Rockland County, NY area. Normative data on 620 participants (aged 8-85 years) who were administered the D-KEFS are described in detail and in comparison to the published D-KEFS standardization sample.

**Results:** Differences in inclusion criteria are reviewed, with the NKI-RS including higher levels of psychiatric symptoms and substance use. The NKI-RS D-KEFS normative data is presented in the same age group format as the standardization tables and includes additional stratification by education levels above 16 years. Correlations among D-KEFS task performance and measures of mood and substance use are described by age grouping. Further, the authors are creating a computerized look-up tool for the NKI-RS D-KEFS data as a normative resource and aim to solicit feedback on its utility.

**Conclusions:** The NKI-RS provides researchers with open-access, pre-publication data for the testing of existing hypotheses and the generation of novel hypotheses through the application of data exploration techniques. All datasets are shared through the web-based Collaborative Neuroinformatics Neuroimaging Suite of the Mind Research Network. Genetic samples are available through the NIMH Genetics Repository. [NIMH BRAINS R01MH094639-01 NIMH R01MH0812118 R01MH083246 R21MH084126]

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**B. GORTER, Y. OH, E. HELDER & M. GUNNOE. The relationship between cognitive inhibition and disinhibited social behaviors in internationally adopted children.**

**Objective:** Internationally adopted children are at an increased risk for developing disinhibited social behaviors (also known as indiscriminate friendliness), (Love, 2015) which is positively correlated with length of early deprivation (Bruce, 2009; Rutter, 2007). Some researchers have found that this relationship is mediated by poor inhibitory control (Bruce, 2009), while others have failed to find this mediating effect (Colvert et al., 2008). We seek to clarify this relationship by measuring inhibitory control at several time-points in a longitudinal design. In addition post-adoption parenting factors will be examined as predictors of disinhibited social behavior.

**Participants and Methods:** Forty nine (16 male, 33 female) internationally adopted were tested at four different time points in a longitudinal design. The mean age of adoption=57 months (SD=47.45); average time spent in adoptive home at year 1=20.9 months (SD =18.94). Neuropsychological assessments of attention and executive functioning were administered in each wave as were parent ratings of disinhibited social behaviors, child behavior, emotional development, executive functioning, and parenting. Child ratings of attachment and peer relationships were collected in the fourth wave.

**Results:** Our findings suggest that greater early deprivation predicted greater disinhibited social behavior with poor inhibitory control tending to mediate this relationship. In addition, post-adoptive parenting discipline practices predicted disinhibited social behaviors over time. Quality of attachment and quality of peer social relationships were not associated with disinhibited social behavior.

**Conclusions:** Uncovering the variables underlying disinhibited social behaviors could aid the development of effective interventions. Also, post-parent discipline practices could be used to mitigate the effects of early deprivation on disinhibited social behaviors.

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**K. HERNANDEZ, G. ALARCÓN, H. STEIN & B. NAGEL. Increased Anxiety Predicts Superior Set-Shifting Performance in Healthy Adolescents.**

**Objective:** Clinical levels of anxiety have been associated with deficits in attention, inhibition, and set-shifting. Set-shifting allows for cognitive flexibility, a skill helpful in coping with distress. The relationship between anxiety and set-shifting has not been investigated during adolescence, a period of development during which maturation of the brain and executive functions is occurring, and base-rates of anxiety increase.

**Participants and Methods:** Thus, this study investigated the relationship between subclinical anxiety symptoms and set-shifting performance in a sample of 144 healthy adolescents, aged 12-15 years (M=13.54, SD= 0.869). Participants completed the National Institute of Mental Health Diagnostic Interview Schedule for Children, Predictive Scale interview (DPS), the Spielberger State-Trait Anxiety Inventory (STAI), and the Delis-Kaplan Executive Function System (D-KEFS) Color-Word Interference task. A composite score for anxiety was created by adding normalized DPS Generalized Anxiety Disorder scores and STAI State Anxiety scores. Set-shifting was investigated by computing a score that incorporated the Inhibition/Switching reaction time and errors, while controlling for inhibition.

**Results:** Multiple regression, controlling for age and sex, revealed that anxiety scores were positively associated with performance on the Inhibition/Switching task,  $F(1, 142) = 3.99, p < .05$ . Relationships between anxiety scores and the Color Naming, Word Reading, and Inhibition components of the task were not significant (all  $p$ 's  $> .05$ ), suggesting that this effect was specific to set-shifting.

**Conclusions:** Along with deficits seen in clinical populations, these findings may support the notion of an inverted U-shaped relationship between arousal and executive functioning, and that a moderate amount of subclinical anxiety may lead to better set-shifting performance.

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**B.D. HOLCOMBE, A.M. CROOKS, A.L. COTTON, D.L. RAINEY & H.M. HILL. Exploring Relationships in Executive Functioning Based on Neurocognitive Performance, Parent Ratings, and Social Support.**

**Objective:** Previous studies have pointed to a positive relationship between parental involvement/social support and executive functioning (EF) outcomes in young children. Specifically, strong parental attachment and security was linked to improvements over time in cognitive flexibility and inhibitory control. The first objective of the present study is to examine relationships between performance-based and parent ratings of EF. The second objective is to explore the predictive nature of social support on performance-based EF outcomes.

**Participants and Methods:** Pilot data from 17 participants (77% female, evaluation age M = 9.41, SD = .618) was collected from a sample of urban elementary school students. Participants were excluded if they met diagnostic criteria for Autism Spectrum Disorder (ASD). This study

used EF data collected during a brief neurocognitive evaluation and social support ratings from a child resiliency/social support instrument.

**Results:** While associations between domain-matched variables were not found for inhibitory control after controlling for age and gender, a moderately significant relationship was found for working memory ( $r(6) = .61, p = .06$ ). Based on parent ratings, significant associations were also found between inhibitory control and attention ( $r(6) = .81, p < .01$ ), inhibitory control and working memory ( $r(6) = .712, p < .05$ ), and attention and working memory ( $r(6) = .828, p < .01$ ). Analysis of social support and EF was not significant.

**Conclusions:** Previous associations between social support and patterns of EF performance were not replicated in this study; however, findings should be interpreted with caution due to sample size. Overall, significant relationships between EF domains were found based on parent report, with relationships between IC and AT, IC and WM, and WM and AT being noted.

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**A.K. HOLLAND, A. ROSA, C. BLANCO, M. DOSTER & D.W. HARRISON. The Association Between Exposure to a Traumatic Event and Compromised Functional Cerebral Systems in the Left and Right Frontal Lobes.**

**Objective:** Functional cerebral systems mediated by the right and left frontal lobes may be diminished with the experience of a traumatic event (i.e.: sexual assault, death of a family member, or car accident). For the current research, it is hypothesized that the functional cerebral systems mediated by the left and right frontal lobes are compromised in those who have been exposed to a significant traumatic event.

**Participants and Methods:** College undergraduates who have reported ( $n=24$ ) and have not reported ( $n=56$ ) being exposed to a traumatic event completed the Controlled Oral Word Association Task (COWAT) and the Ruff Figural Fluency Task (RFFT). Heart Rate (HR) measures were taken before and after completion of these tasks.

**Results:** A Trauma x Trial interaction for the Number of Unique Words Produced ( $F(2, 156)=3.17, p=.04$ ) was found, indicating that individuals reporting having been exposed to a traumatic event evidenced a reduction in unique words produced compared to those reporting no exposure. This interaction was not present when completing the RFFT. A nonsignificant trend for HR ( $F(1, 53)=2.93, p=.09$ ) was found, indicating that those individuals exposed to a traumatic event evidenced an increase in HR upon completion of the COWAT.

**Conclusions:** The current research provides preliminary evidence that exposure to a traumatic event may provide reductions in functional cerebral systems responsible for phonemic fluency production and cardiovascular regulation. The capacity to produce fluent speech and maintain stable levels of frontal lobe activation may be compromised in individuals exposed to a traumatic event.

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**J. KAYLEGIAN, J. PICHE, K. ARES, L.A. KAIS & S. HUNTER. The Relationship between Level of Executive Functioning and Engagement in High-Risk Behavior among Urban Homeless Youth.**

**Objective:** Many youths experiencing homelessness are exposed to challenges that impact their neurocognitive development, contributing to poor decision making and higher risk taking behavior. This study examined the relationship between level of executive functioning (EF) and engagement in risky behaviors including alcohol, marijuana, and high-risk sex, among a shelter-living sample of urban homeless youth.

**Participants and Methods:** 148 youths were recruited from homeless agencies in Chicago and Los Angeles (53% female; 76% African-American; ages 18-22). EF was assessed using summary scores from the

BRIEF, including the Behavioral Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite (GEC). Youths were divided based on EF scores, with youths scoring at least one standard deviation above the normed average on the BRIEF classified as showing high EF, and low EF defined as those scoring at least one standard deviation below the normed average. Risk behaviors were measured using items from an amended version of the National Youth Risk Behavior Survey (YRBS) and the Mini-International Neuropsychiatric Interview (MINI).

**Results:** Analyses revealed that homeless youths who fell into the low EF group were significantly more likely to have engaged in risky levels of alcohol and marijuana use, and unprotected sex, than those in the high EF group. Youth meeting criteria for a substance abuse diagnosis were also shown to have earlier ages of use, highlighting increased risk secondary to homelessness history.

**Conclusions:** Results suggest a strong link between poor EF and engaging in risky behaviors. Better understanding of connections between level of EF and risk behaviors is an important step toward possible treatment and intervention for at risk youth. Results are discussed in terms of approaches to supporting better EF in these youths.

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**K. KLIPFEL, E. BAKER, J. GUNSTAD, J. DUNLOSKY, C. WAS & M. VAN DULMEN. The Relative Contribution of Executive Dysfunction to Psychological, Physical, & Sexual Dating Aggression.**

**Objective:** Preliminary research has shown associations between executive dysfunction and dating aggression, though the relative contribution of executive dysfunction to subtypes of aggression is unexamined. The current study comparatively examined the magnitude of the association of indicators of executive dysfunction with psychological, physical, and sexual aggression.

**Participants and Methods:** Members of heterosexual dating couples ( $N=138$ ; 18-29 years of-age) completed tasks of executive dysfunction, including a clinically-normed indicator (perseverative errors of the WCST; Heaton & PAR staff, 2003) and indicators of shifting (Plus-Minus Task; Jersild, 1927), updating (Letter Memory Task; Morris & Jones, 1990), and inhibition (Go/No-Go Task) difficulties. Psychological, physical, and sexual aggression perpetration were assessed via the Conflict in Adolescent Dating Relationships Inventory (Wolfe et al., 2001). Estimated intelligence (Spot-the-Word; Baddeley & Crawford, 2012) and relationship satisfaction (Relationship Assessment Scale; Hendrick et al., 1998) served as controls.

**Results:** Within structural equation models, pairwise equality constraints revealed that female updating difficulties differed in magnitude of association with psychological ( $\beta=-.02, p=.77$ ) and physical ( $\beta=.13, p=.23$ ) dating aggression [ $\Delta\chi^2(1)=3.77, p=.05; \Delta CFI=-.05$ ]. Female inhibition difficulties differed in magnitude of association with physical ( $\beta=-.17, p=.04$ ) and sexual ( $\beta=.01, p=.90$ ) aggression [ $\Delta\chi^2(1)=5.23, p=.02; \Delta CFI=-.06$ ]. Male shifting difficulties differed in magnitude of association between physical ( $\beta=-.08, p=.32$ ) and sexual ( $\beta=.16, p=.05$ ) aggression [ $\Delta\chi^2(1)=10.36, p=.001; \Delta CFI=-.04$ ], as well as psychological ( $\beta=-.02, p=.84$ ) and sexual ( $\beta=.16, p=.05$ ) aggression [ $\Delta\chi^2(1)=4.77, p=.03; \Delta CFI=.00$ ].

**Conclusions:** Generally, executive dysfunction contributes more strongly to physical aggression for females and sexual aggression for males, though indicator of executive dysfunction impacted findings.

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**A. LETTERI & L. PICK. Effortful Control Skills in Deaf Children with and without Additional Disabilities.**

**Objective:** Research with deaf children often fails to discriminate between children who are deaf and children who are deaf with additional disabilities. When examining concepts such as effortful control

(attention focusing, attention shifting, inhibitory control, and impulsivity) this distinction can be clinically and academically significant. Effortful control has a global impact on developmental processes including language, memory, and affective regulation. Hearing loss, through its impact on language acquisition, is known to affect a child's ability to develop effortful control skills. When providing care to deaf children it is also important to consider the impact of atypical neurodevelopmental burdens above and beyond hearing loss. This research aims to better understand these potential differences in the development of effortful control skills within a heterogeneous group of deaf children.

**Participants and Methods:** Sixty-nine parents of deaf children between the ages of 6-10 years (mean age = 8.69, SD = 251.49 months) were recruited. Forty children were reported as deaf and 29 children were reported as being deaf with additional disabilities. Parents completed online surveys including a demographic questionnaire and the Effortful Control Scale of the Child Behavior Questionnaire.

**Results:** Deaf children were rated as demonstrating significantly stronger attention focusing, attention shifting, and inhibitory control skills when compared to their peers with additional disabilities. Both groups were rated similarly on impulsivity.

**Conclusions:** This research suggests that the presence of additional disabilities is associated with weaker development of regulatory capabilities above and beyond what is typically expected for hearing loss alone. When children who are deaf are seen by clinical providers, it is important to distinguish between those who are deaf and those who are deaf with additional disabilities.

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**M. LØVSTAD, S. SIGURDARDOTTIR, S. ANDERSSON, V. GRANE, T. MOBERGET, J. STUBBERUD & A. SOLBAKK. The utility of the Behavior Rating Inventory of Executive Function across neurological and neuropsychiatric conditions - associations with cognition and emotional distress.**

**Objective:** The present study explored how self-reported executive functioning in daily living is related to neuropsychological test performance and self-reported emotional distress in a large sample comprising both healthy adults and patient populations with neurological and neuropsychiatric disorders.

**Participants and Methods:** Results from the self- and informant reported Behavior Rating Inventory of Executive Function - Adult version (BRIEF-A) are presented, along with scores on standardized tests of executive functioning, and self-reported psychological status in Norwegian healthy controls (n = 118), patients with severe traumatic brain injury (n = 127), focal frontal lobe damage (n = 31), focal cerebellar lesions (n = 25), Parkinsons disease (n = 43), Attention Deficit Hyperactivity Disorder (n=35), type II Bipolar Disorder (n = 21), and Borderline Personality Disorder (n = 20).

**Results:** No or weak relationships between BRIEF-A and IQ, and tests of executive function were found. Strong relationships were observed between BRIEF-A and emotional distress in controls and neurological patient groups. Scores at or above recommended clinical cut-offs were found in the neuropsychiatric, but not in neurological patients. Controls tended to have BRIEF-A scale and index scores 1/2-3/4 SD below the US normative mean of T=50.

**Conclusions:** The study demonstrates the need to regard BRIEF-A results within a broad differential diagnostic context, where measures of psychological distress are included in addition to neuropsychological tests. Uncertainty about the normative data in non-US countries adds to the need for interpretive caution. More empirical knowledge about the BRIEF-A, including cultural response variations, is needed.

**V.W. MARK, B. LAI & A. NAIDU. Anti-saccade Testing May Reflect Impaired Sustained Attention of Acute Rehabilitation Inpatients.**

**Objective:** To test the responses of acute rehabilitation inpatients to anti-saccade testing relative to age-matched control subjects.

**Participants and Methods:** To assess executive control using a simple test, a convenience sample of 35 adult inpatients of diverse disorders (mean age of 55 ± 17 years) and 26 neurologically healthy control subjects (mean age of 60 ± 15) were recruited from an acute inpatient rehabilitation facility. All participants performed the anti-saccades test from the NIH Examiner test battery from a laptop computer. During the task participants must look away from a suddenly appearing dot whose lateralized location is unpredictable. After a brief practice trial, participants were given 2 series of 20 anti-saccade trials each, with about a 1-minute rest period between series. Testing was preceded by 10 trials of prosaccade testing (looking at the dot). Saccades were scored as correct or incorrect by direct examiner evaluation. The amount of errors made on each task was recorded. The mean errors made on each anti-saccades trial and the overall errors made were compared between groups by Student's t-test.

**Results:** There were no significant differences in mean age and years of education between groups (all p's >0.05). There were no significant differences on the mean errors made between patients (4.49 ± 3.95, CI= 3.17-5.80) and controls (3.14 ± 2.30, CI= 2.12-4.15) on the first anti-saccades trial (p=0.14). However, patients made a statistically larger amount of errors (5.35 ± 4.74, CI= 4.03-6.67) on the second anti-saccades task compared to those of the control group (2.27 ± 2.21, CI= 0.56- 4.00; p= 0.006).

**Conclusions:** The anti-saccades test may provide a novel way to evaluate sustained attention in acutely disabled adults, and can be given to individuals who lack manual dexterity or ability to vocalize. Therefore, the anti-saccades test may increase the range of patients who can be evaluated on sustained attention in the acute rehabilitation inpatient setting.

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**K. MULHAUSER, R. VAN PATTEN, C. WHITE, K. WENZEL, Z. MERZ & J. WEINSTOCK. Differential Relationships Among Speeded Neuropsychological Test Performance and Facets of Impulsivity in Individuals with Substance Use Disorder.**

**Objective:** Impulsivity is elevated in individuals with substance use disorder (SUD) as are inefficiencies in information processing and executive functions (EFs). We hypothesized that (a) trait-based measures of impulsivity would remain stable across a ten-day period of initial abstinence and (b) neuropsychological performance on speeded tests of EFs would be negatively related to impulsivity.

**Participants and Methods:** Twenty-seven participants with SUD completed Trails A and B, the Victoria Stroop Task, and phonemic fluency, as well as the UPPS-P, a self-report inventory measuring five facets of impulsivity. Data were collected upon entry to a hospital-based residential treatment program and then again ten days later. Hypothesis one was examined using dependent t-tests and hypothesis two was examined using Pearson's correlation coefficients.

**Results:** Partially consistent with the first hypothesis, impulsivity remained stable over time with the exception of one facet of impulsivity, (lack of) premeditation, which significantly decreased from T1 to T2. Hypothesis two was also partially supported, such that (lack of) premeditation exhibited a strong positive relationship with test performance at both time points, while positive and negative urgency each demonstrated strong negative relationships to test performance at T2 only.

**Conclusions:** These findings are interpreted to suggest that residential treatment for SUD may foster self-reflection and planning abilities that protect against a primary facet of impulsivity. Additionally, (lack of) premeditation may enhance speeded cognitive performance, while positive and negative urgency attenuate such performance. It is noteworthy



that no differential relationships were present across lower-level (e.g., Trails A) compared to higher-level (e.g., Trails B) tasks, suggesting that all tests were measuring a similar, speed-based construct. These findings argue for a more fine-grained conceptualization of impulsivity and its relationship to neuropsychological test performance in SUD.

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### **M. NIERMEYER, E.I. FRANCHOW & Y. SUCHY. Motor Sequence Learning in Older Adulthood: Effects of Complexity and Relationships with Executive Functioning.**

**Objective:** Older adults' motor sequencing (MS) performance is more susceptible to complexity and more reliant on executive functioning (EF) than that of younger adults (Seidler, 2010). This study examined whether these relationships hold for all, or only some, aspects of MS performance, including motor-planning (MP), motor-learning (ML), and motor-control speed and accuracy (MC-Speed; MC-Accuracy).

**Participants and Methods:** 58 young (18 to 37 years) and 87 older (60 to 86 years) healthy adults completed a computerized MS task (Push Turn Taptap task; PTT) designed to assess MP, ML, and MC Speed and Accuracy across 4 blocks of increasing MS complexity, and selected subtests from the Delis-Kaplan Executive Function System as indices of EF and processing speed (PS).

**Results:** All aspects of the older adults' (as compared to younger adults') performance were more negatively affected by complexity (all  $p$  values  $< .01$ ). Hierarchical regressions using each aspect of performance as the dependent variable revealed for MP that EF accounted for variance beyond PS for both age groups. In contrast, for ML and MC-Accuracy, EF was an independent predictor for the older adults only; and for MC-speed, EF was an independent predictor for the young adults only (all  $p$  values  $< .045$ ). Follow-up generalized linear models for each age group revealed a trend towards an EF by complexity interaction for ML ( $p = .08$ ), such that EF accounted for unique variance for only the moderately complex sequences.

**Conclusions:** These results provide additional evidence that older adults' motor sequencing is disproportionately affected by complexity. Additionally, the results suggest MP is reliant on EF across the lifespan, but ML and MC-Accuracy become reliant on EF only with increasing age. MC-speed is related to EF only for younger adults. Collectively these results indicate age, task complexity, and the specific aspect of MS performance all play a different role in the relationship between EF and MS. Correspondence: *Madison Niermeyer, BA in Psychology, Clinical Psychology Department, University of Utah, 992S Roseboro Road, Sandy, UT 84092. E-mail: madison.niermeyer@psych.utah.edu*

### **K.H. NIXON, A.A. NOLTY, S. AMANO, D.S. BOSCH & A. DREYER. Is Executive Functioning Related to Resilience in Humanitarian Aid Workers?**

**Objective:** Neurobiological changes due to chronic stress have serious functional implications for executive functioning and memory. Research has focused on the construct of resilience in an attempt to reverse the long-term sequelae of chronic stress, which is particularly important for humanitarian aid workers as they often work in increasingly violent conflict areas. The goal of this study was to investigate associations between executive functioning and resilience in aid workers.

**Participants and Methods:** Thirty-three aid workers (9 women & 24 men) between the ages of 19 and 60 ( $M = 39.4$ ,  $SD = 10.7$ ) from 14 countries of origin who had been deployed to global areas of need over an average of 10.5 years ( $SD = 7.6$ ) completed the California Verbal Learning Test-II (CVLT-II) during a training workshop. They also filled out questionnaires that included the Headington Institute Resilience Inventory (HIRI), the Stress Vulnerability Scale (SVS), and the PTSD Checklist (PCL-C), as well as the Behavior Rating Inventory of Executive Functioning (BRIEF-A).

**Results:** BRIEF-A indexes correlated with 6 of 7 HIRI factors of resilience ( $ps$  between  $.001$  and  $.03$ ) and with PTSD symptoms of Hyperarousal ( $p = .006$ ) and Avoidance ( $p = .03$ ). The CVLT-II semantic clustering index correlated with the SVS ( $r = -.44$ ,  $p = .02$ ) as did the recall discriminability index ( $r = -.47$ ,  $p = .01$ ).

**Conclusions:** These findings suggest that executive functioning plays a role in resilience, which raises the intriguing possibility of bolstering stress resilience through the scaffolding of executive functioning. Thus future studies should investigate the value of helping aid workers stay organized, routinized, and structured in otherwise chaotic environments as a means of providing resilience to stress and protection from poor mental health outcomes.

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### **Y. OH, B. GORTER, E. HELDER & M. GUNNOE. Longitudinal investigation of memory and executive functioning in internationally adopted children.**

**Objective:** Previous studies have documented the negative effects of early deprivation on cognitive domains, such as memory and executive functioning (Bos, 2009; Pollak, 2010). However, most existing research has been cross-sectional and has not examined post-adoptive parenting as a predictor of cognitive outcomes. This longitudinal study investigates memory and executive functioning in a multinational group of international adoptees and explores potential predictors.

**Participants and Methods:** Forty-nine children (age at study onset  $M = 78.0$ ,  $SD = 46.5$ ) from ten countries were enrolled in the study (age at adoption  $M = 57.0$ ,  $SD = 47.7$ , time post-adoption at year 1  $M = 21.0$  months,  $SD = 18.9$ ). The assessments, completed at 4 waves, consisted of a neuropsychological battery, semi-structured parent interview, and structured parent ratings.

**Results:** Deficits relative to normative samples were found for visual and verbal memory for the first two waves. However, in waves 3 and 4, their performance showed significant improvement. For the domain of executive functioning, including working memory and attention, participants' performance showed deficits for all four waves. Analyses of predictors of outcomes indicated a parental approach involving more consistent discipline and a more equitable balance between mothers' and fathers' contribution to child care predicted better cognitive performances in some domains.

**Conclusions:** Catch-up in certain cognitive domains in post-institutionalized children is evident, though executive functioning demonstrates less catch-up than memory. Findings have implications for parenting approach following international adoption.

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### **H. OKABE, M. ESTERMAN & J. DEGUTIS. Sex differences in sustained attention and inhibitory control across the lifespan.**

**Objective:** Though clear sex differences have been found in verbal (females show verbal memory advantage) and spatial abilities (males show mental rotation advantage), less is known about sex differences in attention and executive function and if these potential differences change over the lifespan. To address these questions, we examined sex differences in sustained attention and inhibitory control ability and strategy using a go/no-go continuous performance task (CPT).

**Participants and Methods:** 10,430 volunteers aged 10-70 visited TestMyBrain.org, a cognitive testing website, and performed the gradual-onset CPT (gradCPT), a go/no-go sustained attention task requiring a response to non-targets (90%) and withholding to rare target images (10%). Measures of interest included commission error rate (sustained attention/inhibitory control ability), mean reaction time (speed/response strategy), and post-commission error slowing (making error-related response setting adjustments).

**Results:** Across the lifespan, compared to males, females showed a similar commission error rate but demonstrated significantly slower reaction times ( $p < 0.001$ ; females:  $M = 878\text{ms}$ ; males:  $M = 866\text{ms}$ ) and significantly more post-error slowing ( $p < 0.001$ ; females:  $M = 78\text{ms}$ ; males:  $M = 56\text{ms}$ ). One notable exception to the equivalent commission error rates across the lifespan is that 10-12 year old boys made significantly more commission errors than same-aged girls ( $p < 0.001$ ; females:  $M = 0.40$ ; males:  $M = 0.49$ ).

**Conclusions:** We find that while males and females have comparable overall inhibitory control/sustained attention abilities, females take a more conservative response strategy and are more likely to make response setting adjustments after errors. Interestingly, amongst only the youngest participants (10-12 year-olds), boys exhibited poorer inhibitory control/sustained attention than girls, which may reflect prefrontal developmental sex differences and has implications for models of ADHD. Correspondence: *Hidelfusa Okabe, BA, GRECC, VA Boston Healthcare System, 150 South Huntington Street, Jamaica Plain, MA 02139. E-mail: okabe@fas.harvard.edu*

**J. PAN, R.A. MACE, D.A. GANSLER, E. HUEY & J. GRAFMAN. The Executive Function–Dysexecutive Behavior Connection: Perspectives on the Contributions of Other Neuropsychological Domains.**

**Objective:** There is growing evidence that classic laboratory performance-based measures of executive function and report-based measures regarding affective, behavioral, and cognitive functioning in daily life (i.e., dysexecutive behavior) of individuals in their natural environments tap into two distinct, and surprisingly modestly related, constructs. We hypothesized that language and executive function are associated, and both bear distinct associations to dysexecutive behavior.

**Participants and Methods:** This study examined data from 243 National Institute of Neurological Disorders and Stroke participants with various forms of neurodegeneration. Structural equation modeling analyses were applied to measures used to represent constructs of executive function, dysexecutive behavior, and language. These included selected subtests from the Delis-Kaplan Executive Function System, clinical subscales from the Frontal Systems Behavior Scale, the Boston Naming Test, and the Token Test.

**Results:** The results of exploratory factor analysis confirmed a three-factor solution. Progression of our confirmatory factor analyses from measurement to structural models also demonstrated validity of hypothesized relationships between constructs. There was a strong association between executive function and language constructs ( $r = 0.72$ ,  $p < 0.01$ ), and between the two, only executive function significantly contributed to dysexecutive behavior ( $\beta = -0.42$ ,  $p < 0.05$ ).

**Conclusions:** Executive functioning, dysexecutive behavior, and language are all important constructs in understanding the cognitive and behavioral symptoms of neurodegenerative populations. We provide evidence that language is related to executive function, and that the two have distinct relationships to dysexecutive behavior. Between executive function and language, the former exerts a more meaningful influence on dysexecutive behavior.

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**B. REYNOLDS, M.R. BASSO, A.K. MILLER, D.R. COMBS, D. WHITESIDE & L. LAU. Behavioral Correlates of the WCST in a Neurologically Normal Sample: Perseveration Corresponds with Risky Acts.**

**Objective:** Executive function measures are presumed to reflect propensity to engage in risky behaviors, but relatively few studies have tested this assumption. Research involving healthy individuals has demonstrated that the Iowa Gambling Test, a measure sensitive to orbital frontal lobe dysfunction, corresponds with binge drinking among college students (Xiao et al., 2009). Arguably, a more robust literature reveals that self-report measures of impulsivity predict risky actions such as

gambling, drinking, and risky sexual acts (cf. Cyders et al., 2007; 2010). No studies have compared the relative predictive validity of cognitive and self-report measures of impulsivity with risky behaviors among healthy individuals.

**Participants and Methods:** Forty undergraduate students were administered the UPPS-P, a self-report measure of impulsivity (Cyders et al. 2007) and the Wisconsin Card Sorting Test (WCST). To address response bias, the Marlowe-Crowne Social Desirability Scale (MCSDS) and the Reliable Digit Span (RDS) were assessed. Self-report retrospective measures of substance use, sexual activity, and antisocial behaviors during the preceding two months were obtained. No other variable achieved significance.

**Results:** Multiple regression was used to evaluate the relative importance of the UPPS-P and WCST in accounting for impulsive behaviors. Across the domains of risky actions, WCST perseverative errors achieved significance ( $p$ 's  $< .01$ ) and the semi-partial correlations ranged from .3 to .4. The UPPS-P accounted for significant variance only in antisocial behaviors ( $r = .3$ ).

**Conclusions:** Extending previous research, these data show that the WCST is better able to account for risky actions than a well-validated self-report measure of impulsivity. Although these data are based on neurologically normal individuals, they lend support to the ecological validity of neuropsychological tests in predicting functional outcomes. These data are limited in that they rely entirely upon self-reported risk-taking and do not include prospective data.

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**B.E. RIDGE, C.R. PENNINGTON, C.N. BRYSON, K.E. MCCALLUM, K.K. MARSHALL & A. SCHMIDT. Connecting the Dots: Relating Executive Dysfunction to the Externalizing Spectrum of Psychopathology.**

**Objective:** Research has demonstrated the connection between executive dysfunction and psychiatric disorders including antisocial behavior, aggression, and substance use. Recent conceptualizations of psychopathology view these conditions as lying along a single externalizing spectrum rather than clearly demarcated categories (see Krueger and Markon 2006). Research is needed to investigate the full spectrum of externalizing symptoms in order to clarify the presence of a common, underlying propensity for executive dysfunction. The current study evaluates executive dysfunction in the context of a broad measure of externalizing behaviors. We hypothesized that executive functioning abilities will be negatively associated with number of externalizing symptoms.

**Participants and Methods:** Participants included 150 undergraduate students (37 males, 108 females; mean age = 20.2). Each participant completed the Externalizing Spectrum Inventory – Brief Form (ESI-BF; Patrick, Kramer, Krueger, & Markon, 2013), and several subtests from the Delis-Kaplan Executive Function System (DKEFS) (i.e., Trail Making Test, Verbal Fluency, and Color-Word Interference).

**Results:** Contrary to our hypothesis, multiple regression analyses revealed consistently positive relationships between executive function abilities and self-reported externalizing behaviors, with most approaching or achieving significance at the 0.05 level. Of note, additional statistical testing suggested these findings were robust and did not appear caused by range restriction in DKEFS or ESI scores.

**Conclusions:** Findings suggest these neuropsychological measures may not be sensitive to normal variations in executive dysfunction and disinhibition caused by personality features, as found in a non-clinical sample. That is, it is possible that in a non-clinical sample, increases in impulsivity and decreases in cognitive inhibition (as measured behaviorally by the ESI) may manifest as decreases in response times rather than increases in errors on traditional neuropsychological tests.

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**A. RIVERA & L. ABRAMS. Competing bilingual advantages and disadvantages: Performance on a linguistic Simon task.**

**Objective:** The purpose of our study was to examine whether a bilingual advantage in cognitive control will emerge when a task has a linguistic component

**Participants and Methods:** Participants included 19 bilingual and 19 monolingual healthy young adults. All participants completed language and background questionnaires. Proficiency was established using a self-rating scale and a Spanish interview (for bilingual participants). Participants received two versions of a modified Simon task. In the linguistic (LS) version, stimuli were the color words blue and green printed in black font either in English or in Spanish (azul or verde). Participants were asked to indicate the color and ignore the language. In the nonlinguistic (NLS) version, stimuli were blue and green-colored rectangles, positioned vertically or horizontally and participants were asked to indicate the color and ignore the orientation. For both tasks, a stimulus appeared on the left or right side of the screen, and participants were asked to press specific keys (z, on the left side, or /, on the right side of the keyboard) to indicate the stimulus color. Congruent trials occurred when the position of the stimulus matched the response key, and incongruent trials occurred when these did not match.

**Results:** Reaction times were used to calculate an Interference effect (IE=incongruent-congruent trials) and a Global effect (GE=average of congruent and incongruent trials). Participants' reaction times to perform the NLS and LS tasks were compared. For both LS and NLS versions, bilinguals showed a larger IE but a smaller GE.

**Conclusions:** Our findings suggest that the bilingual advantage differed as a function of whether the task did or did not have a linguistic component and that the advantage emerged only in global RTs. Further investigation is needed to establish the effect of linguistic tasks on cognitive control for both groups.

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**H.L. SARGENIUS, F.W. BYLSMA, S. LYDERSEN & K. HESTAD. An Examination of the Q-Score as a Method for Coding how Morbidly Obese Subjects Copy the Rey-Osterrieth Complex Figure.**

**Objective:** Several qualitative scoring systems aiming to capture strategy and organization on the Rey-Osterrieth Complex Figure Test (RCFT) exist. The Q-Score, which assumes that the subject should draw the basic structural components first and then add the details in the most efficient manner, has previously been found to fare particularly well in healthy older adult populations. The objective of this study was to investigate how this scoring system applies to an obese clinical sample.

**Participants and Methods:** 96 patients (74 female, 22 male) diagnosed with morbid obesity referred for either bariatric surgery (n=61) or a non-invasive treatment program (n=35) at Innlandet Hospital Trust completed the RCFT. A US normative sample consisting of 101 healthy controls within the same age range (18-60 years) was used as comparison. The flowchart method was chosen in all cases to preserve the drawing sequence on the Copy trial. Raw scores were standardized and converted into age-adjusted T-scores.

**Results:** The Q-score did not correlate significantly with the Copy score ( $r = .188$ ,  $p = .067$ ), but showed a significant positive correlation with the Immediate Recall ( $r = .298$ ,  $p = .003$ ), and Delayed Recall ( $r = .29$ ,  $p = .004$ ) of the figure. Compared to the normative sample, morbidly obese patients scored significantly lower on the construction-organizational measure (Q-Score: Estimate 45.86, 95% CI 43.79 to 47.92,  $p < .001$ ).

**Conclusions:** Our findings suggest that morbidly obese individuals have difficulty perceiving the stimulus figure as comprised of discrete units with certain basic structural components. Problems with construction-organizational ability could be one of the major factors for the development and maintenance of morbid obesity.

**J.C. SHEEHAN & K.A. KERNS. A Tale of Two Towers: Investigation of Tower Tasks in Preschool Children.**

**Objective:** There is controversy regarding the utility of executive function (EF) tasks, such as the Tower of Hanoi/Tower of London in preschool-aged children. This study examined performance of these two Tower tasks, along with other measures of EF adapted for preschoolers, and a parent report of executive function.

**Participants and Methods:** 29 children ages 3-5 (M age= 55 months) completed computerized versions of the Tower of Hanoi (ToH)/Tower of London (ToL) tasks, as well as measures of inhibition, visuospatial working memory (VS-WM), sustained attention, and shifting across two testing sessions (one tower task per session). Not all children were able to complete the Tower tasks, with many discontinuing before the end of the task. Participants were divided into two groups based upon discontinuation type (i.e., those who gave up, or "quit," on the task and those who reached DC criteria, or "non-quit").

**Results:** While Tower performance in the group of children who were unable to complete both Tower tasks was unrelated to any other EF measure, in the children who were able to complete both tasks, the visuospatial working memory measure was strongly correlated with both the ToH ( $r = -.760$ ,  $p < .05$ ) and ToL ( $r = -.907$ ,  $p < .01$ ). Independent-samples t-tests revealed no differences in mean performance on Towers and other tasks of EF between groups, with the exception of the CPT, where children who were not able to complete the Towers performed significantly worse than children who completed both ( $t(27)=2.155$ ,  $p < .05$ ).

**Conclusions:** Differences in sustained attention, rather than an ability to successfully perform Tower tasks, may limit the ability to detect relationships between performance on tower tasks and other cognitive measures of EF. These findings suggest that VS-WM is highly related to Tower task performance in those preschoolers who are able to attend to the Tower tasks through their entirety. Further investigation of the utility of preschool EF tasks is warranted.

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**P. SINGH, A. FRIDMAN, D. PISNER, A. SINGH & W.D. KILLGORE. A Voxel Based Morphometric Analysis of Ventromedial Prefrontal Cortex Volume related with Executive Function Task Performance Post Mild Traumatic Injury.**

**Objective:** Mild traumatic brain injury (mTBI) is often associated with subtle changes in executive functions. The frontal lobes, which contribute to complex executive functioning, are extremely vulnerable to traumatic brain injury because of their size and location. Ventromedial prefrontal cortex (VMPFC) is one of the areas of prefrontal cortex closely associated with executive function tasks such as decision-making, judgment and self-monitoring. It is not known how the VMPFC and its associated capacities change during the months following an mTBI. We investigated the time dependent effects of mTBI on the volume of VMPFC and its relationship with performance on executive function tasks.

**Participants and Methods:** Voxel based morphometric analysis (VBM8) was used to analyze T1 high resolution structural scans of twenty six right handed mTBI participants (mean age=23.38). Segmented images were used to create a custom DARTEL template, and then images were normalized and smoothed prior to analysis. VBM data were correlated with time since injury. The volume data from the resulting cluster were then extracted and correlated with metrics from the Delis-Kaplan executive function system (DKEFS)

**Results:** After controlling for age, gender and intracranial volume (ICV), GM volume in VMPFC correlated positively with time since injury (FWE corrected,  $p < 0.05$ ). VMPFC volume from this cluster was also found to be positively correlated with performance on several DKEFS tasks such as DKEFS-design fluency 1 ( $R^2 = 0.177$ ), DKEFS-design fluency 2 ( $R^2 = 0.164$ ) and DKEFS-sorting test ( $R^2 = 0.230$ ).

**Conclusions:** VMPFC volume was greater with longer time since injury post mTBI. While causal inference cannot be made, we speculate that

the greater volume in VMPFC with longer time since injury might reflect a compensatory phenomenon of neural plasticity aiding in recovery of cognitive functions post mTBI. Future work should examine whether such volume changes can be facilitated by cognitive training.

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**E. SULLIVAN & C. NEUMANN. Assessing the Effect of Trauma and PTSD Symptoms on Executive Functioning in a General Population Sample.**

**Objective:** Individuals with Posttraumatic Stress Disorder (PTSD) frequently show deficits in both “cool” and “hot” executive functioning (EF). Much less is known regarding EF in individuals who have experienced trauma, but do not meet full criteria for PTSD. The goal of this study was to explore cool and hot EF in a non-clinical general population sample. Hypotheses predicted significant relationships between trauma experiences, symptoms of PTSD, and EF performance.

**Participants and Methods:** A total of 104 participants ( $M = 37.5$  years;  $SD = 10.58$ ) from the general population were recruited through Amazon Mechanical Turk (MTurk). The majority of participants reported a diverse range of past traumatic experiences. Assessments included the Trauma History Questionnaire (THQ) and PTSD Checklist – Civilian Version (PCL-C), and traditional Stroop and modified emotional Stroop tasks.

**Results:** Partial correlations, controlling for age, were performed to examine the relationship between trauma experiences, PTSD symptoms, and performance on the Stroop EF tasks. Number of traumatic experiences ( $r = .224$ ,  $p < .05$ ) and PCL-C scores ( $r = .409$ ,  $p < .001$ ) correlated with Stroop performance. Path analysis, using age as a covariate, also demonstrated significant links between trauma, PTSD symptoms, and both cool (Stroop) and hot (modified Stroop) EF (model fit:  $X(5)2 = 3.21$ ,  $p = .99$ , CFI = 1.0, RMSEA = .00).

**Conclusions:** Using a diverse general population, the findings revealed that trauma experiences and PTSD symptoms were linked with worse EF. Results suggest trauma may have a compounding effect, with more traumatic experiences linked to increasingly lower EF.

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**S.K. SULLIVAN, J.K. FAUSETT, J.L. GESS & G. JAMES. Personality Correlates of Executive Function: The Role of Extraversion.**

**Objective:** Extraversion, a personality trait characterized by a propensity for social interactions, reward-seeking, positive emotion, and high energy, has recently been proposed to contribute to individual variation in executive functioning (EF). Emerging evidence suggests similarities in neurological substrates and neurotransmitter systems underlying both extraversion and EF. Results have been variable, with several studies reporting that specific facets of EF are differentially impaired or enhanced by higher levels of extraversion. This study extends the literature by providing convergent and discriminant validity for the association between extraversion and EF.

**Participants and Methods:** These data were collected through the Cognitive Connectome project, which seeks to map neural representations of cognition in a normative sample of healthy adults ( $n=53$ ; males and females aged 18-50). The Big Five Inventory was used to explore the relationship between the personality trait of extraversion and a variety of neuropsychological measures.

**Results:** Extraversion was significantly negatively correlated with a multitude of EF measures including variables from the WCST, D-KEFS Trail Making Test, Stroop Color-Word test, Spatial Span, Digit Span, and the Test of Everyday Attention, with correlation coefficients ranging from moderate to large. Yet extraversion was not significantly associated with domains of memory, language, and visuospatial ability, demonstrating discriminant validity.

**Conclusions:** Personality traits, oft-ignored in neuropsychology, may contribute to individual differences in cognition. Our results suggest that higher levels of extraversion are associated with poorer performance on a variety of EF measures in healthy individuals. Given the number of clinical syndromes that may result in impairments in EF, exploration of personality correlates may help to clarify the ways in which these disorders differentially impact the cognitive functioning of individuals. Correspondence: *Sara K. Sullivan, M.S., Psychology, Binghamton University, 9201 Kanis Rd, Apt 4E, Little Rock, AR 72205. E-mail: ssulliv3@binghamton.edu*

**B. TELLEZ-ALANIS, D. CASTELLANOS & A. BAZAN. Reasoning and Behavioral Rating of Executive Function in Children Aged 11-12 Years.**

**Objective:** Although it is considered that executive functions (such as cognitive flexibility, planning, working memory, attention) are directly related to fluid intelligence, to date there is no definitive evidence. In some studies this relationship was present, while in others the expected relationship was absent. The purpose of this study was to explore whether exists relationship between the behavioral rating of executive function by parents and teachers and the results of a test of reasoning completed by children aged 11-12 years.

**Participants and Methods:** The Behavior Rating Inventory of Executive Function (BRIEF) was used to evaluate executive functions and to test the reasoning was used the Screening Assessment for Gifted Elementary and Middle School Students (SAGES). BRIEF inventories were answered by 178 teachers (of 86 children and 92 girls; mean age 11.9,  $SD = 0.3$ ) and 235 were answered by parents (of 119 boys and 116 girls; mean age 11.8,  $SD = 0.4$ ). The inventories were correlated with the results achieved by children in the scale of reasoning SAGES. On the scale of reasoning SAGES, the sample evaluated by teachers obtained a mean of 93.7 ( $SD = 17.3$ ) and the sample rated by parents got 99.4 ( $SD = 18.3$ ).

**Results:** No correlation was found between the scale of the reasoning SAGES and any of the 8 subscales of BRIEF (planning, working memory, initiation, monitoring, material organization, inhibition, flexibility and behavior control).

**Conclusions:** The results support the idea that executive functions are independent of intellectual functions such as reasoning. However, it is important to consider that this result arises from an indirect rating (by teachers and parents) of executive function. Therefore, to confirm this result it is necessary to test directly the children behavior using neuropsychological tasks.

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**S. TORRES, H.M. HASLER, J.H. WAZNY, J. STILES & N. AKSHOOMOFF. “Touch Your Head Means Touch Your Toes?” Executive Function Deficits In Preterm Children.**

**Objective:** Children born very preterm (<33 weeks gestational age (GA); VPT) who are deemed “healthy” by medical professionals are often found to be at higher risk for behavioral and academic difficulties compared to children born full-term (FT), particularly executive functions (EF). Little is known about the transition from preschool to formal school in healthy VPT children; therefore, information is limited on how to best to provide support to these children who are most at risk. Here we report on the relationship between a child-friendly behavioral measure of inhibitory control, attention, and working memory, the Head-Toes-Knees-Shoulders (HTKS) Task (McClelland et al., 2007; 2014), and a standardized parent report measure, the Behavior Rating Inventory of Executive Function (BRIEF.)

**Participants and Methods:** We tested 39 VPT children ( $MGA$  at birth: 29.56 weeks;  $M$  FSIQ=104.0;  $M$  age=5.9 years) and 24 FT children ( $M$  FSIQ=105.3,  $M$  age=5.8 years). In the first block of HTKS trials, children were instructed to touch their toes when told, “Touch your head” and vice versa. In the second block, they were to touch their knees

when told, “Touch your shoulders”, and vice versa. Each child’s primary caregiver also completed the age-appropriate Parent Form of the BRIEF.

**Results:** The VPT group scored significantly lower than the FT group on HTKS Block 1 ( $M=15.31$  vs.  $17.58$ , max. 20;  $p=0.048$ ), indicating greater difficulty with the task’s initial demands. Significant group differences were found on the BRIEF Emotional Control, Shift, and Inhibit scales, with the VPT group exhibiting significantly greater behavioral dysfunction according to parental report. Performance on the HTKS was also significantly correlated with the BRIEF Emotional Control, Shift, and Inhibit scores.

**Conclusions:** Our results suggest that young “healthy” VPT children are at significant risk of EF deficits in emotional control, shifting, and inhibitory control, both from a behavioral perspective and according to parent report of everyday functioning.

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### **K.A. UMEKUBO, K.A. TRAINO, P.M. FOSTER & S.L. DOLAN. Performance Differences on the Iowa Gambling Task in High Versus Low Schizotypy.**

**Objective:** In attempting to better understand the etiology of psychotic disorders such as schizophrenia, research has sought to investigate cognitive and behavioral correlates among healthy individuals with elevated schizotypal traits. Prior research has demonstrated emotion-based decision-making deficits on the Iowa Gambling Task (IGT) in those with schizophrenia. However, whether similar deficits exist in individuals exhibiting high levels of schizotypy remains largely unexamined. Given both the social-emotional and executive functioning impairments documented in the schizotypy literature, the current study sought to investigate emotion-based decision making in those with high versus low levels of schizotypy.

**Participants and Methods:** Ninety-five undergraduate students completed the Schizotypal Personality Questionnaire (SPQ) and the IGT to assess the relationship between schizotypal personality traits and emotion-based decision-making.

**Results:** Consistent with our hypothesis, independent samples t-tests revealed that individuals in the high schizotypy group exhibited significantly poorer emotion-based decision-making than those in the low schizotypy group ( $p < .05$ ).

**Conclusions:** These results suggest that individuals with heightened schizotypal personality features may exhibit dampened emotion-based decision-making abilities. Moreover, reduced performance in emotion-based decision-making may reflect preexisting impairments in social-emotional processing and executive functioning observed in those with elevated schizotypy. Thus, a decreased capacity for making emotion-based decisions may serve as a unique endophenotypic marker in identifying those at risk for later development of psychosis.

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### **A.B. VANDEN BUSSCHE, C.B. PADULA, N. HAUG, K. CRISANZIO, N. CHOWDHRY & L.M. WILLIAMS. Assessing the Impact of Trauma on Hot and Cold Executive Functions Independent of Diagnosis.**

**Objective:** Traumatic experiences have been shown to impair cognition in domains of attention, executive functioning (EF), and memory. We aimed to assess if trauma disrupts hot EF, such as emotion identification, as well as cold EF, such as sustained attention, inhibition, and planning. We examined if the relationship between trauma-impaired EF holds for trauma-exposed individuals who do not meet criteria for posttraumatic stress disorder (PTSD) and if the relationship is specific to trauma and not related to mood.

**Participants and Methods:** A total of 38 participants (23F, 14M, and 1T, aged 19-61 years), were included. Participants were unmedicated

and recruited from the community. Participants were comprised of a PTSD group ( $n=10$ ), a Trauma-Exposed no-PTSD group ( $n=20$ ), and a no-trauma, but Mood Symptoms group ( $n=8$ ). Groups were age, gender, and education matched. Participants completed the computerized WebNeuro cognitive battery. One-way ANOVAs examined Continuous Performance, Verbal Interference, and Maze tests of cold EF and Emotion Identification for hot EF, interpreted at  $p < .05$ .

**Results:** We observed group differences in hot EF for the identification of fearful ( $p=0.001$ ), angry ( $p=0.012$ ), and sad ( $p=0.007$ ) facial expressions. Contrasts showed that the PTSD group was distinguished by enhanced negative emotion identification compared to both Trauma-Exposed and Mood Symptoms groups. For cold EF, we observed differences in Continuous Performance Test ( $p=0.029$ ). This effect was due to poorer sustained attention in the Mood Symptoms group compared to the PTSD and Trauma Exposed groups.

**Conclusions:** Trauma exposure, regardless of diagnosis, may produce a bias toward negative emotion and enhance hot EF. However, disruptions to cold EF may relate to depression and anxiety rather than trauma exposure. These preliminary findings warrant replication in larger samples, and validation using additional cognitive and neuroimaging measures.

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### **E. VERA-ESTAY, A.G. SENI, C. CHAMPAGNE & M.H. BEAUCHAMP. All for one: Combined contributions of executive functioning and social cognition to moral reasoning in childhood.**

**Objective:** Moral reasoning (MR) is a sociocognitive skill essential to appropriate social functioning in childhood and which evolves in quality and complexity during ontogenetic development. The aim of this study was to explore what factors predict moral maturity in children and identify the specific contributions of age, executive functioning (EF) (inhibition and verbal fluency) and social cognition (theory of mind (ToM) and affect recognition) using an innovative visual MR assessment tool.

**Participants and Methods:** The children’s version of the Socio-Moral Reasoning Aptitude Level task (So-Moral-Child, Beauchamp et al., 2013) was used to account for children’s reality and developmental stages of MR. The So-Moral, ToM Cartoon Stories (Brune, 2005), and three subtests of the NEPSY-II battery (Inhibition, Word generation and Affect Recognition) were administered to 76 healthy developing children aged 6 to 12 years ( $M=9.2$ ,  $SD=1.67$  years, 53% female).

**Results:** MR maturity was positively correlated with age, inhibition, verbal fluency, ToM, and affect recognition skills. A three-steps hierarchical multiple regression indicates that age explains 28% of MR maturity and that verbal fluency explains an additional 5% of this variable. Taking socio-cognitive variables (ToM and affect recognition) into account in the model explains an additional 8% of MR maturity. In the final model, verbal fluency ( $\beta=.24$ ,  $p=.041$ ) and ToM ( $\beta=.22$ ,  $p=.030$ ) were significant individual predictors of MR maturity in childhood.

**Conclusions:** These results contribute to a better understanding of the underpinnings of MR during childhood, suggesting that MR is not reducible to general developmental factors such as age, but that specific higher order skills such as verbal fluency and social cognition contribute to MR. These findings have relevance for both typically developing and clinical populations in which social skills may be reduced, as well as for the identification of potential loci for intervention in children at-risk for socially maladaptive behaviours.

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### **L.C. VOS & R.D. WHITMAN. The Relationship between Creativity, Intelligence, and Executive Function.**

**Objective:** This study examined the relationship between creativity, intelligence, and executive functioning in a non-clinical, adult population.

Theory and research indicate relationships among these constructs, but the nature and degree to which the constructs overlap is unclear.

**Participants and Methods:** Ninety-five university students, ages 18 to 50, completed the Gough Creative Personality Scale, the IPIP Creativity Scale adapted from the HEXACO, the Test of Premorbid Functioning (TOPF) and the Delis Kaplan Executive Function System (DKEFS). Using the factor structure found by Latzman and Markon (2010), composites were created to measure three factors of executive functioning: Inhibition, Monitoring and Conceptual Flexibility.

**Results:** Scores from the two creativity scales were moderately correlated ( $r = .36, p < .001$ ). The creativity measures were not correlated with the TOPF. The TOPF was moderately to strongly correlated with all three factors of executive functioning ( $r = .43-.58, p < .001$ ). Regression analyses were conducted with the two creativity questionnaires and the TOPF as predictors of the three factors of executive functioning. All overall models were significant ( $p < .001$ ), and the TOPF was a strong, significant predictor in all models. The IPIP creativity scale score was not a significant predictor in any model. The Gough Creative Personality Scale significantly predicted Monitoring ( $\beta = .244, p = .016$ ).

**Conclusions:** Intelligence was a strong predictor of executive functioning, whereas creativity only predicted Monitoring. It is possible that creativity only affects executive functioning in tasks that allow for divergent thinking (e.g. verbal fluency tasks), but does not play a role in solving problems in which there is a defined answer. This study is limited by the use of self-report creativity measures; future research will investigate these relationships using performance-based measures of creativity.

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**M. WELSH, E. PETERSON, C. ROHRBACHER, D. WILLIAMS, K. LAFARY, A. BARTHEL, S. PARSEL, R. ALEXANDER & M. YOUNIS. Effects of Task Context and Individual Differences on the “Heat” of Cool Executive Function Tasks.**

**Objective:** We examined task context and participant individual differences with respect to the relative heat of two “cool” EF tasks, exploring the change in performance with heating, as well as associations with individual differences in personality.

**Participants and Methods:** Forty-four college students were administered: cool EF tasks, Tower of London (TOL) and Letter-Number Sequencing (LNS), hot EF task, IGT, and the Psychopathic Personality Inventory-Revised (PPI-R). The heating manipulation involved awarding state lottery tickets for achieving certain performance targets on EF tasks. Incentive (heating) alternated across blocks of trials for the TOL, counterbalancing order, was offered for the second trial in each pair of LNS sequences, and given if the IGT ended with a net gain.

**Results:** Performance on the Cool TOL and LNS did not significantly correlate, but did under hot conditions. The Hot (incentivized) TOL performance correlated with the PPI-R subscales at a rate five times higher than did Cool TOL performance. The Order variable interacted with the heating manipulation; hot TOL score was higher for those who began the task with heating than those who began the task with cool items, with no effect on the cool TOL score. Those who received the heating first exhibited a within person increase in performance with heating, while those receiving heating in the second block exhibited a decrease in accuracy with heating. This order effect was not moderated by sex or personality/temperament individual differences.

**Conclusions:** Heating resulted in a stronger correlation between performances on the TOL and LNS, and a larger number of associations with personality. Order of the heating manipulation affected TOL performance with a greater impact on increasing accurate performance when introduced at the task start, a factor that needs to be considered when manipulating task context within subjects in heating studies. The within-subjects design posed statistical power challenges to examine potential variable interactions.

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**M. WELSH, P. GORMAN BARRY, A. JACOBS & L. BEDDES. Homeless Men Living in Transitional Housing: The BrainWise Curriculum and Improvements in Executive Functions and Coping Self-Efficacy.**

**Objective:** The goal was to examine the effectiveness of a critical thinking skills curriculum, BrainWise, in terms of executive function (EF), coping self-efficacy, and problem solving as reported by homeless single adult males living in transitional housing.

**Participants and Methods:** The Treatment Group receiving BrainWise (N = 210) included men living at a transitional housing facility (diverse in age, ethnicity, and education). A smaller Control Group of men (N = 61) living in transitional housing (demographically similar) did not receive the BrainWise curriculum. Participants were administered the pretests and posttests of the following self-reports: 1) Behavior Rating Inventory of Executive Functions for Adults (BRIEF), Wasik Problem-Solving Rating Scale (WPRS), Coping Self-Efficacy (CSE), and BrainWise Knowledge Survey (BKS; survey of critical thinking skills taught in the program).

**Results:** The four measures were in the acceptable range of reliability (internal consistency) at both the pretest and the posttest and showed adequate test-retest stability. Scores on the measures intercorrelated significantly and in the expected direction; e.g., problems with executive functions on the BRIEF predicted lower skills in BrainWise knowledge, problem solving, and coping self-efficacy. Examining the groups separately due to large sample size difference, dependent t-tests demonstrated significant Pretest to Posttest changes on ALL measures in Treatment Group (N=108) with the exception of the WPRS. In contrast, in Control Group (N=37), there were significant improvements in fewer BRIEF subscales, no changes in BKS, and CSE, and a significant decrease in WPRS.

**Conclusions:** The self-report measures were reliable in this very vulnerable population. Importantly, adding BrainWise to a slate of education programs yielded significant improvements in BrainWise knowledge, coping self-efficacy, and all subscales of the BRIEF executive function measure, as compared to improvements in only a small set of EF skills in the Control Group.

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**C. WILSON, A.E. PRITCHARD, L.A. JACOBSON, J. SCHIFFMAN & T. ZABEL. Clinical Utility of the Barkley Deficits in Executive Functioning-Children and Adolescents Scale in a Mixed Clinical Sample.**

**Objective:** The Barkley Deficits in Executive Functioning-Children and Adolescents (BDEFS-CA) scale is a parent-rated measure of executive functioning (EF) for ages 6-17. Despite its various construction strengths, studies addressing the validity of the BDEFS-CA are limited. Moreover, existing validity studies have reported correlation with other measures, but have not addressed comparability regarding the identification of EF deficits. The validity and clinical utility of the BDEFS-CA was examined relative to a similar parent report measure of EF; the Behavior Rating Inventory of Executive Function (BRIEF). We hypothesized that several of the BDEFS-CA scales would identify symptoms of EF deficit in a manner consistent with the BRIEF index scores.

**Participants and Methods:** Parent ratings from the BRIEF and BDEFS-CA were obtained in a sample of 59 children and adolescents (11.11±3.12 years; 58.2% male) referred for neuropsychological assessment.

**Results:** The BRIEF General Executive Composite score (GEC; M=63.98±12.95) was strongly correlated with the BDEFS-CA EF Summary score (EFS;  $r(59)=.85, p<.001$ ). ROC analysis suggested

that the BDEFS-CA EFS performed significantly better than chance in predicting BRIEF GEC scores ( $AUC=0.94$ ,  $p < .001$ ). Correlations between BDEFS-CA and BRIEF indices ranged from medium to strong [ $r(59)=.48-.82$ ,  $p < .001$ ]. BDEFS-CA Self-Management to Time was most strongly correlated with BRIEF MI, and BDEFS-CA Self-Restraint was most strongly correlated with BRIEF BRI. Clinical categorization using the BDEFS-CA scales to predict deficits on BRIEF indices (T-scores  $\geq 65$ ) showed excellent specificity but lower sensitivity, particularly for males.

**Conclusions:** In this preliminary examination, the BDEFS-CA demonstrated utility in screening children for EF deficits identified using the BRIEF. Several specific BDEFS-CA scales are well calibrated to identify EF deficits in a manner similar to the BRIEF MI and BRI scales, although there is a risk of false negative categorizations when using the BDEFS-CA with males.

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### G. WITKIN, M. JORGENSON, M. MAIMAN & M. VASSERMAN. Utility of Tower of London in Identifying Executive Impairment in Children with ADHD and/or Learning Disability.

**Objective:** The Tower of London (TOL) is a commonly used measure of executive functioning (EF) and is frequently utilized in the assessment of children with ADHD and/or learning disabilities (LD). While EF dysfunction has been consistently documented in these populations, the sensitivity of the TOL to such dysfunction has not been clearly demonstrated in children with LD. Our aim was to assess whether the TOL is sensitive to EF dysfunction in children with LD and whether it is helpful in distinguishing ADHD from LD.

**Participants and Methods:** 95 clinically-referred children (ages 7-18; 63% males; ADHD  $n=42$ , SLD  $n=14$ , ADHD/SLD  $n=39$ ) were administered the TOL as part of a comprehensive battery which included measures of intellectual functioning and academic achievement.

**Results:** Children with comorbid ADHD/LD diagnoses performed significantly poorer than those with ADHD alone on measures of intellectual functioning (101.43 vs. 91.13;  $t(64)=3.08$ ,  $p < .01$ ). While children with LD alone performed more poorly than those with ADHD, these differences were not significant. There were no group differences on any TOL variables. However, examination of rates of impairment across groups reflected that children with LD or comorbid ADHD/LD were twice as likely to show impairment on the Total Moves score than children with just ADHD. Nearly a third of each group showed deficits in execution time and half of each group showed excessive rule violations. Total items correct was least sensitive to impairment. Lastly, all TOL variables were weakly to moderately correlated with intelligence ( $r = .18-.33$ ,  $p < .05$ ), total moves and total time were moderately correlated with reading ( $r = .31-.35$ ,  $p < .01$ ), and weak relations were observed between TOL variables and math skills.

**Conclusions:** In our sample of children with ADHD and/or LD, children with comorbid ADHD/LD performed worse across measures of IQ, reading, and math. No group differences were observed across TOL variables. While TOL appears to be sensitive to EF dysfunction, it has limited specificity.

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### M.M. WONG, K.J. BROWER, D.A. CONROY, S.M. LYNCH & C. WILLIAMS. Sleep quality and neuropsychological functioning among children of alcoholics and controls.

**Objective:** This study examined whether and how parental alcohol use disorder (AUD) and sleep variables are associated with neuropsychological functioning. Previous research showed that children with a biological AUD parent had lower executive functioning vs. controls (Deckel & Hesselbrock, 1996; Nigg et al., 2004, 2006). Studies also reported that

poor sleep predicted lower response inhibition (Wong et al., 2010) and higher emotional reactivity (Yoo et al., 2007; Talbot et al., 2010). However, few studies looked at whether parental AUD and sleep variables are associated with children's neuropsychological functioning.

**Participants and Methods:** Study participants were 40 children (42.5% girls), ages 8 to 12 from an ongoing longitudinal study. Wave 1 cross-sectional data are presented here. Sleep was assessed by actigraphy for one week. From these data, we derived three sleep variables: average sleep efficiency (SE), average sleep onset latency (SOL) and average wake time after sleep onset (WASO). Neuropsychological functioning was assessed about 2-12 weeks after actigraphy. Three measures were examined – Wisconsin Card Sort (WICS), Delis-Kaplan Executive System Trailmaking Task and nonverbal working memory from the Stanford-Binet Intelligence Scale.

**Results:** Parental AUD status significantly interacted with WASO to predict Wisconsin Card Sort perseverative errors ( $b = -1.55$  (.69),  $p < .05$ ). Among children with an AUD parent, WASO significantly predicted perseverative errors ( $b = -.77$  (.32),  $p < .05$ ). Longer WASO was associated with worse performance (i.e., more errors) in these children. This relationship was not observed among controls  $b = .78$  (.67),  $p = .30$ ). Parental AUD status, SE and SOL did not predict any neuropsychological variables.

**Conclusions:** In conclusion, poor sleep quality (i.e., WASO) was associated with more errors in an executive function task among children with one or more alcoholic parents. An important limitation of this study was the small sample size. (Supported by NIH R01 AA020364)

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### R.E. ZIEMNIK, M. NIERMEYER, E.I. FRANCHOW & Y. SUCHY. Reaction to Novelty as a Predictor of Reduced Executive Functioning Following an Expressive Suppression Task.

**Objective:** Expressive suppression (ES), or effortful regulation of facial affect, can subsequently cause a temporary decline in executive functioning (EF) performance (Franchow, 2014). Additionally, increased reaction time due to novelty (termed the “novelty effect [NE]”) on a motor sequencing task is associated with future cognitive decline in older adults (Suchy, 2011), suggesting that difficulty adapting to novelty may signal preclinical declines in EF. We investigated whether a larger NE would also be related to individual differences in the degree to which EF performance was impacted by an ES task.

**Participants and Methods:** Community-dwelling older adults ( $n=102$ , age 60-86) completed selected subtests of the Delis-Kaplan Executive Function System (DKEFS) before and after viewing a compilation of disgusting and amusing videos. Participants were randomly assigned to one of two conditions: maintaining neutral affect during the video (ES condition), or reacting naturally (control condition). Participants also completed a computerized motor sequencing task (Push Turn Taptap task; PTT) designed to assess the NE, and the Geriatric Depression Scale. Consistent with past research, the NE was computed as the difference between the median planning time for the first block and second block of the PTT task.

**Results:** Controlling for age, sex, education, and depressive symptoms, those in the ES condition who also demonstrated a large NE showed reduced EF performance, compared both to those in the ES condition with a small NE and to controls ( $F(1, 90) = 4.0$ ,  $p = .047$ ).

**Conclusions:** These findings suggest that sensitivity to novelty is related to the degree of EF depletion following ES in older adults. This supports the idea that there are measurable individual differences in how susceptible an individual's performance is to cognitive stressors, which may be indicative of subclinical cognitive decline.

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**M. ZUMBA, M. DRAGULIN, D. DEBOER, E. IRONSIDE, J. EGUSQUIZA, S. PAWAR & T. LAFAVOR. Effect of Trauma Exposure on Cognitive Functioning in a Sample of High-risk Adults.**

**Objective:** Studies suggest that most adults experience one or more Potentially Traumatic Event (PTE), defined as an event outside the range of usual human experience that causes distress (Bonanno, 2005). Extreme and/or chronic stress has also been associated with decreased executive function (EF) (Verfaellie, Lafleche, Spiro, & Bousquet, 2014). However, results have been mixed, supporting a need for further study (Golier & Yehuda, 2002). The purpose of this study was to examine the relationship between socioeconomic status (SES), trauma exposure, and cognitive functioning in adults.

**Participants and Methods:** Twelve English speaking participants (mean age = 31, 100% female), were administered verbal and perceptual reasoning tasks, and performance based measures of EF including cognitive flexibility, problem solving, and self-monitoring. Participants were interviewed about demographic information, and negative, neutral, and positive life events. These measures have been used successfully with low income families in multiple studies.

**Results:** Results from this study examined the relationship between cognitive function and trauma exposure in a diverse sample of adults. Adults with a significant trauma history scored lower on cognitive measures compared to normative samples. Card sorting performance was marginally lower in those with a trauma history, compared to non-traumatized participants. Broadly, risk and negative life events were related to low perceptual reasoning and cognitive flexibility.

**Conclusions:** These findings are generally consistent with previous research and demonstrate the importance of examining the effect of trauma on higher cognitive functioning. Significant findings in such a small sample underscore the need for larger studies in this population in order to inform intervention and prevention efforts.

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### Medical/Neurological Disorders/Other (Child)

**J. ALI, J.E. SCHREIBER, J. EHRENTAUF, N. JURBERGS, J. ESTEPP, J. MARTIN, B. AYGUN & W. WANG. Neurocognitive Functioning among Young Patients with Sickle Cell Disease: Associations with Demographic and Disease-related Factors.**

**Objective:** Children with sickle cell disease (SCD) are at risk for neurocognitive problems due to the adverse impact the disease can have on the central nervous system. However, a disproportionate number of children with SCD come from lower socioeconomic (SES) households, and lower SES is also associated with poor neurocognitive development. The present study examined associations among medical indicators of disease severity (genotype, hemoglobin level), SES factors (maternal education, family income), and neurocognitive functioning in preschool and early school age patients with SCD.

**Participants and Methods:** Fifty-one children with SCD underwent a neurocognitive evaluation at a mean age of 5.1 (SD=1.1) years. Neurobehavioral evaluations were performed because of clinical concerns or as part of local standard of clinical practice. Disease-related information was obtained from medical record review. Bivariate Pearson correlations were used to examine association among variables.

**Results:** Maternal education was positively correlated with Wechsler IQ score [ $r(45)=.30, p=.04$ ] and the Bracken School Readiness Assessment (SRA) [ $r(34)=.31, p=.07$ ], and negatively correlated with parent report of concerns regarding their child's executive function from the Behavior Rating Inventory of Executive Function (BRIEF): Shifting [ $r(37)=-.58, p<.01$ ], Emotional Control [ $r(37)=-.40, p=.01$ ], Working Memory [ $r(37)=-.36, p=.03$ ]. Family income was correlated with IQ score [ $r(27)=.46, p=.02$ ] and SRA [ $r(20)=.50, p=.03$ ]. Genotype and

hemoglobin level were not significantly associated with neurocognitive outcomes,  $p>.05$ .

**Conclusions:** Cognitive functioning, school readiness and a measure of executive functioning were significantly correlated with demographic variables but not with medical indicators of disease severity. Results suggest that SES has a greater impact on neurocognitive functioning in younger children with SCD than medical factors. Further study is needed to disentangle the impact of environment versus disease factors. Correspondence: *Jane E. Schreiber, PhD, Department of Psychology, St Jude Children's Research Hospital, 262 Danny Thomas Place, Mail Stop 740, Memphis, TN 38105. E-mail: jane.schreiber@stjude.org*

**T. ANTONINI, A. CHILD, H. STANCEL & L.S. KAHALLEY. Attention and Executive Functions Following Proton Beam Radiation Therapy in Pediatric Patients with Brain Tumors.**

**Objective:** Treatment for pediatric brain tumors (BTs) is associated with cognitive changes, including decreased attention and executive dysfunction. In comparison with surgical resection and chemotherapy, cranial radiation therapy (RT) has been linked to the greatest cognitive declines, which are thought to arise from post-treatment reductions in white matter volumes. Proton Beam RT (PBRT), which spares more healthy brain tissue than conventional photon RT, may mitigate cognitive late effects. This study is one of the first to examine cognitive functioning in pediatric patients with BTs who received PBRT.

**Participants and Methods:** Participants included 39 patients (6-18 years old) with BTs who underwent PBRT. As part of a larger test battery, they completed the Conners' Continuous Performance Test - 2nd Edition (CPT-II) and the D-KEFS Trail Making Test (TMT) at 3.61 years (SD = 2.03; range = 1.16 - 7.43) post PBRT. Their test performance was compared to that of normative samples.

**Results:** Patients' scores across CPT-II indices did not differ significantly from test norms. However, patients were slower on Number Sequencing ( $p<.0001$ ), Letter Sequencing ( $p=.001$ ), and Number-Letter Switching ( $p<.0001$ ) subtests of the TMT than the normative sample. No difference in number of errors on TMT Switching was detected ( $p=.66$ ).

**Conclusions:** In contrast with some studies examining patients who received conventional RT, our sample did not show deficits in sustained attention. However, results were suggestive of weaknesses in processing speed, sequencing, and cognitive flexibility. Although these aspects of executive functioning were less efficient in patients versus the normative sample, the lack of difference in errors suggests that BT patients have the ability to engage these skills with extra time. Findings provide support for accommodations in educational settings (e.g., provision of additional time for assignments). Additionally, results may be suggestive of cognitive sparing with PBRT, although further investigation is warranted. Correspondence: *Tanya Antonini, Texas Children's Hospital, 4055 South Braeswood Blvd., Apt 212, Houston, TX 77025. E-mail: tanya.antonini@gmail.com*

**D. BADALY, E.K. HODGES, C.S. GOLDBERG & K.P. HEINRICH. Executive Dysfunction and Social Maladjustment among Children with Congenital Heart Disease.**

**Objective:** Children with congenital heart disease (CHD) often exhibit difficulty with higher order cognitive abilities, including executive functioning (Calderon & Bellinger, 2015). Recently, researchers have considered how executive dysfunction among children with CHD can adversely impact their quality of life, particularly in the social domain. Yet, most findings have focused on measures of social cognition rather than adjustment in everyday social settings (e.g., Calderon et al., 2010). As such, this study examined the relationship between executive functioning and social adjustment among children with CHD.

**Participants and Methods:** Participants were 56 children with CHD (59% male;  $M$  age = 9.87 years), referred to an outpatient neuropsychology clinic. Measures of executive functioning tapped core and complex skills (Diamond, 2013), including working memory (WISC-4 WMI),



inhibition (CPT-II Commissions), mental flexibility (Trails B), fluid reasoning (WISC-4 Matrix Reasoning), and planning (Tower of London). Social problems and peer relation problems were assessed with parent- and teacher-ratings (ASEBA, Conners' Rating Scales).

**Results:** A multivariate regression model was specified with executive functions predicting social outcomes. Both poorer flexibility and reasoning were associated with greater parent-rated peer relation problems ( $\beta$ s < -0.39,  $p$ s < .05); poorer planning was associated with greater teacher-rated social and peer relation problems ( $\beta$ s < -0.55,  $p$ s < .05). Interestingly, working memory was positively related to parent and teacher-rated peer relation problems, after controlling for other executive skills ( $\beta$ s > 0.55,  $p$ s < .001).

**Conclusions:** As with healthy children (Jacobson et al., 2011), executive functions, particularly complex skills, were associated with social adjustment among children with CHD. This may have important implications for future cognitive and social interventions in this population, as concurrently addressing both areas may be more effective than targeting one domain.

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#### **D.J. BEARDEN & C. MRAKOTSKY. Cognitive, School, and Emotional Functioning in Children and Adolescents with Recurrent Abdominal Pain.**

**Objective:** Recurrent abdominal pain (RAP) is a common problem among children and adolescents, occurring without an identified organic etiology. Research suggests that children with RAP experience more emotional problems than healthy controls. Despite identified emotional difficulties in this population, to date little is known about cognitive and school problems in young patients with RAP. Therefore, the current study compared cognitive, school, and emotional function between RAP patients and healthy controls.

**Participants and Methods:** This study included 27 children and adolescents (age 8-16 years) with RAP and 37 healthy controls who participated in a larger study examining cognitive functions in gastrointestinal conditions. Both groups underwent assessments of cognitive ability, emotional functioning, and quality of life (e.g., WASI, BRIEF, YSR, PEDS-QL). Groups were comparable on demographic variables. We examined group differences using independent t-tests and ANOVA/ANCOVA analyses. Associations between pain and primary outcomes were examined using correlation analyses.

**Results:** Overall intellectual ability in the RAP group was significantly lower than in the control group ( $p < .001$ ). The RAP group endorsed significantly more executive problems ( $p = .015$ ), internalizing ( $p = .001$ ) and externalizing behaviors ( $p = .03$ ), and school problems than controls ( $p = .002$ ). Within the RAP group, more severe pain was associated with more executive and emotional problems. Executive function and emotional problems were negatively associated with school function.

**Conclusions:** Compared to healthy children and adolescents, patients with RAP demonstrated lower overall cognitive ability and more self-reported problems with executive function, internalizing and externalizing behaviors, and school.

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#### **J. CALDERON, PH.D., A.R. CASSIDY, PH.D., J.W. NEWBURGER, MD, MPH & D.C. BELLINGER, PHD, MSC. Cognitive Predictors of Social Cognition Outcomes in Adolescents with Congenital Heart Disease after Infant Open-Heart Surgery.**

**Objective:** Survivors of Congenital Heart Disease (CHD) are at risk for neurodevelopmental dysfunction. Theory of Mind deficits and Autism Spectrum Disorder symptoms are associated with CHD. Despite the high frequency of these deficits, no study has investigated the underlying cognitive mechanisms of social cognition impairments. Our aim is

to identify cognitive predictors of social cognition in CHD. By using a construct-driven approach, we sought to identify the contributions of executive functions, speed of processing, verbal abilities and visual-perceptual skills to performances on the Reading the Mind in the Eyes Test (RMET) and the Autism Spectrum Quotient (ASQ) questionnaire.

**Participants and Methods:** This study reports findings from 159 adolescents with CHD after open-heart surgery (Mage=14 years 2 mo; SD= 2 years 3 mo; n=68 with Tetralogy of Fallot and n=91 with Single-Ventricle CHD), without associated genetic syndromes. All patients underwent a complete neuropsychological assessment (e.g. WISC-IV; BRIEF Parent, D-KFES). Scores were transformed into Z-scores and theory-driven composite constructs were computed (i.e. Working Memory; Inhibitory Control; Cognitive Flexibility; Planning; Processing Speed; Verbal and Visual-Perceptual skills). Adjusted regression models including all constructs were used to identify significant predictors of social cognition.

**Results:** The mean IQ score in the CHD group was within normative values ( $m=94 \pm 17.8$ ). Multivariate adjusted models showed that only verbal abilities significantly predicted performance on the RMET ( $\beta=0.37$ ; SE=0.13;  $p<0.01$ ). In contrast, cognitive flexibility significantly predicted self-reported Autism Spectrum symptoms on the ASQ ( $\beta=0.47$ ; SE=0.17;  $p<0.01$ ). There was a marginally significant contribution of verbal abilities to ASQ outcomes ( $p=0.07$ ).

**Conclusions:** Among adolescents with CHD, deficits in key aspects of social cognition are associated with verbal and higher-order executive function abilities.

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#### **A.M. CHAMBERS, A.L. FRIAS, A. ORTEGA, E.M. MELLOTT & S.C. HEATON. The Relationship Between Childhood Sleep Initiation Problems and Verbal Memory.**

**Objective:** Learning is an important component of the memory process and can be disrupted by a variety of phenomena seen in childhood. Though sleep problems are known to affect some cognitive functions, little is known about the relationship between sleep disturbance and verbal memory impairments in pediatric disorders. Furthermore, there is a scarcity of research examining the developmental aspects of this relationship. The current study sought to identify sleep symptoms that predict verbal learning.

**Participants and Methods:** Participants included 135 children ages 2-17 with developmental and neurological conditions referred for neuropsychological assessment. Parent-reported child sleep behaviors were assessed using the Heaton Children's Sleep Questionnaire (HCSQ), and learning was assessed using the Children's Memory Scale (CMS), Word Pairs Learning. Child's age at time of assessment was used to examine potential moderating effects of developmental stage.

**Results:** Parent-report of child sleep initiation problems was significantly associated with poor learning performance on the CMS Word Pairs subtest ( $r=.159$ ,  $p=.033$ ). Follow up bootstrapped moderation analysis indicated that this relationship was strengthened for youth ages 9-12, although age was not a significant moderator for the model as a whole ( $R^2=.03$ ).

**Conclusions:** Findings suggest that problems with sleep initiation may be a useful predictor of poor memory functioning in clinical pediatric populations, particularly for pre-adolescent youth. Further research is needed to confirm these findings using objectively measured sleep onset latency and to better understand the moderating effects of age. Nonetheless, current findings provide intriguing preliminary evidence for targeting sleep onset latency among youth with memory dysfunction.

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**L.O. CONDIE. Adapted Developmental Assessment for Ages 18 months to 7 years.**

**Objective:** Neurodevelopmental assessment measures typically are designed to address global developmental delay, but without sufficient provisions for children with significant visual, auditory, or motor impairment. This session describes a qualitative and criterion-references measure appropriate for children with significant visual, auditory, and or motor impairment.

**Participants and Methods:** Children ages 18 months to 7 years were seen in a convenience sample clinical setting to set the ranges of the measure, to establish inter-rater reliability, and to address the goodness of fit between the measure and resultant recommendations. Items in the measure were rated for suitability of use with children who have cortical and non-cortical visual impairments, children with hearing impairments, and children with significant hemiparesis, diplegia, hypotonia and hypertonia.

**Results:** Interrater reliability was .89, items were selected for goodness of fit for the populations of interest (across populations), items were vetted for face validity, consensual validity, and construct validity, and results were rated for reliability in terms of (a) category of development, and (b) goodness of fit between findings and recommendations. Ratings on outcomes are pending. Parent ratings of comfort with the tool relative to standardized tools are pending.

**Conclusions:** The Adapted Developmental Assessment measure provides the neurodevelopmental evaluator with a tool that allows for greater participation from children with significant visual, auditory, and motor impairments. It has a lower floor than existing standardized assessment tools, it provides a means for children to participate who otherwise likely would be given only parent questionnaire measures, and preliminary results show that parents have a greater level of comfort with the measure and recommendations that those gleaned from standardized assessment tools that do not account for their children's disabilities.

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**J. DOXIE, M. COHEN, K. LEISER, A. HEFFELFINGER & A. KAUGARS. The Impact of Parental Stress in the Relationship Between Verbal IQ and Adaptive Functioning in Children with Early Neurological Insult.**

**Objective:** Children with neurological insult or disorder are at risk for impairments in adaptive functioning. Variations in these impairments may lie in the severity and type of disorder or injury; however other individual and environmental factors may attribute to variable adaptive outcomes. One factor consistently linked to adaptive functioning is that of cognitive development, however the mechanisms influencing the strength of the relationship are unclear. Parental stress is one mechanism that is important in examining the link in children with neurological insults. The aim of the current study is to examine parental appraisal of stress as a moderator in the association between cognitive development (as assessed by verbal IQ) and adaptive functioning.

**Participants and Methods:** Study participants included 72 preschool children with neurological insults or disorders and their primary caregivers. Primary caregivers completed rating scales and a structured clinical interview about perceived stress as well as their child's adaptive functioning. Children were administered standardized measures of intellectual functioning. Study hypotheses were examined through hierarchical multiple regression analysis.

**Results:** Parent appraisal of stress was found to moderate the relationship between verbal IQ and total adaptive functioning, as well as the adaptive subscales of communication and socialization. In each of these interactions, the relationships between IQ and adaptive functioning were stronger for children whose parents had low appraisal of stress.

**Conclusions:** These results reflect how stress may impact the social and communications skills in the day to day functioning of young children with neurological insults. Decreases in the strength of the relationship

between verbal IQ and adaptive functioning among high stress parents may be related to the tendency for parents to verbally teach these skills to their children; as well as the ability of stress to prevent the teaching of these skills.

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**S. FREDRICKSON, S. STERN, S.E. ELLEFSON, M. LACY & D. FRIM. Cognition following Decompression Surgery among Children with Chiari Malformation Type 1.**

**Objective:** Chiari malformation type I (CM1) is defined by cerebellar tonsillar herniation below the level of the Foramen Magnum (deSouza, Zador, & Frim, 2011). Individuals with CM1 have been documented to display attention, memory and executive deficits (Dunn et al., 2014). Treatment often involves Foramen Magnum decompression surgery (DS) (Duddy et al., 2014), but the cognitive impact of this neurosurgical intervention has never been investigated. The present study examines the neuropsychological functioning of a cohort of children post-DS.

**Participants and Methods:** Children with CM1 aged 6 years, 0 months to 17 years, 11 months were recruited under an IRB protocol. Participants completed a semi-structured interview and neuropsychological tests, including the California Verbal Learning Test-Children's Version (CVLT-C) and Rey Complex Figure Test and Recognition Trial (RCFT). Data for 73 children with CM1 were analyzed (41 males and 32 females; mean age = 11.23 ± 3.43 years).

**Results:** 49.3% of the sample received previous DS (n=36). T-tests comparing immediate, delayed, and recognition verbal and visual memory performance between individuals with and without previous DS revealed no significant differences in memory performance (p > .05). Group comparisons indicated low average to average performance across memory tasks in both groups. Follow-up bivariate linear regression analyses with the total sample revealed that DS status did not significantly predict present verbal or visual memory performance (p > .05).

**Conclusions:** Individuals with CM1 post-DS displayed no difference in memory functioning compared to those who did not have surgery. The current data indicates that DS has little impact on verbal and visual memory. Future prospective studies will be needed to further support this preliminary finding. This study represents a first attempt to document cognitive sequelae of DS. Overall, surgical intervention appears not to adversely impact memory functioning.

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**G.J. GERNER, M.C. GAGE, A.E. PRITCHARD, V. BURTON & M. MAHONE. Contributions of Executive Function to Math Achievement in Children Born Preterm and Children Born at Term with ADHD.**

**Objective:** Preterm birth is a risk factor for lower math achievement, as is diagnosis of ADHD without history of preterm birth. Underlying problems with executive functions (EF) have been proposed as a contributing factor; however, there is limited information as to whether there are different patterns of executive dysfunction in these two clinical populations that contribute to lower math achievement. The purpose of this preliminary study was to further examine whether different aspects of executive dysfunction underlie lower math achievement in these two clinical populations.

**Participants and Methods:** A retrospective analysis of clinical data was performed, including children born preterm (<37 weeks gestation; N = 117) and at term (≥ 37 weeks gestation) with diagnoses of ADHD (N = 379). Group differences in math achievement were examined. After controlling for sex, the relationship between parent reports of executive dysfunction (BRIEF subscales) and math achievement (WJ-III Math Calculation or WIAT-II Numerical Operations) was examined using multiple linear regression for each clinical group.

**Results:** There were no differences in math achievement between clinical groups. The BRIEF did not predict math achievement in preterm children ( $F(9, 107) = 1.219, p = 0.291$ ); however, it did predict lower math achievement in children born at term who were diagnosed with ADHD ( $F(9, 369) = 2.802, p < 0.01$ ). Specifically, the BRIEF Shift and Organization of Materials scales were the only significant predictors of math achievement.

**Conclusions:** Difficulties with mental flexibility, attentional shifting, and organization of academic materials in term born children with diagnoses of ADHD may contribute to lower math achievement. Conversely, math achievement difficulties in children born preterm may be a function of non-executive functional deficits. Further investigation of the cognitive processes underlying lower math achievement in these two clinical groups is warranted.

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#### **L. GROSS, L. GLASS, P.K. GOH & S.N. MATTSO. Specificity of Memory Deficits in Children and Adolescents with Prenatal Alcohol Exposure.**

**Objective:** Although children with histories of prenatal alcohol exposure demonstrate memory impairments across multiple domains, the specificity of these deficits is not known.

**Participants and Methods:** Memory was assessed using the NEPSY-II [Memory for Designs (MD), Narrative Memory (NM), Memory for Faces (MF), and Memory for Names (MN)]. Three groups were tested: individuals with prenatal alcohol exposure (AE;  $n = 150$ ), non-exposed individuals with other clinical behavioral conditions (B-CON;  $n = 111$ ), and typically developing controls (T-CON;  $n = 172$ ). A repeated-measures MANCOVA was conducted [Memory  $\times$  Group  $\times$  Age Group (Child, 5-7y; Adolescent, 10-16y)] with sex and ethnicity as covariates.

**Results:** The Group  $\times$  Memory  $\times$  Age Group and Age Group  $\times$  Memory interactions and all main effects were significant ( $ps < .05$ ). Group differences were similar at both ages for MF and MN (T-CON > B-CON, AE). Profiles varied by age and group for NM and MD; AE and B-CON groups differed on MD (both ages) and NM (Adolescents). Within-group age differences (Adolescent > Child) were present on MF in the AE group and on NM, MF, and MN in the B-CON group. Profiles of performance across subtests also varied by group (AE: NM, MF > MN > MD; B-CON: NM, MF > MN; T-CON: NM > MF > MD).

**Conclusions:** Compared to typical controls, alcohol-exposed children demonstrated memory impairments across domains, though deficits were attenuated when compared to a clinical control sample. AE and B-CON groups only differed on measures of visuospatial and verbal memory, suggesting specific weaknesses in the AE population. Within AE, narrative and facial memory may be relative strengths. Memory performance was generally consistent across age in the AE group, suggesting no improvement. These results present a profile of memory performance for individuals with prenatal alcohol exposure that is consistent across age, but differs by domain tested and comparison group. Research supported by NIAAA grant U01 AA014834. Additional support from NIAAA grants U24 AA014811, U24 AA014815, and F31 AA022261.

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#### **A. HEITZER, J. PIERCY, B. PETERS & S. RAZ. School Readiness and Perinatal Risk in Preschoolers Born Preterm.**

**Objective:** A body of literature supports an association between preterm birth and academic achievement deficits upon school entry. However, less is known about factors affecting school readiness in preterm-born children. The objective of the current investigation was to examine the associations between perinatal risk factors and school readiness in preschoolers born preterm.

**Participants and Methods:** One hundred and twelve preterm (<34 weeks gestation) preschoolers (3-4 years) participated in the study (50 females and 62 males). We excluded cases with congenital anomalies, moderate to severe intracranial hemorrhage, cerebral palsy, and prenatal substance exposure. School readiness was evaluated using a brief battery of eight subtests from the WPPSI-III, CELF-P2, WJ-III and PDMS-2. The eight tasks assessed discrete intellectual, language, mathematics, and visuo-motor skills, respectively.

**Results:** Multivariate analyses of covariance with birth weight, antenatal growth rate, summary scores of ante-, peri-, and neonatal complications, as well as sex, were our predictors of interest. Socioeconomic status was added as a covariate. We found that exposure to a greater number of antenatal complications was associated with lower scores on the linear combination of the WPPSI-III Block Design and Information subtests ( $F[2, 97] = 4.07, p = .02$ ) as well as the linear combination of the CELF-P2 Word Structure, Concepts and Following Directions, and Recalling Sentences subtests ( $F[3, 89] = 2.80, p = .045$ ). Lower birth weight was associated with poorer performance on Visuomotor Integration ( $F[1, 95] = 4.39, p = .039$ ). Male sex was associated with lower scores on the linear combination of the WPPSI-III Block Design and Information subtests ( $F[2, 97] = 4.98, p = .009$ ).

**Conclusions:** Degree of antenatal risk, birthweight, and sex are linked to neuropsychological development and school readiness in the early preschool years. These associations were identified with a brief battery of neuropsychological tasks.

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#### **P.A. KULESZ, A.L. WARE, J.S. ORKISZ, V.J. WILLIAMS, M. DENNIS & J.M. FLETCHER. The Longitudinal Effects of Shunt Treatment Predict Alterations in the Neural Correlates of the Posterior but not Anterior Attention Network in Spina Bifida Myelomeningocele.**

**Objective:** Deteriorating effects of hydrocephalus on grey and white matter tissue, considered as secondary insults to the brain, have important implications for attention function in individuals with spina bifida myelomeningocele (SBM). Though the literature discusses neural and functional deficits in the attention networks (AN) subsequent to hydrocephalus, few studies have looked at the effects of shunt treatment for hydrocephalus on the neural and functional correlates of AN. The current study focuses on investigating the longitudinal effects of the shunt treatment on neural correlates and functional outcomes associated with the anterior and posterior AN.

**Participants and Methods:** Probabilistic diffusion tractography and volumetric quantification of tectal, superior parietal, dorsolateral prefrontal, and anterior cingulate cortical regions were performed on 163 individuals with histories of shunt-treated SBM with assessments of posterior (covert orienting) and anterior (conflict resolution) AN functions. Multiple regression analyses were performed to examine the effects of shunt treatment on the neural and functional correlates of the anterior and posterior AN.

**Results:** Age of initial shunt operation was predictive of integrity of the parietal but not the frontal tectocortical white matter (WM) pathways. Youth who underwent initial shunt operations at an older age had higher FA values and lower RD values in the posterior parietal pathways. A greater number of shunt revisions was predictive of AD values in the posterior and anterior tectocortical WM pathways, and the superior parietal cortex volume. Shunt treatment was not predictive of the functional outcomes associated with anterior and posterior AN.

**Conclusions:** The findings suggest greater neuroanatomical disruption of the posterior AN subsequent to hydrocephalus treatment relative to the anterior AN, suggesting neuroanatomical dissociation between the anterior and posterior AN in SBM.

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**A. LUCCHETTI, C. GREEN & T. BROWN. Neuropsychological Profiles in Parry Romberg Syndrome: A Case Series.**

**Objective:** Parry Romberg Syndrome (PRS) is a rare neurocutaneous disorder characterized by degeneration of the tissues between the skin, typically on one side of the face (progressive hemifacial atrophy). Incidence rates are unknown, but some have suggested 1 in 700,000 (Castro-Govea et al., 2012). Onset is typically between 5 and 15 years of age and progresses for 2 to 10 years (Gulati et al., 2006). It occurs more commonly in females. Associated neurologic features include trigeminal neuralgia, migraine, epilepsy, brain lesions on CT and MRI, and changes in the eyes, skin, teeth, and hair (Stone, 2003). Cognitive outcomes are generally unknown given the rarity of the syndrome. This is a case series of two adolescents with PRS to help better understand their neuropsychological profiles.

**Participants and Methods:** Participants included a 15-year, 7-month-old male and 14-year, 11-month-old female with PRS. Both presented for comprehensive neuropsychological assessment at a major Midwestern medical institution as part of comprehensive multispecialty medical evaluations.

**Results:** Similarities between their neuropsychological profiles include broadly intact verbal and nonverbal reasoning, with relatively stronger nonverbal abilities, average academic skills, and intact sustained attention. Weaknesses included variable executive functioning and variable language skills. The child without epilepsy demonstrated better working memory, processing speed, and fine motor dexterity, while the child with comorbid epilepsy demonstrated better verbal memory abilities and milder executive weaknesses. Both profiles were negative for significant mood concerns.

**Conclusions:** This case series provides preliminary information about the neurocognitive functioning of adolescents with this rare syndrome. Future directions should include more robust neurocognitive data to understand profiles in adolescents with PRS with and without epilepsy, as well as to track disease progression with relation to neurocognitive outcomes.

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**M. MENTZER, F. EICHLER & A.K. MORGAN. Case Study of Krabbe Disease Post-Bone Marrow Transplant.**

**Objective:** Krabbe disease (globoid cell leukodystrophy) is a rare neurological disorder characterized by a mutation that impairs the development of the enzyme glucocerebrosidase (GALC), which is involved in the production and maintenance of myelin throughout the nervous system. This mutation causes inhibition of GALC activity, leading to neuromuscular and cognitive decline. The only effective treatment is bone marrow transplant (BMT), associated with halting progression of the disease. Cognitive outcomes have not been reported. We report clinical data of a patient who underwent BMT for Krabbe with neurological and cognitive outcomes.

**Participants and Methods:** Patient is a 9-year old boy with Krabbe disease who initially presented at 7-years with gross motor difficulties. Corticospinal tract abnormality and sensory and motor demyelinating neuropathy were found. Genetic testing revealed 2 variants of the GALC gene. He underwent BMT. He has had regular neurological evaluations and 3 neuropsychological evaluations: 3 months pre-BMT and 15- and 27-months post-BMT. Cognitive skills ranged from average to superior pre-BMT.

**Results:** Post-BMT the patient had graft vs host disease, renal impairment, optic disc edema and bilateral cataracts. Neuropathy was present but improved. Myelin in the corticospinal tract was stable. Slight worsening of periventricular white matter involvement was noted. Fifteen

months post-BMT, cognitive abilities were stable with a mild decline in processing speed. Twenty-seven months post-BMT, cognitive abilities remained stable and in some instances improved, including processing speed.

**Conclusions:** This study provides an understanding of the cognitive effects of juvenile-onset Krabbe disease and the outcome following bone marrow transplant. Variables that may play a role include time between symptom onset and BMT, forms of genetic mutation and GALC activity. Correspondence: *Amy K. Morgan, Ph.D., Psychiatry, Massachusetts General Hospital, 1 Bowdoin Square, 7th Floor, Boston, MA 02114. E-mail: akmorgan@mgh.harvard.edu*

**A. MITTAL, V.P. CULOTTA & M. BLACKWELL. Implications of Congenital Heart Defect on Neurocognitive Development: Case Study of Ebstein's Anomaly.**

**Objective:** This case study examined neurocognitive features associated with a rare congenital heart defect, Ebstein's Anomaly (EA). EA is marked by tricuspid malformation and subsequent regurgitation. The defect occurs in 1 of 20,000 births. Both genetic and environmental factors are implicated. Depending on severity, symptoms may range from mild to life-threatening. Severe presentations require surgical intervention. EA results in cyanosis and occasionally chronic hypoxia. Medications to prevent heart failure may be ototoxic.

**Participants and Methods:** A 7-year, 3-month old female with EA detected in utero was seen for neuropsychological assessment. This patient required multiple surgical corrections, intubation and ventilation, ototoxic medications, and multiple pacemaker placements.

**Results:** Assessment revealed a Major Neurocognitive Disorder secondary to Hypoxia aggravated by ototoxic medications. Sensorineural hearing loss and vocal impairment were present. Her neuropsychological profile was marked by Borderline Intellectual functioning with verbal cognition more significantly impacted. Weaknesses were evident in bilateral fine motor speed, bilateral gross motor strength, reading comprehension, written expression, verbal confrontation naming, receptive and expressive language skills. Relative strengths were apparent in processing speed, rapid naming, semantic fluency and aspects of verbal memory. Behavioral checklists reflected a positive, well-behaved and social youngster.

**Conclusions:** Congenital heart defects represent a significant neurocognitive risk factor for children. This case study examined a 7-year, 3-month old youngster with EA marked by chronic hypoxia, intubation, multiple surgical corrections, and ototoxicity associated with medications. Her neurocognitive profile revealed marked weakness in aspects of intellectual, academic, and cognitive-linguistic skills. This case study illustrates the neurocognitive risks of heart malformations and the value of early assessment.

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**N.C. MOSS, D. NOVAK, R.E. RIEGER, J. FULLER, S.J. ERICKSON & J.R. LOWE. Parenting Quality and Neurocognitive Outcomes in Children born Term and Preterm.**

**Objective:** Preterm children are at risk for delayed cognitive, language, and self-regulation development compared with term children. Responsive and non-controlling parenting fosters the development of child self-regulation and improves cognitive/behavioral outcomes. We investigated the association between parenting quality, self-regulation and neurocognitive outcomes in preterm compared to full term children.

**Participants and Methods:** A cross-sectional study of 50 term and 49 preterm children (18-24 months) was conducted. Parental and child behavior were assessed during 5 minutes of videotaped play using the Dyadic Parent-child Coding System (DPICS) that measures parent's verbal and physical behaviors including commands, questions, praise, neutral/negative talk, reflective statements, behavioral descriptions, and touch. A composite score was created with positive and negative parent

quality indices. The child's compliance with parental commands was correlated to measures of self-regulation and Bayley-III scores. Self-regulation was measured using the A not B test of object permanence and snack delay test of impulsivity.

**Results:** Mothers of preterm children used more commands ( $p=0.001$ ) and had more negative talk ( $p=0.04$ ) than term mothers. Increased use of unlabeled praise positively correlated with cognitive scores on Bayley-III ( $p=0.05$ ). For term children, increased direct commands inversely correlated to language scores ( $p<0.001$ ) while increased descriptive questions and reflective statements positively correlated to language scores ( $p<0.02$ ). For both groups, increased use of information questions correlated to better snack delay scores ( $p<0.05$ ). When groups were combined, the positive parent quality index score correlated with increased language scores and the negative parent quality index score correlated with decreased language scores ( $p<0.05$ ).

**Conclusions:** We found a positive correlation between parenting quality and neurobehavioral outcomes. This has implications for early childhood intervention and parental education.

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#### **T. NORRIS, C.H. SALAMA, B. SLOMINE, S. SUSKAUER & C.F. SALORIO. Improvements in Functional Independence During Inpatient Rehabilitation for Children with Brain Tumors.**

**Objective:** After a brain tumor resection, some children exhibit functional declines that may warrant inpatient rehabilitation. This study examines functioning in the domains of self-care, mobility, and cognition among children admitted to inpatient rehabilitation after brain tumor resection. It was hypothesized functioning would improve from admission to discharge and outcomes would differ based on tumor location and whether the patient received oncology treatment (chemotherapy and/or radiation) during rehabilitation.

**Participants and Methods:** Participants were 43 patients (3-21 years) admitted to inpatient rehabilitation between 2003-2015 after brain tumor resection (25 males; M age=9.8 years). Mean length of stay was 35.28 days (range=5-116). Tumor location was more commonly infratentorial (69.8% vs 30.2% supratentorial). 23.3% received oncology treatment during rehabilitation. The Functional Independence Measure for Children (WeeFIM) Developmental Functional Quotient (DFQ) was used to measure functional independence across domains (self-care, mobility, and cognition).

**Results:** Paired t-tests indicated improvements in WeeFIM DFQ scores from admission to discharge (Total, Self-Care, Mobility, Cognition= $p<0.001$ ). One-way ANOVAs were conducted to determine if WeeFIM DFQ scores at admission and discharge differed based on tumor location or oncology treatment. One-way ANOVAs were also conducted to determine if change in WeeFIM DFQ scores from admission to discharge differed based on these factors. No significant differences in functioning based on tumor location or oncology treatment were found.

**Conclusions:** Children who have undergone surgical resection for a brain tumor demonstrate improvements in functioning during inpatient rehabilitation. Functional independence did not differ based on tumor location or whether oncology treatment was received during rehabilitation. Further research with a larger sample size is needed to more fully explore the relationship between tumor/treatment characteristics and functional outcome.

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#### **K. ODDI, A.C. GROSS & C.J. BOYS. Neurocognitive Development Among Children Diagnosed with Methylmalonic Aciduria (MMA).**

**Objective:** Since 1965, newborns in Minnesota have been screened for rare disorders that, if untreated, can cause serious illness or death. This study examined the neurocognitive functioning of children diagnosed with Methylmalonic Aciduria (MMA) via newborn screening. MMA is

a rare (about 1 in 100,000 newborns) metabolic disorder presenting due to deficiency of mitochondrial enzyme MCM resulting in metabolic acidosis causing neurodegeneration of the basal ganglia and renal failure. After the neonatal period, infants with MMA demonstrate variable clinical manifestations. Research has shown that children with organic acidurias demonstrate failure to thrive and developmental delays, but a specific trajectory has not been described.

**Participants and Methods:** This study evaluated the neurocognitive development of 6 children (4 male) with MMA seen long-term in a metabolic follow-up clinic. There are 9 total MMA patients in MN. Children were administered age-appropriate measures of intellectual functioning at approximately 5 years of age.

**Results:** At 5 years of age, mean scores on a measure of intellectual functioning fell in the impaired range. The average FSIQ = 58 (range 52-69). Two of the children followed long-term remained in the impaired range beyond 10 years of age. One child was not testable due to impairments at 5 years.

**Conclusions:** Despite variable clinical presentation in the newborn phase, results suggest that children with MMA demonstrate impaired neurocognitive abilities at the age of 5 years. This impaired functioning is despite early identification and ongoing treatment. Findings have implications for early assessment and intervention with children with MMA. The longitudinal trajectory can also assist healthcare providers in presenting accurate long-term expectations to parents following positive newborn screen findings.

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#### **B. PETERS, A. HEITZER, J. PIERCY & S. RAZ. Perinatal Risk and Motor Abilities in Preterm-Born Preschoolers.**

**Objective:** The sequelae of preterm birth may include motor deficits even in children without cerebral palsy (CP), yet little is known about the perinatal antecedents of these adverse functional changes. In this investigation, we wished to examine the unique influence of degree of gestational immaturity and sex on motor development at preschool age, in the context of other early risk factors.

**Participants and Methods:** One hundred and one (41 boys, 60 girls) preterm-born (<34 weeks) preschoolers participated in this study. Children with CP, severe intracranial hemorrhage, and uncorrected sensory deficits were excluded. Motor functioning was evaluated, at  $44.32 \pm 3.39$  months, with the Peabody Developmental Motor Scales-2 (PDMS-2) as well as the Manual Motor Sequences, Imitating Hand Positions, Visuomotor Precision, and Design Copying subtests from a developmental neuropsychological battery (NEPSY-II).

**Results:** We used simultaneous multiple regression with gestational age and sex as predictors of interest. Adjusted age, SES, neonatal complications, and intrauterine growth rate were covariates. Gestational age was associated with performance on PDMS-II gross motor (Object Manipulation;  $p < .05$ ) and fine motor (Visual-Motor Integration;  $p < .05$ ) subtests: a greater degree of immaturity was linked to poorer performance. Female advantage was observed on the PDMS-2 Total ( $p < .05$ ), and Fine ( $p < .05$ ) Motor, scales. Girls outperformed boys on two PDMS-2 subtests, Grasping ( $p < .01$ ) and Locomotion ( $p < .01$ ) and on four NEPSY-II subtests: Design Copying ( $p < .01$ ), Imitating Hand Positions ( $p < .05$ ), Manual Motor Sequences ( $p < .05$ ), and Visuomotor Precision ( $p < .05$ ).

**Conclusions:** Among preterm preschoolers, degree of immaturity was associated with motor outcome despite the restricted gestational age range of our sample. Increased immaturity was linked to decline in both fine and gross motor performance, particularly on tasks requiring eye-hand coordination. Female sex provided both gross and fine motor advantage.

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**J.E. SCHREIBER, H.M. CONKLIN, K. CLARK, J. HANKINS, W. WANG & K. HELTON. Cognitive and Academic Functioning After Initiation of Hydroxyurea in Pediatric Patients with Sickle Cell Disease.**

**Objective:** Hydroxyurea therapy (HU) aims to prevent vaso-occlusion, reduce anemia severity, and decrease pain and fatigue in patients with sickle cell disease (SCD). Consequently, cognitive functioning may improve with HU. The present study examined cognitive and academic functioning before and after HU initiation in pediatric patients with SCD.

**Participants and Methods:** Participants comprised 15 SCD patients who initiated HU [6 male; mean age: 12.2 years, SD=3.4] and five comparison SCD patients who did not initiate HU [3 male; mean age: 9.2 years, SD=2.2]. Participants completed assessments prior to initiation (baseline) and again one year later. Treated participants achieved maximum tolerated dose of HU prior to the one year follow up assessment.

**Results:** At baseline, treated patients demonstrated low average Wechsler IQ (FSIQ) scores (M=80.0, SD=13.8) and impaired to low average Woodcock-Johnson-III (WJ-III) academic achievement scores (range: 78.0-85.6). After one year of HU, both FSIQ scores (M=83.1, SD=14.0,  $p=.04$ ) and Processing Speed Index scores significantly improved (M=87.9 changed to M=92.4,  $p=.03$ ). Treated participants also demonstrated improved WJ-III Passage Comprehension scores (M=78.0 changed to M=81.6,  $p=.04$ ). Non-treated participants demonstrated average FSIQ scores (M=95.0, SD=21.9) and low average to average WJ-III academic achievement scores (range: 84.0-91.6) at baseline. Non-treated participants did not demonstrate significant change on any Wechsler index scores between baseline and follow up testing but demonstrated significant decline on the WJ-III Letter-Word reading test (M=92.6 changed to M=88.2,  $p=.02$ ).

**Conclusions:** Treatment with HU appears to provide benefit to overall cognitive functioning, processing speed, and reading comprehension in SCD patients. Findings highlight the need for close monitoring of cognitive functioning in SCD patients and the implementation of appropriate interventions.

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**S. STERN, S. FREDRICKSON, S.E. ELLEFSON, M. LACY & D. FRIM. Verbal and Visual Memory Performance in a Cohort of Children with Chiari Malformation Type 1.**

**Objective:** Chiari malformation type I (CM1) involves herniation of the cerebellar through the foramen magnum (deSouza, Zador, and Frim, 2011). Increasing research has been directed at investigating the role of the cerebellum in cognition (see review, Koziol and colleagues, 2014). At present, only case studies and small cohorts have been presented examining the potential cognitive sequelae of this unique malformation. Thus the present study attempted to identify the memory profile in the largest cohort of children with CM1.

**Participants and Methods:** 73 children, mean age of 11 (range 6 - 17 years) consecutively recruited at a university based surgery clinic completed a verbal learning and memory test [California Verbal Learning Test-Children's Version (CVLT-C)] and an incidental visual memory test [Ray Complex Figure Test and Recognition Trial (RCFT)]. Means, percentages and T tests were calculated using SPSS-22.

**Results:** Participants displayed mildly impaired visual learning (T=40.1 (11.1)) and delayed free recall (T=38.9 (10.9)) yet intact recognition (T=46.8 (12.6)). In contrast, immediate verbal learning (T=51.5 (11.1)), delayed verbal free recall (T=50.7 (11.5)) and verbal recognition (T=52.9 (9.9)) were in the average range. T-tests between verbal and visual memory trials revealed significantly poorer performance on visual memory tasks (Immediate memory T (72) = -7.57,  $p<.001$ ; Delayed memory T (72) = -8.09,  $p<.001$ ; Recognition memory T (72) = -3.62,  $p<.001$ ).

**Conclusions:** Children with CM1 displayed visual retrieval deficits, yet intact verbal learning and memory processing. This is consistent with

prior research suggesting a role of the cerebellum in visual attention, memory and planning, which may underlie the noted deficits.

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**H. TAM, T. DREHER, M.N. SCOTT, D. CARMODY & S. GREELEY. Neuropsychological Case Presentations of Two Common Monogenic Diabetes KCNJ11 Gene Variants.**

**Objective:** Monogenic diabetes (MD) is a category of rare (approximately 1 in 90,000-160,000) diabetic disorders that includes individuals with congenital/early onset diabetes un-related to insulin insufficiency (i.e., not type I or II). Mutations in the 20+ genes linked to MD produce a range of phenotypic presentations and disease severity, with associated neurological complications that can include epilepsy, developmental delay, and brain malformations. Present reports of the neuropsychological characteristics within MD populations are limited and indicate highly heterogeneous profiles, although few papers have evaluated patterns of cognitive strengths and weaknesses categorized by specific mutation. Functional changes in the ATP-sensitive potassium (KATP) channel are among the most common causes of MD. The objective of this case series is to better understand the neuropsychological profiles of two mutations in the KCNJ11 KATP channel gene.

**Participants and Methods:** R201H (N=4) and R201C (N=2). Patients completed thorough neuropsychological evaluations.

**Results:** Patients with R201H demonstrated normative weaknesses in verbal list learning, visual-spatial production/learning, and behavioral executive skills that were consistent across all 4 individuals. Difficulties with visual-motor integration and fine motor skills were also found in the adolescent and adult individuals with R201H. The neuropsychological profile for the individuals with R201C included borderline to impaired performance in perceptual reasoning, math, written language, set-shifting, inhibition, visual motor integration, and visual-spatial production/learning. Below average verbal list learning skills was also consistent across both individuals.

**Conclusions:** In sum, although both mutations constitute similar changes in primary protein structure, non-trivial differences in neuropsychological profiles appear to be present. Additionally, assessment of changes in skill development over time may be particularly important in this population.

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**B. YUND, D. HABERMAN, C. CASNAR & B.P. KLEIN-TASMAN. Parent Reported Temperament in Young Children with Neurofibromatosis type 1.**

**Objective:** Research suggests that young children with neurofibromatosis type 1 (NF1) have difficulties with learning, attention, and executive functioning; however, research examining temperament and personality in young children with NF1 is more sparse. Evidence suggests that school-aged children with NF1 are at risk for emotional and social difficulties. Given temperament may play an important role in psychosocial functioning in later childhood, this study aims to examine whether a significant difference exists in the temperament of young children with NF1 compared to a contrast group of children without NF1.

**Participants and Methods:** Parents of 57 children with NF1 (33 males, 24 females) and parents of 48 unaffected children (30 males, 18 females) ages 3 to 7 years completed the Children's Behavior Questionnaire (CBQ) in order to assess temperament characteristics.

**Results:** Children with NF1 were rated significantly higher than the contrast group in the Extraversion scale [ $t(104) = 3.126$ ,  $p = .003$ ] of the CBQ. Within this scale, children with NF1 were rated significantly higher in Activity [ $t(104) = 2.762$ ,  $p = .005$ ] and Impulsivity [ $t(104) = 2.878$ ,  $p = .004$ ]. Children with NF1 were rated significantly lower than the contrast group in the Effortful Control scale [ $t(104) = -3.224$ ,

$p = .001$ ]. Within this scale, children with NF1 were rated significantly lower on Attentional Focusing [ $t(104) = -4.315, p < .001$ ] and Inhibitory Control [ $t(104) = -3.157, p = .002$ ] compared to the contrast group. No gender or age differences in ratings were evident on any scale for either group.

**Conclusions:** These findings suggest that the temperament profile of young children with NF1 differ from that of unaffected children. Based on parental report, young children with NF1 tend to be less focused and more impulsive than their peers. These findings may be useful in detecting early and subtle vulnerabilities that place children at risk for later psychosocial difficulties.

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### Acquired Brain Injury (TBI/ Cerebrovascular Injury & Disease - Adult)

**C. LEVITCH, M.E. ZIMMERMAN, M. ZUGHAFI, T. GLATTSTEIN, N. KIM, R.B. LIPTON, W.F. STEWART, M.J. SLIWINSKI & M.L. LIPTON. Soccer Heading during Games is Associated with Neuropsychological Function in Amateur Players.**

**Objective:** The goal of the present study was to examine the relationship between heading, thought to be a repetitive sub-concussive event sustained during normal soccer play, and neuropsychological function in amateur adult soccer players.

**Participants and Methods:** One hundred ninety-three amateur soccer players completed a questionnaire to ascertain heading exposure during the prior 12 mos. CogState was used to assess neuropsychological function across multiple domains. Due to a non-normal distribution of heading data, we divided participants into quartiles based on heading exposure and then dichotomized into two groups: High Heading (HH=4th quartile) and Low Heading (LH=1st-3rd quartile). Linear regression was used to examine the relationship between heading group and neuropsychological function, covarying for lifetime concussion history, age, gender, education, and race. Heading during games or practice was examined separately.

**Results:** Participants had an average age of 27 yrs ( $sd=8.1$ ) and 16 yrs of education ( $sd=2.5$ ). Participants headed the ball a median of 642 times/yr (games=304 times/yr, practice=278 times/yr). HH participants headed the ball at least 1565 times/yr. Participants with HH in games had poorer performance on tests of verbal learning ( $p<.001$ ) and verbal memory ( $p=.005$ ) compared to LH participants. Sixty-nine (36%) participants reported a history of concussion (HH  $n=15$ , LH  $n=54$ ). Lifetime concussion history was not related to neuropsychological function and did not modify the association of heading and cognition. Heading exposure during practice was not related to neuropsychological function.

**Conclusions:** Soccer players in the top quartile of heading exposure during soccer games had poorer performance on tests of verbal learning and delayed verbal memory relative to players who headed less. Heading predicted neuropsychological function independent of concussion in our sample, suggesting that repetitive low level trauma during soccer games is associated with cognitive impairment in amateur soccer players.

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**J. LICHTENSTEIN & D. LAZAR. Prevalence Rates of Concussion in Ultimate Frisbee: Preliminary Findings of the Concussion in Ultimate Frisbee Survey (CUFS).**

**Objective:** This study aimed to determine prevalence rates of concussion in the sport of Ultimate Frisbee. When played at a high level, Ultimate poses a contact risk. While prior estimates have been made, sample sizes were very small; the frequency of concussion in this sport, therefore, is unknown. We hypothesized that Ultimate players would

endorse concussion rates similar to those seen in sports that share its characteristics, such as soccer and basketball.

**Participants and Methods:** An anonymous survey was distributed to Ultimate players at all levels of play, from recreational to professional. Data was returned for 580 participants of approximately 2500 surveyed, for a return rate of 23.2%. The sample consisted predominantly of males in their mid-twenties (69.7% male; MAge = 26.2 years, SDAge = 5.9; range 18-54). Frequency analyses were conducted to determine prevalence rates, and rate of concussions per 10,000 athletic exposures was also calculated.

**Results:** Frequency analyses indicated that 28.2% of participants had experienced at least one concussion playing Ultimate, while 21.5% of respondents who played Ultimate in college experienced at least one concussion at that level of play. Participants identified similar rates of injury at the college and club levels (34.2% vs. 43.5%). When adjusted for athletic exposures, the rate of concussions in college Ultimate players was 3.2 per 10,000 (for men and women combined). This is comparable to many other NCAA sports, including men's soccer, basketball, and lacrosse.

**Conclusions:** The risk of head injury in Ultimate has been grossly underestimated and medical resources provided to teams are currently lacking. The results of this survey demonstrate a high rate of concussions in Ultimate and the need for greater support from institutions, especially at the college level, given the rapid growth of the sport. This support may include the need for baseline and post-injury neurocognitive testing, in which neuropsychologists can play a substantial role.

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**K. LINNEA, K. DONNELLY, D.A. GRANT & J. LICHTENSTEIN. The Effects of a Yoga and Mindfulness Intervention on Executive Functioning in Traumatic Brain Injury.**

**Objective:** Individuals who have sustained a traumatic brain injury (TBI) often experience subsequent difficulties in the physiological, psychological, and cognitive domains. In terms of the latter, such individuals are particularly vulnerable to executive functioning impairments, which can interfere with occupational, social, and emotional functioning. Unfortunately, limited treatments are available that target long-term executive functioning weakness in individuals with TBI. As such, this pilot study examined the effect of a yoga and mindfulness-based intervention on executive functioning skills in adults with a history of TBI.

**Participants and Methods:** A pre-post study design was utilized to examine the effect of an 8-week yoga and mindfulness program on the executive functions in adults who have experienced mild or moderate TBI. Participants included 7 male and 5 female adults with a mean age of 52 years. The Behavior Rating Inventory of Executive Function - Adult (BRIEF-A) was completed as a measure of executive functions pre and post intervention.

**Results:** A paired samples t-test was conducted to compare executive functioning skills pre and post intervention. Results indicated a significant improvement on the Inhibition scale following the intervention program ( $M=5.90, SD=7.25$ );  $t(10)=2.70, p = .022$ . Further, Cohen's effect size value ( $d = 0.81$ ) suggested a high practical significance.

**Conclusions:** Following an 8-week yoga and mindfulness intervention program, adults with TBI histories indicated significant improvements in their ability to control their actions and be less impulsive in their decision-making. Despite the small sample size of this study, these findings are encouraging as they suggest the potential utility of an alternative method of intervention that may improve the daily functioning of individuals recovering from TBI.

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## ADHD/Attentional Functions

**C.E. GAUDET, B.C. KAVANAUGH, L.D. HAISLEY, J. DUPONT-FRECHETTE, P. TELLOCK, I. MAHER, K. BENSON & K.A. HOLLER. The Role of Cultural Bias in the Continuous Performance Test Second Edition (CPT-II) in a Pediatric Sample.**

**Objective:** Cultural bias (CB) can significantly influence neuropsychological evaluation results, potentially leading to inaccurate or skewed conclusions regarding brain-behavior relationships. This study examined the influence of cultural bias on the Continuous Performance Test (CPT-II) within a children's psychiatric inpatient setting.

**Participants and Methods:** A medical chart review was conducted for 77 children aged 6-12 years with at least one psychiatric disorder who completed the CPT-II during a children's psychiatric inpatient program hospitalization from 2010-2014. CB risk was assessed via each child's minority status (white/non-white), insurance status (public/private), and school ranking (high/low state ranking). A total CB risk score (0-3) was calculated for each child based on the sum of CB risk factors. ADHD diagnosis status was determined from the chart review.

**Results:** On the CPT-II, both ISI Change measures (Hit RT & Hit SE) were correlated with the CB risk factor total score. ANOVAs found group differences in both ISI Change measures among those with 0, 1, 2, and 3 CB risk factors. A chi-square test was significant for the relationship between CB risk factors and ADHD diagnosis, with 88% of patients that met the criteria for 3 risk factors receiving an ADHD diagnosis. An ADHD diagnosis was also found to be significantly correlated with both ISI Change measures.

**Conclusions:** Results indicate that the CPT-II's ISI Change measures and ADHD diagnoses are susceptible to CB risk factors. Such CB risk factors may be exerting influence on CPT-II test performance and the subsequent likelihood of receiving an ADHD diagnosis in pediatric populations. Because the CPT-II is a widely used component of neuropsychological assessments in determining the presence of ADHD, it is recommended that CPT-II interpretations, particularly those related to ISI measures, are considered in the context of CB risk in pediatric samples. Correspondence: *Charles E. Gaudet, Doctoral Candidate, Psychology, University of Rhode Island, Chafee Hall, 142 Flagg Rd., Kingston, RI 02881. E-mail: chad\_gaudet@my.uri.edu*

## Cancer

**D. POTVIN, A.R. GIOIA, K.S. WALSH & K.K. HARDY. Traditional versus Computerized Assessment of Executive Dysfunction in Preschoolers within the Pediatric Oncology Population.**

**Objective:** The nature of executive functioning deficits in preschoolers with CNS-impacting cancer is poorly understood, in part because of limited sensitivity of traditional assessment measures.

**Participants and Methods:** We examined the sensitivity of multiple measures of attention and executive function to impairment in a sample of young children with cancer. This study included 22 children (11 brain tumor (BT), 11 Acute Lymphoblastic Leukemia (ALL)) between the ages of 4 and 7 years ( $M=5.2$ ,  $SD=2.7$ ), with all children at least one year post-diagnosis (age at diagnosis  $M=2.7$ ,  $SD=1.3$ ; years since diagnosis  $M=3.0$ ,  $SD=1.4$ ).

**Results:** Neither group (BT and ALL) demonstrated significant deficits on traditional, paper and pencil measures of processing speed (WPPSI-IV: Symbol Search: BT  $M=9.9$ ; ALL  $M=10.8$ ) or working memory (NEPSY-II: Sentence Repetition: BT  $M=10.6$ , ALL  $M=9.8$ ; CMS: Numbers BT  $M=8.6$ , ALL  $M=9.4$ ). Similarly, no deficits were noted on parent report of attention (CBCL: Attention Problems: BT  $M=55.2$ , ALL  $M=52.5$ ) or executive functioning (BRIEF-P: EMI BT  $M=59.4$ , ALL  $M=51.8$ ; ISCI BT  $M=54.6$ , ALL  $M=49.3$ ). In contrast, computerized measures of processing speed (CogState Standard Score: Detection BT  $M=85.1$ , ALL  $M=101.2$ ) and visual attention (CogState Standard Score: Identification BT  $M=86.5$ , ALL  $M=97.0$ ) were sensitive to dysfunction, though only for the brain tumor group. Correlations

between traditional and computerized assessment ranges from  $R=.031$  to  $R=.561$ , with the strongest correlation between traditional and computerized measures of processing speed.

**Conclusions:** Our pilot results indicate that computerized measures may be more sensitive to emerging higher-order cognitive deficits exhibited by young children with CNS-impacting cancer than traditional, paper-and-pencil or parent report measures. Early identification of cognitive difficulties may allow for early intervention to address attention problems and, possibly, ameliorate later academic and social difficulties. Correspondence: *Deborah Potvin, PhD, Neuropsychology, Children's National Medical Center, 7511 13th Street, NW, Washington, DC 20012. E-mail: deborah.potvin@gmail.com*

## Medical/Neurological Disorders/Other (Adult)

**J.H. STENCLIK, S.A. SPERLING & C.A. MANNING. Depression Uniquely Contributes to Performance on the MoCA in Deep Brain Stimulation Surgery Candidates with Parkinson's Disease.**

**Objective:** To examine the contribution of executive dysfunction and depression on scores from the Montreal Cognitive Assessment (MoCA), the most commonly used measure for diagnosis and surgical decision making for patients with Parkinson's disease (PD) who are candidates for Deep Brain Stimulation (DBS) surgery.

**Participants and Methods:** Data from 54 patients with PD who were candidates for DBS were examined. An Executive Composite score was created by averaging T-scores from 4 measures of executive functioning (Wisconsin Card Sorting Test Perseverative Errors, Letter Fluency, Trail Making Test B, and Stroop Color-Word Test Interference). Depression was measured using the Beck Depression Inventory-II (BDI-II). A stepwise multiple linear regression analysis was used to predict MoCA scores based on individuals' executive functioning and depression scores. **Results:** MoCA scores were negatively correlated with BDI-II scores ( $-.514$ ;  $p<.001$ ) and positively correlated with the Executive Composite score ( $.645$ ;  $p<.001$ ). BDI-II scores were not significantly correlated with the Executive Composite score ( $-.215$ ; ns). The model contained two predictors and was reached in two steps without any variables removed. The model was statistically significant  $F(2, 51) = 32.897$ ,  $p<.001$ , and accounted for approximately 56% of the variance in MoCA scores ( $R^2 = .563$ ; adjusted  $R^2 = .546$ ). The Executive Composite Score and BDI-II each uniquely accounted for approximately 30% and 15% of the variance in MoCA scores, respectively.

**Conclusions:** Depression and executive dysfunction independently contribute to MoCA performance in individuals with PD. As might be expected, stronger executive abilities and less depression are associated with better performance on the MoCA. Of note, depression and executive functioning should be considered independently when interpreting MoCA scores and determining candidacy for DBS surgery.

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**J.H. STENCLIK, C.A. MANNING & S.A. SPERLING. The Effect of Depression on Executive Functioning in Deep Brain Stimulation Surgery Candidates with Parkinson's Disease.**

**Objective:** To further understand the contribution of depression on executive functioning in order to inform preoperative decision making for individuals with Parkinson's disease (PD) who are candidates for Deep Brain Stimulation (DBS) surgery.

**Participants and Methods:** Data from 209 patients with PD who were candidates for DBS surgery were examined. Depression was measured using either the Geriatric Depression Scale or Beck Depression Inventory-II. Depression was categorized into three severity classifications based on well-established cut-offs from the literature: (1) normal/minimal ( $n=135$ ), (2) mild/moderate ( $n=61$ ), and (3) severe ( $n=13$ ). An



Executive Composite score was created by averaging T-scores from 4 neuropsychological measures of executive functioning: Wisconsin Card Sorting Test Perseverative Errors, Letter Fluency, Trail Making Test B, and Stroop Color-Word Test Interference. A Kruskal-Wallis H test was used to determine if there were statistically significant differences between the three depression severity groups on the Executive Composite score.

**Results:** There was a statistically significant difference in the Executive Composite Score between the three depression severity groups  $\chi^2(2) = 6.187$ ,  $p = 0.045$ , with a mean rank score of 112.69 for those with normal/minimal depression, 90.54 for those with mild/moderate depression, and 92.96 for those with severe depression. Post-hoc, pairwise analyses revealed only a significant difference between those with normal/minimal vs. mild/moderate depression  $\chi^2(1) = 22.152$ ,  $p = 0.018$ .

**Conclusions:** Individuals with PD with mild to moderate depression perform more poorly than those with minimal depressive symptomatology on measures of executive functioning. Depression contributes to executive dysfunction, a core cognitive deficit in this patient population, and should be considered when determining candidacy for DBS surgery. Correspondence: *Jessica H. Stenclik, Ph.D., Neurology, University of Virginia, 1000 City Walk Wak, Apt 307, Charlottesville, VA 22902. E-mail: jhstenclik@gmail.com*

**INS Arthur Benton (Mid-Career) Award  
Presentation:  
The Evolving Role of Neuropsychological  
Investigations in Multiple Sclerosis**

**Presenter: Ralph Benedict**

**3:45–4:45 p.m.**

**R.H. BENEDICT. The Evolving Role of Neuropsychological Investigations in Multiple Sclerosis.**

Multiple sclerosis (MS) is a demyelinating disease of the central nervous system characterized by relapses and gradual worsening of chronic neurological disability. Charcot described cognitive and personality changes in MS patients in 1877, but it would take a century for the quality and frequency of such impairment to be elucidated by Rao and others. Cognitive impairment occurs in 50-60% of MS patients, and dementia in roughly 15%. While the demyelinating WM lesion is the pathologic hallmark of MS, neuropsychological deficits are more robustly correlated with brain atrophy. This presentation will describe MRI research showing strong correlation between neuropsychological deficits and ventricle volume, normalized gray matter (GM) volume, deep GM structures such as the thalamus, and most recently networks involving the anterior regions of the thalamus. In all cases, neuropsychological tests emphasizing visual processing speed were most sensitive, and closely tied to MRI measures. In addition to characterizing MS dementia, neuropsychological investigations are playing an ever increasing role in the clinical management of this disease. Large neuropsychological batteries were distilled to core tests useful for screening and disease monitoring. Reversible cognitive deficits were recently captured during relapses, broadening the construct of MS disease activity. Based on this and related work, the FDA and EMA now recognize cognitive dysfunction as a core feature of neurological status in MS, making it a central target of clinical trials. The presentation will also cover clinical trials where disease-modifying therapy has shown impact on cognitive status. Correspondence: *Ralph H. Benedict, University at Buffalo, Buffalo General Hospital, Neurology E2, 100 High Street, Buffalo, NY 14203. E-mail: benedict@buffalo.edu*

**Symposium 5. Genes, Neuropsychology, and Child  
Psychopathology**

**Chair: Alysa Doyle**

**Discussant: Larry J. Seidman**

**3:45–5:00 p.m.**

**A. DOYLE, E. WILLCUTT, N. ADAMO, C.L. BURTON, A. DOYLE & L.J. SEIDMAN. Genes, neuropsychology, and child psychopathology.**

**Symposium Description:** Large-scale international collaborations are yielding unprecedented progress in our understanding of the genetic basis of psychiatric illness. In addition to the identification of specific risk variants that may inform novel treatments, recent studies are transforming our understanding of the overarching structure of psychopathology, including the potential for risk to manifest in dimensional traits and across traditional diagnostic boundaries. Because neuropsychological functioning is impaired in a range of conditions that are now known to share genetic risk, cognitive phenotypes represent important targets of investigation in the next wave of studies that aim to dissect conventional diagnoses and their underlying risk factors. In the current symposium, we present work from a group of international collaborators examining genetics, neuropsychological functioning and child psychopathology. Studies capitalize on a range of behavioral and molecular genetic strategies to advance our understanding of risk mechanisms within and across conditions. Specifically, Dr. Willcutt will use a twin strategy to unpack the shared and unique cognitive contributions to reading and math disabilities and ADHD. Dr. Adamo will examine polygenic risk as a contributor to the persistence and remission of ADHD in adulthood. Dr. Burton will use a hypothesis driven genomewide strategy to examine the molecular genetic basis of response inhibition, a putative ADHD endophenotype, in a large, community based sample. Finally, Dr. Doyle will present data relating polygenic risk for schizophrenia to neuropsychological phenotypes in youth referred to a psychiatric assessment clinic who were not specifically selected to be at risk for psychosis. Dr. Seidman will discuss how investigations such as these may contribute to revised, biologically-grounded models integrating genes, cognition and psychopathology.

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**E. WILLCUTT, D.R. LEOPOLD, M. CHRISTOPHER, L.M. MCCRATH, R.L. PETERSON, R. BOADA, R. OLSON, J.C. DEFRIES & B.F. PENNINGTON. Using Twins to Understand the Etiology and Neuropsychology of Comorbidity between ADHD and Learning Disorders.**

Attention-deficit/hyperactivity disorder (ADHD) is frequently comorbid with learning disabilities (LDs) in reading, math, and written language, but the etiological and neuropsychological underpinnings of these associations are not well understood. Univariate twin analyses were used to examine the etiology of individual differences in seven neuropsychological processes, and multivariate analyses were conducted to identify the shared and unique neuropsychological predictors of dimension of ADHD and LDs. Twins with DSM-IV ADHD ( $N = 390$ ), reading disability (RD;  $N = 450$ ), math disability (MD;  $N = 250$ ), disability in written language (WLD;  $N = 140$ ), and a control sample without any of these disorders ( $N = 900$ ) completed an extensive battery of neuropsychological measures as part of their participation in the Colorado Learning Disabilities Research Center twin study. Exploratory and confirmatory factor analyses indicated that the neuropsychological battery assessed seven dimensions of functioning: phonological awareness, response inhibition, response variability, verbal working memory, spatial working memory, processing speed, and naming speed. RD and WLD were uniquely predicted

by naming speed and ADHD was predicted by response inhibition. Shared genetic influences on verbal working memory and phonological processing contributed to comorbidity between RD, WLD, and MD, and weaknesses in processing speed and response variability were a genetically-mediated shared risk factor that accounted for comorbidity between all pairs of disorders. Taken together, these results indicate that the etiologies and neuropsychologies of RD, MD, and ADHD are complex and multifactorial, and illustrate how etiologically-informative methods can help to dissect the shared and unique neuropsychological risk factors for correlated disorders.

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**N. ADAMO, P. O'REILLY, C. CHEUNG, B. FRANKE, S. FARAONE, P. ASHERSON, C. BAU, T. ZAYATS, J. BUITELAAR & J. KUNTSL. Do Polygenic Risk Scores Predict Persistence and Remission of ADHD in Young Adulthood?**

Persistence rates of ADHD in late adolescence and early adulthood can reach as high as 80%. The impairments observed in persistent ADHD are associated with a range of poor outcomes, emphasizing the importance of identifying markers for early detection and targeted intervention. Molecular genetic research is starting to identify genetic risk factors for ADHD, and has found that around 40% of the twin heritability of ADHD is explained by common SNP variation. Polygenic risk scores (PRS) derived from ADHD case-control comparisons have been shown to predict ADHD diagnosis and ADHD-trait scores in a general population sample. Preliminary data from a recent analysis on  $\geq 17,000$  ADHD cases and 94,000 controls identified genome-wide significant loci; PRS generated from such a large dataset are expected to provide greater power for risk predictions. Here, we will extend these findings by examining the predictive effects of PRS on ADHD persistence/remission in a longitudinal follow-up study of children and adolescents with ADHD. We will test whether PRS associated with childhood ADHD predict the persistence of ADHD diagnosis, symptoms and cognitive impairments in adolescence and early adulthood. PRS will be derived from the recent Psychiatric Genomics Consortium ADHD-GWAS analysis and applied to London, Nijmegen and Amsterdam longitudinal data on ADHD persistence/remittance. Children with DSM-IV combined-type ADHD aged 5-19 years completed a baseline assessment, and a subsequent 6-year follow-up assessment where phenotypic data on persistence/remittance of ADHD symptoms and diagnostic status, as well as detailed cognitive and neuroimaging measures, were collected. Of the initial samples, follow-up data on 530 participants are available. Regression models will estimate the predictive effects of GWAS-derived PRS on ADHD diagnosis, symptom severity and cognitive/neuroimaging measures at follow up.

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**C.L. BURTON, J. CROSBIE, L. ERDMAN, A. DUPUIS, A. PATERSON, L. STRUG, P.D. ARNOLD & R.J. SCHACHAR. A Genome-Wide Association Study of a Cognitive Endophenotype of ADHD in a Community-Based Pediatric Sample.**

Background: The power of genome-wide association studies (GWAS) of attention-deficit/hyperactivity disorder (ADHD) is reduced by clinical/genetic heterogeneity and insufficient clinical sample sizes. Using a cognitive endophenotype for ADHD, such as response inhibition, could decrease heterogeneity and increase power. Novel methods such as the hypothesis-driven GWAS (GWAS-HD) could also help identify possible biological pathways involved in response inhibition (e.g., central nervous system [CNS] development). The GWAS-HD conducts genome-wide hypothesis testing while prioritizing single nucleotide polymorphisms (SNPs) within genes involved in the hypothesized pathway. We conducted a GWAS-HD to test the role of SNPs involved in CNS

development on response inhibition measured in a large community pediatric sample.

Methods: Salivary DNA and performance on a measure of response inhibition (stop-signal reaction time [SSRT] from the Stop-Signal task) were collected on 17263 youth (6-17 years of age) visiting a Science Museum. We genotyped 5366 unrelated Caucasians using Illumina HumanCoreExome beadchips, and analyzed 4970 samples at 9,598,793 imputed and genotyped SNPs. For the GWAS-HD, individual SNPs in the CNS development set were tested using Stratified False Discovery Rate (SFDR) while the whole gene-set was tested using permutation tests for association with SSRT.

Results: 94% of the sample passed QC ( $N = 4687$ ). Several SNPs approached genome-wide significance ( $p = 1.3 \times 10^{-7}$ ). The set of CNS development SNPs were significantly associated with SSRT.

Conclusions: SNPs that alter CNS development may be involved in response inhibition, and potentially ADHD (yet to be tested). Measurement of cognitive endophenotype such as response inhibition in a large community sample is a feasible and potentially powerful alternative strategy for psychiatric genetics.

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**A. DOYLE, E. BRAATEN, G. GENOVESE, C. O'DUSHLAINE, P. VUIJK, L.M. MCCRATH, N. DOTY, K. CHAMBERT, J. MORAN, D. TONER, K. HUDSON, J. BLAIS, H. DITMARS, J. SMOLLER, L.J. SEIDMAN, R. PERLIS, P. SKLAR, S. FARAONE, S. MCCARROLL & M. FERREIRA. Association between Polygenic Risk for Schizophrenia and Executive Functions in Clinically-Referred Youth.**

Within the complex genetic landscape of psychiatric illness, there is strong evidence for a polygenic contribution to risk, reflecting the aggregate influence of potentially thousands of common polymorphisms of modest individual effect. These findings converge with epidemiologic data to suggest that, even in relatively rare and severe conditions, liability to psychopathology may, in part, be reflected in dimensional traits that fall within or even across conventional diagnoses (i.e., wherein phenotypic variation associates with variation in risk allele burden). Therefore, identifying the traits that associate with polygenic risk for a given condition may help to clarify how its genetic risk manifests. The current study highlights the potential value of this line of inquiry by relating polygenic risk for schizophrenia (SCZ) to three domains of executive functions in clinically referred youth who are not specifically at risk for psychosis. Data are from the Longitudinal Study of Genetic Influences on Cognition (LOGIC). Subjects were 117 youth, ages 8 to 20, who were consecutively referred for evaluation at a pediatric assessment clinic and who had available genomewide data. Results showed that the burden of SCZ risk alleles, as determined by large studies in the literature, associated with variation in working memory and inhibition but not with goal maintenance. Relationships remained robust after controlling for age, sex and the use of psychotropic medications. Findings suggest that SCZ genetic loading is associated with neuropsychological phenotypes that extend across conventional diagnostic boundaries. Such data support the potential of translational genetic studies that include neuropsychological phenotypes to contribute to an improved psychiatric nosology, as promoted by NIMH's recent RDoC initiative.

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## Invited Symposium 2. Sleep and Cognition

Chair: Ian M. Colrain

3:45–5:05 p.m.

### I.M. COLRAIN, M.S. ALOIA, D.L. BLIWISE & I.M. COLRAIN. **Sleep and Cognition.**

**Symposium Description:** Sleep is a fundamental behavior that supports physical, mental and emotional health and facilitates neuropsychological functioning in humans of all ages. While the fundamental question of why sleep is needed remains largely unanswered, it is clear, that insufficient sleep, disrupted sleep or poorly timed sleep can be extremely disruptive to human health and lead to diminished cognitive capability. Both sleep and cognitive function vary systematically across the lifespan, and interrelationships are clearly complex and may be very different at different points in the normal developmental trajectory. For example, decreases in slow wave sleep and its associated delta EEG power may be associated with decreased cognitive function in older adults, but even more dramatic decreases in delta power across adolescence are typically occurring at a time when cognitive function is improving. As has historically been the case in neuropsychology, the role of sleep in supporting cognitive function can be informed by the examination of pathology. In this symposium three areas of disease known to be associated with sleep disruption will be presented in the context of normal age-related changes in both sleep and cognitive function. Dr. Bliwise will discuss the role of sleep in supporting cognitive function normal aging and relations between sleep and cognitive decline in dementia. Dr. Aloia will discuss interrelationships between Obstructive Sleep Apnea, brain structure and cognitive function and the role of CPAP therapy in restoring brain and cognitive health. Finally, Dr. Colrain will discuss the role of sleep and sleep EEG changes in brain and cognitive changes associated with Alcohol Use Disorder.

Correspondence: *Ian M. Colrain, Ph.D., SRI International, 333 Ravenswood Ave, Menlo Park, CA 94025. E-mail: ian.colrain@sri.com*

### D.L. BLIWISE. **Cognition and Sleep in Normal and Pathological Aging.**

A wide array of research, including both observational cross-sectional and longitudinal population-based work as well as laboratory studies, bear upon associations between broadly defined cognition and sleep (Scullin & Bliwise, *Perspect Psychol Sci* 2015; 10: 97-137). Not surprisingly, the diversity of cohorts studied, the relative precision/crudeness of neuropsychological assessments, and not the least, the types of data that constitute the measurement of “sleep” in these studies have led to widely disparate results. This presentation will attempt to present an overview of this large body of research, with a special emphasis on methodological challenges and study designs and factors that may play a role in the relative consistency or lack thereof of findings. Experimental studies of sleep loss and effects on cognition in particular may present a particularly valuable counterpoint for examining age as a moderator effect of such associations.

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### M.S. ALOIA. **Neuropsychological Consequences of Obstructive Sleep Apnea.**

Obstructive Sleep Apnea affects approximately 7% of the US population and rates are increasing with the obesity epidemic. The disorder is characterized by repeated cessation of breathing during sleep, which is accompanied by increased sleep fragmentation and decreased blood oxygen levels. These events affect directly the brains of some patients. The past decade has seen tremendous growth in the understanding of brain abnormalities associated with the disorder. Neuropsychological studies have consistently focused on attentional and executive networks. Imaging studies have highlighted specific, corresponding brain regions.

Little, however, has disentangled the effects of sleep fragmentation from those of oxygen saturation. This presentation will outline the neuropsychological effects of sleep apnea and will incorporate the neuroimaging studies as well. We will attempt to provide a unifying model and to better understand the potential benefits from treatment.

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### I.M. COLRAIN. **Alcoholism: Sleep, Brain and Cognitive Consequences.**

Alcohol abuse and dependence are associated with changes in brain macro and micro-structure, especially in prefrontal cortex, and diminished neurocognitive function. They are also associated with chronic sleep disturbance, lower slow wave sleep, and more rapid eye movement sleep than normal. There is also recent evidence for altered autonomic nervous system recovery during sleep in alcoholism. Alcohol acts as a sedative that interacts with several neurotransmitter systems important in the regulation of sleep. Acute administration of large amounts of alcohol prior to sleep leads to decreased sleep onset latency and changes in sleep architecture early in the night, when blood alcohol levels are high, with subsequent disrupted, poor quality sleep later in the night. While these aspects of altered sleep can last long into periods of abstinence and may play a role in relapse, there is also evidence for partial recovery of EEG and ANS function with cessation of drinking. This presentation will review the data relating sleep architecture, EEG and ANS changes in alcoholism with changes in brain structure and function, and the extent to which sleep changes may exacerbate the negative effects of alcoholism on brain function during active drinking, and assist in recovery with abstinence.

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## Paper Session 4. HIV/AIDS

Moderator: Michael R. Basso

3:45–5:05 p.m.

### K.N. DEVLIN, T. GIOVANNETTI, D.J. LIBON, W. DAMPIER, V. PIRRONE, M.R. NONNEMACHER, E. SCHELL, C. LAMBERSON, J. KURCZEWSKI, J.M. JACOBSON & B. WIGDAHL. **Empirically Derived Subtypes of Neuropsychological Impairment in HIV-1 Infection.**

**Objective:** Despite combination antiretroviral therapy (CART), neuropsychological impairment (NPI) persists among HIV-1-positive (HIV+) persons, and its heterogeneous profile complicates the study of its etiology and treatment. This heterogeneity may be due to the presence of multiple subtypes of NPI with distinct underlying pathologies. Thus, we used statistical modeling to identify NPI subtypes and their correlates among HIV+ adults.

**Participants and Methods:** 193 HIV+ adults (aged 26-73; 97% on CART) enrolled in the Drexel Medicine CNS AIDS Research and Eradication Study (CARES) Cohort completed tests of working memory, executive function, psychomotor speed, language, episodic memory, and visuoconstruction. Thirteen neuropsychological parameters adjusted for age, education, gender, and race were entered in a latent class analysis (LCA). Demographic, immunological, and substance use characteristics were compared across classes.

**Results:** LCA identified four classes: neuropsychologically intact (n=74; 38%), mild psychomotor slowing (n=30; 16%), mild visuoconstruction/memory impairment (n=57; 30%), and moderate mixed impairment (n=32; 17%). The latter two groups had higher rates of hepatitis C infection and past benzodiazepine use than the intact group, and the moderate mixed impairment group also had longer HIV duration and a higher rate of past opiate use. The psychomotor slowing group was older

and had a higher rate of past stavudine use and a lower rate of current efavirenz use. All impaired groups had higher rates of past zidovudine use. Groups did not differ in sex, race, education, HIV RNA, CD4, ART duration, or use of other substances.

**Conclusions:** Three NPI subtypes with distinct clinical correlates were identified among HIV+ adults. Classification by profile, rather than severity alone, may clarify the study of NPI in HIV+ persons. Future research should examine the pathologies underlying empirically derived NPI subtypes and the efficacy of targeted treatments. NIH R01 NS32092, R01 DA19807, R01 NS089435, T32 MH079785.

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**L. BAKER, R. CABEEN, D.H. LAIDLAW, J. JOSKA, J. HOARE, D. STEIN, J.M. HEAPS, L. SALMINEN & R. PAUL. Topological Organization of Whole-Brain Networks in HIV+ Individuals.**

**Objective:** Neuroimaging studies have revealed that human immunodeficiency virus (HIV) leads to structural and functional abnormalities in specific brain regions and connections. However, little is known about alterations of the topological organization of whole-brain networks. Further, the relationships between topological organization and neuropsychological performance in HIV+ individuals are unclear. In the present study we examined these patterns using graph theory-based approaches with complex network analysis.

**Participants and Methods:** Twenty-nine antiretroviral therapy-naïve HIV+ adults and 16 demographically similar controls in South Africa underwent a magnetic resonance imaging (MRI) scan and neuropsychological testing. Structural network models of white matter connectivity were constructed using diffusion MRI-based multi-fiber tractography and T1-weighted MRI-based regional gray matter segmentation. Global network measures of whole-brain functional integration, connection strength, and functional segregation were examined between groups using multivariate analysis of variance. Further, correlations between topological organization metrics and a global deficit score (GDS) were examined.

**Results:** HIV+ individuals exhibit altered quantitative values in whole-brain networks, characterized by lower functional integration (path length and efficiency), connection strength, and functional segregation (clustering coefficient) compared to controls ( $p < .01$ ). Partial correlation analyses revealed statistically significant relationships between GDS and global efficiency ( $r = -.55$ ,  $p = .006$ ), connection strength ( $r = -.45$ ,  $p = .028$ ), and clustering coefficient ( $r = -.59$ ,  $p = .003$ ).

**Conclusions:** Individuals with HIV demonstrate weaker topological organization of whole-brain networks than seronegative controls, which correspond to worse neuropsychological performance. Future studies should examine the local connectivity in specific regions of interest affected by HIV in order to clarify the impact of HIV on brain connectivity.

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**K.B. CASALETTO, D.J. MOORE, S. WOODS & R.K. HEATON. Metacognition is Associated with Executive Dysfunction and Manifest Everyday Functioning in HIV Infection.**

**Objective:** HIV infection commonly disrupts frontal brain systems and is associated with less accurate awareness of cognitive and functional abilities (i.e., metacognition), which may contribute to poorer real-world outcomes (e.g., medication nonadherence). We assessed the relationship between metacognition and everyday functioning among those living with HIV.

**Participants and Methods:** Thirty HIV+ adults with executive dysfunction performed a complex functional capacity task in the laboratory (i.e., multitasking of medication and financial management, cooking, and health communication) during which awareness of performance was measured according to Toglia & Kirk's (2000) metacognitive model

(e.g., perceived knowledge of tasks, prediction of performance). Participants also completed the Fluid NIH Toolbox Cognitive Battery, Frontal Systems Behavior Apathy Scale, and Beck Depression Inventory-II. A research nurse completed a clinician's rating of each participant's health-related functional status (i.e., Karnofsky Score).

**Results:** More accurate global metacognition was significantly associated with better executive functions (Toolbox Dimensional Change Card Sorting Test;  $p < 0.05$ ,  $\rho = 0.47$ ) and higher current functional status (Karnofsky Score;  $p < 0.05$ ,  $\rho = 0.67$ ) but not attention, memory, or psychomotor speed. In a multivariable regression model, objective executive functions, apathy, depressive symptoms, nadir CD4 and global metacognition accounted for 53.7% of the variance in health-related functional status (Model:  $F(5, 20) = 5.4$ ,  $p = 0.006$ ), with global metacognition emerging as the only significant term ( $\beta = 0.52$ ,  $p = 0.02$ ).

**Conclusions:** Metacognition demonstrated strong and specific associations with executive dysfunction (e.g., set-shifting) and uniquely contributed to manifest functional status in HIV disease. Interventions aimed at aligning awareness of daily functioning abilities with objective capacity may be useful improving everyday and health outcomes in HIV. Correspondence: *Kaitlin B. Casaletto, MS, Psychiatry, SDSU/UCSD Joint Doctoral Program, 220 Dickinson St., Suite B, San Diego, CA 92103. E-mail: kaitlin.casaletto@gmail.com*

**J. MENON, M. NGOMA, J.J. CHINYAMA, R.K. HEATON & K. HESTAD. Effect on HIV and TB co-infection on Neurobehavioural functioning- Evidence from Zambia.**

**Objective:** Human Immunodeficiency Virus (HIV) infection and Tuberculosis (TB) often co-exists in such a way that they are often described as a co-epidemic. TB is the most common HIV-related co-infection in Zambia and is considered an underlying cause of HIV associated neurocognitive deficits. The objective of the study was to explore the effects of TB on neurobehavioural functioning in HIV positive Zambian adults using T-scores developed in Zambia.

**Participants and Methods:** Participants included 243 HIV positive adults from the six clinics offering HIV testing and care in Lusaka, Zambia, with minimum five years of schooling and ability to read and understand English. The Test Battery included standardized tests of Attention/Working Memory, Executive Function, Verbal Fluency, Processing Speed, Verbal fluency. All patients were on anti-retroviral therapy (ART). Clinic records were reviewed to obtain CD4+ T-cell counts and TB history.

**Results:** TB positive ( $n = 65$ ) and TB negative ( $n = 178$ ) groups did not differ in age, gender (69% women), or education. Subjects with a history of TB had lower CD4+ T-cell counts (mean = 405) than those without TB (mean = 509) ( $p < 0.05$ ). Those with a history of TB had worse verbal fluency ( $p < 0.05$ ) working memory ( $p < 0.05$ ), recall ( $p < 0.05$ ), and global cognitive functioning ( $p < 0.05$ ). Groups did not differ in speed of information processing or executive or motor functioning.

**Conclusions:** The results indicate that co-infective of HIV and TB leads to worse neurobehavioral functioning and those with TB are likely to have lower current CD4+ T-cell counts, even though they are on anti-retroviral treatment.

## Symposium 6. Elucidating Depressive Symptom, Cognitive, and Affective Dimensions through Integrated Neuropsychological and Cognitive Neurosciences

Chair: Shawn M. McClintock

3:45–5:05 p.m.

**S.M. MCCLINTOCK, V.M. DOTSON, S.A. LANGENECKER, M. TREADWAY, V.M. DOTSON, S.M. MCCLINTOCK & J. EVANS. Elucidating Depressive Symptom, Cognitive, and Affective Dimensions through Integrated Neuropsychological and Cognitive Neurosciences.**

**Symposium Description:** Depressive disorders affect approximately 14 million adults in the US every year and are associated with significant morbidity and mortality. Neuropsychological and cognitive neuroscience studies are essential to clarifying the etiopathology and consequences of depressive disorders, thereby informing the diagnosis and treatment of depression across the adult lifespan. In light of the heterogeneous nature of depressive symptoms, recent studies in this area have focused on understanding the correlates of specific symptom dimensions of depression. These studies, supported by factor analysis, differentiate between symptom clusters including negative mood, cognitive disturbance, somatic complaints, anhedonia, and interpersonal difficulties. Emerging evidence suggests that different symptom dimensions have distinct cognitive, affective, and neural substrates, as well as unique genetic, physiological, and neurological causes and therapeutic responsiveness. Further research is needed in this relatively new area of inquiry, which is in line with the National Institute of Mental Health's (NIMH) Research Domain Criteria (RDoC) Project. Such work has the potential to enhance our understanding of personalized treatment mechanisms and pathways to enhance the speed and efficiency of our mood disorder treatment strategies. The purpose of this symposium is to: 1) detail clinical evidence for distinct depressive symptom dimensions, 2) discuss cognitive and neuroimaging correlates of symptom dimensions, 3) review recent and emerging studies documenting differential treatment effects on symptom dimensions and disease course, and 4) synthesize information and provide prospective research recommendations. The four presentations will be followed by a discussion facilitated by program staff of the NIMH. Correspondence: *Shawn M. McClintock, Phd, MSCS, Psychiatry and Behavioral Sciences, Duke University School of Medicine, 200 Trent Drive, DUMC 3620, Durham, NC 27710. E-mail: shawn.mcclintock@duke.edu*

**V.M. DOTSON. Symptom Dimensions in Late-Life Subthreshold Depression: Evidence from Cognitive, Neuroscience, and Exercise Intervention Studies.**

Depression is a clinically heterogeneous disorder, with significant variability in symptom profiles of individuals with both subthreshold and major depression. A small but growing body of work has supported the idea of different genetic risks and etiological contributors associated with different symptom dimensions of depression. There is also evidence that symptom dimensions are differentially related to cognitive functioning, brain structure, and brain function. This research is limited and primarily focuses on major depression, with less emphasis on subthreshold symptoms. Subthreshold depression is common, particularly in older adults. These symptoms are clinically meaningful, as they are associated with similar negative outcomes as major depression, including functional disability, poor health, and all-cause mortality. There is also evidence that late-life subthreshold depression is associated with similar cognitive deficits and brain changes as major depression, but the importance of symptom dimensions in these relationships is thus far unclear. This presentation will summarize results of recent studies examining symptom dimensions of late-life subthreshold depression in relation to regional brain volumes, white matter lesions, and cognitive functioning. Data demonstrating distinct genetic risks and responses

to exercise associated with different symptom dimensions will also be presented.

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**S.A. LANGENECKER. Cognitive Control Dysfunction in Major Depression Disorder: a Lifespan Perspective.**

**Objective:** Many individuals with major depressive disorder (MDD) experience executive function difficulties. The present talk will present results from three studies that address the presence, course, state-dependence, and age-related cognitive control and executive function decline in those with MDD across the adult age range.

**Methods:** The first study of adults between 18 and 23, compared those with MDD in remission ( $n = 62$ ) to Healthy controls (HC,  $n = 42$ ) using executive functioning tests. The second study compared a large sample of depressed individuals ( $n = 448$ ) across the adult age range to an age/education matched HC sample ( $n = 276$ ) who completed the Parametric Go/No-go test, a measure of cognitive control. The third study compared elder patients ( $n = 653$ ) without dementia, and in who MDD symptoms were evaluated for impact on executive function.

**Results:** For study 1, in a younger, remitted MDD sample, difficulties in inhibitory control were evident relative to HC. In study 2, there is evidence of broad executive function impairments. These difficulties showed no different slope in decline by age relative to HC group. Study 3 suggested that older adults with depressive symptoms were more likely to have executive function impairment. These executive function difficulties were compounded in those with memory impairment and MDD. **Conclusions:** Cognitive control difficulties appear early in the course of MDD, are exacerbated in the context of active symptoms, yet do not decline at an increased rate relative to healthy adults. In older adults however, there is evidence that the presence of depressive symptoms increases the likelihood that executive function impairments will be present. Such effects are worsened in the presence of memory impairment. It is unclear, whether specific individuals are vulnerable to accelerated cognitive decline, or what mechanisms might account for these cognitive difficulties, which are important questions for future studies.

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**M. TREADWAY. Neural Mechanisms of Effort-Based Decision-Making in Depression.**

**Background:** Psychiatric symptoms of fatigue, anhedonia and low-motivation are common across many disorders. These symptoms have been operationalized in terms of effort-based decision-making. It is unclear, however, whether anhedonia is associated with diminished reward-value encoding, or a hypo-responsiveness to required effort. Preclinical studies suggest that the ventral striatum is critical for both functions, but empirical evidence is lacking in clinical populations.

**Methods:** We present data from a recent functional neuroimaging study of 42 depressed outpatients and demographically-matched controls who were scanned while making a series of decisions regarding effort allocation using a novel effort-based decision-making paradigm. A parabolic discounting model was fitted to each subject to determine the trial-wise subjective value of different effort/reward combinations.

**Results:** Across all subjects, trial-wise subjective value of different effort/reward combinations was shown to selectively elicit activity in vmPFC. In the ventral striatum, neural responses appeared to initially encode reward value when choice options were presented, and then showed a transfer to encoding effort-level at the point of choice healthy. However, this effect was stronger in controls than patients. Moreover, it was significantly correlated with a trait measure of reward anticipation.

**Conclusion:** These results isolate neural differences between depressed patients and healthy controls when engaged in effort-based decision-making. Both groups demonstrated normal responses in vmPFC and ventral striatum in response to initial choice values. Controls and

patients differed though in the extent to which ventral striatum signaling switched from reward value to effort encoding. Moreover, stronger effort encoding at time of choice in the striatum was associated with elevated trait anticipation. These data help further elucidate the neural mechanisms of effort-based decision-making in depression.

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**S.M. MCCLINTOCK. Elucidating Complex Interactions Among Depressive symptoms, Neurocognitive Function, and Neurotherapeutic Stimulation.**

Major depressive disorder (MDD) is comprised of a constellation of heterogeneous affective and cognitive symptoms. Indeed, many individuals with MDD present with multiple depressive symptoms (e.g., sad mood, anhedonia) and inefficient or impaired cognitive functions (e.g., executive dysfunction); however, the relationship among the multiple symptoms remains unknown. Specifically, evidence suggests that affective symptoms lead to changes in cognitive function in younger adults, but that changes in cognitive function lead to affective symptoms in older adults. Across the adult life-span, patients with MDD that is resistant to standard pharmacotherapeutics or psychotherapy often are treated with electroconvulsive therapy (ECT). The use of ECT provides a unique opportunity to examine the association between affective and cognitive symptoms in MDD across the adult life-span, while providing objective neurophysiological metrics (electroencephalography) that underlie such symptoms. This presentation will 1) describe the constellation of multiple MDD symptoms, 2) discuss changes in depressive and cognitive symptoms after treatment with ECT, 3) review the use of standard neuropsychological and cognitive neuroscience tools to assess state and trait cognitive symptoms, and 4) synthesize affective and cognitive symptom measurement with neurophysiological indices.

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**Plenary D (The INS Herbert Birch Memorial Lecture). Adolescence as a Sensitive Period of Social Brain Development**

**Presenter: Sarah-Jayne Blakemore**

**5:15–6:15 p.m.**

**S. BLAKEMORE. Adolescence as a Sensitive Period of Social Brain Development.**

The brain has evolved to understand and interact with other people. This talk focuses on how the social brain, that is the network of brain regions involved in understanding others, develops during adolescence. Adolescence is a time characterised by change - hormonally, physically, psychologically and socially. Social cognitive processes involved in navigating an increasingly complex social world continue to develop throughout human adolescence. Areas of the social brain undergo significant reorganisation in terms of structure and function during the second decade of life, which possibly reflects a sensitive period for adapting to the social environment. The changes in social environment that occur during adolescence might interact with increasing executive functions, heightened social sensitivity and the developing social brain to influence a number of adolescent behaviours, including risk-taking, peer influence and self-consciousness. I will discuss the importance of taking into account the social environment and the social brain when considering adolescent-typical behaviour.

**Learning Objectives**

Through participation in this course, attendees will be able:

To list social brain areas and to describe the development of the social brain in adolescence, and

To demonstrate the importance of the social environment in adolescent development.

**FRIDAY MORNING, FEBRUARY 5, 2016**

**CE 9. Cognitive and Behavioral Aspects of Frontotemporal Degeneration**

**Presenter: Katya Rascovsky**

**7:20–8:50 a.m.**

**K. RASCOVSKY. Cognitive and Behavioral Aspects of Frontotemporal Degeneration.**

Frontotemporal degeneration (FTD) can manifest as a spectrum of clinical syndromes, ranging from behavioral impairment to language or motor dysfunction. Recently, revised diagnostic criteria have been proposed for the behavioral and progressive aphasia syndromes associated with frontotemporal degeneration. The course will summarize these diagnostic guidelines, and highlight some lingering controversies in the classification of FTD clinical syndromes. We will discuss common tools and methods used to identify the insidious cognitive and behavioral changes of behavioral variant frontotemporal dementia (bvFTD). With regards to primary progressive aphasia (PPA), we will discuss the scope of the semantic disorder in semantic-variant PPA, the nature of the speech disorder in non-fluent, agrammatic PPA, and the preliminary utility of a logopenic PPA classification.

**Learning Objectives**

As a result of participation in this course, the learner will achieve the following objectives:

Participants will be introduced to the frontotemporal degeneration spectrum of disorders;

Through patient videos and discussion, participants will be able to recognize the typical cognitive and behavioral characteristics of bvFTD and PPA; and

Participants will be able to diagnose bvFTD and PPA according to revised criteria.

**CE 10. Mild Traumatic Brain Injury and the Postconcussion Syndrome: How Does the Science Translate to Clinical Practice?**

**Presenters: Michael McCrea, Grant L. Iverson**

**7:20–8:50 a.m.**

**M. MCCREA & G.L. IVERSON. Mild Traumatic Brain Injury and the Postconcussion Syndrome: How Does the Science Translate to Clinical Practice?**

The diagnosis and treatment of mild traumatic brain injury (mTBI) have historically been hampered by an incomplete base of scientific evidence to guide clinicians. Major advances in the basic and clinical science of mTBI over the past decade have increased our understanding of the natural history of injury and recovery in civilians, athletes, and military service members affected by mTBI. As a result, we have a more clear understanding of how acute injury characteristics and comorbidities affect recovery and outcome. Collectively, the new evidence base now

establishes a foundation on which to build integrative approaches to injury assessment and treatment. This workshop will provide a focused review of the current scientific literature on mTBI and discuss clinical translation designed to improve outcome and reduce disability associated with this injury.

#### Learning Objectives

Review the latest basic and clinical science of mTBI

Present an integrated model of mTBI recovery

Describe new perspectives for rethinking the Postconcussion Syndrome and conceptualizing treatment and rehabilitation

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## Poster Session 5. Cancer, Cross Cultural, Forensic, Malingering/Effort Testing, and MS/ALS

9:00–10:30 a.m.

### Cancer

**J.M. ASHFORD, T.E. MERCHANT, J.A. BRADLEY, L. HUANG, H. ZHANG & H.M. CONKLIN. Parental Distress and Associated Treatment and Neurocognitive Factors among Children Diagnosed with Craniopharyngioma.**

**Objective:** A cancer diagnosis is stressful for the entire family. Children with craniopharyngiomas (Cp) can present with challenging medical and cognitive problems due to tumor location and associated comorbidities. The current study examined parental distress in a sample of Cp patient families to identify associated treatment related factors for targeted intervention.

**Participants and Methods:** Prior to ( $n=72$ ) and one year after ( $n=40$ ) proton therapy, parents of children diagnosed with Cp (9.66 yrs at baseline; 49% male) completed a self-report measure of distress, the Brief Symptom Inventory (BSI). Parental BSI scores were examined in relation to child cognitive outcomes, parent ratings of child behavior, and medical variables.

**Results:** At baseline, parents scored higher than normative expectations on anxiety ( $53 \pm 10.3$ ;  $p=.015$ ), depression ( $52.1 \pm 8.8$ ;  $p=.046$ ), Global Severity ( $53.2 \pm 9.2$ ;  $p=.004$ ) and Positive Symptom Distress ( $53.4 \pm 10.4$ ;  $p=.008$ ), with no significant change a year later. No meaningful pattern of association was observed between BSI and cognitive performance measures, with isolated correlations in the opposite direction as hypothesized (e.g. higher IQ=more distress). Parents reporting higher levels of distress rated their children as having worse behavior regulation (BASC-2  $ps < .001-.015$ ), executive functioning (BRIEF  $ps < .001-.050$ ), and adaptive skills (ABAS-II  $ps = .010-.050$ ). Parent distress was not associated with medical variables (e.g. number/extent of surgeries, diabetes insipidus).

**Conclusions:** Parents are experiencing significant distress before their child begins proton therapy for Cp. Increased medical complications do not elevate distress risk. The relationship of parent-rated executive function, behavior regulation and adaptive skill difficulties in their child with parental distress suggests these deficits may affect parental coping more than cognitive problems. It may also reflect a negative reporting style among some parents, overestimating patient difficulties through the lens of their own distress.

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**D. BADALY, K.P. HEINRICH, B. GIORDANI & E.K. HODGES. Disordered Sleep and Attention Problems among Children with Histories of Cancer and Stem Cell Transplantation.**

**Objective:** Children with a history of cancer are at an increased risk for sleep problems, and this effect may be enhanced by certain treatments, including hematopoietic stem cell transplantation (HSCT) (Ferry et al., 2007; Rosen et al., 2008). In turn, disordered sleep can have pernicious effects on children's cognition, in particular their attention (Beebe, 2006). As such, the current study examined associations between disordered sleep and attention, among children with a history of cancer. We also investigated differences among those with and without a history of HSCT.

**Participants and Methods:** We conducted a retrospective case review of children with a history of cancer referred to our neuropsychology clinic. Participants including 136 children (60% male;  $M$  age = 11.52 years), of which 30 had a history of HSCT. Sleep problems were assessed with the Sleep-Related Breathing Disorder scale of the Pediatric Sleep Questionnaire. Children completed the Integrated Visual and Auditory Continuous Performance Test, which includes measures of attention and response control. We also collected parent-ratings of inattention (Child Behavior Checklist, Conners' Rating Scale).

**Results:** Using multiple regression analyses, we examined the associations between sleep-disordered breathing and attention, considering differences between cancer survivors treated with and without HSCT. Sleep problems were negatively related to visual attention and auditory response control, only among children treated with HSCT. Sleep-disordered breathing was positively associated with parent-rated inattention, with stronger effects among those treated with HSCT.

**Conclusions:** Prior research has underscored multiple factors which may have a pernicious effect on attention, including histories of cancer, HSCT, and sleep problems. Such risk factors may not only be additive, but multiplicative. Indeed, we found that, among childhood cancer survivors, sleep-disordered breathing confers the greatest risk of inattention when children also have a history of HSCT.

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**P. BANERJEE, K. LEU, R.J. HARRIS, T.F. CLOUGHESY, S. BOOKHEIMER, L. LIAU & B.M. ELLINGSON. Voxel-Based Lesion-Symptom Mapping of Phonemic Fluency versus Semantic Fluency in Brain Tumor Patients.**

**Objective:** We examined the relationship between lesion presence and verbal fluency performance, as well as the neuroanatomical regions specific to fluency type, on a voxel-by-voxel basis in brain tumor patients using innovative voxel-based lesion-symptom mapping (VLSM).

**Participants and Methods:** 98 right-handed adults with primary gliomas were administered Phonemic Fluency and Semantic Fluency tasks. Participants ranged from 18 to 80 years old ( $M = 47$ ) with 60% males. T2-weighted images were registered to a T1-weighted MNI atlas and the tumor region was contoured. For each voxel, patients were grouped by whether or not tumor was present, and a general linear model was performed to compare the fluency scores of these two groups while controlling for demographics and tumor characteristics. Statistical maps of each task along with subtraction maps (Phonemic Fluency minus Category Fluency and vice versa) were created.

**Results:** VLSM identified several clusters of voxels with a significant relationship ( $p < .05$ ) between lesion presence and verbal fluency performance. Neuroanatomical correlates shared across the tasks included the superior longitudinal fasciculus, internal capsule, inferior parietal lobule, postcentral gyrus, rolandic operculum, cingulate gyrus, Heschl's gyrus, corona radiata, middle and superior temporal gyri, and middle and superior frontal gyri. On the subtraction maps, few regions were specific to Category Fluency, whereas Phonemic Fluency was associated with anterior regions including the precentral gyrus, inferior frontal gyrus, anterior cingulate cortex, and anterior limb of the internal capsule.

**Conclusions:** These findings identified the key anatomic structures involved in verbal fluency performance in brain tumor patients using an innovative lesion analysis technique. The resulting statistical parametric maps and subtraction maps were supportive of theories suggesting Phonemic Fluency involves similar posterior structures to those used during Category Fluency while recruiting additional anterior structures. Correspondence: *Pia Banerjee, PhD, Epidemiology and Cancer Control, St. Jude Children's Research Hospital, 262 Danny Thomas Place, MS 735, Room S6010, Memphis, TN 38105. E-mail: piabanerjee@gmail.com*

**A.S. FOURNIER-GOODNIGHT, J.M. ASHFORD, T.E. MERCHANT, L. HUANG, H. ZHANG, J.A. BRADLEY, P. KLIMO & H.M. CONKLIN. Predictors of Learning and Memory Performance in Patients Diagnosed with Pediatric Craniopharyngioma.**

**Objective:** Impairments in learning and memory have been found in pediatric patients with craniopharyngioma treated with surgical intervention and radiation therapy. It remains unclear how pre-irradiation condition and specific treatment variables influence learning and memory. The goal of this study was to investigate the relationship between patient, disease and treatment-related variables with learning/memory outcomes in pediatric patients prior to proton therapy.

**Participants and Methods:** Participants (N=78; 48.7% male) completed the California Verbal Learning Test (CVLT). Patients ranged in age from 1 to 20 (M=9.66; SD=4.67) and the majority (87.18%) had at least one surgical intervention (M=1.42; SD=.96). Linear regression models were conducted to determine whether clinical variables (e.g., gender, degree of pre-surgical hypothalamic involvement [HI], extent of surgical intervention) predicted performance on measures of learning and memory prior to proton therapy.

**Results:** T-tests demonstrated that participants performed worse than normative expectations on indexes of the CVLT (Total Trials  $p=0.00$ ; short delay free recall  $p=0.02$ ; long delay free recall  $p=0.00$ ). Linear regressions revealed degree of pre-operative HI (Grade 3  $\beta=-8.34$ ,  $p=0.01$ ) and extent of surgical intervention ( $\beta=-10.03$ ,  $p=0.01$ ) predicted verbal learning proficiency. Short-term free recall was predicted by degree of pre-operative HI (Grade 3  $\beta=-1.11$ ,  $p=0.00$ ). Long-term free recall was predicted by degree of pre-operative HI (Grade 3  $\beta=-1.16$ ,  $p=0.00$ ) and extent of surgical intervention ( $\beta=-1.12$ ,  $p=0.02$ ). For each of these findings, participants with more extensive surgical intervention and greater degree of HI, including the mammillary bodies, performed more poorly.

**Conclusions:** These findings indicate that patients are at increased risk for impairment in learning and memory prior to adjuvant therapy. Disease and treatment related factors were predictive of risk in a way that may inform treatment planning.

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**A. GIOIA, I. TAORMINA, S. WISE, G. DOME, K. OLSON, V.W. WILLARD & K.K. HARDY. Profiles of Attention-Mediated Neurocognitive Functioning in Survivors of Pediatric Brain Tumors: Comparison with Children with Neurodevelopmental ADHD.**

**Objective:** Attention problems are one of the most common neurocognitive late effects observed in survivors of pediatric brain tumors (BT). Deficits in attention have been linked to declines in intelligence, academics, social and adaptive functioning. Given similarities in functional impairment between BT survivors and children with neurodevelopmental ADHD, researchers have turned to the ADHD literature for intervention ideas. However, no study has compared the neuropsychological profiles of attention and related processes between these two groups.

**Participants and Methods:** Neuropsychological data from clinically-referred samples of survivors of BT (n=72, mean age=11.5, 55.6% male) and children with ADHD (n=43, mean age=10.6, 58.1% male)

were abstracted. Parents completed the CBCL, BRIEF, and ADHD Rating Scale (ADHD-RS), and children completed a Wechsler intelligence scale along with measures of attention and executive functioning. The 9 DSM-5 symptoms of inattention from the ADHD-RS were used to determine which survivors met symptom criteria (i.e.,  $\geq 6$  symptoms) for ADHD.

**Results:** Survivors averaged 6.6 years (SD = 3.96) at diagnosis, and were evaluated 5.2 (SD=2.95) years later. The majority (65.3%) received radiation therapy. 13 survivors (18%) met symptom criteria for ADHD. Participants with developmental ADHD and survivors meeting ADHD symptom criteria had more parent-reported difficulties with working memory (WM) and metacognition than BT survivors without attention problems. Children with attention problems also exhibited significantly lower performance on WM tasks, but not processing speed tasks, than those without ADHD symptoms.

**Conclusions:** Survivors with attention symptoms have neurocognitive profiles that are similar to children with ADHD, although deficits in processing speed appear to be pervasive among all survivors regardless of attention difficulties. Screening for ADHD symptoms among survivors may help providers to more tailored treatment options for a subgroup of survivors meeting symptom criteria for ADHD.

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**B. GOGIA. Neuropsychological Implications of Gliomas in Left Frontoparietal Operculum with respect to Tumor Size and Grade.**

**Objective:** Frontoparietal operculum of dominant hemisphere comprises of Broca's area (Brodmann area 44,45) and Supplementary Motor Area (SMA) or Premotor Cortex (Brodmann area 6). Lesions in these areas are known to produce Neuropsychological deficits like expressive aphasia and difficulty in language comprehension, apraxias, cognitive problems and impaired fine motor control. However, these deficits with respect to size and grade of primary brain gliomas restricted to frontoparietal operculum in dominant hemisphere have not been studied before.

**Participants and Methods:** A retrospective study was conducted on 17 right handed patients with brain tumor in left frontoparietal operculum prior to surgical resection. Data pertaining to tumor grade and pre-operative neuropsychological evaluation was collected from the clinical database. 1 case was excluded due to lack of neuropsychological evaluation. We used a grading system for deficits found on neuropsychological evaluation note. We used 0 for no impairment, 1 for mild and 2 for moderate to severe impairment. We then compared deficits to tumor size and grade.

**Results:** Out of 16 patients, 4 were low grade gliomas (WHO grade I & II) and 12 were high grade gliomas (WHO grade III & IV). The mean size of the tumor was 4.11cms. We observed that LGGs as large as 6cms presented with absent to mild neuropsychological deficits whereas HGGs as small as 1.4 cms presented with severe impairments on neuropsychological evaluation.

**Conclusions:** Neuropsychological deficits are more likely to be present in High Grade Gliomas irrespective of their sizes. Low Grade Gliomas as large as 6 cms either present with mild or no impairment on neuropsychological examination.

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**J. HAMILTON, J.E. SCHREIBER, S.L. PALMER, M. SWAIN, L. CHAPIESKI, D. MABBOTT, M.J. BONNER, S. KNIGHT, C.L. ARMSTRONG, R. FRANKS, L. HUANG, H. ZHANG & A. GAJJAR. The Impact of Family Functioning on Executive Functioning in Pediatric Medulloblastoma.**

**Objective:** Brain tumors and treatment (e.g., surgery, radiation therapy) are associated with executive function impairment that is a risk



factor for potential loss of eventual independence. There is new interest in the causes of executive dysfunction, such as family function. This study examined how longitudinal profiles of family functioning following diagnosis are associated with executive function in pediatric medulloblastoma survivors.

**Participants and Methods:** Participants comprised 111 medulloblastoma patients (mean age at diagnosis=8.64 years) enrolled on a longitudinal, multi-institution study. Caregivers completed questionnaires at baseline (after surgery) and 12- and 36-months post-diagnosis. A prior report used longitudinal latent profile analyses to identify discrete patterns of functioning on scales of the Family Environment Scale. Families endorsed high, moderate, or low levels that were generally stable over time for the Control, Independence, and Organization scales. ANCOVA was used to examine differences among family functioning profiles on caregiver report of child executive functioning at 36-months post-diagnosis via the Behavior Rating Inventory of Executive Function. Age at diagnosis and disease risk status were covariates.

**Results:** For the Control scale, families with stricter rules and procedures rated their child as having more problems with emotional control ( $p=.01$ ), shifting ( $p=.04$ ), and initiation ( $p=.01$ ). For the Independence scale, families who were the least assertive and self-sufficient rated their child as having more problems with initiation ( $p<.01$ ) and working memory ( $p=.02$ ). For the Organization scale, families who were the least structured and organized rated their child as having more problems with organizing materials ( $p=.01$ ).

**Conclusions:** Results suggest family functioning is associated with executive function outcomes in pediatric medulloblastoma survivors. Development of interventions aimed at improving family functioning along with educational resources for families may be warranted.

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### **S. HILE, S.M. DINCES, R.D. ANNETT & S.J. ERICKSON. Functional Impairment in Childhood Cancer Survivors: Relationship with NIH Examiner Executive Measures and General Intellectual Functioning.**

**Objective:** Childhood cancer survivors are at risk for long-term neurocognitive late effects including impairments in executive functioning (EF) and general intellectual functioning (IQ) (Moore, 2005; Moore, Ater, & Copeland, 1992; Mulhern, Wasserman, Fairclough, & Ochs, 1988). The functional impact of these late effects is not well understood. In our previous work (Hile et al. 2014) functional impairment (FI) in survivors occurred frequently (26%); however, no control group comparison was made. The objective of the current study is to build upon current understandings of functional impairment by examining the relationship between EF, IQ and FI in cancer survivors compared with healthy controls.

**Participants and Methods:** Child cancer survivors, ages 5-18, at least 1 year post-treatment were eligible. Health controls (HCs) were recruited from the community. Parents completed the 23-item Brief Impairment Scale (BIS; Bird et al., 2005). Children completed the Brief Impairment Scale-Child Version (BIS-CV), IQ (Reynolds Intellectual Screening Test) and EF measures (NIH Examiner).

**Results:** 20 survivors and 41 HCs enrolled. No difference in rate of FI between survivors and HCs was observed. IQ and EF measures were comparable in survivors and HCs. Multiple stepwise regression examined the relationship between IQ, EF and FI in survivors and HCs. Results found that verbal IQ significantly predicted FI in survivors  $F(1, 16) = 9.49, p = 0.01, b = -0.62$ , but not in HCs  $F(1, 33) = 1.49, p = 0.23, b = -0.27$ .

**Conclusions:** Functional impairment (FI) is common in 5-18 year old cancer survivors and HC children, thus FI does not discriminate survivors from HCs. Our findings indicate that EF and IQ are not adversely impacted by pediatric cancer; yet verbal reasoning specifically predicted functional impairment in cancer survivors only.

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### **J. IRISH, S.K. PATEL & A.A. NOLTY. Childhood Cancer Survivors' Executive Functioning Skills: Does Scaffolding Bolster Behavioral Functioning?**

**Objective:** In order to accommodate for weak executive functions (EF), exterior scaffolding is often indicated for children and adolescents who are survivors of cancer. Since parents typically become accustomed to intervening with the child during acute illness and medical treatment phases and are comfortable acting as a child's external executive, a psychoeducation intervention was provided to empower them to help their child cancer survivors. We expected children whose parents participated in the intervention to demonstrate improvement in EF, and that EF at baseline would be associated with greater improvements in behavior functioning (BF).

**Participants and Methods:** Our sample consisted of 44 childhood cancer survivors between the ages of 6 and 18 whose parents were randomly assigned to a parent training intervention or a waitlist. The intervention included eight 75- to 90-minute sessions over a 3-month period in which parents learned about various aspects of attention, EF, and memory, and practiced techniques to implement with their child. Phone support was provided on a bi-weekly basis for an additional 3 months, after which there was follow-up testing for the child.

**Results:** Children of parents in the intervention group tended to have less proactive interference on the CVLT-C following the intervention. Additionally, children with stronger pre-intervention BRIEF General Executive Composites (GEC) benefited more from their parents' intervention, such that the GEC tended to correlate with decreases in BASC-2 Externalizing Problems ( $r = .46, p = .07$ ) and Behavioral Symptoms ( $r = .67, p = .007$ ), which was not the case for children in the control group ( $r = .03, p = .92, \& r = .22, p = .41$ ).

**Conclusions:** Intervening with parents of pediatric cancer survivors seems to provide scaffolding that can help children improve BF. Early interventions focused on improving EF for cancer patients should be explored so as to provide a solid foundation for bolstering behavior.

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### **L.M. JACOLA, K.R. KRULL, S. JEHA, L. HALL, Q. AN, K. CLARK, C. CHENG & H.M. CONKLIN. The Utility of Parent Report in Predicting Future Neurocognitive Outcomes in Very Young Survivors of Childhood Acute Lymphoblastic Leukemia (ALL) Treated with Chemotherapy Only.**

**Objective:** Neurobehavioral late effects of therapy may be amenable to early intervention; however, performance-based assessment during therapy is challenging, particularly with very young children. In this preliminary analysis, we examined whether parent ratings during therapy predicted end-of-therapy neurocognitive problems.

**Participants and Methods:** Parents of 107 children (52% males, 67% Low Risk, age at diagnosis:  $M=3.0, SD=1.0, range=0.7-4.8$  years) rated executive function, behavior, and adaptive skills early during therapy. Logistic regression was used to determine if ratings predicted problems on end-of-therapy neurocognitive testing conducted roughly 29 months later.

**Results:** Parents rated increased frequency of problems (score  $\geq 1 SD$  from the population mean) on the BRIEF Working Memory (28%), Plan-Organize (25%), and Emotional Control (24%) scales, the BASC-2 Anxiety (25%) and Somatization (44%) scales, and the ABAS-II Self-Care scale (51%;  $ps \leq .01$ ). At end-of-therapy testing, an increased frequency of survivors had problems with sustained attention (CPT2; 30-49%), Emotional Control (31%), Working Memory (34%), processing speed (WJ-COG Decision Speed, 28%) and reading (WJ-III Letter-Word Identification, 27%), compared to normative data ( $ps$

$\leq .01$ ). End-of-therapy outcomes did not differ by treatment intensity. Children with anxiety problems during therapy had increased risk of end-of-therapy problems with processing speed ( $OR=4.9$ , [95%CI, 1.02-23.77]). Concerns with Emotional Control during therapy predicted increased risk for problems in this domain at end-of-therapy (3.85, [1.05-14.12];  $ps \leq .05$ ).

**Conclusions:** Young children treated for ALL are at risk for neurobehavioral concerns that emerge early and are detectable at the end of therapy. Contrary to prior research, we found that treatment intensity did not mediate risk, emphasizing the need to monitor all young children. Parent ratings may be useful for monitoring, as concerns during therapy were moderately predictive of increased risk for end-of-therapy problems.

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**S. NA, T.Z. KING, R. MORRIS & B. SUN. BOLD Activity in Adult Survivors of Childhood Brain Tumors Following Continued Exposure on a Working Memory Task.**

**Objective:** Behavioral studies have documented impaired working memory in childhood brain tumor survivors and the neural foundations for these deficits are starting to be identified using fMRI. To explore a potentially more sensitive measure of difference between survivors and healthy peers, changes in brain activation over time were examined. Short-term effects of continued exposure on a working memory task were investigated in survivors on average 14 years post diagnosis.

**Participants and Methods:** Functional magnetic resonance imaging was utilized to evaluate BOLD activity in twenty adult survivors (age  $M=23.1$ ;  $F=55\%$ ) and twenty age- and gender-matched controls at the beginning (first two runs) and end (last two runs) of a twenty minute 5-run n-back letter recall task with pseudo-randomized task order among runs. An F-test was conducted on the [3-back>0-back] contrast to determine effects of group and time.

**Results:** Although there were no signs of behavioral improvement over time, reductions in BOLD signal were demonstrated in left prefrontal (Brodmann Area 8) and left premotor regions (BA 6) over time in both groups. The main effect of group was also present, with adult survivors recruiting bilateral prefrontal (including the dorsolateral prefrontal cortex; DLPFC) and parietal regions of the brain to higher degrees than controls during the course of the entire task.

**Conclusions:** Findings suggest that adult survivors of pediatric brain tumor may require increased cognitive control (i.e., top-down processing and attentional control in the DLPFC) during working memory tasks and that activation in the DLPFC did not decline over time. In addition, both groups similarly recruited left prefrontal and premotor regions of the brain at the beginning of the task; these regions became less activated with exposure over time in the absence of statistically significant task performance change. These results suggest that dynamic changes in the brain occur even within the course of a twenty minute task.

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**I. PALTIN, C. ZEBROWSKI, C.E. HILL-KAYSER, R.A. LUSTIG, J. BELASCO, A.J. WAANDERS, K. COLE, T. KANG, P. PHILLIPS, A.M. GREEN, M.J. FISHER, J. MINTURN & L.P. BARAKAT. Neuropsychological Functioning at Baseline and at least 2 Years Post Cranial Proton Radiation Therapy.**

**Objective:** Proton radiation therapy (PRT) improves the targeting of tumor tissue. Cranial PRT should reduce radiation-related morbidity for pediatric brain tumor patients (PBTP). Little prospective research has evaluated PRT in PBTP. This study describes neuropsychological functioning after pediatric cranial PRT.

**Participants and Methods:** 15 PBTP (11 male), age 2 to 16yrs ( $M=8.4$ ,  $SD=4.6$ ) completed evaluations pre-PRT and at least 2 years post-PRT (off-treatment). PBTP included 9 tumor types with many pre-existing

conditions (e.g., Autism, learning disability, stroke, visual impairment) and were compared by location (8 infratentorial), PRT field (9 focal; 4500-5940cGy) and age (7 over 9yrs at baseline). Assessment included intellectual (Wechsler), memory (CMS, WRAML2, CVLT), processing speed (Wechsler), motor/visual-motor (PPT, Beery), attention (TEACh, CCPT2) and executive (DKEFS, RCFT, TOLDx) abilities.

**Results:** No significant change over time identified for FSIQ, VIQ, PIQ, memory (CMS, CVLT), or motor (PPT) ability. Paired samples t-tests revealed significant decline in Coding ( $d=1.09$ ,  $p<.05$ ) and improvement in Word Generation ( $d=-0.97$ ,  $p<.05$ ). Only Coding consistently declined over time when dividing cohort by age (over 9yrs;  $d=1.25$ ), tumor location (infratentorial;  $d=1.18$ ), and PRT field (ventricle/craniospinal;  $d=2.19$ ) all  $ps<.05$ . At follow-up, mean performance was average for intelligence, attention, problem solving, visual memory and story memory. Visual scanning time and list learning was low average (TEACh, CVLT) with motor/graphomotor abilities impaired (PPT, Beery VP+MC).

**Conclusions:** In context of small sample size, minimal neuropsychological change was evident 2 to 4 years post-PRT. General neuropsychological functioning is preserved with relative weakness in visual scanning and list learning. PBTPs with diverse medical/psychological backgrounds demonstrate impaired motor/graphomotor abilities. Ongoing research with larger PRT cohorts is needed to describe PBTP functioning post-PRT.

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**J. PETERSEN, S. AMEDORO & C.L. ARMSTRONG. Late-Delayed Effects on Verbal and Visual Memory from Photon Radiotherapy for Pediatric Brain Tumors.**

**Objective:** This prospective, longitudinal study examines the late-delayed effects (<6 years) of standard photon radiotherapy (XRT) on memory in children and adolescents with mixed brain tumors. XRT is the conventional treatment for many types of brain tumors, but a brief, clinically effective cognitive marker of resulting toxicity is still needed in children because it will be more feasible to follow treatment effects overtime. We hypothesize verbal and visual memory to be differential indicators of cognitive toxicity resulting from XRT, as both hippocampal and total white matter volumes show reductions following XRT.

**Participants and Methods:** Participants included 37 patients with mixed primary brain tumors (19 males; age range: 4-22,  $M=10$ ,  $SD=4$ ). All patients completed baseline and at least one follow-up assessment. Verbal memory was assessed using the Rey Auditory Verbal Learning Test (encoding, retrieval after interference, and retrieval after a delay). A complex figure test and picture recognition measured visual memory. Immediate free recall, delayed free recall, and speed and accuracy of recognition were analyzed. Analyses used age-referenced Z scores in a nonlinear regression, with age predicting variability index scores. A one-way ANOVA examined the times points at which patients varied and a regression mapped the general pattern of change.

**Results:** Our results provide some support for the use of verbal and visual memory as markers of cognitive toxicity resulting from XRT. However, as sensitive as these measures of the late-delayed effects of XRT appear, further research of cognitive change is needed.

**Conclusions:** Understanding the time course of injury from XRT is needed for multi-disciplinary treatment and rehabilitation. Neuropsychological evaluation of the late-delayed cognitive effects of XRT, particularly verbal and visual memory, will inform treatment teams from a variety of disciplines, and promote appropriate supports throughout recovery.

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**Z. TAIWO, S. NA & T.Z. KING. The Neurological Predictor Scale Is Associated with Long-term Core Cognitive Outcomes in Adult Survivors of Childhood Brain Tumors.**

**Objective:** Prior research has demonstrated the reliability and validity of the Neurological Predictor Scale (NPS) in relation to short- and long-term intellectual and adaptive outcomes for childhood brain tumor survivors. However, the concurrent validity of the NPS with core cognitive skills has yet to be examined. The current study examines the concurrent validity of the NPS with long-term cognitive outcomes relative to individual variables alone.

**Participants and Methods:** Sixty one adulthood survivors of childhood brain cancers (M age=24 years, SD=6), on average 16 years post diagnosis completed neuropsychological assessments examining attention (Wechsler Memory Scale Digit Span Forward raw), processing speed (Symbol Digit Modalities Test z-score) and working memory (Auditory Consonant Trigrams 36 second delay z-score). NPS scores were computed from data acquired from medical records. Hierarchical regressions were conducted to evaluate whether NPS accounted for a significant amount of variance above and beyond the contributions of individual treatment and illness-related variables (i.e., presence or absence of radiation, chemotherapy, neurosurgery, hydrocephalus, hormone deficiency and seizure medications).

**Results:** NPS was significantly associated with processing speed ( $R^2 = .214, p < .05$ ) and working memory ( $R^2 = .204, p < .05$ ) outcomes over and above each individual risk factor. NPS was significantly associated with attention outcomes after covarying for age ( $R^2 = .092, p < .05$ ) over and above each risk factor except presence of hormone deficiency and chemotherapy. These two variables were not significantly associated with cognitive outcomes.

**Conclusions:** These findings demonstrate the concurrent validity between the NPS and core cognitive outcomes. The NPS may be an informative clinical research tool especially in studies with heterogeneous brain tumor samples.

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**L.V. TRAVERS, J. GRIECO, C. EVANS, K. KUHLETHAU, T.I. YOCK & M. PULSIFER. Executive Functioning and Quality of Life in Pediatric Brain Tumor Patients Post-Proton Radiation Therapy.**

**Objective:** Conventional radiation therapy for brain tumors is associated with cognitive sequelae (e.g., executive dysfunction) and reduced quality of life (QL). Proton radiotherapy (PRT), which limits dose to normal tissue, may improve outcome. Executive functioning (EF) and QL at follow-up were examined in PRT pediatric patients.

**Participants and Methods:** 61 patients (M=12.6 yrs; SD=3.6) were evaluated >1 year PRT (M=3.10 yrs, Range=1.00-8.83). 52% were infratentorial tumors; 44% medulloblastoma; 49% whole brain radiation; 85% resection; 71% chemotherapy. Measures were: Wechsler intelligence scale, Continuous Performance Test-II, Behavior Rating Inventory of Executive Functioning (Global Executive Composite-GEC, Parent), Behavior Assessment System for Children-2 Attention scale (Parent), and Pediatric Quality of Life Inventory 4.0 (Child/Parent) Total (PedsQL-T) and School Functioning (PedsQL-SF); higher QL scores indicate better QL (at-risk for impaired QL < 69.7).

**Results:** Full Scale IQ, sustained attention, working memory (WM), and GEC were average. Processing speed (PS) was low average. Mean PedsQL-T was 79.7 (Child) and 74.1 (Parent); Mean PedsQL-SF was 73.0 (Child) and 65.4 (Parent). Parent/Child PedsQL scores were correlated ( $p < .01$ ); although parents reported greater problems. Poorer WM and PS were related to lower PedsQL-T (Parent/Child) ( $p < .05$ ). PedsQL-SF (Parent/Child) was correlated with all attention and EF measures ( $p < .05$ ). Whole brain PRT had lower PS, WM, and PedsQL-T/PedsQL-SF (Parent).

**Conclusions:** 3 years after PRT, IQ, attention, WM and EF in everyday life were intact. PS was low average. Parent and child reported QL were below norms for healthy children and at risk for impaired QL in school functioning (Parent). Poorer attention/EF scores were significantly

related to lower Total and School QL. Screening for attention/EF deficits should be conducted to identify patients vulnerable to reduced QL. Proactive EF support should be provided to PRT patients to promote QL. Correspondence: Lea V. Travers, Ph.D., Psychiatry, Massachusetts General Hospital, 309 W. 4th Street, Boston, MA 02127. E-mail: leatravers@gmail.com

**K. VAN DYK, L.M. ERCOLI, L. PETERSEN, S.A. CASTELLON & P.A. GANZ. Cognitive Complaints in Breast Cancer Survivors (BCS): Association with Mood and Cognition.**

**Objective:** Among breast cancer patients, risk for post-treatment cognitive difficulties is a survivorship concern. Self-reported cognitive complaints in BCS are subtle and variably associated with cognitive functioning and mood; questionnaires that discriminate between complaints associated with cognitive dysfunction vs. mood would inform appropriate intervention. The Functional Assessment of Cancer Therapy – Cognitive Function (FACT-Cog) is a multidimensional self-report instrument measuring cognitive strengths with the Perceived Cognitive Ability (PCA) scale, weaknesses with the Perceived Cognitive Impairment (PCI) scale, and Cognitive Quality of Life (QoL); few studies have examined its association with cognition and mood.

**Participants and Methods:** 103 BCS (mean age = 56.81 ± 7.91, mean years since treatment = 4.44 ± .66) were evaluated with a neuropsychological battery; the Beck Depression Inventory, 2nd edition (BDI-II), and FACT-Cog (higher scores = better ratings). Three hierarchical linear regressions were performed with PCA, PCI, or QOL as the dependent variable, BDI-II, and Memory and Attention cognitive domain scores as predictors, controlling for age and IQ. FACT-Cog scores were then compared between groups of those with Depression and intact Memory (D; BDI-II ≥ 14; n=17), Memory Impairment ( $z < -.5$ ) with or without Depression (M±D; n=17), or Neither depression nor impairment (N; n=69).

**Results:** All final models were significant ( $p < .05$ ); both the BDI-II ( $\beta = -.46$ ) and the Memory domain ( $\beta = .24$ ) were significant predictors of PCA, whereas the BDI-II was the only significant predictor of PCI ( $\beta = -.65$ ) and QOL ( $\beta = -.71$ ). The D group had the lowest PCI scores ( $p < .05$ ); M±D and D groups had lower PCA and QOL than the N group, but weren't different from each other.

**Conclusions:** The FACT-Cog scales are differentially sensitive to mood and objective cognitive function. The FACT-Cog may be helpful for identifying BCS who may benefit from mood or cognition-related clinical services.

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**K. VAN DYK, A.M. HUNTER, L.M. ERCOLI, L. PETERSEN, S.A. CASTELLON, A.F. LEUCHTER & P.A. GANZ. Resting State EEG, Depression, and Memory in Breast Cancer Survivors (BCS).**

**Objective:** Self-reported cancer-related cognitive decline (CRCDD) in BCS correlates variably with objective decline as well as mood. Resting-state quantitative EEG (qEEG) may be informative for investigating physiological correlates of mood and cognitive performance and exploring the “accelerated aging” hypothesis of CRCDD.

**Participants and Methods:** We assessed depression severity (Beck Depression Inventory, BDI-II), neuropsychological test performance (Memory domain), and neurophysiologic function (qEEG) in a cross-sectional analysis of 62 BCS (mean age = 57.40 ± 8.39, mean years post-treatment = 4.42 ± 0.61). Analyses included: 1) partial correlations controlling for age between qEEG measures (i.e., qEEG cordance, relative anteroposterior (AP) gradient) and memory and depression scores; 2) ANOVA and Bonferroni-corrected post-hoc tests of qEEG measures among 3 groups: Memory Impaired (M;  $z < -.5$ ; n=10); Depressed (D; BDI-II ≥ 14; n=12); or Neither (N; n=40).

**Results:** Memory domain scores correlated with qEEG relative theta AP gradient ( $r = .26, p < .05$ ), and with a trend towards prefrontal theta cordance ( $r = .24, p = .06$ ). BDI-II score correlated with relative theta AP

gradient ( $r=-.30, p=.02$ ), relative delta AP gradient ( $p=-.251, p=.05$ ), and prefrontal (.45,  $p<.01$ ) and global (-.323,  $p=.01$ ) alpha cordance. The D group had greater prefrontal alpha cordance and lower anterior delta and theta power vs. N, and greater posterior beta power vs. M and N ( $p$ 's  $<.05$ ). A group difference trend for prefrontal theta cordance showed lower power in the M vs. N group ( $p=.09$ ).

**Conclusions:** qEEG measures appear to be differentially sensitive to memory performance and depression symptoms in BCS, and may be useful biomarkers of these factors in CRCD. Our findings are consistent with emerging evidence that higher resting-state theta power may indicate successful cognitive aging (Vlahou et al., 2014), relevant to the "accelerated aging" model of CRCD.

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**S. WISE, G. DOME, A. GIOIA, I. TAORMINA, K. OLSON, N. WINICK & K.K. HARDY. Rates of Neuropsychological Impairment among Children Being Treated for High-Risk Acute Lymphoblastic Leukemia.**

**Objective:** Acute Lymphoblastic Leukemia (ALL) is associated with increased risk for neuropsychological late effects; however, less is known about the onset, timing, and trajectory of deficits. Our objective was to examine rates of impairment at multiple timepoints over the course of chemotherapy in High-Risk ALL patients being treated on Children's Oncology Group (COG) protocol AALL1131.

**Participants and Methods:** The sample includes children aged 6-11 years enrolled on a COG trial for newly-diagnosed patients with high-risk ALL. At five timepoints between the end of Consolidation throughout Maintenance, participants ( $n=265$ ) complete five tasks from the CogState battery, a brief computerized neuropsychological assessment. In addition, parents complete the BRIEF. We then identified the percentage of patients with scores of clinical concern on each measure (i.e., CogState Standard Score  $\leq 85$ ; BRIEF T-score  $\geq 65$ ) at each timepoint.

**Results:** 265 out of 376 (70.4%) eligible patients consented to the study (51.9% female, mean age at diagnosis=9.3 years;  $SD=1.83$ ). Approximately three months after diagnosis (Time 1), 39% of participants exhibited a deficit on at least one of the five CogState tasks and 22% showed elevations on at least one of four scores of interest on the BRIEF; 18% and 14% showed more than one abnormal score on each measure, respectively. After two years of therapy, participants exhibited similar rates of abnormal CogState scores, with most low scores occurring for the processing speed (23%) and sustained attention (21%) tasks. In addition, 23% showed elevations on at least 2 of 4 scales on the BRIEF.

**Conclusions:** Children being treated for HR-ALL appear to exhibit higher rates of parent-reported and performance-based executive dysfunction compared to population-based expectations. Our study adds to the existing literature by demonstrating the evolution of problems with processing speed and attention as they emerge over the course of treatment.

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## Cross Cultural

**J. ALI & B. POTTER. Challenges in Cross-cultural Neuropsychological Consultation: a Case Study of a Non-verbal Guatemalan Immigrant.**

**Objective:** Immigrant youth comprise one-quarter of the children in the US, and are projected to make up one-third of children in the US by 2050. The increased diversity of the youth in the US places greater emphasis and demand for culturally-sensitive neuropsychological services. The fields of psychology and neuropsychology have made many advances with regard to multicultural treatment, consultation and

assessment. Despite these advances, significant challenges continue, particularly related to the impact of cultural or economic disadvantages on access to neuropsychological services. Thus, the purpose of the case study was to describe some of the challenges and barriers associated with a neuropsychological consultation with a non-verbal Guatemalan youth.

**Participants and Methods:** The current case examines a 12-year-old, non-verbal, Guatemalan male who was referred for a neuropsychological consultation due to developmental delay and a reported untreated, remote, non-accidental traumatic brain injury. Relevant information was obtained via review of available medical and educational records and through a clinical interview with his mother (who speaks Quiché) with the assistance of an interpreter.

**Results:** This case study exemplified many of the challenges related to cross-cultural neuropsychological consultation and assessment. Notably, this case emphasized role of neuropsychologists as an intermediary between immigrant clients and available resources and community services, and highlighted the limitations of the current medical system to assist persons without insurance and other associated cultural barriers.

**Conclusions:** Neuropsychologists need to be keenly aware of cultural barriers that impact the patient before, during, and after consultation. Assisting with communication, and understanding the specific cultural needs and barriers of the patient played an important role in ensuring the patient received appropriate care.

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**J. AVILA, J. RAZANI & S.P. VERNEY. Differential Reading Achievement-IQ Associations Across Ethnic Groups.**

**Objective:** Reading achievement scores are often used to estimate premorbid IQ because these skills are correlated with IQ scores and generally resistant to neurological dysfunction. However, sociocultural and educational experiences may mitigate this reading-IQ relationship. The purpose of this study was to investigate the relationship between reading achievement and IQ scores across four different ethnic groups.

**Participants and Methods:** Adult participants aged 18-71 years were recruited into four ethnic groups, Hispanic (HI;  $n=48$ ), Asian (AS;  $n=56$ ), Middle Eastern (ME;  $n=80$ ), and monolingual English-speaking European Americans (MESEA;  $n=81$ ). Participants completed WRAT-3 (reading subtest) and the WASI-II (FSIQ, VIQ, and PIQ) and demographic questionnaires.

**Results:** Three hierarchical multiple regressions were conducted on each ethnic group separately, with FSIQ, VIQ, and PIQ as the DVs. After accounting for age, gender (step 1), and SES (step 2), the addition of WRAT scores resulted in significant  $R^2$  changes in the AS ( $R^2=7.2\%$ ), ME ( $R^2=23\%$ ), and MESEA ( $R^2=24.8\%$ ) models, but not in the HI model ( $R^2=6.8\%$ ). Results for VIQ and PIQ, following a similar pattern, varied across groups. To further investigate the variability found in the WRAT reading and IQ associations, bivariate correlations revealed different associations across groups between WRAT and IQ scores and demographic/cultural variables (i.e., age, gender, years of education, SES, bilingualism, immigrant status, years living in the US, and education in the US).

**Conclusions:** These findings suggest the relationship between reading achievement and IQ may not be consistent across different ethnic groups. Demographic/cultural variables affect both sides of the WRAT-IQ equation, likely changing the nature of this association. Failure to examine and account for the effect of sociocultural contexts on the reading achievement-IQ relationship may result in inaccurate prediction of premorbid intellectual ability.

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**R. CHHAYA, J. WEISS, V. SEFFREN, A. SIKORSKII, I. FAMILIAR, H. RUISEÑOR-ESCUADERO, N. NAKASUJJA, B. GIORDANI & M.J. BOIVIN. The Use of Eye Tracking Technology in a Modified Fagan Test to Assess Neurocognitive Development in Rural Ugandan Infants Exposed to HIV.**

**Objective:** The Fagan test of infant intelligence uses gaze length for familiar and unfamiliar human faces to gauge working memory in infants. A modified Fagan test was used with an automated eye-tracking instrument to measure infant gaze length favoring unfamiliar compared to familiar faces in children born to Ugandan mothers with HIV.

**Participants and Methods:** A modified Fagan test was administered to 31 HIV-exposed Ugandan infants 6 to 12 months of age (11 boys;  $M=0.69$  yrs,  $SD=0.14$ ; 20 girls;  $M=0.79$ ,  $SD=0.15$ ). A series of faces are presented in a repeated pattern for a fixed presentation length throughout a six-minute video (unknown Face 1 is presented for 25 seconds, followed by 15 seconds where the now familiar Face 1 is presented with unfamiliar Face 2). We programmed a Tobii X2-30 infrared camera for pupil direction for an automated eye-tracking measure of gaze location and length in response to digitized photographs of local Ugandan faces selected to correspond to the gender, age (adult, child), face expression, and orientation of the original series of Fagan test faces. We correlated modified Fagan test performance to performance on the Mullen Scales of Early Learning (MSEL).

**Results:** Infants spent significantly more time gazing at the novel picture than familiar over 10 novelty preference trials ( $t=9.17$ ,  $P<0.001$ ). Boys tended to look at the faces longer than girls ( $t=1.98$ ,  $P=0.06$ ). The MSEL was correlated with overall time spent looking at all faces ( $r=0.52$ ,  $P=0.004$ ). The MSEL Fine Motor scale, which measures visual-spatial working memory requiring a motor response, was correlated with gaze length at novel faces ( $r=0.40$ ,  $P=0.03$ ), gaze length at familiar faces ( $r=0.38$ ,  $P=0.04$ ), and overall gaze length during for all faces ( $r=0.54$ ,  $P=0.002$ ).

**Conclusions:** Our modified Fagan test is a sensitive working memory measure predictive of overall infant/child development. Use of eye scanning technologies in infants provides a neurocognitive outcome for evaluating risk and resilience in low-resource settings for at-risk children. Correspondence: *Michael J. Boivin, PhD, MPH, Psychiatry and Neurology/Ophthalmology, Michigan State University, West Fee Hall, Room 321, 909 Fee Road, East Lansing, MI 48824. E-mail: boivin@msu.edu*

**J. WEISS, R. CHHAYA, V. SEFFREN, A. SIKORSKII, I. FAMILIAR, H. RUISEÑOR-ESCUADERO, N. NAKASUJJA, B. GIORDANI & M.J. BOIVIN. Automated Eye Tracking Technology Improves the Sensitivity of an Early Childhood Vigilance Test (ECVT) of Attention in Ugandan Children Perinatally Exposed to HIV.**

**Objective:** We evaluated automated eye tracking technology for enhancing the sensitivity of the Early Childhood Vigilance Test (ECVT) of attention with younger children perinatally exposed to HIV in rural Uganda. We also evaluated whether this technology could enable the ECVT to correlate better with a color-object association test (COAT) of memory and learning and the Mullen Scales of Early Learning (MSEL).

**Participants and Methods:** 44 children were evaluated with the ECVT, COAT, and MSEL (24 boys  $M=52.3$   $SD=11.4$  months of age; 20 girls  $M=52.4$ ,  $SD=12.2$ ). The ECVT attention measure is the proportion of time a child looks at the monitor during 7 min cartoon video. The ECVT was scored from a computer monitor webcam scored for % time the child spent looking using PROCODER. A Tobii X2-30 portable camera was also programmed to automatically record the child's pupil direction during the cartoon to calculate % time watching.

**Results:** Children watched 78% of the cartoon using Tobii automated eye tracking, while PROCODER webcam scoring resulted in an average of 67% ( $r=0.84$ ,  $P<0.001$ ). Older children performed better on the ECVT ( $r=0.41$ ,  $P=0.008$ ), although no gender differences were observed. ECVT Tobii eye tracking significantly correlated with COAT immediate recall for color-object associations (tracking moving animals  $r=0.33$ ,  $P=0.019$ ; total percent time screen gaze  $r=0.31$ ,  $P=0.035$ ), and

with MSEL Fine Motor performance (visual-spatial learning with motor response;  $r=0.33$ ,  $P=0.037$ ). ECVT webcam PROCODER % was also significantly correlated with COAT memory ( $r=0.42$ ,  $P=0.005$ ) and learning ( $r=0.38$ ,  $P=0.011$ ), but not with MSEL Fine Motor.

**Conclusions:** Enhancing the sensitivity of the ECVT by using automated eye tracking technology efficiently improves correspondence with other visual-spatial measures of working memory and learning in Ugandan children perinatally exposed to HIV. Eye tracking technology has the potential of improving the validity and reliability of other neurocognitive measures in at-risk African children in clinical settings. Correspondence: *Michael J. Boivin, PhD, MPH, Psychiatry and Neurology/Ophthalmology, Michigan State University, West Fee Hall, Room 321, 909 Fee Road, East Lansing, MI 48824. E-mail: boivin@msu.edu*

**K. BOYER, C. RYAN & C. VEGA. Assessment of Arabic-speaking International patients: Experience from a Pediatric Epilepsy Center.**

**Objective:** Practice of neuropsychology increasingly demands understanding of cross-cultural variables that impact assessment, with educational and linguistic diversity being at the forefront. More subtly, culture also affects engagement in the assessment, and can result in departure from standardization practices designed primarily for Western cultures. We have experienced an increase in referrals from Arabic-speaking countries, and have adapted assessment strategies to better serve this population.

**Participants and Methods:** Retrospective review of patients from Arabic-speaking countries referred from 2013-2015 included 17 patients (one seen twice), age range 2 to 17 years. Sixty-five percent were referred as part of epilepsy surgery evaluation. Assessment strategy is reviewed. General cognitive ability and descriptive analyses are provided.

**Results:** Less than half of the evaluations included a test of verbal IQ or language (Bilingual Verbal Abilities Test completed on 28%); no tests of verbal memory were employed. Nonverbal IQ was measured with the Wechsler scales (67%) or the DAS-2 (4/18). Preschool and older patients also completed tests of visual-motor integration (13/16) and fine motor dexterity (11/16), while younger patients completed the Bayley-III. Fifteen patients likely met criteria for intellectual disability. Thirteen were recently or currently enrolled in school. Mean parent education was 14.4 years.

**Conclusions:** Assessment methods relied heavily on interview and observations with tools selected for cultural and developmental appropriateness. Referral questions regarding language and memory function were typically not addressed with diagnostic tests. Consultation between colleagues regarding cultural communication was highly valuable and yielded multiple observations that improved assessment practices for subsequent evaluations. Notably, awareness of inter-gender communication and parenting practices among Arabic cultures enhanced clinical intervention with families.

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**K.R. BRYANT, R. JESSI, C. LILLY, M.W. HAUT, P.M. DEAN, M.T. MORAN, C. WILSON & M. PIFER. Education and Reading Ability Affects BNT Item Difficulty in a Rural Adult Sample.**

**Objective:** Item response theory (IRT) with a single factor Confirmatory Factor Analysis (CFA) was used to examine individual item difficulty on the Boston Naming Test (BNT) as a function of premorbid ability.

**Participants and Methods:** Participants consisted of a consecutive clinical sample of 849 adults at a rural academic medical center. Factor analysis was used as a data reduction technique to create a regression factor based on education and reading level (WRAT-4). A median split was used to separate the sample into groups of higher (Education  $M=15.11$ ,  $SD=2.37$ ; WRAT-4  $M=103.66$ ,  $SD=11.44$ ) and lower (Education  $M=11.44$ ,  $SD=1.56$ ; WRAT-4  $M=85.02$ ,  $SD=9.23$ ) premorbid

abilities. IRT with a single factor, two group CFA was used to observe variations in item difficulty based on the regression factor.

**Results:** The best fitting model was the two group metric invariance single factor CFA, and exhibited excellent goodness of fit (e.g., RMSEA = 0.016, CFI = 0.989, TLI = 0.988). Item difficulties were greater for the lower education/reading level group. Chi-Square tests for percent correct were significantly different for all but two items (funnel, latch), and there was a 20% difference on half of the items. The following items had the greatest item difficulty discrepancies (reporting percent correct of lower versus higher Premorbid Ability group): abacus (9% vs 41%), palette (20% vs 53%), accordion (46% vs 73%), stethoscope (71% vs 94%), protractor (18% vs 41%), and compass (27% vs 51%).

**Conclusions:** In a large rural clinical sample, premorbid ability substantially affects BNT performance, especially for the more difficult items. Therefore, premorbid schooling is important to consider when interpreting performance on BNT items. Standardized scores derived from norms that do not consider premorbid background (educational attainment and reading level) may overestimate naming difficulties in individuals with lower premorbid abilities, which could lead to over-interpreting word-finding problems.

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### C. CARRION, N. PLISKIN, A. THOMAS & L.H. LU. Measures of Executive Functioning as Predictors of Adaptive Functioning in a Hispanic Sample with Limited English Proficiency.

**Objective:** Cognitive and behavioral measures of executive functioning (EF) positively predict adaptive functioning, but these findings have yet to be demonstrated in limited English proficiency (LEP) Hispanics who often have limited educational attainment (Farias, Mungas, Hinton, & Haan, 2011; Karzmark et al., 2012). We examined the extent to which the Frontal Systems Behavior Scale (FrSBe; Grace & Malloy, 2001), when combined with measures of EF, improve our ability to predict adaptive functioning in LEP Hispanics.

**Participants and Methods:** Archival data from 35 Hispanic individuals with LEP who completed a full set of EF measures [Stroop (SCWT), Wisconsin Card Sorting Test (WCST), Verbal Fluency, Color Trails (CTT)] were analyzed [mean age=60.86, SD=14.17; mean education 7.40, SD=3.43].

**Results:** Using listwise deletion, the WCST emerged as a superior predictor of adaptive functioning as measured by instrumental activities of daily living (IADL) (WCST  $r=-.33$ ,  $p=.04$ ; SCWT  $r=-.02$ ,  $p=.47$ ; Verbal Fluency  $r=.10$ ,  $p=.31$ ; CTT  $r=-.042$ ,  $p=.41$ ). All four FrSBe scores including Apathy (A), Disinhibition (D), EF, and Total scale significantly predicted IADL (A  $r=-.69$ ,  $p<.01$ ; D  $r=-.47$ ,  $p<.01$ ; EF  $r=-.62$ ,  $p<.01$ ; Total  $r=-.45$ ,  $p<.01$ ). Hierarchical regression including demographic variables in Step 1 (age, sex, education), WCST in Step 2, and the FrSBe Total in Step 3 revealed that the overall model explained 35.6% of the variance in IADL scores. Neither demographic nor cognitive variables contributed to the IADL variance. Adding the FrSBe Total increased the variance explained by 32.4% (adjusted  $R^2=.245$ ;  $F(5,29)=3.21$ ,  $p<.05$ ).

**Conclusions:** Findings suggest that informant reports of executive functioning predict functional decline for LEP Hispanics. These results differ from previous findings in which executive dysfunction was found to be the strongest predictor of adaptive functioning in an English-speaking sample (Karzmark et al., 2012).

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### C.M. FUNES, C. CLENDINEN, J. RAZANI, F.C. GOLDSTEIN & R. MORRIS. The Impact of Explicit Strategy Instruction on the Verbal Learning Outcomes of English- and Spanish-speaking Older Adults.

**Objective:** This study investigated learning strategy use and overall memory performance of healthy, Spanish-speaking older adults and English-speaking older adults. It explored the possibility that the novelty of verbal memory tasks, along with demographic differences, may lead to differences in Spanish-speaking elders' effective use of organizational strategies. It was hypothesized that added instruction would reduce differences in effective strategy use and overall performance observed between the Latino and Caucasian groups.

**Participants and Methods:** Forty-eight healthy, Spanish-speaking older adults of Hispanic/Latino descent and 55 healthy, English-speaking Caucasian older adults were administered list-learning tasks in their dominant language. One list was administered using standard task instruction while a second list provided explicit detail on how to use the effective semantic clustering strategy.

**Results:** Under standard task instruction, Spanish-speaking older adults with low levels of formal education learned fewer words on the task than Caucasian and Latino participants who had higher levels of education. Latino participants, regardless of educational levels, also utilized semantic clustering recall at lower rates than Caucasian participants. When provided with explicit strategy instructions, both groups showed reduced total list learning. Latino elders also demonstrated reduced response to strategy manipulation compared to Caucasian participants. Finally, in the Latino sample, the quality of their formal education and level of acculturation were identified as important predictors of verbal learning outcomes.

**Conclusions:** These findings highlight the need to continue to examine the complex role of demographic and cultural variables on verbal learning and memory processes, as they may impact the assessment of pathological processes, as well the development of effective cognitive interventions for diverse elders.

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### K.A. HOLLER, B.C. KAVANAUGH, J. DUPONT-FRECHETTE, P. TELLOCK, I. MAHER & L. HAISLEY. The Role of Cultural Bias: Childhood Intellectual Performance in a Psychiatric Inpatient Sample.

**Objective:** Cultural bias (CB) can significantly influence neuropsychological evaluation results, potentially leading to inaccurate or skewed conclusions regarding brain-behavior relationships. This study examined the influence of cultural bias on intellectual testing performance within a children's psychiatric inpatient setting.

**Participants and Methods:** A medical chart review was conducted for 103 children aged 6-13 years with at least one psychiatric disorder who received a neuropsychological evaluation during a psychiatric inpatient program hospitalization from 2010-2014. CB risk was assessed via each child's minority status (white/ non-white), insurance status (public/private), and school ranking (high/low state ranking). A total CB risk score (0-4) as calculated for each child based on the sum of CB risk factors. Intellectual functioning (IQ) was assessed as full-scale intelligence (FSIQ), verbal IQ (VCI), and perceptual IQ (PRI).

**Results:** FSIQ, VCI, and PRI all correlated significantly with at least one CB risk factor. Multiple regression analyses found that the total CB risk score accounted for a statistically significant amount of variance in FSIQ and VCI performance, but not PRI performance. Receiver operating characteristic (ROC) analysis revealed that the total CB risk score was able to distinguish between intact versus low VCI (< 1 SD), identifying a cut-score of 2 as the optimal cut-point for detecting CB risk. ANOVAs found differences in VCI between those with 0, 1, 2, and 3 CB risk factors, with approximately 14 VCI points separating those with 0 CB risk factors from those with 3 risk factors.

**Conclusions:** Results indicate that CB risk has a significant and cumulative influence on verbal IQ but not perceptual IQ performance in children. In order to avoid inaccurate conclusions regarding brain-behavior relationships, the assessment of cultural bias risk should be a core component of all pediatric intellectual and neuropsychological evaluations.

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**C. LUONG-TRAN, L. KENWORTHY, C. ROTHWELL, A. RATTO & L.G. ANTHONY. Differences in Executive Functions and Behaviors of Asian and Caucasian Children.**

**Objective:** Compare EF and behaviors of Asian-American and Caucasian children.

**Participants and Methods:** Data from participants evaluated at an outpatient neuropsychology clinic between 2014-15 were drawn from an IRB-approved clinical database. 39 Asian and 39 Caucasian children were matched by primary diagnosis (48.7% ASD, 28.2% no diagnosis, 17.9% ADHD, 2.6% language disorder, 2.6% neurocognitive disorder), age (3.6-19 years), gender (74.4% male), and nonverbal IQ ( $M=92.79$ ,  $SD=19.12$ ). Parents and teachers completed the BRIEF and CBCL. Objective tests included Wechsler scales, DAS, TEA-Ch and Tower of London.

**Results:** Independent samples t-tests indicated that parents of Caucasian children reported greater concerns with global EF ( $t(71)=-2.087$ ,  $p<.05$ ) and organization ( $t(54)=-2.284$ ,  $p<.01$ ) than parents of Asian children. Similar trends were found in teacher BRIEF data. Parents of Caucasian children also reported greater concerns on the CBCL for Anxiety/Depression ( $t(70)=-2.092$ ,  $p<.05$ ), Aggression ( $t(71)=-2.718$ ,  $p<.01$ ), Externalizing ( $t(71)=-2.279$ ,  $p<.05$ ), and Oppositional ( $t(71)=-2.164$ ,  $p<.05$ ). No differences found in objective tests. Further analyses indicated group differences were primarily in reports made by parents/teachers of children with ASD. Caucasian children with ASD were more likely reported to have problems with inhibition, plan/org, and global EF on the BRIEF, and aggression and ext/int behaviors on the CBCL.

**Conclusions:** There are clear differences in parent/teacher reports of EF dysfunction and behaviors between Asian/Caucasian students, while objective tests are similar. This may be related to differences in cultural perception of problems or differences in the manifestation of problems. Furthermore, these perceptual differences were more prominent for children with ASD in this study and may be due to cultural differences in attribution of observed behaviors or manifestation of behaviors. This is the first study to examine these factors. Further research and analysis is needed to confirm these findings.

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**K.A. MUSIELAK, J. FINE & M.J. BOIVIN. Effects of Mediation Intervention for Sensitizing Caregivers (MISC) and a Health and Nutrition Education Program on the Sustained Attention of Ugandan Children with HIV.**

**Objective:** Children with HIV may experience difficulties with sustained attention. The current study examined the effects of two caregiver intervention programs, the Mediation Intervention for Sensitizing Caregivers (MISC) and a health and nutrition education (HNE) program, on the sustained attention of Ugandan children with HIV. It was hypothesized that both interventions would improve sustained attention, but that MISC would be associated with greater improvements than HNE. It was also hypothesized that one year of intervention would lead to greater gains than six months of intervention.

**Participants and Methods:** 111 Ugandan HIV-positive children ages 2 to 5 years old and their primary caregivers were randomized by geographic cluster to MISC or HNE. Caregivers in both groups participated in biweekly intervention sessions for one year and received monthly

food packages. Children completed the Early Childhood Vigilance Test (ECVT) of sustained attention at baseline, six months into the intervention, and at the end of the intervention year. Mixed-effects modeling was used to examine the effects of the two intervention groups and how the length of the interventions influenced sustained attention skills.

**Results:** Both groups made significant gains in sustained attention during the yearlong intervention ( $p < .05$ ), but there was no significant difference between the gains made by the two intervention groups. In both groups, significant gains were observed only during the second six-month period ( $p < .05$ ).

**Conclusions:** This study highlights the potential benefits of interventions addressing health, nutrition, and caregiver-child interactions for children with HIV. The full year of intervention may be necessary for significant gains in sustained attention. This study provides a foundation for future research to examine additional questions surrounding interventions that promote sustained attention growth in children with HIV. Correspondence: *Kayla A. Musielak, Michigan State University, 426 North Shore Rd, Gray, ME 04039. E-mail: musielak@msu.edu*

**H. KAUR, A. NEHRA, S. CHOPRA & V. SREENIVAS. Are we getting Smarter? Generational change of cognitive test performance in India.**

**Objective:** Neuropsychological evaluation ascertains intact or impaired cognitive abilities & establishes a marker to assess the progress of pharmacological, surgical, rehabilitation efforts, & the course of cerebral dysfunction & recovery. This is done by careful interpretation of performance of the individual on a wide range of standardized tests. Widely used neuropsychological evaluation for memory is the Post Graduate Institute Memory Scale (PGI-MS) developed in 1976 to assess ten domains of memory. Its relatively quick test which can also be used for illiterates with different age and education based norms. The objective was to see the evidence of Flynn Effect (FE) in memory functioning.

**Participants and Methods:** Normative sample of 305 consenting individuals constituted our cross-sectional study design. People with 0-5, 6-9 and more than 10 years of education matching the earlier age range i.e. from 20 to 69 years were evaluated on PGIMS.

**Results:** In 0-5 years of education FE is seen in recent memory, temporal sequencing, delayed & immediate recall. In 6-9 years of education FE is seen in attention, remote & recent memory, delayed & immediate recall, new learning ability & visual retention. More than 10 years of education FE is seen in attention, delayed & immediate recall. Across different education levels such significant changes are seen in different age ranges. The cognitive abilities for people between 20-69 years, on the basis of previous norms are an underestimate of their present abilities. Present generation with 0-5 and 6-9 years of education perform better in their cognitive abilities as compared to those assessed in 1976.

**Conclusions:** Education influences the cognitive functioning and therefore FE needs to be assessed not only in cognitive functioning but also in IQ for the developing nations like India. Neuropsychological tests with updated norms should be used for clinical & research purposes so that they do not lead to a misdiagnosis while assessing memory complaints. Correspondence: *Harsimarpreet Kaur, Post Graduation, CLINICAL NEUROPSYCHOLOGY, ALL INDIA INSTITUTE OF MEDICAL SCIENCES, ROOM NUMBER NS-718, 7TH FLOOR, NEUROSCIENCES CENTRE, ALL INDIA INSTITUTE OF MEDICAL SCIENCES, ANSARI NAGAR, New Delhi 110029, India. E-mail: harsimar9@hotmail.com*

**R.E. RIEGER, N.C. MOSS, R.K. OHLS & J.R. LOWE. Differential Associations Between Verbal IQ and Performance IQ and Executive Functioning Measures in Ethnically Diverse Preschoolers.**

**Objective:** Preschoolers born very low birth weight (VLBW,  $\leq 1500$  grams) are at risk for deficits in verbal (VIQ) and performance IQ (PIQ) and executive functioning (EF). EF skills play a critical role in overall cognitive, behavioral, and social-emotional development. Children from different racial and ethnic backgrounds may display EF dysfunction

differently. We examined relationships between VIQ, PIQ and EF measures in VLBW preschoolers of diverse ethnic backgrounds.

**Participants and Methods:** Preschoolers 3 to 4.5 years born VLBW (14 Native American, 30 Hispanic, and 31 Caucasian) were evaluated using the WPPSI-III (PIQ and VIQ). EF was measured using Gift Delay, Spatial Memory (SM), Beery VMI Copy and Visual Perception (VP) WJ-III Word Memory (WM), NEPSY Comprehension of Instructions, (CI) and Word Generation (WG).

**Results:** After controlling for income and test age, in the Native American group, VIQ was associated with SM ( $p = .001$ ), Copy ( $p < .001$ ) and VP ( $p = .016$ ), CI ( $p = .003$ ), WG ( $p < .001$ ), and WM ( $p = .003$ ). PIQ was associated with SM ( $p = .006$ ), Copy ( $p < .001$ ) and VP ( $p = .013$ ), CI ( $p = .003$ ), WG ( $p = .001$ ), and WM ( $p = .020$ ). In the Hispanic group, VIQ was associated with WG ( $p = .002$ ) and CI ( $p < .001$ ). PIQ was associated with WG ( $p = .004$ ). The Caucasian group had associations between VIQ and CI ( $p = .003$ ) and WM ( $p = .029$ ). There was no association for PIQ.

**Conclusions:** There were differential associations among VIQ, PIQ and EF measures across Native American, Hispanic, and Caucasian preschoolers. For Hispanics and Caucasians, VIQ was associated with verbally laden tasks such as CI, WG, and WM. For Native Americans, VIQ was associated with verbally and nonverbally laden tasks. For Hispanics, PIQ was associated with one verbally laden task. Native Americans PIQ was associated with the same verbally and nonverbally laden tasks as was the VIQ. These findings highlight the need to use multiple EF measures to assess for deficits in young children from different racial and ethnic backgrounds.

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**M.A. SEDO, L. MALLOY-DINIZ & A. MOREIRA. Advanced Pre-alphabetic Stroop Describes Processing Speed and Executive Control in Foreign-language-speaking Children and Adults.**

**Objective:** FIVE DIGIT STROOP (FDS) offers four basic characteristics: a) the simplicity of its decoding content (appropriate for pre-reading and dyslexic children and for illiterate or demented adults); b) its lower left-brain requirements, not involving any kind of alphabetic analysis; c) the special sensitivity of its switching situation, created by Bohnen in 1992; d) its highly kurtotic and dissymmetrical response curves, which separate to a maximum the times and error scores of “clinical” and “control” groups; and very specially e) its multilingual oral administration, which is totally appropriate for linguistic minorities and for non-English speakers

**Participants and Methods:** FDS introduces four timed reading exercises of identical content and increasing cognitive difficulty: reading, counting, choosing, and switching. Items used are groups of 1 to 5 pre-alphabetic signs (digits or stars), which are recognized or read well before the acquisition of phonological reading. DS yields objective measures of “automatic” readiness and “executive” oral-mental production. FDS was administered (in Brazil) to groups of senescent subjects (80 MCIs and controls); and groups of 93 children aged 4 to 7, in public and private schools, presorted as “analyzers” and “non-analyzers” with the Ferreiro dictation method, which is valid for all languages with transparent phonetics. DS yields objective measures of “automatic” readiness and “persistent executive” oral production.

**Results:** FDS shows high differences ( $p=.01$ ) in the speed and errors between “automatic” and “controlled” oral naming and decision-making of clinical and healthy groups of adults and children.

**Conclusions:** This allows diagnostic work with foreign populations and language minorities, based on biological processing, naming and decision-making speed.

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**A. SOTO, T.L. VICTOR, M.J. WRIGHT & D. HARDY. Neuropsychological Assessment: Operationalizing “Quality of Education” as High School Rankings Instead of Reading Level.**

**Objective:** Prior research has used reading level to operationalize the construct of quality of education (QOE) in neuropsychological research examining performance difference between groups (e.g., Byrd et al., 2005); however, it can be argued that reading level does not directly measure QOE (Manly et al., 2002). The purpose of this study is to use high school rankings (i.e., college readiness index [CRI], academic performance index [API], and student to teacher ratio [STR]) to operationalize QOE in an attempt to improve measurement. Consistent with prior research (Boone et al., 2007), it was hypothesized that QOE would account for a significant portion of the variance associated with ethnic group performance differences. It was further predicted that high school rankings (though correlated with reading scores) would serve as a stronger predictor.

**Participants and Methods:** The sample consisted of 45 neurologically and psychologically healthy college undergraduates divided into two groups: Hispanics ( $n=35$ ) and Caucasians ( $n=10$ ). Only individuals who reported English as their first language were included. All participants were administered a comprehensive neuropsychological test battery.

**Results:** Groups were equivalent with respect to age, education and gender. Results showed that Caucasians outperformed Hispanics on WAIS-III Vocabulary and the Boston Naming Test (BNT). Surprisingly, reading scores were not significantly correlated with high school rankings. Further, linear regression analysis revealed that WAIS-III Vocabulary scores were predicted by both reading scores and high school rankings, whereas for the BNT, scores were predicted by high school rankings only (i.e. API).

**Conclusions:** This study questions the use of reading level as a proxy for QOE in past research, and discusses this in light of methodological limitations and directions for future research.

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**E. WILNER, F.M. GEIER, R. WERSHIBA, C.M. CHOW & M. LANCA. Cross-cultural Literacy Screening in Low-educated Immigrants: A Pilot Study.**

**Objective:** The need to assess foundational literacy skills is of paramount importance to neuropsychological assessment when evaluating immigrants educated abroad. While education level has implications for literacy, years of education alone is not a sufficient proxy particularly cross-culturally. A cross-cultural literacy screen can be used as a guiding tool in neuropsychological assessment, from the conceptualization of baseline cognitive abilities to test selection and interpretation. The objective of this pilot study was to identify the basic elements of literacy for a sample of immigrant, low-educated adults.

**Participants and Methods:** Participants included 47 low-educated ( $\leq 9$  years of education;  $M=3.45$ ) immigrant patients educated abroad, who were referred for outpatient neuropsychological. A basic literacy screen assessing knowledge of the alphabet, numbers, high frequency word reading and writing abilities in patients’ native language among other skills was administered prior to comprehensive neuropsychological evaluation.

**Results:** The age of patients ranged from 20 to 92 ( $M=65.0, SD = 15.4$ ) and most were female (62%). Approximately half were from Brazil, Portugal, or Haiti. The majority of patients could sign their names and read/write numbers and approximately half could read/write high frequency words. Analyses revealed that ability to write/recite the alphabet was unrelated to ability to read/write high frequency words. There were no significant differences between lower (0-4) or higher (5-9) educated groups on reading and writing high frequency words. Number recitation appears to be a more sensitive variable to years of education.

**Conclusions:** Years of education was not related to basic literacy skills of reading/writing high frequency words, or writing/reciting the alphabet. Future directions include developing functionally-based literacy screens with ecological validity (i.e., reading a prescription).



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## Forensic Neuropsychology

**C.P. PECK, E. MITCHELL, A.J. MASSE, C.M. VARGA, R.J. HEINRICHS & R.W. SCHROEDER. Utility of FBS-r scores in Differentiating Conversion Disorders from Probable Malingering.**

**Objective:** Peck et al. (2013) examined the utility of the MMPI-2 Symptom Validity Scale (FBS) in distinguishing conversion disorders from probable malingering—two groups with excessive symptoms. FBS raw score of >30 accurately classified 50% of probable malingerers and misclassified 6% of the conversion disorder group. This study's aim was to evaluate the utility of FBS-r in differentiating these groups.

**Participants and Methods:** This quasi-experimental study reviewed 82 archival charts that met criterion designed to update the Peck et al. study. Individuals in the conversion disorder group were video-electroencephalogram confirmed cases of psychogenic non-epileptic seizures (PNES) who scored >40 on Test of Memory Malingering Trial 1 ( $n=38$ ). The probable malingering group consisted of mixed outpatients who scored <40 on this measure ( $n=44$ ). T-tests and chi-square tests were used to identify differences in demographic variables and mean FBS-r scores. Receiver operating characteristic (ROC) with area under the curve (AUC) calculation was examined for test accuracy rates.

**Results:** A significantly higher number of females were in the PNES group ( $p = .01$ ); no other demographic differences emerged (Age:  $p = .16$ ; Education:  $p = .39$ ; Handedness:  $p = .92$ ). Mean FBS-r scores were significantly different ( $p = .003$ ). AUC for FBS-r (AUC = .670, CI = .544 – .796) was adequate. The ROC indicated that an FBS-r T-score cutoff of >89 correctly classified 21% of the probable malingering group and misclassified only 6% of the PNES group.

**Conclusions:** While FBS had more robust findings, FBS-r still adequately discriminated the groups. An FBS-r cutoff score of >89 maximized the sensitivity rate, while maintaining >90% specificity. Interestingly, Schroeder et al (2012) recommended this cutoff for differentiating probable malingering from other clinical groups. Overall, FBS-r appears useful for helping to distinguish these clinical groups.

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## Malingering/Effort Testing

**R. BAEK, D. HONG, J. GRAZIANO, B.W. MACONE, A. FATZINGER, M. RADER & A. CASHER. Diagnostic group differences in embedded performance validity testing among patients who scored below Word Memory Test or Medical Symptom Validity Test failure cutoff.**

**Objective:** Stand-alone performance validity tests (PVTs) such as Green's Word Memory Test (WMT) or Medical Symptom Validity Test (MSVT) are not adequate in detecting suboptimal effort on cognitive testing. We examined whether patients with cortical dementia (AD;  $n=30$ ), Mild Cognitive Impairment (MCI;  $n=32$ ), psychiatric disorders (PSY;  $n=37$ ), and no cognitive impairment (NoDx;  $n=35$ ) who scored below either WMT or MSVT failure cutoff show differential performance on embedded performance validity measures [e.g., Repeatable Battery for the Assessment of Neuropsychological Status Effort Index (EI), Reliable Digit Span (RDS), Wisconsin Sorting Card Test Failure to Maintain Set (FMS) and unique errors (UE), Vocabulary minus Digit Span Scaled Score (VC-DS)].

**Participants and Methods:** Neuropsychological data were collected from patients referred to the Neuropsychology Lab at a large urban medical center in 2014 and 2015.

**Results:** A multivariate analysis of variance demonstrated a statically significant difference among diagnostic groups on the EI, RDS, and FMS ( $F(15, 348)=2.82, p<.001$ ; Wilks' Lambda=.73). Post-hoc tests revealed that the AD group ( $M=3.92, SD=1.89$ ) performed significantly worse on EI compared to the other three groups (MCI  $M=2.72, SD=0.91$ ; PSY  $M=2.22, SD=1.84$ ; NoDx  $M=2.77, SD=1.68$ ). The MCI, PSY, and NoDx groups did not differ on EI and RDS. The AD group ( $M=7.05, SD=1.89$ ) performed significantly worse on RDS compared to the MCI group ( $M=8.87, SD=2.22$ ). The PSY group ( $M=1.60, SD=1.35$ ) performed significantly worse on FMS compared to the MCI group ( $M=1.01, SD=.90$ ).

**Conclusions:** These findings demonstrate that the pattern of performance on PVTs can be diagnostically helpful. Results also suggest that performance on the embedded PVTs can vary across diagnostic groups as some of the PVTs can be relatively more indicative of genuine impairment. The optimal approach to performance validity testing in the future may involve use of individually tailored PVTs for different diagnostic groups.

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**R. BRANSON, J.C. YOUNG, Z. RITTER & A. CLARK. Detecting Suboptimal Effort in Undergraduate Students Who Simulate Brain Injury.**

**Objective:** Effort put forth during neuropsychological assessment can affect tests scores dramatically. Moreover, research conducted with college students should incorporate measures of response bias given psychological research's reliance on this population. The purpose of this pilot study was to examine the effectiveness of the Word Choice Test (WCT), and several commonly used embedded performance validity measures, in classifying participants putting forth best effort or feigning a brain injury for the purposes of secondary gain.

**Participants and Methods:** Undergraduate participants from the University of Tennessee at Chattanooga were randomly assigned to a Simulating Brain Injury group ( $n = 21$ ) or a Do Your Best group ( $n = 20$ ). After reading instructions to simulate a brain injury or an allegory on doing one's best, participants completed the WCT, WAIS-IV Digit Span, DKEFS Verbal Fluency, Wisconsin Card Sorting Task (WCST), and Slip Induction Task (SIT; Clark, Parakh, Smilek, and Roy, 2012).

**Results:** Analyses revealed that the Simulating Brain Injury group performed significantly worse on WCT ( $p = .007$ ). Additionally, the simulation group made significantly more WCST errors overall ( $p = .004$ ), more perseverative errors ( $p = .041$ ) and failed to maintain set more often ( $p = .016$ ). Regardless of group differences, the mean scores of the Simulating Brain Injury group on the WCT and failure to maintain set of the WCST did not exceed established cutoffs. Furthermore, no significant group differences were found on Digit Span, DKEFS Verbal Fluency or SIT performance.

**Conclusions:** Despite being instructed to feign, participants in the Simulating Brain Injury group did not suppress effort adequately enough to be classified as probable malingerers. Therefore, the findings of this pilot study indicate that the examined performance validity indicators may be able to detect significant group differences yet lack the ability to correctly classify suboptimal effort when applied in undergraduate research settings.

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**T.W. BREARLY, R.D. SHURA, H.M. MISKEY, S.L. MARTINDALE & J.A. ROWLAND. Understanding the Word Memory Test: Performance Validity Beyond Learning and Memory.**

**Objective:** The Word Memory Test (WMT) is a performance validity test sensitive to invalid performance on tests of learning and memory; however, its relationship to other cognitive domains is not well established. The following hypotheses were evaluated: 1) participants failing the WMT would perform worse on tests across all cognitive domains, and 2) when comparing performance across cognitive domains, WMT performance would be most sensitive to learning and memory outcomes. **Participants and Methods:** Participants included 204 post-9/11 Veterans. Participants completed: tests assessing all major neurocognitive domains except language, self-report psychiatric measures, and a diagnostic clinical interview. A priori power analysis was utilized to ensure sufficient sample size for analyses.

**Results:** Bonferroni corrected mean comparisons contrasted participants passing and failing the WMT. Differences across all cognitive domains except sensation were noted. Variables demonstrated to be significantly different between groups were entered into separate regression analyses predicting each of the continuous WMT validity outcome variables (IR, DR, CNS). Learning and memory variables alone explained over 40% of the variance in each WMT validity outcome (IR=43%, DR=49%, CNS=41%); however, the inclusion of other cognitive domains significantly increased the variance explained (IR=52%, DR=61%, CNS=52%). Self-reported symptoms did not improve the models. Significant predictors from the final model included tests of learning, memory, attention, and executive function.

**Conclusions:** Results demonstrated that WMT performance shared unique variance with performance across cognitive domains, including learning, memory, attention, and executive function. This suggests that invalid performance on the WMT may indicate invalid performance across a variety of cognitive domains with the possible exception of sensation.

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**M. BROWER & J. CHAMBERLAIN. Utility of the WAIS-IV Digit Span for Detecting Poor Effort.**

**Objective:** Research emphasizes the utility of performance validity tests (PVTs) as a method of evaluating adequate effort during neuropsychological evaluations. There is a special importance of PVTs that are embedded and those that do not rely on forced-choice options. The Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV; Wechsler, 2008) Digit Span (DS) subtest can be utilized as a viable PVT that is not only embedded, but also does not rely on forced-choice options. The purpose of this study was to compare different ways of using the DS – the reliable digit span (RDS) and the enhanced reliable digit span (ERDS) – in detecting poor effort. It was hypothesized that the ERDS will have greater specificity/sensitivity than the RDS for detecting poor effort.

**Participants and Methods:** This study was a quasi-experimental, using archival data. The sample of this study (n=113) was collected from an outpatient neuropsychology clinic. Individuals who failed either the Test of Memory Malingering (TOMM; Tombaugh, 1997) or the Word Memory Test (WMT; Green, 2003) were considered to have poor effort versus those who did not fail a PVT. Sensitivity and specificity was calculated for both the RDS and ERDS for detecting poor effort.

**Results:** Sensitivity and specificity was calculated for both RDS and ERDS for detecting poor effort (i.e., those who failed the TOMM or WMT). Results indicate that the ERDS had slightly better specificity/sensitivity for detecting poor effort than the RDS.

**Conclusions:** While both the RDS and ERDS performed well in detecting poor effort, there was not much of a difference. Still, results suggest further investigation of the ERDS measure to further establish its validity for use in clinical practices. For clinical implications, it is recommended that several PVTs, not just the ERDS/RDS, be administered within a neuropsychological battery to increase specificity.

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**J.A. CALLOWAY & R.L. DENNEY. Initial Validation of a New and Quick Performance Validity Test: Green's License Plate Test.**

**Objective:** Green's License Plate Test (LPT) is a new computer administered cognitive task, designed to identify poor task engagement, and only takes approximately seven minutes to administer. This project sought to obtain initial validation data for the LPT as a performance validity test (PVT), and to establish preliminary normative scores for a nonclinical group applying appropriate effort and a group simulating traumatic brain injury (TBI).

**Participants and Methods:** Participants (n = 100) were acquired through a convenience sample drawn from communities in southwestern Missouri and northeastern Tennessee. Participants were randomly assigned to either a simulator group instructed to feign impairment secondary to TBI according to a script, or a normal group instructed to provide optimal effort. Exclusion criteria included history of TBI diagnosed by a medical professional and individuals under the age of 18-years. Participants' ages ranged from 18- to 57-years (M = 28.59, SD = 7.67). Seventy percent of the sample was female. Education ranged from high school diploma to doctorate degree; median education was college degree.

**Results:** Since experimental data for each scale were not normally distributed, Mann-Whitney U tests were performed for comparison of mean scores between groups. There were statistically significant differences on each of the eight scales of the LPT, with simulators scoring lower on each (all  $p < 0.001$ ). There was no demonstrated statistically significant difference between groups for gender ( $p = .275$ ), age ( $p = .479$ ), or education ( $p = .142$ ). Receiver operating characteristics (ROC) revealed the highest area under the curve (AUC) value for the Words Recognition scale (AUC = .922) followed by Free Recall Images (AUC = .891).

**Conclusions:** These data support construct validity of the LPT as a measure to detect simulated cognitive dysfunction. Further validation of the LPT is warranted in both nonclinical and clinical populations.

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**F. GOMES, J. FERNANDES, C. PINTO, A. GONÇALVES, E. ALMEIDA, I. MOREIRA & S. CAVACO. Predictors of adequate performance on the Coin in the Hand Test: findings from a clinical sample.**

**Objective:** To investigate the impact of cognitive functioning and psychopathological symptoms on a memory test designed to detect malingering or suboptimal effort.

**Participants and Methods:** The Dementia Rating Scale - 2 (DRS-2), the Hospital Anxiety and Depression Scale (HADS), and the Coin in the Hand Test (CITHT) were applied to 147 patients with diagnosis of Mild Cognitive Impairment or Dementia and without legal or forensic issues. DRS-2 scores below the 5th percentile of demographically adequate norms were indicative of impairment. The cut-off score used for anxiety and depression on HADS subscales was  $\geq 11$ . The explored cut-off score for adequate effort was CITHT < 2 errors. A multiple logistic regression was used for data analyses.

**Results:** Sixty-four (44%) subjects had impaired DRS-2 scores, 46 (31%) had anxiety, and 37 (25%) had depression. Adequate performance on CITHT (i.e., < 2 errors) was found: in 114 (78%) of the total sample, in 41 (64%) subjects with impaired DRS-2, in 37 (80%) subjects with anxiety, and in 28 (76%) subjects with depression. The odds of having adequate performance on CITHT decreased with impaired DRS-2 scores (adjusted odds=0.242;  $p < 0.001$ ), but not with anxiety (adjusted odds=1.429;  $p = 0.448$ ) or depression (adjusted odds=0.826;  $p = 0.691$ ).

**Conclusions:** The CIGHT specificity levels are high in subjects with anxiety and depression, but decrease in cases with very low cognitive functioning. The results confirm the potential utility of this free-standing validity test in a clinical setting and demonstrates its robustness in the presence of psychopathology.

**S. COLLIER, J.B. NEWMAN, C.G. VAUGHAN & G.A. GIOIA. Evaluation of Automatized Sequences Task as an Index of Performance Validity in Pediatric Concussion.**

**Objective:** Examine the Automatized Sequences Task (AST) as a performance validity measure in a sample of concussed youth by exploring relations between performance on AST, Test of Memory and Malingering (TOMM) and Reliable Digit Span (RDS). Effect of AST performance on Digit Span (DS) scores was further explored.

**Participants and Methods:** 66 youth (age 8-17, 51% female) evaluated 2-146 days post-concussion (M=22, SD=9) completed the AST and DS subtest. An RDS cutoff of 6 or lower was used as an indicator of noncredible effort and was compared with AST cutoffs using chi-square. DS scores were examined in both groups to demonstrate ecological validity. A subsample of youth (n=24) were administered the TOMM.

**Results:** AST cutoffs were used to categorize elevated (n=28) and non-elevated groups (n=38). Groups did not differ in gender, time since injury, injury characteristics (LOC, amnesias, mechanism of injury), or premorbid history of ADHD, learning disability, or prior concussion. Fourteen youth in the elevated group (50%) scored below RDS cutoffs whereas one person (2%) in the non-elevated group scored below cutoffs ( $\chi^2=15$ ,  $p=.06$ ). A significant relation was found between AST performance and recommended TOMM cutoff scores (<45) across trials, and 89% of youth in the elevated group (N=9) scored below TOMM cutoffs whereas no participant in the non-elevated group scored below cutoffs (Trial1:  $\chi^2=14$ ,  $p<.001$ ; Trial2:  $\chi^2=16$ ,  $p<.001$ ). The elevated AST group also performed significantly worse across DS conditions compared with the non-elevated group ( $p<.001$ ).

**Conclusions:** In a sample of concussed youth, AST performance was significantly associated with performance on the TOMM, but nearly significant with RDS. AST performance was associated with worse performance on an attention/working memory test. The findings provide evidence for convergent validity between the AST and other measures of effort in this population as well as ecological validity of AST performance to correspond to poor test performance on an attention-based task.

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**J. DOUGAN & B.J. CANNON. Effectiveness of the ImPACT, TOMM, and an Emotional Stroop Paradigm to Detect Simulated "Sandbagging" on Baseline Concussion Testing.**

**Objective:** With increasing public awareness of the impact of sports-related brain injury, research into accuracy of concussion detection methods is vital. Unfortunately, some athletes intentionally perform poorly on baseline assessments in order to more quickly return to play. The validity indicators of the Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) or specific tests of effort have been used to identify sandbagging; however, these validity tools have not been combined.

**Participants and Methods:** The current study included 38 student participants who completed the ImPACT, Test of Memory Malingering (TOMM) and a malingering emotional Stroop paradigm under two conditions: best effort and "sandbagging." Instructions were counter-balanced and examiners were blind to experimental condition.

**Results:** There were no order effects. Participants who were instructed to sandbag scored significantly worse on all trials of the TOMM, all trials of the Stroop, and four of the five ImPACT composites (Verbal Memory, Visual Memory, Visual Motor Speed, and Impulse Control). The expected emotional Stroop effect to malingering words was not replicated. The TOMM demonstrated high sensitivity (81%) and specificity

(88%), while the ImPACT's validity indicator's sensitivity was 68% and specificity was 85%. The ImPACT accurately identified 58% of sandbagging participants, while the TOMM accurately identified 79%. When these measures were combined, 84% of participants instructed to sandbag were identified. Further analysis of ImPACT validity subscores revealed variable sandbagging detection rates. Common themes in participant sandbagging strategies included numerical patterns (e.g., answering every 15th question incorrectly), intentionally choosing the wrong answer, and not paying attention or ignoring the instructions and/or stimuli.

**Conclusions:** These findings emphasize the need for baseline concussion testing to include established tests of effort, in order to detect sandbagging and reduce the potential harm to these athletes.

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**T.J. FARRER, E.D. BIGLER & M. BROOKS. Clinical Utility of TOMM Trial 1 in Academic Accessibility Populations.**

**Objective:** Performance validity tests (PVT) are considered a critical component of a neuropsychological assessment. Given clinical time constraints in standard practice, it is important that clinicians can provide concise yet thorough examinations. As such, having a flexible approach to performance validity assessment may be beneficial in clinical practice. The Test of Memory Malingering (TOMM), a frequently administered PVT, has two trials and a delay trial, making administration time upwards of twenty minutes. However, prior research suggests that using trial 1 of the TOMM can have robust clinical utility negating the need of trial 2, although this has not been examined in academic accommodation seeking college students. The present study sought to extend prior research by examining the utility of TOMM trial 1 in this unique sample.

**Participants and Methods:** Participants were 539 male (62%) and female college students (mean age 24.8; SD= 6.9) who were referred to a university's student accessibility center to determine their need for academic accommodations. Evaluations included academic and cognitive testing. Trials 1 and 2 (T1 & T2) of the TOMM were part of evaluation procedures in 228 cases. Comparisons were made between T1 and T2 to determine overall fail rate of each and the chance of failing T2 when T1 is above the standard cut-score of 45.

**Results:** 200/228 examinees passed T1 (range 26-50; M= 48.0; SD= 3.5) and 224/228 passed T2 (range 29-50; M= 49.67; SD= 1.77). Fail rate of TOMM T1 was 12% (n= 28). However, fail rate of TOMM T2 was 2% (n= 4). Of the 200 people who passed TOMM T1 (<45), all passed T2 (Hit Rate= 100%).

**Conclusions:** If patients pass T1 it is uncommon for a failing score on T2. Findings support prior research of a possible discontinuation rule given minimal incremental validity to T2 when T1 scores are above 45. A flexible approach to using T1 of TOMM as a PVT could save clinicians administration and scoring time in an otherwise busy clinical setting.

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**J.M. GRABYAN, R. COLLINS, W.A. ALVERSON & D. CHEN. Errors on the First 10 Items of the Test of Memory Malingering Predicts Failure on Later Trials of the Test of Memory Malingering.**

**Objective:** Effort testing is becoming an increasingly vital component of neuropsychological evaluation. However, standalone measures of effort can be time consuming to administer. This barrier is made more salient in the context of busy inpatient evaluations, where time with the patient is at a premium. As the Test of Memory Malingering (TOMM) is the most commonly used and widely researched effort measure, much work has been focused toward developing abbreviated versions of it, including cut scores for Trial 1, that still preserve its diagnostic accuracy for predicting insufficient effort. It was hypothesized that a recent addition to these efforts, number of errors on the first 10 items of Trial 1 (TOMMe10),

would predict future failure on Trial 1 and/or Trial 2 of the TOMMe10 with high sensitivity and specificity.

**Participants and Methods:** Subjects were 179 inpatient veterans referred for neuropsychological screening as part of a week-long inpatient observation on an epilepsy monitoring unit to establish the presence of epileptic seizures or psychogenic non-epileptic events. Patients were administered both learning trials of the Test of Memory Malingering as part of a larger battery.

**Results:** Using a previously established score cut-score of  $\geq 2$  errors as indicative of failing TOMMe10 yielded a sensitivity rate of .92 and specificity of .93. Youden's Index of receiver operator characteristic (ROC) analysis also revealed the  $\geq 2$  errors cut-off as the optimal choice.

**Conclusions:** The TOMMe10 shows great promise in its ability to predict future TOMM failure rates. In populations where time with the patient is at a premium, such as brief inpatient stays, a clear failure of the TOMMe10 can potentially be used as a stand in for TOMM failure. This early discontinue criteria could allow the examiner to potentially use their time more effectively. At the least, adding TOMMe10 to examinations of Trials 1 and 2 could assist in cementing an examiners diagnostic certainty on effort failure.

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**Z. BOUMAN, M. HENDRIKS, A. ALDENKAMP & R.P. KESSELS. Indicators of suboptimal effort embedded in the Wechsler Memory Scale – Fourth Edition (WMS-IV).**

**Objective:** The Wechsler Memory Scale (WMS) is one of the most widely used test batteries to assess different memory functions in impaired patients with brain dysfunctions of different etiologies. Recognition and visual working memory tasks from the Wechsler Memory Scale – Fourth Edition (WMS-IV) have previously been documented as useful indicators for suboptimal effort. The present study examined the clinical utility of the Dutch version of the WMS-IV (WMS-IV-NL) for the identification of suboptimal effort using an analogue study design.

**Participants and Methods:** The patient group consisted of 59 patients with moderate to severe acquired brain injury (ABI); the simulating malingerers were 50 healthy individuals who were asked to simulate cognitive impairment as a result of a TBI; the last group consisted of 50 healthy controls who were instructed to put forth full effort.

**Results:** Simulating malingerers performed significantly lower on all WMS-IV-NL tasks compared to ABI patients and healthy controls. A binary logistic regression analysis was performed on the simulating malingerers and ABI patients. The first model contained the visual working memory subtests (Spatial Addition and Symbol Span) and the recognition tasks of the following subtests: Logical Memory, Verbal Paired Associates, Designs, Visual Reproduction. The results showed an overall classification rate of 78.4 %, and only Spatial Addition explained a significant amount of variation ( $p < .001$ ). Subsequent logistic regression analysis and Receiver Operating Characteristic (ROC) analysis supported the discriminatory power of the subtest Spatial Addition. A scaled score cut-off of  $< 4$  produced 93% specificity and 52% sensitivity for detection of suboptimal effort.

**Conclusions:** The WMS-IV-NL visual working memory subtest Spatial Addition may provide clinically useful information for the detection of suboptimal effort.

**E.S. SCHWARTZ, J. HOELZLE, E. VOGT & K.A. RITCHIE. Development and Preliminary Validation of the Vegas Odds Test.**

**Objective:** This research will describe the underlying theory and statistical development of the Vegas Odds Test, a performance validity test based on binomial probability. In the first 25 item trial, four target stimuli (playing cards) are presented for 2 seconds and then after a 3 second delay the participant is asked to identify one target stimuli out of five choices. The perceived difficulty increases in the second 25 item trial due to a target stimuli display of 1 second and a 6 second delay interval.

Unique to the test, during the retention trial there are four correct answers and one foil. A score of 24 or 25 per trial is statistically better than chance; a score of 16 or below is statistically worse than chance.

**Participants and Methods:** A simulation study was conducted using 51 young adults who were assigned to a feigning ( $n = 26$ ) or control condition ( $n = 25$ ). Individuals in the feigning condition were asked to perform as if they had attention, memory, and processing speed deficits. Diagnostic classification statistics were derived to evaluate the Vegas Odds Test ability to differentiate the two groups.

**Results:** Individuals in the feigning group achieved statistically lower Vegas Odds Test scores than the control group [ $t(26,16) = 3.52, p < .01$ , Cohen's  $d = .98$ , ROC A.U.C. = .78,  $p < .01$ ]. Sensitivity was maximized with a cut score of 48 ( $Sn = 1.00$ ), whereas, specificity was maximized with a cut-score of 50 ( $Sp = .69$ ). Further analyses will be conducted to analyze specific trials and various combinations of cut scores.

**Conclusions:** The Vegas Odds Test is a novel performance validity test. It effectively differentiates between groups of individuals putting forth valid performance and those exaggerating cognitive symptoms. Further validation is needed in clinical and forensic samples.

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**D. HONG, R. BAEK, J. GRAZIANO, B.W. MACONE, A. FATZINGER, M. RADER & A. CASHER. Sensitivity and specificity of the Dementia Profile of Word Memory Test and Medical Symptom Validity Test among Patients Who Failed the Easy Subtests.**

**Objective:** Dementia Profile (DP) was developed to address the false positives for poor effort on the Word Memory Test (WMT) and Medical Symptom Validity Test (MSVT). Although it was found useful in distinguishing severe cognitive impairment from stimulated malingering, its utility in a clinical setting has not been thoroughly examined. This study assessed the sensitivity and specificity of the DP in a clinical sample of adults who scored below the suggested cutoff scores for the WMT or MSVT.

**Participants and Methods:** Neuropsychological data of 154 participants was extracted from a larger data set of patients referred to the Neuropsychology Lab at a large urban medical center in 2014 and 2015. The patients were divided into two groups: 1) genuine cognitive impairment (GCI) group, including patients with dementia or Mild Cognitive Impairment diagnoses ( $N=82$ ; 50% female; 89% Caucasian;  $M\ age=72.3$ ,  $SD=9.2$ ), and 2) no neurological symptoms (NoDx) group, including patients with psychiatric illness or other non-neurological factors ( $N=72$ ; 57% female; 75% Caucasian;  $M\ age=47.0$ ,  $SD=15.9$ ). Sensitivity and specificity of the DP were computed using these two groups.

**Results:** 76 out of 82 patients in the GCI group exhibited a DP and 38 out of 72 patients in the NoDx group showed a DP. The sensitivity of the DP for the detection of genuine cognitive impairment was 92.7% while the specificity of the DP (or the probability that a DP will not be produced when genuine cognitive impairment is not present) was 47.2%.

**Conclusions:** The DP is a sensitive instrument in identifying genuine cognitive impairment among patients who scored below WMT or MSVT failure cutoff. However, results indicated that the DP had a relatively low specificity in our sample. Further studies are necessary to consider new approaches to address the low specificity of DP (e.g., increasing cut-off scores) among clinical patients with WMT or MSVT failure.

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**R.J. KANSER, L.J. RAPPORT, J.R. BASHEM, S.I. KROHNER, B. VERMILION, R.K. KEELAN, N. BILLINGS, J.L. WOODARD & R.A. HANKS. Detection of Simulated versus Bona Fide Traumatic Brain Injury Using Response Time on a Performance Validity Test.**

**Objective:** Threats to performance validity test (PVT) security and utility have increased efforts to develop covert measures of performance

validity. Response time (RT) is a promising covert measure to distinguish between honest and feigned performance; however, research investigating RT patterns on PVTs is sparse and troubled by methodological problems. This study examined the incremental utility of RT variables on a traditional PVT in distinguishing adults with verified TBI from adults coached to feign neurocognitive impairment.

**Participants and Methods:** Participants included 25 adults with moderate to severe TBI (TBI), 43 healthy adult controls (HC), and 31 healthy adults coached to simulate TBI (SIM). Participants completed the Test of Memory Malingered adapted for computer administration. A number of RT variables were examined along with the standard accuracy score. Groups were equivalent in age and education.

**Results:** ANOVA and Kruskal-Wallis tests indicated that RT variables differing among the three groups included average RT for correct and total responses, coefficient of variation for Trial 2 responses, ratio of RT for correct to incorrect responses, and frequency of lengthy (> 2000ms) responses. Follow-up analyses revealed that only average RT for correct and total responses and the frequency of lengthy responses differed significantly between SIM and TBI. Binary logistic regression revealed that average RT for Trial 2 responses added incremental value to standard Trial 2 accuracy in discriminating HC from SIM; however, it did not add predictive value to Trial 2 accuracy in discriminating SIM from TBI.

**Conclusions:** Several RT variables differed between HC and SIM on the TOMM, but only one improved discrimination of HC and SIM. Fewer RT variables differed between SIM and TBI, and none improved discrimination between these groups. These findings highlight the importance of including individuals with bona fide TBI when evaluating and developing performance validity measures.

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**J.M. KLAVER, A.N. RABKIN, E. KRAPF, D.T. PULSIPHER & L.D. STANFORD. The Relationship between Self-Reported Symptom Validity and Performance Validity in Children with Neurologic Disorders.**

**Objective:** There is a growing interest in the investigation of performance validity (PV) in neuropsychological test performance of children, but there are relatively few studies evaluating childhood symptom validity (SV) reporting. Studies with adults suggest that PV and SV are strongly associated, but Kirk et al. (2014) reported no significant relationship between SV (self-report BASC-2) and PV (Medical Symptom Validity Test [MSVT]) scores in a mild TBI (mTBI) sample of children. However, no study has investigated this relationship in a general clinical population (e.g., mTBI, epilepsy, brain tumor, prematurity, etc.).

**Participants and Methods:** 113 consecutive, age-eligible clinically-referred patients ages 7-17 years ( $M=10.47$  years,  $SD=1.72$ ) were administered the MSVT and the Revised Children's Manifest Anxiety Scale, 2nd Edition (RCMAS-2), a self-report anxiety measure including a validity index (Defensiveness subscale), as part of a larger neuropsychological battery. The MSVT was scored as pass or fail (raw score < 85 on any of three primary indices was considered failing). The RCMAS-2 was also scored dichotomously with a T-score of 65+ on the Defensiveness subscale considered invalid. A Fisher's exact test and Spearman's rho correlations were used to determine the relationship between MSVT and RCMAS-2 validity scores.

**Results:** 20 patients failed the MSVT, and the majority of these patients (90%) provided valid self-report RCMAS-2 profiles, with only 2 patients (10%) producing an invalid profile. There was not a significant relationship between MSVT and RCMAS-2 scores ( $p=1.00$ , two-tailed Fisher's exact test;  $r^2 < 0.10$ ).

**Conclusions:** Although the present study only examined anxiety SV, findings are consistent with Kirk et al. (2014) and add to the literature that SV and PV tests are unrelated and provide differential, non-overlapping information in children with neurologic disorders.

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**R. LAURENT & J.D. GFELLER. Detecting Feigned ADHD Symptoms in College Students with the Test of Variables of Attention.**

**Objective:** The Test of Variables of Attention (TOVA) is a recognized continuous performance test used primarily as an auxiliary diagnostic tool for assessment of Attention Deficit-Hyperactivity Disorder (ADHD). The latest edition of the TOVA utilizes a Symptom Exaggeration Index (SEI) as an embedded measure of performance validity. The current study examined how well the SEI correctly classified participants as having provided good or poor effort on a brief battery of neuropsychological measures.

**Participants and Methods:** Data were collected from undergraduate research participants which included 27 individuals assigned to an optimal effort group and 24 individuals to a simulated ADHD group. Participants in the simulated ADHD group were coached on symptom presentation of ADHD and asked to perform in such a way as to simulate ADHD symptoms and deficits.

**Results:** Logistic regression was performed to ascertain the likelihood that greater SEI scores could predict group membership. The model explained 42.9% (Nagelkerke R-squared) of the variance in group membership and correctly classified 77.6% of participants. Positive predictive power of the TOVA was 73.9%, while negative predictive power was 80.8%.

**Conclusions:** These findings provide some support for the efficacy of the SEI as an effort indicator embedded in the TOVA. Future research should compare the accuracy of the SEI against other embedded and stand-alone effort indicators.

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**S.M. LIPPA, B.N. AXELROD & R. LANGE. Subjective Memory Problems, Performance Validity Test Failure, and Objective Neurocognitive Performance.**

**Objective:** Patients' cognitive complaints are often considered an important part of neuropsychological evaluations. The current study examines the relationship between self-reported memory problems (SMPs), performance validity test (PVT) failure, and objective cognitive test performance.

**Participants and Methods:** Participants were 321 patients with mixed etiologies (91.0% male; Age:  $M=52.4$ ,  $SD=17.4$ ) from a Department of Veterans Affairs neuropsychology clinic. Participants were divided into two groups based on their SMPs (SMP-Present:  $n=257$ ; SMP-Absent:  $n=64$ ).

**Results:** PVT failure rates were not significantly different between the SMP-Present group (18%) and the SMP-Absent group (10%). Compared to participants in the SMP-Absent group, a similar proportion of the participants in the SMP-Present group had low scores (i.e., >1SD below the mean of the normative sample) on Wechsler Memory Scale-IV (WMS-IV) Logical Memory (LM) and Visual Reproduction (VR) Immediate Recall (IR) and Delayed Recall (DR) and California Verbal Learning Test-II (CVLT-II) Trial 1, Total Recall, and Short and Long Delayed Free Recall. Of participants in the SMPs-Present group, 36-38% had low scores on LM, 46% on VR IR, 60% on VR DR, and 48-65% on each of the CVLT-II measures. Of participants in the SMP-Absent group, 42-43% had low scores on LM, 37% on VR IR, 56% on VR DR, and 47-69% on each of the CVLT-II measures. Logistic regression was used to predict intact ( $\leq 1SD$  below the mean) versus impaired ( $> 1SD$  below the mean) cognitive test performance using FSIQ, SMP, and PVT performance as predictors. Results revealed that FSIQ, but not PVT performance or SMPs, was related to WMS-IV

Delayed Memory Index ( $p < .001$ ;  $\text{Exp}(B) = .938$ ) and CVLT-II Total Recall ( $p < .001$ ;  $\text{Exp}(B) = .941$ ).

**Conclusions:** SMPs do not appear to be associated with objective memory difficulties or failure on PVTs. SMPs or lack thereof are not sufficient for making inferences about a patient's objective memory problems.

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**P. MARTIN, R.W. SCHROEDER, K.A. WYMAN-CHICK, B. HUNTER & R.J. HEINRICH. Does Performance Invalidity Impact the Accuracy of TOPF Word Reading Predictions of Premorbid FSIQ?**

**Objective:** Word reading estimates of premorbid functioning are widely used in neuropsychology as word reading abilities are thought to be relatively resistant to neurologic injury and disease. There is limited research indicating whether such estimates can be interpreted when individuals fail performance validity tests (PVTs); the current study aims to address this gap in the literature.

**Participants and Methods:** Participants were 259 patients referred for neuropsychological evaluation, excluding for dementia, intellectual disability, and left-sided cerebral vascular accident. Participants were placed into one of three groups according to whether they passed all PVTs ( $n=165$ ), failed 1 PVT ( $n=51$ ), or failed 2+ PVTs ( $n=43$ ). ANCOVA's were used to assess for group differences in TOPF word reading predicted FSIQ while controlling for education. Additionally, discrepancies between word reading predicted FSIQ and demographic predicted FSIQ were also compared across the three groups.

**Results:** PVT failure status had a significant effect on word reading predicted FSIQ after controlling for education,  $F(2,255) = 12.48$ ,  $p < .001$ . The adjusted mean predicted FSIQ scores were 101.3, 96.7, and 93.6 for the PVT pass, 1 failure, and 2+ failure groups, respectively. Bonferroni corrected pairwise comparisons revealed that predicted FSIQ scores were significantly lower at  $p < .05$  for both PVT failure groups as compared to the PVT pass group. The discrepancy between word reading and demographic predicted FSIQ also differed between groups ( $p < .001$ ), with the magnitude of the discrepancy being more than three times larger in those failing 2+ PVTs ( $M=9.7$ ) when compared to those passing all PVTs ( $M=3.01$ ).

**Conclusions:** Individuals invalidating neuropsychological testing are likely to underperform on TOPF word reading. Thus, word reading predicted FSIQ estimates should not be interpreted in individuals suspected of performance invalidity. In such individuals, demographically based predictions might provide a more accurate estimate of FSIQ.

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**L. NORDSTROM, C.E. JACKSON, C.B. FORTIER, W.P. MILBERG & R. MCGLINCHEY. Performance Validity Testing Among OEF/OIF/OND Veterans in Research and Clinical Contexts.**

**Objective:** Veterans with possible deployment-related TBI are referred for a Comprehensive TBI Evaluation through the Veterans Health Administration (VHA). Many individuals are subsequently referred for neuropsychological evaluations to further characterize their cognitive functioning. The current study compared measures of cognitive performance as well as measures of performance validity for 19 veterans of Operations Enduring Freedom (OEF), Iraqi Freedom (OIF), and New Dawn (OND) who completed clinical neuropsychological testing and participated in a longitudinal research study.

**Participants and Methods:** Participants included OEF/OIF/OND Veterans enrolled in the Translational Research Center for TBI and Stress Disorders (TRACTS). CVLT-II scores, including Forced Choice (a validity measure) were extracted from veterans' medical records and research data; Recognition Memory Test (RMT) data and Medical Symptom Validity Test (MSVT) were obtained from clinical and research records respectively.

**Results:** The difference in CVLT-II total scores between the clinical and research contexts was not significant, however, mean clinical scores on all four delayed recall measures were significantly lower ( $p < .05$ ) than scores from research. Although there was no significant difference in CVLT-II Forced Choice scores between the research and clinical contexts ( $p = .06$ ), 28.6% of individuals performed below expectation during clinical evaluation, compared to 5.3% during research evaluation ( $n=19$ ). On the RMT, 60.0% performed below expectation based on an empirically validated cutoff (Warrington, 2010) ( $n=15$ ), while 10.5% performed below cutoff on the MSVT during participation in TRACTS ( $n=19$ ).

**Conclusions:** OEF/OIF/OND veterans had lower performance on the CVLT-II within a clinical context, but also exhibited higher rates of failure on stand-alone and embedded performance validity tests compared to a research context. These findings highlight the importance of including performance validity tests during a clinical neuropsychological evaluation.

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**N.J. PASTOREK, R. MARTIN, B. MILLER, J. ROMESSER, A. SIM & J. LINCK. Choice of Performance Validity Test Drastically Alters the Relation between PTSD Diagnosis and Cognitive Testing.**

**Objective:** PTSD is generally considered to have direct effects on cognitive test performance. Studies of PTSD and cognition that have incorporated performance validity tests (PVTs) have arrived at disparate conclusions regarding the presence of these effects after performance invalidity is taken into account. The aim of the current study is to examine the relation between PTSD and cognitive testing before and after excluding for performance invalidity using three different PVTs with widely varying detection rates.

**Participants and Methods:** Participants were drawn from a sample of 257 veterans referred for neuropsychological evaluation secondary to suspected combat-related mild TBI in the Iraq or Afghanistan wars. The final sample consisted of 150 participants (mean age = 31.5 years; 98% male). PTSD was defined as a score of 50 or higher on the PTSD Checklist. PVTs used in the current study were Reliable Digit Span (RDS), Test of Memory Malingering Trial 1 (TOMM1), and the Word Memory Test. Fourteen cognitive variables were derived from 10 standardized measures of processing speed, attention, visuospatial skills, verbal fluency, and executive functioning. PTSD group differences on cognitive testing were analyzed using T-tests.

**Results:** Significant PTSD group differences ( $p < .05$ ) were noted on 9 of 14 cognitive variables prior to exclusion for performance invalidity. The detection rates for the RDS, TOMM1, and WMT were 12.7%, 27.3%, and 47.3%. PTSD group differences were noted on 7, 6, and 0 of the cognitive variables following exclusion for invalidity on the RDS, TOMM1, and WMT, respectively.

**Conclusions:** Notably divergent results were obtained when using different, but well validated, measures of performance validity prior to examining the relation between PTSD and cognition. The results of the current study strongly suggest that use of dissimilar PVTs will likely contribute to contradictory or otherwise inconsistent findings in future research on the relation between cognition and psychiatric disorders.

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**A.N. RABKIN, J.M. KLAVER, E. KRAPF, L.D. STANFORD & D.T. PULSIPHER. Classification Accuracy of an Embedded Forced Choice Measure of Effort in the Rey Auditory Verbal Learning Test Among Youth.**

**Objective:** There is growing interest in the use of stand-alone and embedded performance validity measures as indicators of effort among youth. While a forced choice recognition component in list-learning

tasks is sometimes used as an embedded effort measure among adults, this has not been reported in youth to date. The purpose of this study was to examine the classification accuracy of a newly-developed forced choice recognition component of the Rey Auditory Verbal Learning Test (RAVLT) in clinical evaluations of youth.

**Participants and Methods:** The sample included 320 consecutive clinically-referred youth ( $M=14.1$  years, ages 7-18) who received a neuropsychological evaluation in a medical setting. All included participants completed the Medical Symptom Validity Test (MSVT) and the RAVLT, including a 15-item forced choice recognition component (RAVLT-FC). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were examined using various cut-offs on the RAVLT-FC. Classification functions were also examined by creating subgroups based on referring medical diagnosis such as concussion ( $n=205$ ) and other medical conditions (e.g., epilepsy, cancer/tumor, genetic disorders).

**Results:** Results indicated that a cutoff of 15 (100% correct) on the RAVLT-FC showed adequate sensitivity (94.3%) and PPV (89.8%) with more weak specificity (32.1%) and NPV (47.4%) among the entire sample. A significant decline in specificity occurred using a cut-off of 14 or lower. Similar patterns of adequate sensitivity and PPV with weak sensitivity and NPV were seen across subgroups.

**Conclusions:** The RAVLT-FC is a potentially useful clinical indicator of effort among clinically-referred youth. While it may be useful in evaluating adequate effort, it shows less promise as an indicator of poor effort. The ease of use makes it a relatively simple addition to most neuropsychological test batteries, and it can be used in conjunction with other stand-alone and embedded measures to provide incremental validity.

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#### **K.A. RITCHIE, E. VOGT, J. HOELZLE & E.S. SCHWARTZ. Effectiveness of the Vegas Odds Test in Comparison to Traditional and Embedded Performance Validity Tests.**

**Objective:** The Vegas Odds Test is a recently developed, novel performance validity test based on binomial probability. While preliminary research has documented that the measure effectively differentiates between individuals who put forth sufficient and insufficient effort, it is unknown whether it is as effective as traditional and embedded performance validity tests. This research will compare the Vegas Odds Test with the Victoria Symptom Validity Test (VSVT), WAIS-IV Reliable Digit Span (RDS), and CVLT-II Forced Choice (FC). This will facilitate a greater understanding of the Vegas Odds Test potential clinical utility.

**Participants and Methods:** 51 participants completed an hour long battery. Measures were randomly administered and participants were asked to put forth their best effort ( $n = 25$ ) or feign cognitive symptoms ( $n = 26$ ). Performance differences between groups across measures were investigated.

**Results:** Diagnostic classification varied among the measures. The VSVT displayed the best sensitivity (1.00) and specificity (.84). The Vegas Odds Test ( $Sn = 1.00$ ,  $Sp = .46$ ) was more effective at differentiating groups than the embedded RDS ( $Sn = .96$ ,  $Sp = .38$ ) and CVLT-II FC ( $Sn = 1.00$ ,  $Sp = .13$ ). The Vegas Odds Test correctly classified 73% of the participants, which is less than the VSVT (92%), but greater than embedded effort tasks (RDS = 67%; CVLT FC = 58%).

**Conclusions:** The Vegas Odds Test appears to be more effective at accurately predicting group membership than embedded effort indicators, but is not as effective as the VSVT, a well-validated stand-alone effort measure. While promising, additional research is needed to fully evaluate the Vegas Odds Tests. It is quite possible revisions to the task and directions may improve the effectiveness of the measure.

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#### **M. ROSSETTI, R. COLLINS & M.K. YORK. Performance Validity in Deep Brain Stimulation Candidates.**

**Objective:** Effort and motivation are important factors that influence performance on neuropsychological tests. To date, no one has looked at performance validity tests (PVTs) in a sample of highly motivated individuals who are at risk for developing dementia. Neuropsychological assessments are routinely conducted as part of comprehensive evaluations for candidacy for deep brain stimulation surgery (DBS) with good cognitive performance further endorsing a patient's candidacy. Thus, we can assume that candidates for DBS are motivated to do well and to have a low failure rate on PVTs. This study will investigate effort in Parkinson's disease (PD) and essential tremor (ET) in DBS surgery candidates who are at increased risk for cognitive impairment.

**Participants and Methods:** Thirty DBS candidates underwent neuropsychological evaluation including completion of the Word Memory Test (WMT). The sample consisted of 21 participants with PD and 9 with ET ( $Mage=66$ ). Half of the participants did not meet criteria for a neurocognitive disorder, while 2 subjects were diagnosed with PD-Dementia and 13 were diagnosed with MCI.

**Results:** Using manualized cut scores, a total of 19 DBS candidates earned a WMT pass score, whereas 8 patients obtained scores in the "caution" range, and 3 patients produced failing scores. Two of the three WMT failures met the 30 point Genuine Memory Impairment Profile (GMIP) criteria. Verbal memory performance (learning, short-term, and delayed) was average for the "pass" and "caution" group and mildly impaired for the "fail" group. Depression scores were highest for the "caution" group.

**Conclusions:** This pilot study is the first to describe PVT performance of DBS candidates. Of the 15 patients with cognitive impairment in this group of highly motivated older individuals, only one patient failed the PVT and did not reach the GMIP criteria. Future studies will include a larger sample size and will evaluate the role of mood in PVT performance.

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#### **R.L. STEGMAN & W.R. COLE. Equal versus Separate Distributions of Neuropsychological Data Relative to Numbers of Performance Validity Measures.**

**Objective:** Performance validity measures (PVMs) in neuropsychological (NP) assessments are standard of care for determining credibility of psychometric data. Per literature, guidelines for the interpretation of positive PVMs are: 1 is possible, 2 is probable, and 3 or more is definite noncredible data. Dissent, reflected in the literature as well, is a concern of a Monte Carlo effect: the more PVMs administered, the greater the probability of chance positive results. Using a combination of statistical significance and Cohen's  $d$ , examiners tested two hypotheses:

1. There are separate NP score distributions relative to the number of positive PVMs.
2. There is a Monte Carlo effect.

**Participants and Methods:** The data from 154 consecutive comprehensive NP assessments administered in a military clinical setting were analyzed. They were heterogeneous with regard to severity of injuries and purposes for a comprehensive assessment. Each had been administered 8 to 10 established PVMs as part of a comprehensive assessment.

**Results:** Number of positive PVMs ranged from 0 to 9 with 1 positive PVM as the mode. Those with 5 or more positive PVMs did not differ significantly and were grouped as 5+. Distribution: 0 = 16%, 1 = 23%, 2 = 17%, 3 = 12%, 4 = 8% and 5+ = 24%. The average Cohen's  $d$ : 0 v 1 = 0.187, 0 v 2 = 0.361, 0 v 3 = 0.518, 0 v 4 = 0.872, and 0 v 5+ = 1.252.

**Conclusions:** Hypotheses 1: There is a clear pattern of emerging separate distributions of data related to the number of positive PVMs. Hypothesis 2: There is a limited Monte Carlo effect. Distributions of 0 and 1 PVM groups are almost identical. 2 and 3 positive PVMs groups are heterogeneous. Separate distributions are not apparent until 4 or 5 positive PVMs. Results indicate 4+ positive PVMs is definite noncredible, reveal

a need for critical thinking with 2 or 3 positive PVMs, and emphasize the need for multiple and varied PVMs throughout a NP assessment.

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**S.E. TOLFO, H. HOUSTON, M.A. TEAFORD, A. KRIVENKO & A.M. POREH. Base Rate and Norms for the Embedded Rey Auditory Learning Test in Samples of Patients Suspected of Dementia, Forensic Patients, Simulators, and Normal Control.**

**Objective:** The present study examined the base-rate and norms of the Rey Auditory Learning Test Performance Rey Validity Indicator (RAVLT-VI) in several samples.

**Participants and Methods:** Participants were patients referred for screening of dementia subdivided into mild, moderate, and severe impairment based on the St. Louis Mental Status Exam. Four categories of participants consisted of a sample of forensic patients identified as not exhibiting adequate effort (N=28), a sample of college students who were instructed to simulate PTSD (N=34), and a sample of normal control in a random sample (N=198).

**Results:** Using specificity and sensitivity analysis, the data shows that unlike the RAVLT-FCR (Forced Choice Recognition Index), the RAVLT-VI is more likely to identify individuals with poor effort, high sensitivity, but is also likely to misidentify some individuals who are not exhibiting poor effort, particularly among older adult patients (low specificity).

**Conclusions:** The limitations and benefits of utilizing the RAVLT-FCR and RAVLT-VI are discussed.

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**K. WHEARTY, E. DICKINSON, A. MARTINI, K.H. FROST & G.P. STRAUSS. Evaluation of the Validity of the Reliable Spatial Span as an Effort Index on the MATRICS Consensus Cognitive Battery in Schizophrenia.**

**Objective:** Past studies have indicated a wide range of neuropsychological effort test failure rates in patients with psychotic disorders on free-standing and embedded effort tests. Increased failure rate has been associated with greater severity of negative symptoms and lower IQ. It has yet to be determined whether an effort index can be derived from the gold standard neuropsychological test battery, the MATRICS Consensus Cognitive Battery (MCCB). This study aimed to test validity of such an index – the Reliable Spatial Span (RSS), calculated from the spatial span subtest of the MCCB.

**Participants and Methods:** Participants included 30 outpatients with schizophrenia (SZ) and 33 demographically-matched healthy controls (CN) who received the MCCB. A measure of insufficient effort was derived from the MCCB Spatial Span subtest by calculating the RSS.

**Results:** A total of 30% SZ and 3% CN fell below the RSS effort index cut-off. SZ who failed differed from SZ who passed only on a visual memory subtest and the spatial span subtest. However, there were no differences between patients who passed and failed the effort index on measures of processing speed, executive functioning, attention, social cognition, or verbal memory. There was also no association with clinically rated negative symptoms, including avolition.

**Conclusions:** These findings question the validity of the RSS as an effort index on the MCCB. Results suggest that the RSS may be tapping into true cognitive deficits rather than effort in SZ.

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**D. WHITESIDE, H. LUU, M. MILLER, O. GAASEDELEN, L. RICE & M.R. BASSO. Cross Validation of a Cross-Domain Logistically Derived Performance Validity Test in a Psychiatric Sample.**

**Objective:** Combining individual performance validity tests (PVT) using logistic regression has received increasing empirical attention recently as methodology for developing difficult to coach embedded PVTs (Miller et al., 2011; Wolfe, et al., 2010). Whiteside et al., (2015) extended this methodology by using cross-domain measures to create a logistically derived PVT (CLEP). The current study evaluated the replicability of this PVT in a sample of non-neurological psychiatric patients. The Whiteside et al., (2015) CLEP used measures from multiple domains, including verbal memory (the California Verbal Learning Test-II Trial 5 [CVLT-T5], Total Hits [CVLT-TH], and False Positives [CVLT-FP]), attention (Brief Test of Attention [BTA]), and language (Boston Naming Test [BNT], and Animal Fluency [AF]), and had excellent classification accuracy.

**Participants and Methods:** Participants included 146 consecutive referrals who completed all measures and were diagnosed with a depressive or anxiety disorder and no history of neurocognitive, neurodevelopmental, or substance use disorders. The FAILPVT group included patients who failed >2 free-standing or embedded PVTs (N=14) while the PASSPVT group included participants who passed all PVTs (N=121). MANOVA and ROC analyses were conducted to determine group differences and classification accuracy.

**Results:** MANOVA and post-hoc analyses indicated that the FAILPVT group performed significantly lower on CVLT-TH, CVLT\_FP, and the CLEP compared to the PASSPVT group. On ROC analysis, CVLT-TH (AUC=.73) and BNT (AUC=.73) had adequate classification accuracy, while CLEP had slightly higher classification accuracy (AUC=.79).

**Conclusions:** The CLEP AUC was slightly lower than in the original sample but continued to demonstrate improved classification accuracy over individual embedded PVTs.

The results indicated that the CLEP variable could be replicated in a different, non-neurologically impaired, sample and support the use of this logistical-derived PVT.

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## Multiple Sclerosis/ALS/Demyelinating Disorders

**V. CHAVARRO, A. LACHETA, F. PACHE, J. BELLMANN-STROBL, F. PAUL & A. BRANDT. Cognition, Fatigue And Depression in Neuromyelitis Optica Patients.**

**Objective:** Neuromyelitis Optica (NMO) is a neuro-inflammatory disease affecting the optic nerve and spinal cord, which was recently described to have a distinct etiology from Multiple Sclerosis. Cognition, fatigue and depression within Caucasian populations with NMO are not yet well understood. Our objective was to investigate cognitive performance and its relation to fatigue and depression in patients diagnosed with NMO.

**Participants and Methods:** We conducted a cross-sectional observational study including 26 patients with NMO and 25 age and sex matched healthy controls. Cognitive performance was evaluated with the Brief Repeatable Battery of Neuropsychological Tests (BRB-N). Participants also completed the Fatigue Severity Scale (FSS) and the Beck Depression Inventory (BDI). We compared performance of patients and healthy controls on individual cognitive domains of the BRB-N and tested its association with FSS and BDI scores.

**Results:** Our data show that depression and fatigue are more prevalent in NMO patients compared to controls (BDI>19: 46% versus 4%, p=.001; FSS>4: 54% versus 12%, p=.002, respectively). NMO patients had significantly lower performance on Attention and Concentration (z-score diff.=.594, p=.04), which remained marginally significant for Executive Function (z-score diff.=.607, p=.09) and the total BRB-N



scores ( $z$ -score diff.=.569,  $p=.06$ ). When sub-scores of BRB-N were adjusted for fatigue and depression, we did not observe a significant effect of group on adjusted BRB-N scores.

**Conclusions:** NMO patients suffer from comorbid depression and fatigue. In addition, they exhibit lower cognitive performance within the domain of attention and concentration. However, our subsequent analyses imply that these differences may be at least partially accounted for by levels of fatigue and depression, suggesting that treating fatigue or depression may improve cognitive performance in NMO patients.

**M. CLEM, A. FAYAD, L. MCCOWEN, B. GREENBERG & L. HARDER. Premorbid Cognitive Problems in Pediatric Multiple Sclerosis: Could grade retention be an early sign?**

**Objective:** The present study compared historical data of educational problems in pediatric patients diagnosed with multiple sclerosis (MS). Since MS is a demyelinating disease that affects the brain and spinal cord pediatric transverse myelitis (TM) patients, with pathology in the spinal cord only, were included as a comparison group. Given brain-based pathology, it was hypothesized that MS patients would have more early educational problems compared to TM.

**Participants and Methods:** Parents of 46 pediatric MS and 41 pediatric TM patients reported Early Educational Services (EES; i.e., Early Childhood Intervention/Preschool Program for Children with Disabilities), grade retention, suspension and utilization of special education services.

**Results:** Chi-squared and independent  $t$ -tests indicated no significant group differences for gender, ethnicity or race. However, TM patients were younger at initial visit ( $p < .01$ ) and reported to have utilized significantly more EES ( $p < .05$ ), while the MS group was reported to have significantly more grade retention ( $p < .05$ ). Chart review revealed that within the TM group, EES did not predate diagnosis; however 89% of grade retentions predated diagnosis in MS patients.

**Conclusions:** The hypothesis was partially supported, as TM patients utilized more EES; however, the MS group had significantly more grade retentions, most of which predated the actual diagnosis. Research has shown that the national average of grade retentions in elementary school ranges from 3-5%, which is well below the incidence rate in the MS sample (18%). Present findings suggest that there may be an association between historical educational issues and later diagnosis of MS. This may be indicative of early signs of cognitive dysfunction prior to diagnosis of MS.

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**A. FAYAD, M. CLEM, L. MCCOWEN, B. GREENBERG & L. HARDER. Fatigue, Sleep, Quality of Life and Academic Functioning in Pediatric Multiple Sclerosis (MS).**

**Objective:** Multiple Sclerosis (MS) is an autoimmune disorder typically diagnosed in adults; however, 2-5% of patients with MS experience their first symptoms before age 18. Although many attempts have been made to assess fatigue and sleep disturbances in adults with MS, little is known about such problems in pediatric MS patients. Furthermore, existing research has revealed inconsistent findings. The purpose of this study was to determine if pediatric MS patients report significantly more fatigue, as well as disturbances in quality of life and sleep, compared to a normative sample. Study aims also include evaluation of the relationship between these factors and academic functioning.

**Participants and Methods:** Forty-five MS participants, ages 8 to 18 years (mean=15.2), completed the Pediatric Quality of Life Inventory and the Multidimensional Fatigue Scale. Information on academic functioning was provided by caregivers. Participants were divided into two groups based on level of school problems (history of retention, special education enrollment, poor grades).

**Results:** One-sample  $t$ -tests revealed statistically significant differences in pediatric MS patients from the population mean ( $p < 0.05$ ) for general

fatigue, sleep/rest fatigue, cognitive fatigue, as well as physical, emotional, social, and school functioning. One-way ANOVA revealed statistically significant differences between school problems and no school problems groups on self-report emotional  $F(1,41) = 4.51$ ;  $p < .05$  and social functioning  $F(1,41) = 4.19$ ;  $p < .05$ .

**Conclusions:** Results indicate pediatric MS patients are at risk for problems with fatigue and quality of life. Findings suggest a relationship between academic functioning and social-emotional functioning. Results highlight the need for a multi-disciplinary approach in the care of pediatric MS patients and regular surveillance of psychosocial functioning. Additionally, results suggest potential opportunities for intervention and further research.

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**A. FAYAD, A. TAN, B. GREENBERG & L. HARDER. Impact of Fatigue, Sleep and Quality of Life on Cognition in Pediatric Multiple Sclerosis (MS).**

**Objective:** Fatigue and sleep problems are commonly reported symptoms associated with multiple sclerosis (MS). Although not as thoroughly studied in pediatric MS, adult patients with MS report increased fatigue, which is associated with poor cognitive performance. Additionally, sleep difficulties are associated with diminished quality of life and are reported to independently predict mental and physical well-being in adults with MS. Existing research suggests individuals with pediatric MS experience many of these symptoms, but investigation of the relation between these variables remains limited. This study assesses the association between measures of fatigue, sleep, and quality of life and cognitive performance in pediatric MS.

**Participants and Methods:** Forty-five MS participants, ages 8 to 18 years (mean=15.2), and their caregivers completed the Pediatric Quality of Life Inventory and the Multidimensional Fatigue Scale. Participants also completed a brief neuropsychological screening battery as part of their multi-disciplinary clinic visit.

**Results:** Caregiver and self-report cognitive fatigue, and physical and emotional quality of life were positively correlated with verbal memory ( $p < .05$ ). Caregiver report of social and physical quality of life were also positively correlated with processing speed and visual-motor integration ( $p < .05$ ). Multiple regression revealed that self-report cognitive fatigue significantly predicted verbal memory scores ( $p < .05$ ). Furthermore, parent and self-report sleep/rest fatigue significantly predicted information processing speed ( $p < .05$ ) and verbal memory scores ( $p < .05$ ).

**Conclusions:** Results show an association between fatigue and quality of life variables, and cognitive functioning that is generally consistent with what is known about adult MS. In addition, these findings warrant further investigation on the impact of intervention to address cognitive fatigue and sleep to determine if such intervention will improve cognitive functioning in pediatric MS.

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**V.M. LEAVITT, C.S. RILEY, U. NOCENTINI, G. TOSTO, O. ARGENTO, V. PISANI & J.F. SUMOWSKI. Warmer Body Temperature is Associated with Better Cognitive Efficiency in Relapsing-Remitting Multiple Sclerosis: A Multi-Center Study.**

**Objective:** In 1938, Nathaniel Kleitman proposed that warmer body temperature in healthy individuals enhances cognitive performance by leading to increased metabolic activity of cells in the cerebral cortex thereby increasing speed of thinking. Having recently provided the first-ever report of elevated body temperature in patients with relapsing-remitting multiple sclerosis (RRMS), we propose this clinical sample as a natural in vivo model in which to observe the relationship of endogenously elevated body temperature to cognitive performance. Here, we

investigate the relationship of body temperature to cognitive efficiency in three samples of RRMS patients.

**Participants and Methods:** RRMS patients from 3 sites served: New York (n=26), New Jersey (n=82), and Rome, Italy (n=25). Body temperature was measured with an infrared aural thermometer. Mean body temperature for each sample was elevated relative to published data for healthy individuals (98.2°F): NY, 98.7°F; NJ, 98.4°F; Rome, 98.4°F. Cognitive efficiency was measured with the Symbol Digit Modalities Test (SDMT; age-adjusted scores were used). For each sample, we examined partial correlations (controlling for age) of body temperature and cognitive efficiency.

**Results:** Warmer body temperature was associated with better cognitive efficiency in each sample; R-values were .401 (NY), .317 (NJ), and .405 (Rome).

**Conclusions:** Our findings suggest a relationship of warmer body temperature and enhanced cognitive efficiency. They also highlight the distinction between benefits of elevated body temperature and the detrimental effect of exogenous heat stress on cognitive performance that has been demonstrated in healthy humans and in MS patients (i.e., Uthoff's phenomenon), including our own work showing an association of warmer outdoor temperature to worse cognitive performance in MS patients. Future work is needed to delineate this endogenous/exogenous distinction of heat's impact on cognition.

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**J. RANDOLPH, J. RANDOLPH, M. BOSHART & H. WISHART. Association between Cognitive Complaints and Vulnerability to Environmental Distraction in Multiple Sclerosis.**

**Objective:** Individuals with multiple sclerosis often report cognitive complaints, although neuropsychological testing may not correlate with subjective concerns. One factor that may explain this lack of correspondence is the controlled testing environment, which differs from busier settings where cognitive lapses are noted to occur. The present study used a novel environmental manipulation to determine whether individuals with MS who report cognitive dysfunction are more vulnerable to the effects of auditory distraction during neuropsychological testing.

**Participants and Methods:** Twenty individuals with clinically definite MS and two with clinically isolated syndrome were administered a cognitive battery during two counterbalanced auditory conditions: 1) quiet/standard condition, and 2) distraction condition with random office background noise. Participants were divided into age-matched high vs. low cognitive complaint groups using a median split analysis of Perceived Deficits Questionnaire responses. Mean difference scores were computed to determine the effects of quiet vs. noisy auditory conditions on performance.

**Results:** Participants with more cognitive complaints showed a decrement in performance on the oral SDMT during the distraction condition (average of 6 fewer completed items), whereas those with fewer cognitive complaints demonstrated stable performance across conditions (average difference of < 1 item;  $p < .05$ ). These findings remained significant after controlling for education, premorbid intellect, fatigue, and depressed mood. Complaint group comparisons for other measures were not significant, although a trend was noted for the SDMT written trial.

**Conclusions:** These findings suggest that individuals with MS with cognitive complaints are vulnerable to environmental distraction, particularly regarding cognitive efficiency. Incorporating random environmental noise during testing may enhance the ecological validity of neuropsychological evaluation results with MS and possibly other patients. Correspondence: *John Randolph, Ph.D., Psychiatry, Geisel School of Medicine at Dartmouth, 20 W. Park Street, Suite 215, Lebanon, NH 03766. E-mail: john.randolph@randolphnp.com*

**C.A. ROMAN, N.V. GARCIA & P. ARNETT. Structural Correlates of Emotion Processing in Multiple Sclerosis.**

**Objective:** Affective processes, such as emotion processing, have been shown to be impaired in multiple sclerosis (MS). These deficits are thought to emerge, in part, from the degradation of frontoparietal and subcortical regions, such as the parietal and frontal cortices, and the hippocampus, amygdala, cingulate gyrus. Therefore, the current study aims to examine the relationship between these areas and performance on an affective face processing task.

**Participants and Methods:** Thirty-eight individuals with MS (13m, 25f) were scanned during a functional and structural neuroimaging protocol. Behavioral data were collected during an emotion processing task known to evoke robust responses in cortico-subcortical regions (described in Passamonti et al., 2009). Participants were asked to complete six neutral blocks (i.e., shape matching) and six emotion blocks (i.e., face-affect matching). Accuracy and reaction time (RT) were calculated for each condition. High-resolution T1-weighted scans were also acquired and processed using FreeSurfer to obtain volumetric values for the hippocampus, amygdala, anterior cingulate, as well as cortical thickness values for the superior parietal and superior frontal areas.

**Results:** Multiple regression analyses were conducted controlling for sex and intracranial volume. Significant relationships (at least  $p < .05$ ) were found between emotion-associated variables (i.e., number of correctly-matched emotions and RT) and the left and right hippocampi, right amygdala volumes, and left superior parietal cortex, such that larger volume and thickness were associated with a greater number of correct responses and faster RT.

**Conclusions:** This is one of the first studies to examine the relationship between affective-associated brain areas and emotion processing in MS. These data point to the role of subcortical and parietal areas in emotion processing in MS. Future research should examine the role of depression in these relationships.

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**B.M. SANDROFF, C.H. HILLMAN, R.H. BENEDICT & R.W. MOTL. Acute Effects of Varying Intensities of Treadmill Walking Exercise on Cognition in Persons with Multiple Sclerosis.**

**Objective:** Exercise training represents a promising approach for managing cognitive impairment in persons with multiple sclerosis (MS). There is preliminary evidence that treadmill walking might be the modality of exercise that exerts the greatest beneficial effects on inhibitory control in fully-ambulatory persons with MS. However, the dose-dependent effects of varying intensities of treadmill walking exercise on this cognitive function are unknown. Such an investigation is critical for better delineating the optimal exercise stimulus for improving inhibitory control in MS.

**Participants and Methods:** The present study compared the acute effects of light, moderate, and vigorous intensity treadmill walking exercise on inhibitory control (i.e., interference control) relative to quiet rest in 24 fully-ambulatory persons with MS, using a within-subjects, repeated-measures experimental design. Participants completed 4 experimental conditions that consisted of 20 minutes of light, moderate, and vigorous intensity treadmill walking exercise, and quiet rest in a randomized, counterbalanced order. Participants underwent a modified flanker task as a measure of inhibitory control immediately prior to and following each condition.

**Results:** Repeated-measures ANOVAs indicated large, statistically significant reductions in the cost of interfering stimuli on reaction time, but not accuracy, on the modified flanker task for light, moderate, and vigorous intensity exercise compared with quiet rest ( $F(3,69)=4.27, p=.01, \eta^2=.16$ ). There were no differences in magnitude of reduction across the three exercise intensities.

**Conclusions:** The present results support light, moderate, and vigorous intensity treadmill walking as exercise stimuli that might particularly benefit interference control of reaction time. This represents the next

step in delineating the optimal exercise stimuli for improving this cognitive function in fully-ambulatory persons with MS, and perhaps is important for informing a subsequent longitudinal exercise training intervention.

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**L. SEGALÀ, S.R. DELGADO, K. RAMMOHAN, M.R. ORTEGA, M. HOFFMAN, J. ROOKS, N. SUN-SUSLOW, H.L. SCHNEIDER, M. FORTE & B.E. LEVIN. The Effects of Dispositional Optimism on Cognition in Multiple Sclerosis.**

**Objective:** Prevalent non-motor changes in multiple sclerosis (MS) include executive dysfunction, chronic fatigue, depression and anxiety. It is possible that one's sense of hopefulness and well-being plays an important role in cognition and emotional function. The purpose of this study was to examine the relationship between self-reported optimism and executive function in MS.

**Participants and Methods:** Forty one patients (28% males) with confirmed MS participated in this study. Participants were administered a small battery assessing depression (BDI-II), anxiety (BAI), fatigue (MFIS), general optimism (LOT-R), executive function (D-KEFS Sorting) and attentional processing (PASAT).

**Results:** Linear regression analyses revealed that responses on the LOT-R, a measure of dispositional optimism, predicted a greater number of correct sorts on the D-KEFS Sorting test, and a higher percentage of correct responses on the PASAT. The LOT-R predicted performance on the D-KEFS Sorting test even after controlling for level of disability (EDSS). No relationship was found between measures of fatigue, depression, or anxiety and the cognitive tasks.

**Conclusions:** Self-reported dispositional optimism, but not mood, fatigue, or anxiety, predicts cognitive functioning among MS patients. While depression, anxiety, and fatigue are linked to quality of life and cognitive performance, the current finding highlights the importance of measuring positive outcome expectancies, as they may have unique, important implications for healthy cognitive functioning.

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**J.F. SUMOWSKI, M.A. ROCCA, V.M. LEAVITT, G. RICCITELLI, A. MEANI, G. COMI & M. FILIPPI. Reading, Writing, and Reserve: Literacy Activities are linked to Hippocampal Volume and Memory in Multiple Sclerosis.**

**Objective:** The cognitive reserve hypothesis posits that persons who engage in mentally-stimulating lifestyles are at lower risk for subsequent disease-related memory decline. Among persons with multiple sclerosis (MS), we have linked engagement in cognitive activities (e.g., reading, hobbies) during early adulthood to (a) lower risk for memory decline and (b) larger hippocampal volume, which may represent a neuroanatomical basis for reserve. We now investigate which types of cognitive activity are most beneficial.

**Participants and Methods:** MS patients from Italy (n=187) and the United States (n=55) reported on early adult engagement in three types of cognitive activities: reading-writing, art-music, games-hobbies. Patients underwent 3.0T MRIs to quantify hippocampal volume. In each sample, stepwise regression (entry  $p=.05$ , removal  $p=.10$ ) predicted hippocampal volume with the three types of cognitive activity, controlling for demographics (including education). Memory was evaluated in representative subsamples of Italian patients (n=97) with the SRT and SPART, and American patients (n=53) with the SRT and BVMT-R. The same regression was performed to predict memory in each sample.

**Results:** Greater engagement in reading-writing during early adulthood was linked to larger hippocampal volume in Italian ( $rp=.240$ ,  $p=.001$ ) and American ( $rp=.332$ ,  $p=.018$ ) samples. Art-music and games-hobbies did not contribute. Similarly, greater engagement in reading-writing was linked to preserved memory in Italian ( $rp=.245$ ,  $p=.019$ ) and

American ( $rp=.270$ ,  $p=.063$ ) samples. Art-music and games-hobbies made little-to-no contribution.

**Conclusions:** Engagement in reading-writing activities during early adulthood was linked to larger current hippocampal volume and preserved memory. Findings inform the development of targeted evidence-based enrichment programs aiming to bolster reserve against memory decline, which may provide causal evidence that cognitive reserve can be bolstered among persons with neurologic disease.

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**C. TILL, M. SADEGHI, A. NOGUERA, J. O'MAHONY, A.E. YEH & B.L. BANWELL. Age at onset predicts working memory following acute demyelinating syndrome in children.**

**Objective:** Acute demyelinating syndrome (ADS) may occur as a transient illness or, in approximately 25% of patients, it represents the first attack of multiple sclerosis (MS). Cognitive dysfunction can occur following CNS demyelination, with higher risk among children with MS as compared with monophasic ADS (monoADS). Younger age at onset may increase vulnerability to executive dysfunction due to interference to normal CNS development. This study examined the relationship between age at incident demyelinating attack and working memory (WM) in pediatric patients with monoADS and MS.

**Participants and Methods:** Participants included 42 patients with ADS (monoADS: n = 30; MS: n = 12) aged 6-17 (mean=12.6 ± 3.3 yrs). WM was assessed using the Numbers Reversed and Auditory WM subtests from the Woodcock-Johnson Tests of Cognitive Abilities. IQ was assessed using the WASI. The association between age at ADS onset (range 3.7-15.8 yrs) and WM was investigated using Spearman correlation.

**Results:** Patients with MS had an older age at onset (13.0 ± 2.4 yrs) as compared with the monoADS group (9.9 ± 3.3 yrs). Testing was conducted 19.0 ± 9.4 months from time of incident event in the monoADS group and 20.7 ± 6.7 months in the MS group. IQ did not differ between groups. Below average (<15th percentile) performance on either WM test was demonstrated among 3/12 MS patients (25%) versus none of the patients with monoADS ( $X^2 = 8.1$ ,  $p<.005$ ). Contrary to our hypothesis, older age at onset correlated with worse performance on the Auditory WM subtest in both the MS ( $r = -.63$ ,  $p = .019$ ) and monoADS ( $r = -.34$ ,  $p = .04$ ) groups. The same trend was observed for the Numbers Reversed subtest, but did not reach significance.

**Conclusions:** Poorer WM performance was observed among patients with MS relative to monoADS. Older age at incident demyelinating event correlated with worse WM. Whether this finding is due to maturational or structural differences associated with age at disease onset should be explored.

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**J. ZAMZOW, J.D. KLOSS, E. CULNAN & M.T. SCHULTHEIS. The Association Between Sleep Disorder Symptoms and Cognitive Function in Relapsing-Remitting Multiple Sclerosis.**

**Objective:** Individuals with multiple sclerosis (MS) experience a high rate of sleep disorders, which have been negatively associated with cognitive function in the general population. This study may identify potential targets for intervention aimed at improving cognitive function in MS.

**Participants and Methods:** 41 individuals with relapsing-remitting (RR) MS were administered the Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), the STOP BANG questionnaire for sleep apnea and Global Sleep Assessment Questionnaire (GSAQ) for restless legs syndrome (RLS) and periodic limb movement disorder (PLMD). Participants also completed tasks assessing attention (DKEFS trails: sequencing), set-shifting (DKEFS trails: switching) inhibition (Stroop), working memory (PASAT, N-Back), processing speed (symbol digit

modality test [SDMT]), verbal fluency (COWAT) and verbal memory (Selective Reminding Test).

**Results:** Preliminary analyses revealed ISI was associated with working memory (PASAT,  $r = -.30$ ,  $p = .04$ ). ESS correlated with working memory (PASAT,  $r = -.44$ ,  $p < .01$ ) and attention (DKEFS,  $r = -.36$ ,  $p = .01$ ). STOP BANG was associated with processing speed (SDMT,  $r = -.31$ ,  $p = .03$ ) and working memory (PASAT,  $r = -.50$ ,  $p < .01$ , NBACK  $r = -.64$ ,  $p < .01$ ). RLS and PLMD symptoms were associated with processing speed (SDMT  $r = -.54$ ,  $p < .01$ ) working memory (PASAT,  $r = -.38$ ,  $p = .01$ , NBACK  $r = -.40$ ,  $p < .01$ ), semantic fluency ( $r = -.35$ ,  $p = .02$ ) and attention (DKEFS sequencing,  $r = .37$ ,  $p = .01$ ). All correlations reflected poorer performance associated with greater sleep disorder symptomology. There were no significant associations between symptoms of sleep disorders and verbal memory, inhibition, or set-shifting.

**Conclusions:** Among individuals with RR-MS, sleep disorder symptoms were associated with compromised attention, verbal fluency, processing speed and working memory. Sleep disorders are treatable and may serve as a modifiable risk factor for cognitive impairment in MS.

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#### **M.D. ZUPPICHINI, H.M. GENOVA & J. SANDRY. Structural White Matter Differences related to Learning and Memory Impairment in Multiple Sclerosis: An Exploratory DTI Analysis.**

**Objective:** Learning and memory impairment is common in multiple sclerosis (MS). This study aimed to (1) replicate recent research suggesting that working memory capacity (WMC) is related to learning and memory impairment in MS and (2) use diffusion tensor imaging to investigate differences between white matter tracts in MS participants with and without memory impairment. Based on past research we hypothesized that memory-impaired participant's would show greater diffusion in white matter tracts that have been correlated with verbal working memory, including the left superior longitudinal fasciculus (SLF) frontal-parietal white matter tract.

**Participants and Methods:** 31 MS and 20 healthy control (HC) participants with neuropsychological tests and structural neuroimaging scans. WMC was estimated using Digit Span Total and Letter Number Sequencing. Memory-impairment was defined as scoring 1 or more standard deviations below the HC mean on the number of trials to criterion on the Open-Trial Selective Reminding Test (OT-SRT). Fractional anisotropy (FA) was calculated using tract-based spatial statistics in FSL. White matter differences were analyzed using a 3D t-test in AFNI.

**Results:** WMC was negatively correlated with the OT-SRT for MS participants ( $r = -0.53$ ,  $p < .05$ ) but not for HCs ( $p = n.s.$ ). Memory-impaired MS participants had lower FA values (higher diffusion) in the left SLF as well as the corticospinal tract, forceps major, forceps minor, and the right anterior thalamic radiation

**Conclusions:** WMC was related to learning and memory in MS but not in HCs. Memory-impaired MS participants had lower FA (higher diffusion) in the SLF, which has been implicated in working memory. These findings provide corroboratory structural neuroimaging evidence that disconnectivity in white matter tracts related to working memory may contribute to learning and memory-impairment in MS

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#### **Cognitive Intervention/Rehabilitation**

#### **T.F. BERGQUIST, D. KLUNK, C. GREEN, K. KRISHNAN & A. BROWN. Relationship between Injury Severity and Outcome in Adults with Traumatic Brain Injury (TBI) Receiving Post-Acute Rehabilitation.**

**Objective:** Analyze association between injury severity and outcome in adults with traumatic brain injury (TBI) undergoing post-acute brain rehabilitation.

**Participants and Methods:** Participants were 56 patients receiving post-acute rehabilitation after TBI. Mean age=46.68 years, SD=16.71; 52% male. Using the Mayo Classification System for TBI severity, 59% were classified as Definite, 25% as Probable, and 16% as Possible. Patients classified as Probable/Possible were grouped together to create two similarly sized samples. All patients completed the Participation Index from the Mayo-Portland Adaptability Index (M2PI), Patient Health Questionnaire (PHQ-9), and Satisfaction with Life Scale (SWLS) at admission and dismissal.

**Results:** Over the course of treatment the M2PI, SWLS, and PHQ-9 improved significantly ( $p < 0.001$ ;  $p < 0.028$ ;  $p < 0.001$ ) for all patients in this study. When broken down by injury severity, there were no significant differences between SWLS scores over time for patients in Definite or Probable/Possible classifications, but patients in both groups scored significantly lower on the M2PI ( $p < 0.001$ ;  $p < 0.003$ ) and PHQ-9 ( $p < 0.024$ ;  $p < 0.011$ ) at dismissal. Definite TBI patients showed greater improvement on the M2PI, whereas Probable/Possible TBI patients showed greater improvement on SWLS and PHQ-9.

**Conclusions:** There was significant improvement in functioning, life satisfaction, and mood following rehabilitation in all severity groups. Patients with Definite TBI reported greater functional improvement while patients with Probable/Possible TBI reported increased life satisfaction and fewer depressive symptoms at dismissal. Greater levels of participation restrictions on the M2PI at admission in the definite TBI group and more depressive symptoms and lower life satisfaction at admission in the Probable/Possible group allow more room for improvement in these areas respectively.

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#### **F.E. RAMIREZ & N. NEDLEY. Use of oral lavender oil for anxiety in a depression medical residential program.**

**Objective:** Evaluate the effectiveness of lavender oil during a 10 day intensive medical depression and anxiety program.

**Participants and Methods:** Data was collected from 368 patients that finished the 10 day program. The 10-program took place in Oklahoma and California, interventions included medical, nutritional, exercise physiologist, psychology and spiritual. From the 368, 30 patients with severe anxiety were selected to use lavender oil up to 3 times a day PRN. The average age of participants was 43 SD 16.5. Participants came from 11 countries, 80% Caucasian, 3.5% African American, 2% Asian, 4% blacks from the Caribbean, 8% Hispanics, .5% native Americans. Standardized depression and anxiety tests were applied at baseline and at the end of the 10 days.

**Results:** From the 30 patients that took lavender oil, average Beck Anxiety Inventory (BAI) at baseline was 23.5 SD 12.9, by the end of the 10 days average BAI was 10.5 SD 6.8. From the 337 that didn't take the lavender oil at baseline, mean BAI was 16.4 SD 10.4 by the end of the 10 days mean BAI was 6.5 SD 6.5.

**Conclusions:** Lavender oil seems to be effective in decreasing anxiety in severe anxiety cases. Some patients reported gastrointestinal reflux while using it. More cases should be documented.

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## Dementia (Alzheimer's Disease)

### A.M. BRYANT & J. SUHR. Family History of Alzheimer's Disease Predicts Performance on Executive Functioning Measures in Cognitively Intact Adults.

**Objective:** Alzheimer's Disease (AD) affects more than 5.2 million Americans. As the population continues to live longer, early diagnosis becomes increasingly important. Focus on memory decline remains at the forefront of AD research; however, other cognitive domains, such as executive functioning (EF) may be of diagnostic utility. Previous research has demonstrated EF tests are sensitive at differentiating healthy controls from those with AD, and a recent study showed that healthy older adults with a family history (FH) of AD performed worse on the Wisconsin Card Sorting Test. The purpose of the present study was to examine whether healthy older adults with a FH of AD performed worse on other EF measures.

**Participants and Methods:** Participants were healthy, cognitively intact older adults (39% male, 60-87 years old, average college educated) with a first-degree FH of AD ( $n = 14$ ) or no known FH of AD ( $n = 43$ ). All were participants in a larger study of cognitive correlates of driving. EF measures included Semantic Fluency, Coding, Trail Making Test B (TMT-B), Matrix Reasoning (MR), DKEFS Color-Word Interference Task, and N-Back.

**Results:** There were no significant differences between groups on gender, age, or years of education (all  $p$ 's  $> .05$ ). Several hierarchical linear regressions were conducted with performance on EF measures as the dependent variable on Step 2, while controlling for age, sex, and years of education on Step 1. Family History accounted for significant variance in performance on TMT-B ( $\beta = .341, p = .003, \Delta R^2 = .114$ ) and MR ( $\beta = -.301, p = .019, \Delta R^2 = .090$ ); however, FH did not account for significant variance on all other EF measures.

**Conclusions:** These results demonstrate measurable EF performance differences in cognitively intact older adults with a first-degree FH of AD and those without a FH of AD. As such, EF measures may be of clinical utility for early detection of AD. Memory decline remains the hallmark symptom of AD, yet given its insidious onset, other sensitive tests should continue to be researched.

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### H. CHANG, Y. LIN, Y. LAI, M. CHIU, T. CHENG, T. CHEN & M. HUA. Content- and Context-Component Memory Task Performance in Elderly Individuals with Subjective Cognitive Decline.

**Objective:** The issues of whether the manifestation of subjective cognitive/memory decline (SCD/SMD) deserves one of the diagnostic inclusions of amnesic mild cognitive impairment (aMCI) and it can also be deemed as an individual entity other than the prodromal Alzheimer's disease (AD)-aMCI remain disputable. Literature shows that associative memory is dissociable into content and context components. Accordingly, the present study was to explore the controversial issues based on such a memory concept.

**Participants and Methods:** A total of 189 individuals comprising 5 subject groups, SCD ( $n = 41$ ), aMCI-single domain (aMCI-sd,  $n = 38$ ), aMCI-multiple domain (aMCI-md,  $n = 33$ ), dementia of Alzheimer's type (DAT,  $n = 39$ ), and healthy control ( $n = 38$ ) groups were recruited in the present study. All participants received the modified Family Pictures subtest and their performances were further differentiated into content and context components.

**Results:** Compared to healthy controls' performance with a cut-off point of 7th percentile rank (around 1.5 SD below mean) as a defective performance, the proportion of impaired performance on the content-related memory was higher than that of context-related memory tasks in participants with SCD (22% vs. 4.9%), aMCI-sd (37% vs. 13%), aMCI-md (55% vs. 30%) and DAT (59% vs. 36%).

**Conclusions:** The results revealed the heterogeneity of content and context memory functioning pictures evident in individuals with SCD, partly supporting the SCD as a manifestation involved in aMCI

diagnosis, and also a meaningful concept independent of aMCI. Both memory-component evaluations thus appear to have respectively clinical utilities to AD in terms of the disease-progression monitoring and memory remediation.

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### K.N. SPALDING, E. GUZMÁN-VÉLEZ, J.P. HESKJE, K.K. WIGGS & D. TRANEL. Two-Day Intervention Significantly Reduces Stress in Dementia Caregivers.

**Objective:** Providing care for a person with dementia can lead to decline in psychological and physical health (e.g., increased stress, depression, anxiety, compromised immune response). There is an immense need to provide treatment for caregiver burden; however, most current behavioral interventions are costly and time-consuming. The present study investigated the effectiveness of a low cost, two-day intervention in reducing caregiver burden.

**Participants and Methods:** Primary caregivers of an individual with dementia were randomly assigned to a two-day intervention group ( $N = 22$ ) or a waitlist-control group ( $N = 18$ ). The intervention focused on acceptance, compassion, mindfulness, and "meeting the individual in their reality," through the use of improvisation techniques. At baseline, participants completed questionnaires regarding caregiver burden, stress, symptoms of anxiety and depression, and distress caused by the patient's psychiatric symptoms. Questionnaires were re-administered by mail one and three months following the completion of the intervention.

**Results:** Results from a repeated-measures ANOVA indicate a significant reduction in perceived stress over time for the intervention group, but not for the control group,  $F(31) = 4.25, p = .023$ , when controlling for caregiver education and dementia stage. Additionally, there were trends for reduced anxiety, depression, and caregiver burden, although these findings were not statistically significant.

**Conclusions:** A low cost two-day intervention has been shown to effectively reduce perceived stress in caregivers up to three months after the intervention. Although caregivers continued to have objective symptoms of depression and anxiety, it appears these symptoms had a reduced impact on their overall perception of stress, and participants felt better able to cope with caregiving. These findings suggest that it is possible to have a lasting impact on dementia caregiver quality of life with an accessible, low cost, brief intervention.

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### J. SPAT, H. MURPHY, F. VIQAR, S. GANDY, M.A. GOLDSTEIN, J. MACHAC & H.A. BENDER. The Neuropsychological Profile and Neuroimaging Biomarkers in a Patient with Corticobasal Syndrome with Underlying Alzheimer's Pathology: A Case Study.

**Objective:** This case study describes the neuropsychological and behavioral profile of a 57-year old Arabic speaking woman, experiencing a rapidly progressive, 3 year decline in speech and language, executive function, and motor abilities. The patient was previously diagnosed with Alzheimer's disease (AD) based on neurologist review and an FDG-PET revealing moderate bilateral hypometabolism in parietotemporal areas. However, the patient's relatively strong memory was atypical for AD, as was her prominent motor-related symptoms. Despite additional neuroimaging biomarkers (Florbetapir F-18) indicating AD, her clinical course and cognitive profile was instead suggestive of Corticobasal Syndrome with underlying Alzheimer's disease pathology (CBS-AD).

**Participants and Methods:** A limited battery of cognitive metrics was administered due to the patient's profound cognitive difficulties and cultural/linguistic limitations. The patient was administered the Repeatable Battery for the Assessment of Neuropsychological Status and the Dementia Rating Scale-2.

**Results:** The results of the evaluation were suggestive of widespread neurocognitive dysfunction (i.e., profound frontal systems dysfunction, visual perceptual deficits, and impaired motor skills), with relative sparing of learning and memory. A neurobehavioral/motor examination revealed myoclonus, cog-wheeling, postural imbalance, akinetic UE rigidity, and utilization behavior. Contrary to the working diagnosis of AD with supporting biomarkers, the patient's clinical course and cortical signs with extrapyramidal involvement suggested a neuropathologically distinct disorder, CBS-AD.

**Conclusions:** The literature documenting CBS-AD is limited, with study of individual cases highly valuable in understanding the cognitive, motor and behavioral sequelae unique to this rare disorder. Even in cases where neuroimaging biomarkers are consistent with AD, improved understanding of CBS-AD may facilitate earlier identification and, by extension, swifter, more targeted interventions.

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### Drug/Toxin-Related Disorders (Including Alcoholism)

**F.E. RAMIREZ, P. GRILO & N. NEDLEY. Lead Exposure and Mental Health.**

**Objective:** The study researches a link between the exposure to lead via water pipes and mental health, before and after an 8-week depression and anxiety recovery program.

**Participants and Methods:** Data obtained from 5621 participants that finished the 8-week program was used. Participant demographic were 86% white, 4% black, 6.5% Hispanic and 3% Asian, average age 52.6 SD 15. The educational program meet every week for a 2 hour session, participants watched a pre-recorded lecture by a mental health professional during the first hour, in the second hour lifestyle topics are discussed in small groups. At baseline and at the end, every participant filled out a 75 item questionnaire to measure depression using a modified PHQ-9 [patient health questionnaire], anxiety, emotional intelligence and demographics together with patient history including the question "Does your house have any lead pipes or water hoses used for drinking water?". Lifestyle concepts were taught like physical exercise, diet, rest, etc.

**Results:** From 5621 participants, 6.4% (n=359) answered positively the lead pipes question. At baseline these participants presented a depression group average of 14.7 (moderate) SD 7, anxiety of 8 (mild) SD 4.4. At baseline those without a lead exposure had a depression group average of 12.2 (moderate) SD 7.5 and anxiety of 7 (mild) SD 4.6. At the end of the program 5.2% (n=294) reported lead exposure, with a depression average of 8.3 (mild) SD 6.4, anxiety of 4.7 (mild) SD 4. The other participants without exposure to lead had a depression average of 6.4 (none) SD 5.9, anxiety 3.7 (none) SD 3.6.

**Conclusions:** At the beginning participants that reported lead exposure had 17% higher depression and 12.5% higher anxiety. Both groups improved with the program. At the end, the group without lead exposure had 22% less depression and 10.6% less anxiety. Lead exposure screening is advised.

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### Epilepsy/Seizures

**K.D. SRNKA, D. JACKSON, J. JONES, D. ALMANE, B.P. HERMANN & M. SEIDENBERG. Examination of Attention "Stability" in Children with Recent Onset Epilepsy.**

**Objective:** Attentional impairment is a common neuropsychological co-morbidity of childhood onset epilepsy (COE). Mirsky proposed a

4-factor attention model which has proven useful in examining attention processes in various clinical populations, including epilepsy. Recently, a fifth factor was added, Stabilize, a measure of intra-individual variability (IIV). We compared the performance of a COE group and a non-epilepsy cousin control group on IIV and also examined the relationship of the Stabilize factor to IQ and academic achievement in COE.

**Participants and Methods:** 133 COE, average age 12 years, 49% males, mean onset 11.3 years of age, and 54% with localization-related epilepsy, and 92 first degree healthy cousins (HC) were administered the Connors CPT -2 (CPT-2). Inclusion criteria for COE: diagnosis of epilepsy within the previous year, minimum IQ of 70, and attendance at regular school program. The Hit rate SE Block change and variability indices from the CPT-2 were used to measure the Stabilize factor. Regression analyses examined the relationship between the Stabilize factor and both intellectual functioning (Verbal and Performance IQ from the WASI) and academic achievement (WRAT).

**Results:** No significant group differences in age or gender distribution were found ( $p$ 's > .05). COE group showed significantly higher Stabilize scores (increased variability) than the HC group ( $p < .001$ ). Hierarchical regression showed a significant increase in predicted variance for the Stabilize factor for Performance IQ ( $\beta = -.30, p < .05$ ), Word recognition ( $\beta = -.25, p < .05$ ), and Arithmetic ( $\beta = -.21, P < .05$ ), after accounting for age, gender, epilepsy syndrome, and time since last seizure.

**Conclusions:** Findings provide some preliminary validity support, discriminant and predictive, for the Stabilize factor in COE. Additional research is needed to determine the potential value of the Stabilize factor in childhood epilepsy in the study of attention ability in childhood epilepsy

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### Symposium 7. Advances in Understanding the Organization and Cognitive/Behavioral Functions of the Cerebellum

**Chair: Carol L. Armstrong**

**Discussant: Mark Mahone**

**9:15–10:45 a.m.**

**C.L. ARMSTRONG. Advances in Understanding the Organization and Cognitive/Behavioral Functions of the Cerebellum.**

**Symposium Description:** The cerebellum has a differentially longer and steeper developmental trajectory, potent neural stem cells, and rapid learning capacity. It is relevant to the cognitive outcomes of many neurological disorders. It's role in human non-motor cognition is recognized, but more empirical support and understanding is needed.

Cognitive, emotional, and behavioral disorders observed after cerebellar injury are multifactorial, and do not often present a delimited or eloquent syndrome or dysfunction. While neuroimaging studies suggest a relationship of covaried cerebellar asymmetry with cerebral asymmetry, this relationship may not result in predictable functional impairments. For example, injury within the cerebellar vermis, part of the archicerebellum, may result in a complex and varied syndrome of complex neurobehavioral disturbances.

This symposium will provide several lines of evidence on the neuroimaging, neuropsychiatric, and neurocognitive outcomes of cerebellar injury that test assumptions about the influence of the cerebellum in complex human behavior. C. Limperopoulos will present groundbreaking investigations on relatively subtle cerebellar abnormalities early in life, which present multi-dimensional disabilities later in life. K. Walsh will present findings on the cerebellar mutism syndrome and the cerebellar cognitive affective syndrome, which are disturbances of wide ranging neuropsychological behaviors in children and adults, whose neural pathways are

still debated. D. Smith will present an investigation of the reported functional asymmetry of cerebellar injury on complex cognitive behaviors using widely used clinical neuropsychological tests. C. Armstrong will present the risk for mood disorders from cerebellar lesions.

We will use empirical findings to articulate predicted neurocognitive and neuropsychiatric outcomes of injury to cerebellar-cortical tracts. Results will be discussed in the contexts of Schmahmann's and Ito's models of cerebellar function.

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### **C. LIMPEROPOULOS. The vulnerable immature cerebellum: Structural and functional consequences following early-life injury.**

Cerebellar development follows a highly regulated program of critical developmental processes. This vulnerable developmental period can be derailed by a host of potential insults. Recently, we have pioneered high-resolution quantitative MRI (qMRI) techniques to study the developmental trajectory of the cerebellum in utero. Using qMRI during the third trimester of pregnancy, we have demonstrated that the cerebellum undergoes its most rapid growth unsurpassed by any other cerebral structure over the same time period. However, this accelerated growth is impeded by premature birth, where many of these critical development events take place within the hazards of early exposure to the extra-uterine environment. Despite the increased recognition of cerebellar injury in survivors of extreme preterm birth, the structural and functional consequences of cerebellar injury have been largely unexplored. Our data suggest that both direct and indirect mechanisms of cerebellar injury arrest cerebellar development, lead to secondary remote cortical impairments, and a high-prevalence of multidimensional disabilities by school age including: cognitive deficits, executive dysfunction, language impairments and social-behavioral dysfunction including autism spectrum disorders. We will explore the emerging functional topography of the immature cerebellum using qMRI, demonstrate how prematurity-related cerebellar injury can alter cerebellar development, and examine the long-term structural-functional correlates. Finally we will appraise the current opportunities and limitations afforded by qMRI for studying early life injury to the developing cerebellum and the role of qMRI for identifying early imaging-biomarkers for later neurodevelopmental disabilities.

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### **K. WALSH. Cerebellar Cognitive Affective Syndrome in Pediatric Neuro-Oncology: Intensification and Acceleration of Emerging Late Effects.**

The importance of the cerebellum in higher order neuropsychological function has become increasingly clear. Volumetric and functional disruptions in the cerebellum impact the integrity of the dorsal cognitive circuit and this is likely one contributing factor in the emergence and presence of the neuropsychological sequelae. The description of the Cerebellar Cognitive Affective Syndrome (CCAS) in adults described the constellation of cognitive and affective symptoms seen with cerebellar dysfunction and has become increasingly incorporated into pediatric nomenclature. About 25% of children with cerebellar tumor undergoing resection exhibit acute symptoms of mutism, ataxia, hypotonia, and emotional lability following surgery (Cerebellar Mutism Syndrome). These children exemplify the CCAS in pediatrics. There is emerging evidence that these children may exhibit more significant neuropsychological late effects that may emerge sooner than is typical in children treated for brain tumor. We show that children who present with CMS following surgery have significantly greater atrophy and gliosis on imaging at 1 year than those without CMS. In two separate studies significant differences were shown between those with (CMS+) and without

(CMS-) mutism as early as 1 year from treatment, with the CMS+ groups showing substantially lower IQ (Study 1 CMS+ = 87 [16.4], CMS- = 97 [15.9]; Study 2 CMS+ = 78 [19.8]; CMS- = 89 [26.5]) and require greater supports by that time point (CMS+ Spec Ed=60%; CMS- 29%). In a matched case series, we again show discrepancies at 1 year, particularly for nonverbal functions (CMS+ PIQ=79 [6.1]; CMS- PIQ=111 [8.3]), with 80% of CMS+ children showing clinical impairments and but none of the CMS- children. A similar pattern was observed for executive functions. We show data for a possible acceleration and intensification of cognitive late effects in this unique population of children. Correspondence: *Karin Walsh, 111 Michigan Avenue NW, Washington, DC 20010. E-mail: kwalsh@childrensnational.org*

### **D. SMITH, C.L. ARMSTRONG & M.J. FISHER. The Paradox of Cerebellar Lateralization of Cognitive Function.**

Involvement of the cerebellum (CB) in non-motor cognitive tasks has gained widespread acceptance within the neuroscience community. Recent anatomical studies reveal close connections from the posterior hemispheres to contralateral cortical association areas. Functional imaging reveals co-activation of the CB during tasks from a range of non-motor domains (e.g., right CB activation during language tasks). In the clinical setting, patients with large lesions of the CB may present with absent or subtle cognitive impairments, presenting a paradox between the literature and the applied setting. The only studies to date investigating the differential effects of CB hemispheric damage in children suffer from small sample size. In the present retrospective study, data from comprehensive neuropsychological assessments were examined for lateralization effects in 38 children having tumors definitively in the left, right, or central/bilateral hemispheres of the CB. Children with CB lesions performed similarly to the normative groups (mean z-score = -0.10, SD=1.26) except in tasks requiring a motor component such as grooved pegboard (mean z-score = -1.30, SD=1.48). The only tasks showing differences in hemispheric tumor locus were phonemic fluency and right hemisphere ( $F = 3.38, p = 0.04$ ) and backwards digit span and bilateral/central injury ( $F = 3.83, p = 0.03$ ). While the results were commensurate with prior investigations, showing that patients with right CB injury perform more poorly on measures of phonemic fluency (z-scores: left = 0.83; central = -0.37; right = -0.62) and patients with bilateral injury have greater deficits in backwards digit span (z-scores: left = 0.54; central = -0.47, right = 0.06), the pattern of findings would not be considered clinically significant. Results will be discussed in the context of current developmental and anatomic frameworks with emphasis placed on the utility of the standard neuropsychological battery in detecting cerebellar injury.

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### **C.L. ARMSTRONG. Mood Disorders Related to Cerebellar Activation and Cerebellar Injury.**

In addition to impaired executive dysfunction causing behavioral dyscontrol, cerebellar lesions, both hemispheric and vermal, can present as mood disturbance. Differential cerebellar activation has been found for positive and negative induced moods, and for negative mood disorders. A current model proposes that the cerebellum is involved in the regulation of emotional perception and encoding, to maintain synchrony of multiple information processing streams (Schmahmann and Schutter). The cortico-cerebellar association with depression and anxiety was examined in a sample (n=91) of children with brain tumors. Analyses revealed that 29% had clinically elevated anxiety, which exceeds the frequency in the general population, and 8% had elevated depression. Patients with right cortical tumors or left cerebellar tumors had significantly greater anxiety than those with midline/bilateral tumors and those with left cortical or right cerebellar tumors ( $F(2,99)=6.35, p=0.006$ ), with little correlation with depressive symptoms. A second study examined the cerebellar lesion patients only (L, R, Bil/Mid) in two separate cohorts (n=21, and 23), and though the left cerebellar

group had highest anxiety, the F was not significant in either cohort. The neuropsychological effect may be significant only when including the cortical lesions, suggesting a synergistic effect caused by diaschisis. Neuropsychiatric and mood disturbances are inconsistently associated with cerebellar syndromes and lesions, for example in Friedreich's ataxia. The strength of association of impaired mood with different cerebellar syndromes/lesions will be presented. The risk of mood disturbance across syndrome and lesion studies suggests a differential role for the cerebellum in emotional and affective disturbance, and in lesion vs. degenerative disorders.

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## Paper Session 5. Dementia 1

Moderator: **Dorene M. Rentz**

9:15–10:45 a.m.

**A.M. RACINE, C.R. NICHOLAS, L.R. CLARK, S.E. BERMAN, R.L. KOSCIK, S. ASTHANA, K. BLENNOW, H. ZETTERBERG, C.M. CARLSSON, B. CHRISTIAN & S. JOHNSON. Cluster Analysis of Biomarkers and Memory Test Scores Provide Empirical Support for Preclinical AD Staging and Non-AD Cognitive Decline in Late Middle Age: Findings from the WRAP Study.**

**Objective:** Preclinical Alzheimer's disease (pAD) is characterized by progressive amyloidosis, neurodegeneration, and cognitive impairment (CI). Clustering of biomarkers and neuropsychological test scores may be helpful in staging pAD and subsequent decline.

**Participants and Methods:** 103 cognitively healthy adults (mean age 61) enriched with genetic and parental family history (FH) risk for AD from the WRAP cohort underwent PET-PiB imaging of brain beta-amyloid (A $\beta$ ), MRI, lumbar puncture, and cognitive testing. Hierarchical clustering grouped subjects based on 4 disease indicators: total-tau (t-tau) and A $\beta$ 42 cerebrospinal fluid levels, PiB burden, and RAVLT delayed recall score. Clusters were compared by post hoc tests with multivariate ANOVA on clustering variables and demographics, and by ANCOVA, controlling for age, sex, APOE4, and FH, on several concurrent pAD-related measures: hippocampal volume (intracranial volume-corrected), atrophy, total white matter hyperintensity lesion volume (WMH), and a different memory test, WMS-R Logical Memory I and II (additionally controlling for literacy).

**Results:** The 5 derived clusters were characterized as healthy (n=42), pAD stage 1 (low A $\beta$ 42; n=11), pAD stage 2 (low A $\beta$ 42, high PiB, high t-tau; n=12), suspected non-pAD CI (low RAVLT scores; n=13), and tauopathy (high t-tau; n=24). As expected, clusters differed significantly on all clustering biomarkers (p<.001). Differences were not detected for age, sex, APOE4, FH, literacy, hippocampal volume, or atrophy. Suspected non-pAD CI had elevated WMH compared to all other clusters (p<.05), suggesting a better cluster characterization is vascular-mediated CI. Vascular-mediated CI and pAD stage 2 consistently scored worse on WMS immediate and delayed recall (p<.05).

**Conclusions:** Cluster analysis, which does not rely on arbitrary cut-points or long-term trajectory, successfully identified preclinical stages of AD and suspected non-AD etiology for the first time in midlife. Clinical endpoints can confirm the diagnostic accuracy of these clusters.

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**K.V. PAPP, E.C. MORMINO, R.E. AMARIGLIO, Y.T. QUIROZ, A. SCHULTZ, S. JAIMES, S.L. AGHJAYAN, C.E. MUNRO, K.A. JOHNSON, R.A. SPERLING & D.M. RENTZ. The Neuropsychology of Biomarker-Defined Preclinical Stages of Alzheimer's Disease.**

**Objective:** Furthering our understanding of the relationship between amyloidosis (A $\beta$ ) on PET imaging, neurodegeneration (ND), and cognition is imperative for early identification and early intervention in Alzheimer's disease (AD). Previous research has shown that individuals with both A $\beta$  and ND show decline on cognitive composites. In line with this, our goal is to determine whether individuals with A $\beta$  and ND show decline on particular neuropsychological measures and/or in a domain-specific manner and whether A $\beta$  and ND together or in isolation are associated with different neuropsychological profiles longitudinally.

**Participants and Methods:** A total of 270 clinically normal older adults from the Harvard Aging Brain study were grouped according to preclinical AD stages: Stage 0 (A $\beta$ -/ND-), Stage 1 (A $\beta$ +/-ND-), Stage 2 (A $\beta$ +/-ND+), and suspected non-Alzheimer's associated pathology (SNAP; A $\beta$ -/ND+). Linear mixed models controlling for age, sex and education were used to examine cognition over a mean of 2.42 years across multiple measures and domains including Memory (6-trial SRT, FCSRT), Language (BNT, category fluency), Executive Functioning (TMT A and B, Digit Span, D-S Coding, letter fluency), and Visuospatial Skills (Visual Form Discrimination). Pairwise comparisons between preclinical stages were explored.

**Results:** Stage 2 showed consistent decline across multiple domains including decline in memory, language, and executive functioning; while basic attention and visuospatial processing were preserved. In Stage 1, there was a decline in language (category fluency and naming) and on one memory measure (FCSRT). Stage 0 and SNAP remained cognitively stable.

**Conclusions:** The combination of A $\beta$  and ND appears to drive longitudinal decline in a clinical pattern consistent with AD. Some changes in language and memory functions are already observable in Stage 1, while Stage 0 and SNAP are associated with cognitive stability.

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**C.W. WATSON, L.B. ZAHODNE, N. SCHUPF, M. TANG, A.M. BRICKMAN & J. MANLY. Socioeconomic and Educational Factors Account for Racial Inequities in Dementia Incidence in a Community Dwelling Population.**

**Objective:** Some studies show greater dementia risk and faster rates of cognitive decline among racial and ethnic minorities in the U.S. compared to whites. However, the magnitude and determinants of this health inequity are debated. The current study compares rates of dementia incidence and subsequent cognitive decline among elderly African-Americans, Hispanics, and whites to determine whether observed differences can be explained by educational, socioeconomic, or health-related factors.

**Participants and Methods:** Participants were 3,459 initially dementia-free older adults (30% African-American, 46% Hispanic, 24% white) in the Washington Heights-Inwood Columbia Aging Project with up to 24 years of follow-up (694 incident dementia cases). Cox proportional hazard models estimated the influence of baseline differences in educational attainment, reading level, income, occupation, APOE status, and comorbidities on dementia rates. Growth curve models estimated cognitive trajectories post-diagnosis.

**Results:** Hispanics and African-Americans were more likely than whites to be diagnosed with dementia (25.4% vs.19.6% vs. 10.5%). In an unadjusted model, greater hazard ratios for dementia were found for Hispanics (HR: 3.11) and for African-Americans (HR: 2.25) compared to whites. When covariates were included in models, the elevated dementia risk compared to whites was attenuated among Hispanics (HR: 1.30) and no longer significant among African-Americans (HR: 1.01). There were no racial disparities in rates of cognitive decline post-diagnosis.



**Conclusions:** Our findings suggest that educational and socioeconomic factors may account for higher rates of dementia observed in minority racial and ethnic groups in the U.S. Factors which attenuated dementia risk most for Hispanics were years of education and income level. For African-Americans, reading level, a proxy for educational quality, had the largest impact on diminishing dementia risk.

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**T.J. HOHMAN, K. GIFFORD, D.J. LIBON & A.L. JEFFERSON. Asymptomatic Alzheimer's Disease: Building a Better Resilience Phenotype.**

**Objective:** Limited empirical attention has focused on elucidating factors underlying "asymptomatic" Alzheimer's disease (AD) in which individuals present with autopsy-confirmed pathological AD (plaques and tangles) but without marked cognitive impairment. This project sought to build on the reserve hypothesis by using a partial least square (PLS) path model to quantify "AD resilience" (the degree to which an individual's neuropsychological performance outpaces expected performance given their level of AD biomarkers) as an endophenotype for future genomic projects.

**Participants and Methods:** Data from 869 participants (301 normal, 432 with MCI, and 136 with AD) in the ADNI cohort were included in analyses. Inclusion criteria required cerebrospinal fluid biomarker data, a composite measure of memory and executive function, and a measure of hippocampal volume. We used a PLS path model to quantify three first-order latent traits – "cognitive reserve", "brain reserve", and "AD resilience" – and one second-order latent trait – "global resilience". Resilience measures were calculated using baseline data and evaluated by predicting diagnostic conversion. Post hoc analyses integrated longitudinal data into the PLS path model to build a more robust phenotype for future aims.

**Results:** Only the "AD resilience" (OR = 0.34,  $p=7 \times 10^{-16}$ ) and "global resilience" (OR = 0.35,  $p=5 \times 10^{-12}$ ) metrics successfully predicted protection from future conversion. Further, when including longitudinal slopes in the PLS model we were able to identify a group of non-decliners that remained cognitively intact across the follow-up interval.

**Conclusions:** These results suggest that the inclusion of biomarker data into models of cognitive and brain reserve may increase their predictive power. Moreover, the further integration of longitudinal data results in a strong resilience phenotype that can be leveraged in genomic and proteomic analyses to better understand the molecular basis of resilience. Funding: K12-HD043483, K24-AG046373, R01-HL111516

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**B. YEW & D.A. NATION. Increased Cerebrovascular Resistance is Associated with Greater Amyloid- $\beta$  Deposition and Worse Cognitive Performance in Preclinical and Clinical Alzheimer's Disease.**

**Objective:** Elevated regional cerebrovascular resistance has been identified in Alzheimer's disease and mild cognitive impairment (MCI) relative to cognitively normal samples but how cerebrovascular stiffening relates to amyloid- $\beta$  remains to be explored.

**Participants and Methods:** Arterial spin labelling MRI was used to measure cerebral blood flow (CBF) in regions typically affected by Alzheimer's disease, for participants with Alzheimer's dementia ( $n=30$ ), MCI ( $n=125$ ), or healthy cognition ( $n=73$ ). Brachial artery blood pressure values for both steady (mean arterial pressure) and pulsatile (pulse pressure) components were then each divided by regional CBF values to index estimates of regional cerebrovascular resistance. Regional amyloid- $\beta$  deposition was also measured using PET imaging with

a florbetapir-fluorine-18 tracer. Cognitive ability was assessed globally and across domains of memory and executive function.

**Results:** General linear models indicated that CBF was lower and cerebrovascular resistance indexes higher in Alzheimer's relative to MCI and cognitively normal groups. Cerebrovascular resistance indexes were also higher in MCI compared to cognitively normal cases despite an absence of significant CBF differences. Elevated cerebrovascular resistance in the inferior temporal and parietal cortices was associated with increased global and regional amyloid- $\beta$  deposition, and worse cognitive performance. Strongest associations of cerebrovascular resistance indices with both amyloid deposition and cognitive performance were observed in preclinical stages of disease (i.e. amyloid positive without dementia).

**Conclusions:** Cerebrovascular resistance is associated with cerebral amyloidosis and cognitive decline in preclinical and clinical Alzheimer's disease. Findings indicate that cerebrovascular stiffening may predate changes in gross CBF since increases in cerebrovascular resistance were evident prior (i.e. in preclinical groups) to differences in CBF observed in those with dementia.

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**S.A. SCHULTZ, E.A. BOOTS, T. KIRBY, R. DOUGHERTY, D. EDWARDS, J. EINERSON, R.L. KOSCIK, C.L. GALLAGHER, C.M. CARLSSON, B.B. BENDLIN, H. ZETTERBERG, K. BLENNOW, S. ASTHANA, M.A. SACER, B.P. HERMANN, S. JOHNSON, J. STEIN, D. COOK & O.C. OKONKWO. Sedentariness and moderate-intensity physical activity are associated with CSF biomarkers of Alzheimer's disease: Findings from the Wisconsin Registry for Alzheimer's Prevention.**

**Objective:** Amyloid ( $A\beta$ ) plaques and neurofibrillary tangles are hallmark features of Alzheimer's disease (AD). Emerging evidence suggests that physical activity (PA) might alter these pathological changes that occur in AD. Accordingly, we sought to examine the relationship between objectively-measured PA and cerebrospinal fluid (CSF) levels of  $A\beta_{42}$  and tau in asymptomatic late-middle-aged adults at risk for AD. **Participants and Methods:** Seventy-two cognitively healthy late-middle-aged adults (age=64.03 years, 68.1% female) from the Wisconsin Registry for Alzheimer's Prevention participated in this study. They wore an accelerometer (ActiGraph GT3X+) for one week to record free-living PA. Accelerometer data yielded measures of sedentariness and various intensities of PA. Participants also underwent lumbar puncture for collection of CSF, from which  $A\beta_{42}$ , total tau (t-tau) and phosphorylated tau (p-tau) were immunoassayed. We additionally computed tau-to- $A\beta_{42}$  ratios. Regression analyses were utilized to examine the association between sedentariness/PA and CSF biomarkers, while adjusting for confounds.

**Results:** Sedentariness was significantly associated with reduced  $A\beta_{42}$  ( $p=.006$ ) and increased p-tau/ $A\beta_{42}$  ( $p=.040$ ). Furthermore, engagement in moderate-intensity PA was significantly associated with higher  $A\beta_{42}$  ( $p=.002$ ), lower t-tau/ $A\beta_{42}$  ( $p=.006$ ), and lower p-tau/ $A\beta_{42}$  ( $p=.027$ ). In contrast, neither light- nor vigorous-intensity PA was significantly associated with  $A\beta$  or tau levels. The relationship between moderate-intensity PA and CSF biomarkers persisted ( $p=.009$  for  $A\beta_{42}$  and  $p=.028$  for t-tau/ $A\beta_{42}$ ) even after accounting for time spent in light- and vigorous-intensity PA categories.

**Conclusions:** In a late-middle-aged cohort, sedentary time was associated with more pathophysiology consistent with AD, whereas engagement in moderate-intensity PA was associated with less such pathophysiology. These data add to a growing body of evidence that a physically active lifestyle may play a role in protecting against AD.

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**E.A. BOOTS, S.A. SCHULTZ, B.F. DARST, R.L. KOSCIK, B.B. BENDLIN, C.M. CARLSSON, C.L. GALLAGHER, S. ASTHANA, M.A. SAGER, B.P. HERMANN, S. JOHNSON, C.D. ENGELMAN & O.C. OKONKWO. BDNF Val66Met Polymorphism Predicts Cognitive Decline in the Wisconsin Registry for Alzheimer's Prevention.**

**Objective:** The brain-derived neurotrophic factor (BDNF) Val66Met polymorphism – a Valine (Val) to Methionine (Met) substitution at codon 66 – has been implicated in Alzheimer's disease (AD), but its role in preclinical AD is not fully characterized. The objective of this study was to examine the influence of this polymorphism on longitudinal cognitive trajectories in a large cognitively healthy cohort enriched for AD risk.

**Participants and Methods:** 1,023 middle-aged adults (baseline age=54.94±6.41 years; 69.7% female) enrolled in the Wisconsin Registry for Alzheimer's Prevention underwent BDNF genotyping and extensive cognitive assessment at up to five time points, with four years between the first two time points and two years between all subsequent time points. Four cognitive factors, including Verbal Learning & Memory, Speed & Flexibility, Working Memory, and Immediate Memory, were examined. Random coefficient regression was used to elucidate the effect of the BDNF Val66Met polymorphism on cognitive trajectories while adjusting for relevant covariates.

**Results:** 32.3% of the sample was Met carriers. Val/Val and Met carriers did not differ in age, sex, education, parental family history of AD, or apolipoprotein ε4 status. Compared to BDNF Val/Val carriers, Met carriers showed steeper decline in cognitive domains of Verbal Learning & Memory (p=.002) and Speed & Flexibility (p=.017). Analysis of the component tests of these cognitive domains revealed that Met Carriers had greater cognitive decline in Rey Auditory Verbal Learning Test (RAVLT) Long Delay (p=.007) and Recognition (p=.016), with trends in RAVLT Total Learning (p=.061) and Trails B (p=.056).

**Conclusions:** In a large middle-aged cohort enriched for AD risk, carriage of the BDNF Met allele was associated with steeper decline in episodic memory and executive function. These findings suggest that the BDNF Val66Met polymorphism may play an important role in AD-related cognitive decline and could be considered as a target for novel AD therapeutics.

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## Paper Session 6. Medical/Neurological Disorders, Child

**Moderator: Celiane Rey-Casserly**

**9:15–10:45 a.m.**

**J.C. PIERCY, A. HEITZER, B. PETERS & S. RAZ. Multiple Gestation and Neuropsychological Performance in Preschoolers Born Preterm.**

**Objective:** Multiples are thought to be at increased risk for developmental outcome deficits in the preschool years, following preterm birth. Little research has been conducted to determine whether this group remains at higher risk in the age of assisted reproductive techniques and surfactant therapy. We therefore wished to determine whether multiplicity is a risk factor for neuropsychological outcome deficits in preterm-born preschoolers recruited from a 2007-2011 birth cohort.

**Participants and Methods:** We compared 49 multiples (46 twins 3 triplets) and 75 singletons born preterm (< 34 weeks) and without disabilities. The WPPSI-III, the NEPSY-2, and the PDMS-2 were used to measure cognitive, language, and motor skills, respectively, between 3–4 years of age.

**Results:** Simultaneous multiple regression analyses revealed that multiplicity explained a significant portion of the variance in the PDMS-2

Total Motor (F(1, 101) = 4.39, p = .039) and Fine Motor (F(1, 105) = 5.94, p = .017) quotients as well as NEPSY-2 Word Generation (F(1,95) = 11.70, p = .001) and Oromotor Sequences (F(1, 92) = 7.34, p = .008) subtest scores, over and above the variance explained by birth weight, SES, intrauterine growth, medical complications, age at testing, and sex. The direction of the effect was opposite to our prediction, with multiples demonstrating superior performance. Significant multiplicity by sex interactions were found for NEPSY-2 Oromotor Sequences scores (F(1, 90) = 4.15, p = .045) and PDMS-2 Total Motor Quotient (F(1, 97) = 5.01, p = .027), revealing a female twin advantage over male twin and singleton performance.

**Conclusions:** In this investigation of preterm preschoolers born in the surfactant era we found that multiplicity was not associated with a poorer neurodevelopmental prognosis compared to singleton birth. The absence of expected group differences is probably attributable to the more benign causes of prematurity in multiples receiving modern neonatal intensive care, compared to their singleton counterparts.

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**J. CALDERON, PH.D., C. STOPP, M.S., D. WYPIJ, PH.D., D. DEMASO, J.W. NEWBURGER, MD, MPH & D.C. BELLINGER, PH.D. MSC. Impact of Early-Term Birth on Neuropsychological and Psychiatric Outcomes in Adolescents with Congenital Heart Disease.**

**Objective:** Congenital Heart Disease (CHD) is associated with delayed fetal brain development and neurodevelopmental impairments. The last 5 weeks of gestation are crucial for fetal brain maturation. Early-term (ET) birth (i.e. 37 to 38 GA weeks) has been recently linked with lower cognitive outcomes in the general population. Our study aims at investigating, for the first time in adolescents with critical CHD, the long-term impact of ET birth on neuropsychological and psychiatric outcomes. More specifically, we sought to compare outcomes between patients born ET to those born full-term (FT) (≥39 GA weeks).

**Participants and Methods:** This is a single-center study of neurodevelopmental and brain MRI outcomes in adolescents after open-heart surgery. 133 patients with critical CHD participated in this study (n=33 ET and n=100 FT). All adolescents underwent a complete neuropsychological and psychiatric evaluation (e.g. IQ, BRIEF, D-KFES, Autism Spectrum Quotient [ASQ], Conners' ADHD/DSM-IV scale). Regression analyses with adjustments for genetic status and SES were conducted to identify GA group differences in outcomes.

**Results:** Patients born ET were comparable to those born FT on most demographic and medical characteristics. Both groups did not differ in terms of IQ (91.5 ± 14.1 and 92.8 ± 17.1 for the ET and FT groups respectively). However, the proportion diagnosed with ADHD was higher in the ET group (79% versus 66% in the FT group) (p=0.04). Adolescents born ET and their parents reported more executive function problems (p=0.04 BRIEF-self report and p=0.004 BRIEF Parent report) and more attention issues (p<0.01). ET birth was also associated with higher levels of anxiety, stress and more severe psychiatric symptoms (all p<0.01).

**Conclusions:** Birth before 39 GA's weeks has an adverse impact on long-term outcomes in CHD. Higher-order functions such as executive functions are predominantly affected by ET birth. This study challenges the common assumption that birth at any time during the term gestation is equally safe.

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**S.E. SCRATCH, A.C. BURNETT, K. TREYVAUD, A. URE, L.W. DOYLE & P.J. ANDERSON. Toddler Behavior is Associated with School-age Cognitive Performance in Children Born Very Preterm.**

**Objective:** This study aimed to assess the relationship between observed toddler behavior and cognitive functioning at school-age.

**Participants and Methods:** 169 very preterm (VP; <30 weeks' gestation or <1250 g birthweight) and 55 term children completed a parent-toddler problem-solving task at age 2, which assessed six domains of toddler behavior (persistence, positive affect, negative affect, activity level, dependence, and quality of transitions), and had a neuropsychological assessment at age 7. Variables were standardized against the control group mean. Regression models were used to examine these relationships, controlling for social risk.

**Results:** Persistence at age 2, which measured the extent to which the toddler was problem-oriented and motivated to complete the presented task, emerged as a strong predictor of cognitive performance at age 7. However, these relationships differed across birth groups. In the VP group, more persistent task behavior during toddlerhood predicted stronger cognitive performance at school-age across multiple domains, including IQ ( $\beta=0.29$ ,  $p<0.001$ ), language ( $\beta=0.35$ ,  $p<0.001$ ), attention and executive functioning ( $\beta=0.47$ ,  $p<0.001$ ), and academic achievement (e.g. maths,  $\beta=0.29$ ,  $p<0.001$ ). In contrast, an inverse relationship was found for term children, with greater task persistence at age 2 related to poorer school-age language ( $\beta=-0.26$ ,  $p=0.007$ ) and reading performances ( $\beta=-0.22$ ,  $p=0.047$ ). The other five toddler behaviors were not consistently associated with school-age cognitive outcomes in either birth group.

**Conclusions:** Task persistence at age 2 was strongly associated with better cognitive performance at age 7 in VP children. These findings have implications for the development of early screening tools and identification of VP toddlers who may be at risk of school-age cognitive vulnerabilities and academic underachievement.

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**R. WASSERMAN & G.N. HOLMBECK. Profiles of Neuropsychological Functioning in Children and Adolescents with Spina Bifida: Associations with Biopsychosocial Predictors and Functional Outcomes.**

**Objective:** The current study examined neuropsychological performance among children with spina bifida (SB) to determine biological and functional associations with distinct subgroups or "profiles" of cognitive functioning.

**Participants and Methods:** 96 children with SB myelomeningocele (ages 8-15) completed a brief assessment battery, including measures of IQ, academic achievement, executive functioning, attention, fine motor speed, social emotional processing, and contextual language. Hierarchical and non-hierarchical cluster analyses were used to identify and confirm a cluster solution. Hypothesized predictors of cluster membership included lesion level, number of shunt surgeries, history of seizures, age, ethnicity, socio-economic status, family stress, and family environment. Outcomes included independence, academic success, expectations for the future, and quality of life.

**Results:** Ward's cluster method indicated a 3-cluster solution, and was replicated with 2 other cluster methods. The following labels were applied to the clusters: "Average Cognitive Ability, Impaired Motor" ( $n=39$ ), "Average Cognitive Ability" ( $n=32$ ), and "Extremely Low to Borderline" ( $n=25$ ). SES and shunt status significantly predicted group membership. Cluster membership significantly predicted independence, academic success, parent expectations for the future, and child reported physical quality of life.

**Conclusions:** Cluster analyses identified 3 distinct cognitive profiles with different patterns of cognitive strengths and weaknesses. Few

predictors (SES and shunt status) were associated with cluster membership. Yet, these clusters proved to distinguish the groups on daily functioning outcomes and quality of life (as reported by children and their parents). Findings from this study highlight the variability in cognitive profiles among children with SB, and the relevance of neuropsychological functioning to day-to-day adaptive functioning and quality of life. Clinical implications and future research are discussed.

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**M.E. FOX & T.Z. KING. Pituitary Disorders as a Predictor of Apathy and Executive Dysfunction in Adult Survivors of Childhood Brain Tumors.**

**Objective:** Both behavioral and endocrine changes are frequently observed following the presence and subsequent removal of a brain tumor. Clinically significant apathy, a notable detriment to one's quality of life, emerges as one common outcome, and while apathy's association with endocrine dysfunction has been established in some populations, it has not yet been investigated in brain tumor survivors. The present study aims to evaluate the relationship between pituitary disorders and apathy, executive dysfunction, and disinhibition as measured by informant report on the Frontal Systems Behavior Scale (FrSBe).

**Participants and Methods:** Seventy-six survivors of childhood brain tumors at least five years past diagnosis were, on average, 23 years old ( $SD=4$ ) at the time of participation. An informant completed the FrSBe, and information on hormone deficiencies was confirmed through medical chart review.

**Results:** The presence of a pituitary disorder significantly predicted total score on the FrSBe,  $R^2=.05$ ,  $p<.05$ . Among the subscales, presence of a pituitary disorder explained 9% of the variance in apathy scores,  $R^2=.09$ ,  $p<.01$ , and a chi-square test confirmed that presence of a pituitary disorder had a significant effect on whether an individual presented with clinical levels of apathy  $\chi^2(5.51, N=76)$ ,  $p<.05$ . Presence of a pituitary disorder accounted for 5% of the variance in executive dysfunction,  $R^2=.05$ ,  $p<.05$  but did not affect whether a participant reached clinical levels of dysfunction. Presence of a pituitary disorder was not significantly related to disinhibition.

**Conclusions:** Apathy and executive dysfunction in survivors of childhood brain tumors were strongly predicted by the presence of a pituitary disorder, and individuals with a pituitary disorder were more likely to present with clinical levels of apathy. Future studies should investigate endocrine and executive dysfunctions and how they may relate to treatment and long-term adaptive outcomes.

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**C. MRAKOTSKY, C.G. WATSON, A. MATOS, S. FRIEL, R. ANAND, B. GAGOSKI, M.J. RIVKIN, E. GRANT & S. SNAPPER. Brain Structure and Neuropsychological Function in Pediatric Crohn's Disease.**

**Objective:** Structural brain changes in gray and white matter have been found in adults with Crohn's disease (CD). Potential underlying mechanisms include intestinal and systemic inflammation as well as anti-inflammatory therapy. To date little is known for pediatric CD. We previously demonstrated decreased white matter density, cortical thickness and subcortical volume in a small sample of children with CD compared to healthy controls with effects of inflammation and steroids (Mrakotsky et al., 2012, 2013, 2015). We found inflammation associated with poorer memory and mood. We here aim to replicate earlier findings in a larger independent CD sample.

**Participants and Methods:** Thirty-five children 10-14 years (25 CD, 10 healthy controls) underwent structural MRI, DTI, neuropsychological assessment, and phlebotomy for inflammatory markers. Patients

were scanned and tested during active disease or in remission. Cortical thickness and volume was measured with Freesurfer, fractional anisotropy with TBSS. Analyses were adjusted for intracranial volume, and included correlation, regression and group comparisons. Groups were comparable on demographics.

**Results:** Compared to controls, CD patients had widespread reduced cortical thickness in posterior [bilateral inferior parietal, superior parietal, supramarginal (<.001-.01)] and middle frontal regions (<.05), reduced subcortical volume [bilateral putamen, hippocampi, right thalamus (<.01-.05)], altered FA in limbic tracts [cingulate, uncinate (<.05)], and poorer verbal memory and cognition. Inflammation during active disease was associated with cortical thinning (<.001-.05), lower FA, (<.05), and poorer memory and cognition (<.05-.01). Direct relationship between brain structure and function was less clear.

**Conclusions:** Results confirm our prior findings of gray and white matter involvement in pediatric CD, with effects of inflammation and treatment. Current studies of the immune response aim to elucidate underlying molecular mechanisms with the goal to inform medical therapies.

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**C. CASNAR, B. YUND, K.M. JANKE & B.P. KLEIN-TASMAN. Longitudinal Examination of Fine Motor Skills in Children with Neurofibromatosis type 1.**

**Objective:** Preschool-aged and school-aged children with NF1 have been shown to have significant difficulties with fine motor (FM) skills. No study has systematically examined early FM skills over time in young children with NF1. The aim of this longitudinal study is to better characterize the developmental course of early FM functioning in young children with NF1.

**Participants and Methods:** Participants were 25 children (17 boys) with NF1 ages 3 through 8 who were assessed at three, consecutive time points (T1, T2, T3) across a 5-year-span. General intellectual ability, nonverbal reasoning abilities, and fine motor functioning were examined using select subtests from the Differential Ability Scales – Second Edition and NEPSY-II.

**Results:** Children with NF1 scored significantly lower than the normative mean on all FM tasks across all three time points (Copying T1, T2, T3:  $p > .001$ ; IHP T1, T2:  $p > .001$ ; Imitating Hand Positions T3:  $p = .013$ ; Visual Motor Precision T1:  $p = .002$ ; VMP T2, T3:  $p > .001$ ). No significant effects of time on Copying (Wilks' Lambda = .97,  $F(2, 23) = 0.97$ ,  $p = .673$ , multivariate partial eta squared = .04), nor VMP (Wilks' Lambda = .87,  $F(2, 16) = 1.23$ ,  $p = .317$ , multivariate partial eta squared = .13) were found. There was a significant effect for time on IHP (Wilks' Lambda = .68,  $F(2, 23) = 5.42$ ,  $p = .012$ , multivariate partial eta squared = .32), with improvements seen between T1 to T3 and T2 to T3.

**Conclusions:** For children with NF1, FM functioning is falling significantly below the level that would be expected for their age and, generally, does not improve over time. While results indicate that there was improvement in IHP performance over time, scores continued to remain significantly below the normative mean across all three time points. These findings suggest that FM functioning consistently remains an area of significant difficulty for young children with NF1 and highlights the importance of early assessment and continued monitoring of FM functioning for children with NF1.

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**Symposium 8. Deployment Trauma: Insights from the TRACTS Cohort on the Clinical, Cognitive, and Neuroanatomical Effects of Mild TBI and its Comorbidities in OEF/OIF/OND Veterans**

**Chair: Catherine B. Fortier**

**Discussant: Grant L. Iverson**

**9:15–10:45 a.m.**

**C.B. FORTIER, M. AMICK, V. POOLE, C.B. FORTIER, A. KENNA, G.L. IVERSON & B.B. TROTTER. Deployment Trauma: Insights from the TRACTS Cohort on the Clinical, Cognitive, and Neuroanatomical Effects of Mild TBI and its Comorbidities in OEF/OIF/OND Veterans.**

**Symposium Description:** Mild traumatic brain injury (mTBI) is the most common physical injury among Veterans of Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn (OEF/OIF/OND). However, mTBI is frequently accompanied by multiple physical and psychiatric comorbidities. The Translational Research Center for TBI and Stress Disorders (TRACTS) TBI Center of Excellence has developed a multidisciplinary approach to the assessment of mTBI and its comorbidities that will improve our understanding of the complex pathophysiology associated with co-occurring mTBI and related stress disorders. Dr. Amick will describe the TRACTS clinical dataset and how it has been used to empirically derive functionally significant clinical phenotypes. The prevalence and functional disability of the Deployment Trauma Phenotype (DTP; presence of comorbid mTBI, PTSD, and Depression), previously linked to severe disability in the TRACTS sample, will then be discussed using a novel epidemiological sample. Highlighting the cognitive consequences of deployment related mTBI, Dr. Poole will describe the unique effect of mTBI upon sustained attention independent of PTSD symptoms. Extending these findings, Dr. Fortier will discuss two new empirically derived phenotypes (mTBI phenotype: mTBI, Pain, Sleep; PTSD phenotype: PTSD, Depression) and their effects on cognitive functioning using standardized neuropsychological measures. Mr. Trotter will present neuroanatomical correlates of blast exposure and PTSD, including brain-aging trajectories. Finally, Dr. Kenna will present a novel integrated intervention focused on cognitive skill building to treat the range of deployment-related psychological and behavioral conditions that is being empirically evaluated in the TRACTS sample. Our increased understanding of the systemic multiple interacting problems common among OEF/OIF/OND Veterans will help to create effective, targeted rehabilitation and treatment approaches and inform the future of our military.

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**M. AMICK, M. METERKO, C.B. FORTIER, W.P. MILBERG & R. MCCLINCHEY. The Deployment Trauma Phenotype and Employment Status in OEF/OIF/OND Veterans.**

The presence of comorbid mild traumatic brain injury (TBI), post traumatic stress disorder (PTSD), and depression (deployment trauma phenotype, DTP) has been linked to difficulty with reintegration and disability among individuals deployed to Iraq and Afghanistan. In this study we used an epidemiological sample ( $n=86,140$ ) of veterans to examine the prevalence and clinical characteristics of DTP and its associated functional disability. Methods: A database review of the comprehensive TBI Examination (CTBIE) employed by all VA hospitals was conducted. The CTBIE is a standardized measure for assessing and characterizing TBI experiences, psychological disorders, and neurobehavioral symptoms. The frequency of mild TBI, PTSD, and Depression in isolation, pairs, and as a triad and their association with employment status was examined. A measure of symptom validity was used to exclude participants with questionable response validity (7,194 excluded).

Results: DTP was observed in 17.9% of the final sample ( $n=48,821$ ). Both DTP and co-occurring PTSD and Depression were associated with the highest levels of unemployment (19.9% both). Unemployment did not greatly differ between individual diagnoses of mTBI (3.6%), PTSD (14.7%) or Depression (15.5%) compared to individuals with none of these diagnoses (13.8%). Examination of age indicated that DTP was associated with a greater percentage of Veterans out of the work force across all age ranges, except for the oldest Veteran's with PTSD and Depression (33.6% unemployed). Discussion: Our previous finding of the negative functional consequences of comorbid mild TBI, PTSD and Depression are validated in a large epidemiological sample of Veterans. It is of grave concern that almost 20% of veterans with DTP have left the workforce; underscoring the need for multi-faceted psychological, behavioral, and vocational interventions to improve reintegration post deployment.

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**V. POOLE, F. FORTENBAUGH, W.P. MILBERG, R. MCCLINCHEY, J. DEGUTIS & M. ESTERMAN. Chronic Military-related Mild Traumatic Brain Injury is Associated with Decreased Sustained Attention Ability, Not Decreased Global Neuropsychological Functioning.**

Mild traumatic brain injury (mTBI) is of growing national concern for OEF/OIF Veterans. However, it remains unclear how (and if), months-to-years post-injury, mTBI affects cognitive performance and functioning beyond other common co-morbidities (e.g., post-traumatic stress disorder, PTSD). Considering that sustained attention has been identified as a potentially vulnerable cognitive domain, we assessed those with and without mTBI on a sensitive measure of sustained attention and compared these results to standard neuropsychological measures of attention, executive function, and memory. We enrolled 118 Veterans ( $M=32.3$  yrs): 23 with deployment-related mTBI only, 19 with PTSD only, 50 with mTBI and PTSD, and 26 with neither condition. Participants performed neuropsychological tests and the gradual-onset continuous performance task (gradCPT), a go/no-go sustained attention task where participants respond to non-targets (90%) and withhold to rare targets (10%). The task eliminates the exogenous effects of abrupt stimulus onsets and is more reliant on intrinsic sustained attention abilities than traditional CPTs. Reaction time, commission/omission errors, and d-prime were among the performance measures assessed. When compared to those without an mTBI, Veterans with a deployment-related mTBI had significantly lower  $d'$  (poorer sustained attention ability), driven by higher omission errors (failures to press to non-targets). These effects were significant after controlling for PTSD (Clinician-Administered PTSD Scale score). In contrast, no effects of mTBI were found on standard neuropsychological measures of attention, executive function, or memory. These findings suggest deployment-related mTBI is associated with difficulties in sustaining attention beyond PTSD and that these deficits may not be detected by standard neuropsychological assessments.

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**C.B. FORTIER, M. AMICK, A. KENNA, J. FONDA, W.P. MILBERG & R. MCCLINCHEY. Deployment Trauma: Clinical Phenotypes and their Impact on Cognition in OEF/OIF/OND Veterans.**

Objective: OEF/OIF/OND Veterans are returning from deployment with multiple interacting physical and mental health conditions. We have demonstrated that depression, PTSD, and military mTBI statistically cluster together, and that this Deployment Trauma Phenotype was associated with high risk for substantial disability (Lippa, 2015). We extend these findings in our larger dataset to define two new empirically derived phenotypes that have distinct cognitive signatures.

Methods and Participants: Data from the VA RR&D TRACTS was analyzed to investigate the effects of deployment-related psychiatric and

behavioral conditions on neuropsychological test performance in 450 OEF/OIF/OND Veterans. Structured clinical interviews assessed TBI and psychiatric conditions; self-report questionnaires assessed disability and behavioral conditions (sleep disturbance, pain).

Results: Over 90% of Veterans had a psychiatric and/or behavioral condition; over half presented with  $\geq 3$  conditions. Exploratory factor analysis revealed four clinically relevant psychiatric and behavioral phenotypes (variance explained=72.3%): (1) military mTBI, pain, and sleep (mTBI factor); (2) PTSD and depression (PTSD factor); (3) anxiety disorders, other than PTSD (anxiety factor); (4) substance abuse or dependence (substance use factor). Veterans with conditions comprising both the mTBI and PTSD phenotypes showed slowed response times and made more errors on tasks of executive function. Veterans with only the mTBI phenotype showed deficits in verbal memory (immediate and delayed recall and recognition memory).

Conclusions: The combined diagnoses of military mTBI, current pain, and current sleep disturbance may comprise a harmful clinical phenotype associated with cognitive impairment, including slowing and verbal memory deficits. The phenotype of mTBI combined with PTSD may result in additional frontal dysfunction relative to either phenotype in isolation.

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**B.B. TROTTER, J. SPIELBERG, M.E. ROBINSON, V. CORBO, W.P. MILBERG, R. MCCLINCHEY & D.H. SALAT. Neuroanatomical correlates of blast exposure and PTSD, including brain aging trajectories.**

Objective: Blast exposure (BE) and post-traumatic stress disorder (PTSD) are common in Veterans and have been linked to altered brain structure. It is unknown how different aspects of deployment trauma may alter neuronal integrity across the lifespan. This study examined how PTSD and BE may respectively moderate associations between the T1/T2 ratio in the cortical ribbon (imaging marker of myelination) and diffusion measures of white matter (WM) integrity and age.

Participants and Methods: Studies of PTSD (217/67 +/-) and BE (190/59 +/-) examined how these features of deployment trauma might exacerbate the effect of age on neural structure. T1/T2 values taken from 35% projection fraction from the gray/white to pial surface and diffusion measures (e.g. fractional anisotropy) were used as estimates of cortical myelination and white matter integrity, respectively. Formal interaction between PTSD status and the regression coefficient for T1/T2 with age was tested, as well as a similar interaction between BE and age on white matter integrity.

Results: Analyses revealed a significant and widespread positive association between T1/T2 ratio and age, and follow-up analyses revealed that a negative association between age and T2 drove this effect. PTSD moderated the effect of age on T1/T2 ratio in the left inferior temporal lobe, with the PTSD+ group showing a stronger age effect. BE moderated the cross-sectional relationship between age and white matter integrity, with BE+ linked to a more rapid trajectory towards reduced white matter integrity.

Conclusions: T1/T2 ratio and diffusion measure age associations could help reveal how patterns in cytoarchitecture are differentially impacted by age, PTSD and BE. The current work is limited due to the cross-sectional nature. Examining the longitudinal trajectories of the interactive effect of age and PTSD/BE will provide important follow-up to these results.

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**C.B. FORTIER, R. MCGLINCHEY, W.P. MILBERG & A. KENNA. Feasibility and Acceptability of STEP-Home: A Rehabilitation Workshop to Facilitate Civilian Reintegration Among OEF/OIF/OND Veterans.**

**Objective:** Veterans from Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) are a clinically complex group with multiple comorbidities who often do not engage with typical VA standard of care models. These Veterans require integrative interventions tailored to their unique needs that are palatable, engaging, and destigmatizing.

**Participants/Methods:** The 12-session STEP-Home workshop uses key ingredients from the evidence-based civilian TBI rehabilitation program, "STEP" (Short-Term Executive Plus; Cantor et al., 2014), while adding content tailored directly to military-to-civilian challenges. Workshop modules included problem solving, emotional regulation, self-awareness, planning, attention training, community reintegration, vocational rehabilitation, Veteran-to-Veteran support/mentorship, family involvement, and psychoeducation. Six groups (n=47) of OEF/OIF/OND Veterans participated in the study. Evaluation of program feasibility was assessed by interest to enroll, actual enrollment, and interest in workshop goals. Program acceptability was measured by session adherence, attrition, and Veteran satisfaction ratings.

**Results:** A treatment manual and training program were developed and refined. Therapist adherence to content was high across six groups. Willingness to enroll (87%), actual enrollment (62%), and adherence across group sessions (63%) were high, while attrition was low (6.4%). Interest in workshop goals showed a 19.6% increase post-intervention and Veteran satisfaction ratings were consistently high. Veterans expressed desire for STEP-Home to continue and an increase in their openness to other VA services.

**Conclusions:** STEP-Home offers a much needed, palatable, and less stigmatizing intervention for returning Veterans struggling with reintegration difficulties that is both feasible and acceptable.

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## Plenary E. The Statistical Crisis in Science

**Presenter: Andrew Gelman**

**11:00 a.m.–12:00 p.m.**

### A. GELMAN. The Statistical Crisis in Science.

Top journals in applied science routinely publish ridiculous, scientifically implausible claims, justified based on " $p < 0.05$ ." And this in turn calls into question all sorts of more plausible, but not necessarily true, claims, that are supported by this same sort of evidence. To put it another way: we can all laugh at studies of ESP, or ovulation and voting, but what about MRI studies of political attitudes, or embodied cognition, or stereotype threat, or, for that matter, the latest potential cancer cure? If we can't trust p-values, does experimental science involving human variation just have to start over? Can Bayesian inference supply a solution? Maybe. These are not easy problems, but they're important problems.

#### Learning Objectives

As a result of attending this presentation, the learner will achieve the following objectives:

Have a deeper understanding of the ways in which classical statistical methods can yield overconfident, biased claims, and  
Become aware of new statistical techniques for recognizing and reducing these biases.

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## FRIDAY AFTERNOON, FEBRUARY 5, 2016

### Poster Session 6. Aging, MCI, and Visuospacial/Neglect

**12:30–2:00 p.m.**

#### Aging

**K. ALLEN, T. BURDA, B. OTT & M.G. O'CONNOR. Distractibility, Aging, and Driving: Relationship of Scores on the Useful Field of View Across Mini Mental State Exam, Age, Diagnosis and Drivewise Assessment Outcome Scores.**

**Objective:** The purpose of this study was to understand how age and diagnosis of PD, AD, and MCI impacts visual distractibility on the Useful Field of View test. Further, the researcher was seeking to understand how distractibility impacts driving risk as determined by the Drivewise assessment.

**Participants and Methods:** An archival, correlational design was used to examine the impact of age on UFOV performance and the impact of age, diagnosis and UFOV performance on driving. Data was gathered from the records of the neurobehavioral unit of a teaching hospital in a large northeastern US city. Of a larger research database, 236 participants were entered into the study due to the availability of UFOV test scores. Statistical analyses were conducted to investigate the relationship between age, MMSE, and diagnosis across performances on UFOV 1, UFOV 2, and distractibility (UFOV 2 – UFOV 1).

**Results:** The results indicated that age had a slight positive correlation with UFOV 2 and distractibility. Participants with impaired mental status were significantly more likely to perform in the "slow" category on UFOV 2 and the high distractibility category than normal MMSE participants. There were significant diagnostic group differences for UFOV 2 and distractibility. The results also revealed that low distractibility participants were significantly more likely to pass the driving evaluation than high distractibility participants.

**Conclusions:** The findings of this study suggest that a single measure to determine driving risk is insufficient. These results are also consistent with Ball & Owsley's (2003) report that age is not a reliable predictor of driving risk, as many older adults are able to continue driving safely. Recommendations for future research include larger diagnostic groups, alternate or revised measures of distractibility as well as including measures of symptom severity.

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### S. ALLISON & D. HEAD. Route Repetition and Reversal in Older Adults.

**Objective:** Prior studies indicate age differences in learning routes from a start location to a target destination. There is less research on age effects on reversing a learned path. The method used to learn routes may also impact navigation. This study examined how encoding methods influence the ability of older adults to recreate routes in forward and reverse directions.

**Participants and Methods:** Young ( $n=50$ ) and older ( $n=50$ ) adults were randomly assigned to learn a route in a virtual reality environment by either self-navigation or map study. Participants first completed multiple study-test trials to learn a route in the forward direction. Participants then recreated the route in the reverse direction. After 15 minutes, participants recreated the route in forward and reverse directions. ANOVAs were conducted in SPSS to examine performance.

**Results:** Older adults in the map study condition took significantly more trials to learn the route in the forward direction ( $p<.01$ ). Across encoding methods, older adults made more errors than young adults in recreating the route in reverse after initial forward learning ( $p<.01$ ). Older adults also made more errors than young adults for both forward and reverse directions after a delay ( $p<.01$ ). Finally, older adults had greater difficulty recreating the route in the reverse direction compared to forward after a delay ( $p<.01$ ). There was no significant effect of encoding method for immediate reversal, delayed forward or delayed reversal.

**Conclusions:** Results suggest that initially learning a route from a map is more difficult for older adults, but then encoding method may not modulate recreation of the route. Older adults also have difficulty not only learning a route to a target destination, but also traversing back to the start location. Older adults may have particular difficulty in retaining sufficient environmental information to reverse direction after a delay. Future work could examine methods to improve both learning routes from maps and route reversal abilities for older adults.

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#### **D. BARULLI, J. STEFFENER, P. LEMAIRE & Y. STERN. Cognitive Strategies as a Possible Mechanism of Cognitive Reserve.**

**Objective:** Using an arithmetical strategy selection task we aimed to determine if greater levels of cognitive reserve (CR) could be used to predict better strategy selection, independently of related abilities such as executive functions or domain-specific arithmetical ability. We also aimed to see if strategy selection ability could function like CR in a moderated-mediation model in which CR was previously demonstrated to moderate the effect of age-related cortical thickness variation on fluid reasoning ability.

**Participants and Methods:** 32 healthy young adults and 33 healthy older adults participated. Each received a strategy selection task requiring them to estimate the product of 2 two-digit numbers using one of two strategies: rounding both numbers down to the nearest decade, or rounding both numbers up to the next highest decade. Participants were also administered tests of their fluid reasoning ability, executive functions, arithmetic ability, and several assessments serving as CR proxies. Structural MRI scans were also given to derive cortical thickness measures for each participant using FreeSurfer software.

**Results:** Results suggest that strategy selection is associated with CR independently of executive functions and arithmetical ability. Furthermore, in at least one brain region strategy selection behaved like CR proxies in moderating the effect of age-related differences in cortical thickness on fluid reasoning performance.

**Conclusions:** Strategy selection is associated with CR independently of executive functions and domain-specific expertise, and furthermore it acts like CR in certain fundamental ways which suggest it might be a potential mechanism of this important moderator. This has important implications for potential interventions.

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#### **L. BHERER, M. LUSSIER, L. DESJARDINS-CRÉPEAU, S. FRASER, N. BERRYMAN, L. BOSQUET, D. PREDOVAN, M. KERGOAT, T. T.M. VU & K. Z.H. LI. Effects of combined physical exercise and cognitive training on executive functions and dual-task performance in older adults.**

**Objective:** Several studies have reported benefits of exercise interventions (see Bherer, Erickson & Liu-Ambrose, 2013 for a review) and cognitive training (see Belleville & Bherer, 2012 for a review) on cognitive performance in older adults. This study assessed the effect of combining both interventions in an older adult population.

**Participants and Methods:** In this study, 136 healthy older adults were randomly assigned to one of the 4 combinations 1) aerobic training and dual-task training; 2) aerobic training and placebo computer; 3) stretching training and dual-task training; 4) stretching training and placebo computer. Pre and post-test assessment involved physical functioning, neuropsychological tests and computerized dual-task.

**Results:** Results show improved performance neuropsychological test of executive control (switching) after cognitive training, but no substantial added benefits of the aerobic training. In the computerized dual-task, results showed larger change in dual-mixed than in single-mixed trials, but only for the groups that completed the dual-task training (vs. placebo computer), with no substantial difference between aerobic and stretching exercise. Improvement in other task conditions was equivalent among all groups.

**Conclusions:** Results of the present study further support the benefits of dual-task training on executive functions and dual task performance, and suggest equivalent effect of aerobic and stretching exercise on executive control and dual-task performance.

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#### **A.C. BIRDSILL, S. KAUR, C. CASSILL, P. PARKER, A. IRETON & A. HALEY. Executive Function, Not Memory, Is Associated with White Matter Structure in Middle Age.**

**Objective:** Indices of white matter changes over the adult lifespan have been associated with declines of memory and executive functioning. Characterizing these associations at middle age is of particular importance, as middle age may be a crucial time when cognitive-aging trajectories may be modified. We hypothesized that fractional anisotropy (FA), a marker of white matter health, will display positive regional associations with memory and executive functioning in healthy middle age participants.

**Participants and Methods:** Healthy participants ( $N = 162$ ) between the ages of 40 and 62 ( $M = 49.5$ ,  $SD = 6.4$ ) underwent MRI scanning with a Siemens Skyra 3T system and neuropsychological testing. Executive functioning was calculated from digit span, Stroop interference, Trail Making Test A and Trail Making Test B. Memory was calculated from CVLT short delay free recall, long delay free recall, and recognition discriminability. Whole brain analysis was performed by full tensor registration in DTI-TK. Tract-based spatial statistics (TBSS), permutation testing with Randomize, and Threshold-Free Cluster Enhancement were used in FSL to identify statistically significant clusters.

**Results:** Controlling for age, education, and sex, executive function was positively associated with FA throughout the white matter. Peak voxels were located in the left and right inferior fronto-occipital fasciculi. Memory was not associated with FA.

**Conclusions:** The results provide evidence that white matter differences are associated with differences in executive functioning, but not memory, in middle age. These results are consistent with previous research indicating that executive function is particularly sensitive to white matter damage. These results highlight the need to identify therapeutic targets to maintain white matter health to prevent cognitive decline. This research was supported by NINDS R01 NS075565 and a NSF Graduate Research Fellowship.

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**L.M. CAMPBELL, J. EPPIG, E.C. EDMONDS, C.E. WIERENGA, L. DELANO-WOOD, A.J. JAK & M.W. BONDI. Comparisons of Traditional and Comprehensive Approaches in Defining SuperAgers.**

**Objective:** Prior research has investigated ‘SuperAgers’ defined as older adults with superior recall on verbal list learning memory tests. We sought to examine the longitudinal stability and outcomes of ‘SuperAging’ based on traditionally defined criteria reflected by an above average performance on a single memory score versus a more comprehensive approach across multiple memory tests.

**Participants and Methods:** 95 community-dwelling, non-demented/non-MCI, older adults (age  $\geq 70$ ) received annual neuropsychological assessment. Traditional SuperAgers (tSA) were defined as performing  $\geq 1.5$  SD above norms on CVLT I/II long delay free recall (LDFR) alone. Comprehensive SuperAgers (cSA) performed  $\geq 1$  SD above norms on CVLT LDFR and WMS-R Logical Memory II (LM II). Both criteria also required normative performance  $\geq -1.0$  SD on language and executive functioning tests. SuperAging groups were subsequently compared to typically-aging normal older adults who did not meet either SuperAging criteria at baseline (n= 62).

**Results:** 22 individuals (23%) met criteria for tSA and 26 (27%) for cSA. Neither group differed from typical-agers on demographic comparisons. At baseline cSA performed significantly better on Trails B, category fluency, and the Boston Naming Task than typical-agers ( $p$ 's  $\leq .04$ ). Upon one year follow-up there was no difference ( $p=.29$ ) in percentage of tSA (50%) versus cSA (36%) who continued to meet respective criteria; at two years, a similar pattern emerged (tSA 42% vs. cSA 47%;  $p=.84$ ).

**Conclusions:** There was no difference in longitudinal stability regarding decline to typical-aging between the traditional and comprehensive approach. However, cSA tended to demonstrate better performance than typical-agers in non-memory domains than tSA. Future research should examine longitudinal stability of these criteria and generalizability of superior cognition to non-memory domains in conjunction with neuroimaging techniques.

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**J.E. CHANG, C.B. DUNN, J.E. BOOTH & N.M. WISDOM. Discriminant Validity and Diagnostic Utility of the Test of Practical Judgment (TOP-J).**

**Objective:** The Test of Practical Judgment (TOP-J) is a neuropsychological measure which assesses an older individual's ability to rationalize and problem solve. Questions focus on safety, medical, social/ethical, and financial issues. The purpose of this archival study was to examine this measure for the first time in a Veteran sample and develop a cut score to differentiate between cognitively healthy versus impaired adults.

**Participants and Methods:** Participants included 1 female and 42 males referred as outpatients for a comprehensive neuropsychological evaluation at a large Veterans Affairs hospital. Participants were excluded if they failed Word Memory Test (n=7). All participants were evaluated by a Board Certified Neuropsychologist and were categorized as either cognitively intact, mild neurocognitive disorder, or major neurocognitive disorder (per DSM-V criteria). Descriptive statistics and correlations were run in SPSS.

**Results:** Major and mild neurocognitive disorder were grouped together due to small sample sizes. No significant demographic differences were observed between the cognitively intact and impaired groups. As hypothesized, convergent validity indicated the TOP-J was significantly

( $p<.05$ ) correlated with measures of language, lexical fluency, and list learning and not correlated with measures of processing speed, visual spatial processing, story memory, attention, and working memory. Surprisingly, the TOP-J was not strongly correlated with verbal abstraction and semantic fluency. A cutoff score of  $<21$  yielded SE=.75, SP=.58 for predicting individuals with cognitive impairment.

**Conclusions:** The TOP-J demonstrated sound convergent and divergent validity; however, its use for diagnostic classification was limited given the small range of observed scores, which was also a noted limitation in the original normative study. Limitations include: relatively small sample size, mostly male sample, and selection bias on when to administer the TOP-J.

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**E. GRANDFIELD, D. IGNACIO, L. ISLAS, V. SANCHEZ & B.J. CHERRY. Blood Pressure and Cognition.**

**Objective:** Structural equation modeling (SEM) was used to model latent variables of blood pressure (2008; 2014) and cognition (2014) to determine whether blood pressure predicts specific cognitive domains. Data from a longitudinal study investigating older adults (50 years of age or older) with and without chronic pain were utilized. Levin et al. (2014) recently used SEM to investigate metabolic syndrome and its association with cognition and found that blood pressure but not measures of obesity, lipid or blood glucose levels significantly predicted cognitive domains (language, memory, executive function, motor processing speed).

**Participants and Methods:** Data from 50 participants were available for diastolic and systolic blood pressure (2008; 2014) to create a latent variable of blood pressure using SEM. Scores from cognitive measures including a 10-item word list, Digit Span Forward/ Backward, Trail Making Tests A/B, Stroop Color/Word Test, Digit Symbol Substitution, Everyday Problems Test and Animal Fluency created latent variables for episodic memory, executive function/processing speed and working memory. Standardized regression coefficients were then used to regress the cognitive domains on covariates (age, education, depression) and blood pressure.

**Results:** The Blood Pressure factor showed strong model fit. Cognitive indicators also demonstrated model fit, with first order factors exceeding .4, and the second order cognitive factor defined by episodic memory, executive function/processing speed and working memory. Using standardized regression coefficients, both adjusted and unadjusted models demonstrated that blood pressure significantly predicted all three cognitive domains.

**Conclusions:** Blood pressure over six years was significantly associated with episodic memory, executive function/processing speed and working memory in 2014. These types of studies are important for better understanding underlying biological mechanisms related to cognitive aging. Correspondence: *Barbara J. Cherry, PhD, Psychology, CSUF, 800 N State College Blvd, Fullerton, CA 92834. E-mail: bcherry@fullerton.edu*

**A. CHOI, N. SCHWAB, J.J. TANNER, J. JONES, L. HIZEL, S.J. CROWLEY & C. PRICE. Cerebral Oximetry and Leukoaraiosis Contributions to Working Memory in Older Adults.**

**Objective:** Regional cerebral oxygen saturation (rSO<sub>2</sub>) is reported to be a) lower for those with impaired MMSE scores prior to hip fracture surgery, and b) a potential risk factor for post-operative complications. There is little to no research, however, examining the neuroimaging risk factor for reduced oximetry or the specific cognitive domain implicated in low rSO<sub>2</sub>. From an ongoing federally funded investigation studying neuroimaging predictors of post-operative cognitive decline, we investigated the hypothesis that increasing amounts of cerebrovascular disease as measured by white matter hyperintensities (leukoaraiosis; LA) would significantly relate to lower bilateral rSO<sub>2</sub>. We secondarily



examined how patients' presurgery LA and bilateral rSO<sub>2</sub> predicted working memory and declarative memory.

**Participants and Methods:** Participants included 39 older adults. For aim 1, Pearson product moment assessed relationships between MRI-LA controlling for total intracranial volume and bilateral cerebral oximetry acquired during the day of surgery (48 hours after baseline testing/MRI), but before anesthesia induction. For aim 2, bilateral rSO<sub>2</sub> and LA were examined as contributors to presurgery working memory (Digit Span Backward, Spatial Span Total, Letter Number Sequencing) and declarative memory (HVLT-R Delay/Recognition; WMS-III Logical Memory Delay) composites.

**Results:** Participants included 39 adults (17M:22F; age=69.2 ± 6.2 years). LA/TICV and cerebral oximetry did not associate ( $r(35) = -0.14$ ,  $p > .05$ ). Linear regression analyses showed higher baseline oximetry ( $\beta = 0.39$ ,  $p < .05$ ) and lower LA/TICV ( $\beta = 0.29$ ,  $p < .05$ ) predicted better working memory, with a trending relationship for declarative memory ( $p = 0.06$ ).

**Conclusions:** Data demonstrate no association between LA and bilateral rSO<sub>2</sub>. However, both cerebral oximetry and LA load are considerations for pre-operative cognitive health, specifically working memory. R01NR014181 (CP).

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#### H. CHUNG & A. ZARTMAN. Assessing Medication Management Abilities in Older Adults in an Inpatient Medical Rehabilitation Setting.

**Objective:** Studies indicate older adults diagnosed with a neurocognitive disorder are at higher risk for medication mismanagement. In an inpatient medical rehabilitation setting, this can have serious implications with discharge disposition. This study examined the differences 1) between performance of a medication management task on perceived medication management abilities, 2) between medication adherence prior to inpatient rehabilitation admission and performance of medication management task, and 3) between patients who have a primary diagnosis of cognitive versus psychiatric disorder and performance of a medication management task.

**Participants and Methods:** Forty-five participants admitted to a Veteran Affairs (VA) inpatient rehabilitation unit were administered a medication management task, the Pillbox Test, and the Self-Efficacy for Medication Management Scale to assess older adults' perceived abilities about medication management.

**Results:** An independent t-test found no significant difference between perceived abilities to manage medications as both patients who passed or failed the Pillbox Test rated their abilities as high. However, a Chi-square test of independence found a significant relationship between patient's diagnosis and Pillbox Test performance ( $X^2(2) = 8.71$ ,  $p < .05$ ), as well as medication adherence and Pillbox Test performance ( $X^2(1) = 9.35$ ,  $p < .05$ ).

**Conclusions:** Results suggest patients diagnosed with a neurocognitive disorder were more likely to fail a medication management task than patients with a psychiatric diagnosis or no diagnosis at all. Eighty-three percent of nonadherent patients failed the Pillbox Test suggesting patients and caregivers may benefit from further intervention or treatment to improve adherence. Finally, our study highlights a potential problem with self-reported adherence as patients with limited self-awareness overestimate their ability to manage medications.

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#### J. COHEN, M. GONZALES, A. KARSTENS & M. LAMAR. The Oblique Effect: Applying Ophthalmological and Neurophysiological Principles of Visuospatial Processing to Cognitive Aging and Vascular Health.

**Objective:** From early work in ophthalmology to later, international work in neurophysiology, studies have examined the visuo-perceptual experience known as the oblique effect (OE). The OE denotes a performance advantage when processing visual stimuli oriented horizontally or vertically and a performance disadvantage when processing diagonal, i.e., oblique, stimuli; a disadvantage exacerbated by executive and/or attentional dysfunction.

**Participants and Methods:** We explored the OE in 45 vasculopaths (23 males; ~age=65+5.5). Given that cardiovascular risk factors negatively impact executive functioning (EF) and attention, we hypothesized that poorer cognitive and/or vascular health would be negatively associated with the OE using the Judgment of Line Orientation (JOLo) Test. Lines were considered oblique if they fell near the 45-degree angles of the JOLo array (lines 3,4,8,&9) and non-oblique if out of this range, horizontal, or vertical. The percentage of oblique line errors (%OErr) was calculated as: (#OErr/#oblique lines)\*100; the percentage of non-oblique line errors (%non-OErr) was similarly calculated.

**Results:** Vasculopaths produced a higher %OErr (31.94±17.64) than %non-OErr (7.59±6.74;  $t(43) = 10.67$ ,  $p > .001$ ). After controlling for age, %OErr was negatively associated with EF [ $r(36) = -.646$ ,  $p < .001$ ] and attention [ $r(36) = -.446$ ,  $p = .005$ ], and positively associated with hemoglobin A1c levels [ $r(39) = .314$ ,  $p = .04$ ]. Only the correlation between %OErr and EF remained after controlling for age, education, and MMSE.

**Conclusions:** Poorer cognition and vascular health negatively associated with participants' ability to distinguish oblique lines. We are currently examining the OE in younger and older non-vasculopaths and dementia patients compared to our current sample, and determining the neuroanatomical associates of the OE for a more comprehensive model of this visuo-perceptual experience.

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#### N.E. DEFORD, S. Y. DEJESUS, H.M. HOLDEN, F.V. LOPEZ, C.N. HARTLEY, K. SCROGGINS & P. GILBERT. Does Less Efficient Pattern Separation Contribute to Age-Related Deficits in Spatial Memory?

**Objective:** Spatial memory is known to decline with advancing age, which may have implications for everyday functioning in older adults. Spatial memory may be particularly impaired in older adults when interference is high, possibly due to age-related changes in pattern separation. We used signal detection theory (SDT) to evaluate spatial memory utilizing a new test hypothesized to tax pattern separation. Correlations with standardized neuropsychological tests also were examined.

**Participants and Methods:** Healthy young ( $n = 40$ ) and older ( $n = 30$ ) adults completed a new spatial recognition memory test involving trials with high or low levels of spatial interference. On each trial, participants remembered the location of a circle that appeared on a computer screen. Then, a circle appeared either in the same location or a different location that was separated from the original location by 0.5, 1.0, 1.5, or 2.0 cm. Participants indicated whether the circle was in the "same" or a "different" location. Smaller spatial separations (0.5 and 1.0 cm) on "different" trials were hypothesized to result in greater interference than larger separations (1.5 and 2.0 cm), and hence place greater demands on pattern separation.

**Results:** A mixed model ANOVA with  $d'$  as the dependent variable revealed that older adults were significantly impaired relative to young adults on the high and low interference conditions ( $ps < .05$ ). Both groups performed significantly better in the low interference condition compared to the high interference condition ( $ps < .05$ ), with young adults exhibiting greater improvement relative to older adults (47% larger effect size). Performance was found to correlate significantly with

standardized measures of delayed memory ( $p < .05$ ), but not language, working memory, or fluency.

**Conclusions:** Using a new test and SDT, we found that age-related differences in spatial memory may depend on the level of interference. Correlational analyses with standardized neuropsychological tests revealed preliminary evidence for construct validity.

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**K. DENNY, C. BARBA & S. TOMASZEWSKI FARIAS. Assessment of a Multi-Modal Intervention to Enhance Cognitive Compensation Strategies and Promote Brain Health Activities.**

**Objective:** The purpose of this study is to evaluate the effectiveness of a multi-modal intervention to enhance cognitive compensation strategies and promote brain health activities in older adults.

**Participants and Methods:** Older adults ( $n=9$ ) living independently within the community completed an eight-week program which targeted two areas of intervention aimed at: 1) enhancing cognitive compensation strategies and 2) promoting brain health activities. The three cognitive compensation strategies were designed to promote habitual use of a calendar, use of "To Do" lists for achievement of short- and long-term goals, and the development of functional organizational systems at home. The three brain health modules included physical exercise, engagement in cognitive stimulating activities, and enhancing positive outlook in part through practicing gratitude and mindfulness meditation.

Participants completed questionnaires on the first and last day of the course to assess to what extent they engaged in the specific compensatory skills emphasized in the program and the frequency with which they participated in the brain health activities.

**Results:** Results showed significant increases in the use of compensation strategies ( $p = 0.015$ ) and increased brain health activity engagement ( $p = 0.04$ ) following completion of this course

**Conclusions:** This study adds to the growing literature on the use of multi-modal interventions for older adults to promote cognitive and functional health. Novel aspects of the current program include the emphasis on enhancing compensations strategies to maintain independence in everyday functioning and the integration of compensation strategies to promote healthy lifestyles. Greater improvement was observed in the use of compensation strategies as compared to the brain health activities, suggesting that the former may be particularly amenable to intervention. Future studies should assess whether the improvement in everyday compensation strategies translate into slower rates of loss of functional independence.

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**Y. CHEN, K. DENNY, D. HARVEY, S. TOMASZEWSKI FARIAS, D. MUNGAS, C. DECARLI & L. BECKETT. Progression from Normal Cognition to Mild Cognitive Impairment in a Diverse Clinic- and Community-Based Elderly Cohort.**

**Objective:** To investigate annual rate of conversion from normal cognition to mild cognitive impairment (MCI) and identify risk/protective factors associated with diagnostic change.

**Participants and Methods:** Participants ( $n=267$ ) who were clinically confirmed as cognitively normal at baseline were followed up to seven years as part of an ongoing prospective longitudinal study in a university based Alzheimer's center. Potential predictors of conversion included: source of recruitment (either directly from the community or through clinic-based referrals), demographic factors (age, gender, race/ethnicity, year of education, APOE  $\epsilon 4$  positive), and baseline measures of cognitive performance (executive function, memory), everyday function, and neuroimaging measures (total brain volume, total hippocampal volume, white matter hyperintensity volume).

**Results:** Of 267 participants, 66 (12 from the clinic, 54 from the community) progressed to MCI with a mean (SD) time of follow-up of 2.87 years (2.06) for clinic-based sample and 4.55 years (2.31) for the community-based sample. The clinic-based sample showed an annual conversion rate of 30% per year, whereas the community-based sample showed a conversion rate of 4-6% per year. Being referred for a clinical evaluation, older age, and worse baseline executive function and everyday function were all independent risk factors for conversion, while larger standardized total brain volume was protective.

**Conclusions:** Having a concern about cognitive decline and/or being referred for a clinical evaluation is a risk for the subsequent development of MCI. Such findings are consistent with the emerging importance of subjective cognitive concern in the literature and suggests that it is important for this group of older adults to be followed with repeat assessments. However, regardless of the presence of cognitive concern, being older, having lower executive function and everyday functional, and greater brain atrophy are also independently predictive of increased risk for conversion to MCI.

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**N. DO, Y. XU, C.P. MOLDOVAN, A. ARÉCHIGA, S. RAJARAM & J. SABATÉ. Predictors of Premorbid Intelligence and Cognitive Decline.**

**Objective:** Prior researchers have found that demographic factors, attention, and working memory significantly impact premorbid intelligence (PI). PI is a predictor of overall cognitive functioning, a key component to age-related dementias and neurodegenerative diseases. As cognitive function decreases with age, it is important to examine the determinants of cognitive decline prior to symptom onset. Executive functioning has not yet been tested as a predictor of PI. Consequently, the present investigation examined age, education, attention, working memory, and executive functioning as predictors of PI in a sample of healthy older adults.

**Participants and Methods:** 365 participants between the ages of 62-80 years were recruited through Loma Linda University ( $M = 69.57$ ,  $SD = 3.90$ ). PI was assessed using the AMNART, attention was measured using the Stroop Color-Word test, working memory was assessed using the RAVLT, and executive functioning was measured using the TMT (Part B).

**Results:** A hierarchical regression analysis was used to determine the influence of age, education, working memory, attention, and executive functioning on PI. Age and education were included in the first step of the analysis, attention was added in the second step, working memory was added in the third step, and executive functioning was added in the fourth step. Overall, the regression model accounted for 35.6% of the variance in PI,  $F(5,361) = 39.39$ ,  $p < .001$ . PI was significantly predicted by education ( $\beta = .540$ ,  $t = 11.98$ ,  $p < .001$ ), attention ( $\beta = .196$ ,  $t = 4.30$ ,  $p < .001$ ), and executive functioning ( $\beta = -.100$ ,  $t = -2.21$ ,  $p < .05$ ).

**Conclusions:** Results of the current study support previous findings showing that education and attention significantly predict PI, and introduce executive functioning as another predictor of PI. Further, results suggest that executive function is an additional cognitive domain that can be examined to predict cognitive decline before symptoms reach clinical levels.

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**A.G. GERTSBERG, R.F. KAPLAN, N. LEGATE, L. STRAINGE & J. CHASMAN. Cognitive reserve: The Role of Occupational Experience.**

**Objective:** High levels of education and occupational attainment have been traditionally linked to preserved cognitive functioning in early dementia. This study explored relationships between specific occupational

skills and cognitive reserve, both overall and within specific cognitive domains, in the normal elderly and early dementia.

**Participants and Methods:** One hundred eighty eight patients aged 34-94 ( $M=75.45$ ,  $SD=10.99$ ) completed a neuropsychological test battery as part of a routine clinical visit. A patient's longest work experience defined their occupation. Occupation abilities are rated by the U.S. Department of Labor Occupation Information Network based on the cognitive abilities needed to perform that work.

**Results:** Hierarchical multiple regressions were used to predict test scores using age, gender, education, and occupational abilities as predictor variables. Occupations rated high in verbal skills predicted higher verbal and language neuropsychological test scores above and beyond education. Occupations requiring high verbal skills also protected performance in other cognitive domains, even when the effect of education was no longer significant. Occupations rated high in verbal abilities protect against cognitive decline in patients with dementia in domains of executive functioning/processing speed, learning and memory, and visuospatial/construction. These protective effects were limited to verbal job experience. Other occupational skills did not predict neuropsychological test scores in any cognitive domain.

**Conclusions:** These findings indicate that occupation-related verbal abilities, but not other occupation-related skills, predict higher neuropsychological test scores independent of education, particularly for individuals with dementia. Experience in other domains did not show better neuropsychological test scores, even in those domains related to type of work experience. These data suggest that it is the verbal components of education rather than years of education underlying cognitive reserve. Correspondence: *Anna G. Gertsberg, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT CT. E-mail: anna.gertsberg@gmail.com*

**E.I. GRACIAN, M.B. AUSTIFF, D.O. WRIGHT & K.E. MOSACK. Executive function and memory contributions to medication management ability in cognitively normal, older adults.**

**Objective:** Medication nonadherence among older adults may negatively influence or be influenced by physical and psychological health. Critically, cognitive deficits can impair medication management that could contribute to unintentional medication nonadherence in older adults. Researchers have reported that executive function (EF) and memory deficits in standardized measures are significantly related to problems with medication management in clinical and aging populations. The purpose of our study, then, is to examine EF and memory contributions to medication management ability in cognitively normal, older adults using two novel computerized tasks that tap into EF and memory domains.

**Participants and Methods:** Twenty six participants (Women,  $n = 24$ ; Mean Age = 72.9 years,  $SD = 8.4$ ) completed the reversal task (RT), transverse patterning task (TPT), and Medication Management Ability Assessment (MMAA). RT is an executive function computerized task dependent on the prefrontal cortex that is adapted from animal models in which contingencies were learned and then reversed. TPT, an adaptation of the rock/paper/scissors problem, is a learning and memory computerized task dependent on the hippocampus. The MMAA is a role-play in which participants were given instructions for taking fake medications and then were asked to inform the researcher how and when they will take pills.

**Results:** Regression analyses revealed that better performance in the TPT predicted higher scores on the MMAA ( $p=.033$ ). Conversely, the RT was not related to performance on the MMAA ( $p=.824$ ).

**Conclusions:** The findings suggest that learning and memory as measured by TPT is more predictive of medication management compared to EF as measured by RT. Importantly, the TPT may be useful in detecting and predicting impairments in medication management that could ultimately affect medication adherence in aging populations.

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**E.Z. GROSS, E.M. HOLCOMB & J.L. WOODARD. Convergent and Discriminant Validity of Ex-Gaussian Parameter Estimates.**

**Objective:** Ex-Gaussian parameter estimation is a method for characterizing intra-individual variability of response times (RT) beyond the mean and standard deviation (SD). This approach provides a third parameter,  $\tau$ , which accounts for variability in the right tail of the distribution.  $\tau$  is independent of estimates of  $\mu$  and  $\sigma$ , the central tendency and dispersion of the RT distribution.  $\tau$  represents attention, while  $\mu$  and  $\sigma$  are associated with processing speed. Prior research using this analytic strategy has used tasks that strongly rely on these abilities, raising the possibility that the associations simply reflect task demands. This study used a semantic knowledge task to validate this approach.

**Participants and Methods:** Cognitively healthy older adults ( $N = 64$ ; mean Age = 68.8) completed a two-choice semantic memory task (famous or unfamiliar names) and a brief test battery. Bootstrapped parameters were estimated separately for famous and unfamiliar stimuli. Correlations with attention (RAVLT Trial 1, Logical Memory I) and processing speed (digit symbol, symbol search) were expected to demonstrate convergent validity, while lack of correlations with executive function (Stroop), memory (LM II), and depressive symptoms (GDS-15) were expected to demonstrate discriminant validity.

**Results:** Parameter estimates for unfamiliar names were not correlated with any tests. Estimates for famous names were not significantly correlated with executive function, delayed recall, or depressive symptoms. For famous names, all parameters correlated significantly with at least one processing speed test, ranging from  $-.25$  to  $-.33$  ( $p < .05$ ). Only  $\tau$  correlated with attentionally demanding measures: LM I ( $r = -.31$ ,  $p < .05$ ) and RAVLT T1 ( $r = -.29$ ,  $p < .05$ ).

**Conclusions:** These results demonstrate good convergent and discriminant validity for ex-Gaussian parameter estimates using a semantic memory task. Parameter estimates for lures did not correlate, while estimates for targets did correlate with cognitive tests as hypothesized. Correspondence: *Evan Z. Gross, B.A., Psychology, Wayne State University, 21546 Gregory Street, Dearborn, MI 48214. E-mail: evan.gross@wayne.edu*

**V.A. GUZMAN, J. GUTIERREZ-CONTRERAS, R. SCOTT, E. GRIFFITH, B.S. LAST, J. MANLY & A.M. BRICKMAN. Vascular Injuries to The Brain: Which Holes Matter?**

**Objective:** Perivascular spaces (PVS) are interstitial fluid filled cavities that form between penetrating vessels and their surrounding parenchyma. PVS are common in older adults and often associated with vascular risk factors. Findings regarding the extent to which PVS contribute to cognitive dysfunction are mixed. One important issue is how measurement protocols distinguish between large PVS and lacunar infarcts. Informed by clinical-pathological correlates studies, we applied a protocol to distinguish large PVS from infarcts. We tested the extent to which total large PVS and infarct volumes relate to cognitive function in older adults.

**Participants and Methods:** Participants included 331, non-demented, older adults (mean age=80yrs) from a community based study of cognitive aging. Participants received structural MRI and neuropsychological evaluation that yielded scores for overall cognition, memory, language, executive, and visuospatial function. We calculated the total volume of hypointense voids ( $>5\text{mm}$ ) on axial T1weighted images that were accompanied by a hyperintense rim on FLAIR images. Large PVS were distinguished from infarcts based on anatomical distribution and FLAIR characteristics. We examined the relationship of infarct and PVS volumes with cognition, controlling for age, sex, race/ethnicity, education, and vascular factors.

**Results:** Total infarct volume was negatively associated with overall cognitive function and executive function, but PVS did not correlate

with cognitive function. Mean total PVS volume was significantly greater than mean total infarct volume and vascular risk factors were related to both PVS and infarct volume.

**Conclusions:** Our results suggest that total infarct volume, but not large PVS, are associated with poorer cognitive functioning. Careful distinction between infarcts and PVS is important for understanding the impact of vascular lesions on cognitive aging.

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**L. HIMES, N. HUBBARD, M. TURNER, S. SUNDARAM, D. MUNGALL, L. OASAY & B. RYPM. White Matter Lesion Burden and Functional Connectivity of Resting State Network in Healthy Aging.**

**Objective:** Healthy aging is associated with neural changes in both structure and function yet the relationships between these changes are not fully understood. One manifestation of age-related structural changes is an increase in white matter lesions. One manifestation of age-related functional changes is a decrease in resting state functional connectivity. We investigated whether white matter lesions affected resting state networks across a wide-range age sample. We hypothesized that individuals with higher lesion burden (older individuals) would have a less functionally connected resting state network compared to individuals with less lesion burden (younger individuals).

**Participants and Methods:** Twenty-two ( $N = 22$ ) participants ages 21-66 ( $M = 42.68$  [ $SD = 12.26$ ]; 17 female) were selected. White matter lesion burden (LB) was estimated using T2-FLAIR magnetic resonance imaging. Resting state connectivity was measured using quantitative centrality (QC) - a measure of functional connectivity of each voxel within the resting network.

**Results:** LB increased with age ( $r = .48$   $p < .05$ ). QC decreased with age in the default mode network (DMN) nodes (e.g., precuneus, hippocampal formation; all regions  $p < .05$ ,  $k > 11$ ). LB significantly predicted decreases in QC within these regions (all  $ps < .05$ ).

**Conclusions:** Age-related increases in LB appear to be associated with disconnection of the DMN. These findings reflect a decrease in the overall cohesiveness of brain function as a result of increasing white matter lesion burden during healthy aging.

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**J.K. HO & D.A. NATION. Protective Effects of Angiotensin II Type 1 Receptor Blockers on Cognition and Alzheimer's Disease.**

**Objective:** Findings from several observational studies and clinical trials suggest that antihypertensive treatment may have beneficial effects on cognition and highlight Angiotensin II type 1 receptor blockers (ARBs) as a drug class that may provide the greatest benefit. We hypothesized that ARB-users would display improved cognition and reduced amyloid retention relative to other-antihypertensive-drug-users.

**Participants and Methods:** Participants were 1,626 non-demented adults ages 55-91 from the Alzheimer's Disease Neuroimaging Initiative. 804 participants used antihypertensive drugs. Three groups were compared: ARB-users, other-antihypertensive-drug-users (Other-antiHTN) and a group that did not take any antihypertensive drugs (No-antiHTN). Vascular risk burden, cognition, and florbetapir-fluorine-18 (F18) PET retention were compared using ANCOVA, multiple linear regression and chi-square tests.

**Results:** The Other-antiHTN group performed significantly worse than the No-antiHTN group on Rey Auditory Verbal Learning Test Immediate Recall ( $p=.004$ ), Delayed Recall ( $p<.001$ ), Recognition ( $p=.002$ ), Trails A ( $p<.001$ ) and Trails B ( $p=.008$ ), but ARB-users did not perform significantly worse than the No-antiHTN group on any measures except for Trails A ( $p=.005$ ). The ARB users performed significantly better than Other-antiHTN group on Recognition ( $p=.04$ ). There were no gross

group differences in relation to florbetapir-F18 PET retention or amyloid positivity; however, older ARB-users tended to show less amyloid retention than other-antiHTN peers (ages: 70-75,  $p<.05$ ; 76-91,  $p=.06$ ).

**Conclusions:** Participants on antihypertensive drugs demonstrated worse cognitive performance compared to those not taking these drugs, unless they were ARB-users. Older ARB-users tended to show less amyloid retention but differences in amyloid were less apparent than differences in cognition. Potential protective effects of ARBs on cognition may involve amyloid-dependent and -independent mechanisms.

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**H.M. HOLDEN, L.D. MEDINA, S.M. TIERNEY, E. PIROGOVSKY TURK, S. WOODS, V. FILOTEO & P. GILBERT. Time-Based Prospective Memory Uniquely Predicts Financial Management Capacity in Older Adults.**

**Objective:** Prospective memory (PM) may play an important role in the ability of older adults to carry out complex activities of daily living. Although PM is reliant on the integrity of other cognitive processes (e.g., executive function), evidence suggests that PM may be a unique predictor of self-reported everyday functioning in older adults, over and above other cognitive abilities. The aim of the current study was to utilize performance-based assessments to examine the incremental value of PM in predicting medication and financial management capacity in older adults.

**Participants and Methods:** Participants included 57 healthy older adults who were administered performance-based measures of the constructs of interest, including Memory for Intentions Screening Test (MIST) for prospective memory, Advanced Finances Test (AFT) for financial management, and Medication Management Ability Assessment (MMAA) for medication management. Participants also completed a set of standardized neuropsychological assessments.

**Results:** A separate hierarchical linear regression was conducted for each of the everyday functioning measures. In Step 1 of each analysis, demographic factors (age, education, gender) and an executive function composite score were entered. In Step 2, time-based and event-based scales from the MIST were entered. Results revealed that time-based scores uniquely predicted scores on AFT ( $p < .05$ ). However, neither MIST score was a significant predictor of MMAA scores.

**Conclusions:** The results suggest that PM ability uniquely contributes to functional capacity in older adults. However, the role of PM in everyday functioning may not be ubiquitous in all functional activities. The specific relationship between time-based PM and financial management suggests that financial management capacity in older adults may depend on strategic, self-initiated retrieval processes. Overall, the results of this study suggest that performance-based assessment of PM may play an important role in evaluations of functional capacity in older adults.

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**M. JOANNETTE, D. GANDINI, I. ROULEAU, M. LAVALLÉE, G. VALLET & S. JOUBERT. The Ability to Detect Changes in the Spatial Relations of Faces Is Impaired in Alzheimer's Disease.**

**Objective:** Persons suffering from Alzheimer's disease (AD) present with difficulties in recognizing familiar faces. Even though specific memory disturbances may be accountable, it is not known however if face perception deficits may also explain some of these difficulties. Therefore, the aim of the current study was to investigate if AD patients showed impaired visuoperceptual processing of faces. It was hypothesized that patients would have difficulties processing spatial relations in faces.

**Participants and Methods:** 18 mild AD patients and 19 matched healthy elderly controls completed a same/different unfamiliar face discrimination task. To assess whether configural strategies in face processing were impaired in AD, participants had to detect changes in the distance between the eyes (horizontal axis) and between the mouth

and the nose (vertical axis). As a control task, participants had to process faces where local attributes such as the eyes or the mouth had been changed by those of another face.

**Results:** Independent samples *t*-tests were carried out between the two groups of participants for reaction times (RT) and error rates (ER). Overall, no differences were found between AD patients and controls when specific local parts such as the mouth or the eyes had been changed. AD patients, however, showed significantly longer RT ( $p < 0.01$ ) and higher ER ( $p < 0.01$ ) relative to controls in their ability to detect changes in the distance between the mouth and nose. In regard to their ability to detect changes in the distance between the eyes, AD patients showed significantly worse ER ( $p < 0.05$ ) and a trend toward significance was also found in terms of RT ( $p = 0.07$ ).

**Conclusions:** Persons suffering from mild AD seem to present with difficulties in processing faces at a configural level (i.e. changes in second-order relations) but do not seem to be affected when required to detect local changes in facial configurations. These results provide new insights on the specific face perception mechanisms that may be affected in the disease.

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#### **A. KARSTENS, J. COHEN, O. AJILORE, S. SHANKMAN, A. KUMAR & M. LAMAR. The Separate and Interactive Effects of Trauma and Depression on Cognition in Urban Dwelling Adults.**

**Objective:** Approximately 89% of urban dwellers have experienced traumatic events defined by exposure to actual or threatened death, serious injury, or sexual violation. Trauma exposure puts one at risk for depression and various cognitive alterations including slowed attention/information processing (AIP). Depression alone may also impact AIP. Little work has been done investigating the comorbid contributions trauma and depression have on cognition.

**Participants and Methods:** We examined the separate and interactive effects of Trauma and Depression on AIP and other cognitive domains in urban dwellers ranging in age from 30–89 (~56+13yrs): 78 depressed adults with trauma, 62 depressed adults without trauma, 69 euthymic adults with trauma, and 93 euthymic adults without trauma. All completed i) a comprehensive psychological evaluation including the SCID to assess trauma history and depression, objective and subjective depression measures; ii) a comprehensive neuropsychological assessment including tests of EF, AIP, learning and memory.

**Results:** 2X2 ANCOVAs controlling for age revealed no interactions across cognitive domains and a main effect of trauma on AIP only,  $F(4,282) = 5.09, p = 0.02$ . Participants with trauma performed worse on AIP, driven primarily by WAIS-III Digit Span-Forward performance [ $F(2,294) = 5.12, p = 0.02$ ].

**Conclusions:** Results suggest individuals with trauma have difficulty with AIP such that they cannot focus attention on verbally mediated information for immediate rote recall – an area where cognitive training may prove useful for these trauma-exposed individuals. Results did not suggest an interaction of trauma and depression on cognition or a main effect of depression; this may be due, in part, to our wide age range, issues of depression severity and/or duration in our population.

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#### **S. KIELB, S. WEINTRAUB, E. ROGALSKI & A. RADEMAKER. Objective Cognitive and Functional Loss and Dementia Risk in Subjective Cognitive Decline.**

**Objective:** Subjective cognitive decline (SCD) is common in cognitively normal for age individuals but is not well understood. We analyzed SCD in relation to [1] longitudinal cognitive scores, [2] functional activities of daily living, and [3] incidence of mild cognitive impairment (MCI) and

dementia in a large, longitudinal dataset from the National Alzheimer's Coordinating Center.

**Participants and Methods:** The sample included participants who were over age 65, designated as having "normal cognition" (CDR=0, MMSE>26), with at least two annual neuropsychological evaluations (mean=4.5), and no more than "mild" baseline depression (GDS<8/15). SCD was based on the single question, "Does the subject report a decline in memory relative to previously attained abilities?" at baseline (no=763, yes=3152). *T*-tests and Chi-square analyses were used to compare groups on average rates of change (best linear unbiased predictors) on 8 neuropsychological tests, total baseline Functional Assessment Questionnaire scores, and incidence rates of MCI and dementia over a five-year period.

**Results:** Compared to the group without SCD, the group with SCD had greater decline in processing speed (Coding, Trails A), naming (Boston Naming Test), and executive attention (Trails B), reduced episodic memory practice effects (Logical Memory Immediate and Delayed Recall) (all  $p < 0.005$ ), more restrictions in independent living abilities at baseline ( $p < 0.001$ ), and higher five-year incidence of both MCI (17% v 12%) and dementia (6% v 4%, both  $p < 0.05$ ).

**Conclusions:** Results support the hypothesis that SCD may be a harbinger of cognitive decline and dementia. In a sizable sample of cognitively normal older adults, those with SCD showed subtle weaknesses in longitudinal cognitive performance and independent living abilities and were more likely to develop MCI and dementia. Reduced psychomotor speed and a lack of episodic memory practice effects may be objective cognitive markers related to SCD.

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#### **B.S. LAST, M. GARCIA RUBIO, C. ZHU, S. COSENTINO, J. MANLY, C. DECARLI, Y. STERN & A.M. BRICKMAN. The Cost of Brain Aging: Medicare Expenditure Correlates of Atrophy and Cerebrovascular Disease in Older Adults.**

**Objective:** It is well documented that MRI-derived age-associated atrophic and cerebrovascular markers are strongly related to several clinical outcomes. Despite the known clinical and functional correlates, their financial costs are poorly understood. We studied whether increased Medicare expenditures were associated with brain markers of atrophy and cerebrovascular disease in older adults.

**Participants and Methods:** Using high resolution structural MRI data from 592 diverse participants in a community-based study of cognitive aging, we determined the association of Medicare expenditure data, averaged over the ten year period prior to scan acquisition, with markers of brain atrophy (i.e., whole-brain and hippocampal volume), and cerebrovascular disease burden (i.e., white matter hyperintensity volume and presence of infarcts).

**Results:** Increased Medicare spending was associated with higher white matter hyperintensity volume, presence of cerebral infarcts, and smaller total brain volume. When examining specific components of Medicare expenditures, we found that inpatient spending was strongly associated with white matter hyperintensity volume and that increased ratios of inpatient-to-outpatient and inpatient-to-total spending were associated with infarcts. These associations were independent of dementia status, medical burden, and several demographic features.

**Conclusions:** The findings suggest that increased health care system costs are associated with measures of vascular brain injury and atrophy in this ethnically diverse community sample. As the size of the older adult population continues to increase, future work should focus on strategies to prevent or delay these age-associated cerebral changes.

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**M. LAVALLÉE, D. GANDINI, I. ROULEAU, M. JOANNETTE, G. VALLET & S. JOUBERT. Holistic face processing is impaired in Alzheimer's disease and Lewy Body dementia.**

**Objective:** Difficulties in the ability to recognize familiar persons have been reported in both Alzheimer's disease (AD) and Lewy Body dementia (LBD). It is unclear, however, to what extent these difficulties may be due to underlying difficulties in facial perception. One paradigm which allows testing both analytic and holistic face processing strategies is the face-inversion effect (FIE). The FIE reflects a normal decline in performance when matching inverted faces relative to upright faces. In contrast, a reduction or suppression of the FIE may reflect difficulties in holistic processing of faces. The aim of the present study was to investigate the FIE in mild AD and LBD.

**Participants and Methods:** 25 mild AD patients, 10 mild LBD patients and 25 healthy elderly adults (HE) participated in a study in which they were required to match upright or inverted faces. Moreover, in order to assess the specificity of the FIE, participants were also required to match upright or inverted cars in the same experiment.

**Results:** For each group of participants (HE, AD, and LBD), repeated measures ANOVAs were carried out on error rates (ER) and reaction times (RT). Category (cars vs. faces) and Presentation (upright vs. inverted) were used as within-subjects variables. ER analysis revealed that only HE showed an interaction between Category and Presentation, typical of the FIE. In regard to RT, HE and LBD patients exhibited a significant interaction between Category and Presentation, but not AD patients.

**Conclusions:** In regard to error rates, both AD and LBD patients showed a reduction in the FIE relative to controls. In regard to RT, only AD patients showed a reduction in the FIE. These results seem to suggest that holistic processing strategies are impaired in AD. They also appear to be affected in LBD but to a lesser extent.

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**C. MCALISTER & M. SCHMITTER-EDGEcombe. Executive Function Subcomponents and their Relations to Everyday Functioning in Healthy Older Adults.**

**Objective:** Everyday functioning and its executive functioning cognitive correlates were investigated in healthy older adults (HOAs) using multiple methods of functional status. We were especially interested in the contributions of both process pure and traditional measures of the executive function subcomponents of switching, inhibition, and updating.

**Participants and Methods:** Seventy HOAs (45 young-old and 25 old-old) and 70 younger adults completed executive function and neuropsychological tests. In addition to self- and informant questionnaires of functional abilities, HOAs completed two performance-based measures.

**Results:** An aging effect was found on all executive function measures. Old-old older adults and their informants did not report more functional difficulties, but demonstrated more difficulties on performance-based measures relative to young-old participants. For the HOAs, after controlling for age and education, the traditional, but not process pure, executive function measures explained a significant amount of variance in the informant-report and both performance-based measures. Updating measures differentially predicted performance-based measures, while switching was a unique predictor of informant-report and problem-solving measures.

**Conclusions:** These findings highlight the importance of taking a fractionated approach to the study of executive functioning and functional status, and suggest that switching and updating abilities may contribute to age-related decline of everyday functioning in HOAs.

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**C. MCALISTER & M. SCHMITTER-EDGEcombe. Everyday Functioning and Cognitive Correlates in Healthy Older Adults with Subjective Cognitive Concerns.**

**Objective:** Few studies have examined functional abilities and complaints in healthy older adults with subjective cognitive concerns (SCC). The aims of this study were to assess everyday functioning in healthy older adults with varying SCC, and examine cognitive correlates of functional abilities.

**Participants and Methods:** Twenty-six healthy older adults with high SCC, and 27 healthy older adults with low SCC, as well as their knowledgeable informants completed the Instrumental Activities of Daily Living-Compensation (IADL-C), a questionnaire measure of everyday functioning.

**Results:** Although the high SCC group did not self-report more physical limitations or depressive symptoms, compared with the low SCC group, they self-reported significantly more everyday difficulties. Compared to the low SCC group, informants for the high SCC group endorsed more difficulties on the IADL-C and specifically the money and self-management, and social skills subdomains. For the high SCC group, poorer self-report of everyday functioning was related to poorer executive functioning, while the informant-report was related to temporal order memory. No significant associations were found for the low SCC group.

**Conclusions:** These findings indicate that there may be subtle functional changes that occur early in the spectrum of cognitive decline in individuals with high SCC. Individuals with both SCC and functional difficulties may be at an even higher risk for progression to dementia.

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**E. MCINTOSH, A. JACOBSON, N. KEMMOTSU, E. GREEN & C. MURPHY. MetS and Cortical Thickness of Entorhinal Cortex in Middle-Aged and Older Adults.**

**Objective:** We had two objectives: 1) To examine differences in cortical thickness of entorhinal cortex in middle aged and older adults with and without metabolic syndrome (MetS), 2) To explore the contribution of type II diabetes (T2DM) to any differences in cortical thickness.

**Participants and Methods:** Participants were 34 middle-aged and 41 older adults with and without MetS. Medical histories, medication use and clinical data were acquired prior to imaging. T1-weighted MRI scans were acquired at 3.0T. Structural images were processed using the Freesurfer image analysis suite. Analyses of covariance were performed to investigate group differences (MetS vs. control) in entorhinal cortical thickness separately in middle-aged and older adults. These analyses were repeated excluding participants diagnosed with T2DM.

**Results:** Group analyses revealed less cortical thickness in the left entorhinal cortex in middle-aged ( $p = 0.007$ ;  $\eta^2 = 0.228$ ) but not older adults ( $p > 0.05$ ) with MetS. When excluding participants with T2DM, these differences remained in middle-aged adults ( $p = 0.029$ ;  $\eta^2 = 0.199$ ).

**Conclusions:** The findings in this study demonstrated that middle-aged adults, but not older adults, with MetS have decreased entorhinal cortical thickness relative to those without MetS. The medial temporal lobe (MTL), particularly the entorhinal cortex, is the site of early Alzheimer's disease pathology. Past studies show metabolic and cardiovascular abnormalities, especially in middle age, increase risk for cognitive impairment and dementia. The present results indicated that T2DM, a condition associated with MTL atrophy and dementia, was not sufficient to explain the findings. In conclusion, this study demonstrates that MetS in midlife may negatively impact brain structure and further supports the notion that middle age may be a sensitive period in determining risk for pathological aging.

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**J. MCNEELY, K. STEWARD, S. KAUR, C. CASSILL & A. HALEY. Blood Glucose Mediates the Relationship between Cognitive Function and Sleep Quality in Middle-Aged Adults.**

**Objective:** Previous work suggests that sleep disturbances and hyperglycemia independently contribute to impaired cognitive function. However, since fragmented sleep promotes alterations in glucose metabolism, it is possible that the negative impact of sleep problems on cognitive test performance is driven by disturbances in glucose metabolism. The purpose of the current study was to examine the relationship between sleep quality, blood glucose, and cognitive function in a healthy, middle-aged population.

**Participants and Methods:** One hundred twenty-three participants (mean age = 49.76, 50% male), ages 40-60, completed the Medical Outcomes Sleep (MOS) questionnaire, a full neuropsychological assessment, and a general health assessment, including a fasting blood draw, to assess for glucose levels.

**Results:** Linear regression models adjusted for age, education level, and gender were used for the analyses. Results demonstrated that greater sleep problems positively correlated with higher glucose levels ( $B = .27$ ,  $p = .002$ ) and worse performance ( $B = .22$ ,  $p = .01$ ) on Trails B. Likewise, higher glucose levels indicated worse performance ( $B = .24$ ,  $p = .007$ ) on Trails B. A mediation analysis, using Baron & Kenny's traditional causal steps approach, revealed that sleep no longer predicted worse performance on Trails B when adjusted for glucose levels ( $B = .15$ ,  $p = .089$ ). Results of the Sobel test, used to test for indirect effect, were also significant ( $p = .04$ ).

**Conclusions:** These findings indicate that greater sleep problems correlate with worse performance on Trails B as a result of higher glucose levels in middle-aged adults. The findings provide novel insight into the relationship between blood glucose, cognition, and sleep disturbances. Correspondence: *Jasmine McNeely, Psychology, University of Texas at Austin, University of Texas at Austin, Department of Psychology, 1 University Station A8000, Austin, TX 78712. E-mail: jasmcneely@gmail.com*

**M.B. MEMEL, H. RITCHIE & L. RYAN. The Role of Visual Integration and Working Memory in Age-Related Associative Memory Deficits.**

**Objective:** Associative memory is selectively impaired during healthy aging, but the mechanisms responsible for this decline are not fully understood. The relationship between visual integration of stimuli and associative memory performance is relatively unexplored. Differences between age groups in the ability to bind visually integrated and non-integrated stimuli might contribute to our understanding of the associative memory deficit. We hypothesize that older adults may perform similarly to young when visual stimuli are integrated and will be particularly impaired when visual stimuli require integration.

**Participants and Methods:** Twenty-four older adults and nineteen young adults studied photographs of typical household objects and realistic scenes. In the integrated condition, an object was positioned naturally in a scene. In the separated condition, an object was presented on a white background next to and visually distinct from a scene. An associative recognition task followed. Three executive function measures (updating, task-switching, inhibition) were collected during a separate neuropsychological battery.

**Results:** Older adults responded with more false alarms than young across conditions. However, both groups exhibited a similar pattern of increased false alarms in response to separated pairs. No interaction between condition and age group was observed. Executive function scores, specifically updating and task-switching, were differentially related to associative recognition.

**Conclusions:** In line with the associative binding deficit (Naveh-Benjamin, 2000), older adults were more susceptible to false alarms than young across conditions. In contrast to our hypothesis, both groups experienced a similar decrease in accuracy when required to integrate visually distinct items, suggesting visual integration does not overcome the age-related binding deficit. Importantly, individual differences in

working memory amongst older adults predicted associative recognition, with the high updating group performing as well as young.

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**C. MORENO, L. GRAVES, K.L. DOYLE, L. DELANO-WOOD, M.W. BONDI, S. WOODS, D.C. DELIS & P. GILBERT. Recall and Recognition Discriminability in Healthy Aging.**

**Objective:** Performance on verbal memory tests is known to decline with age. The California Verbal Learning Test-Second Edition (CVLT-II) includes a new experimental measure termed recall discriminability, which is analogous to recognition discriminability. Discriminability scores from the CVLT-II are expressed as a single  $d'$  score, which provides the opportunity to make direct comparisons between recall and recognition raw scores. The objective of the present study was to examine the effect of age as a continuous variable on each CVLT-II score of recall and recognition discriminability in a sample of healthy adults.

**Participants and Methods:** Participants were 193 healthy adults 18-91 years old ( $M = 46.78$ ,  $SD = 23.47$ ), 93 of which were female. Participants were administered the CVLT-II as part of a larger neuropsychological test battery. Age was the independent variable of interest. Raw recall discriminability scores (Total, Immediate, Delayed, Free, and Cued) and recognition discriminability scores (Total, Source, Semantic, and Novel) were the dependent variables of interest.

**Results:** Multiple regression analyses revealed that performance on each CVLT-II measure of recall and recognition discriminability significantly decreased as age increased, controlling for gender and education ( $p < .001$ ).

**Conclusions:** The findings indicate that recall and recognition discriminability scores from the CVLT-II decline with increasing age. These measures might provide more accurate assessments of recall and recognition abilities, by quantifying target words recalled relative to intrusion errors (recall) and hit rates relative to false positive rates (recognition). Correspondence: *Charles Moreno, Psychology, San Diego State University, 11255 Paseo Montanoso apt 180, San Diego, CA 92127. E-mail: charles.c.moreno@gmail.com*

**R. MORIN & E. MIDLARSKY. Predictors of WAIS Vocabulary Among Black and White Older Adults.**

**Objective:** Vocabulary scores tend to be significantly related to education in heterogeneous groups of older adults, even after controlling for confounding variables. However, there may be other factors that impinge on cognitive functioning for certain demographic groups, particularly among older adults whose educational opportunities were limited and who may have experienced considerable stress as a result of their minority status. This study explores possible predictors of vocabulary scores in Black and White older adults.

**Participants and Methods:** In this study, samples of Black ( $N = 165$ ) and White ( $N = 146$ ) community-dwelling older adults reported their level of education, perceived health status, number of stressful life events, and were administered the WAIS-R vocabulary subtest.

**Results:** Among the White participants, level of education was the only significant predictor of vocabulary score after controlling for perceived health and exposure to stress. Among Black participants, education was also a significant predictor of vocabulary score, however perceived health and number of stressful life events were also significantly predictive of vocabulary score.

**Conclusions:** Findings indicate that for certain cohorts of older adults, especially those who may have experienced stressful life circumstances and health disparities as a result of societal racial inequality, education may not be the only variable that predicts verbal intelligence. The importance of investigating cognitive functioning within a broader socio-cultural context is discussed.

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**M.C. MUNIZ, Z.Z. ZLATAR, S. ESPINOZA, R. GRATIANNE, T.H. GOLLAN, D. GALASKO & D.P. SALMON. Associations between Subjective Cognitive Decline, Depression, and Objective Cognitive Performance in Hispanic Elderly.**

**Objective:** Cognitive complaints are common in the elderly and this subjective cognitive decline (SCD) has been viewed as a subtle but meaningful change that may relate to neurodegeneration. However, we recently found that SCD was more closely related to symptoms of depression than to objective cognitive impairment in a random sample of community-based older adults. Whether or not this is also true in a clinic-based sample where cognitive complaints may be more specific, or in cohorts with culturally distinct views of cognitive or depressive symptoms, remains unknown.

**Participants and Methods:** We examined this issue in 149 patients age 60 or older (mean=74.02 years, SD=7.6) referred by community health clinics for screening of cognitive impairment. All patients were Hispanic, lived near the U.S.-Mexico border, and spoke Spanish only or were Spanish-English bilingual (mean education=7.8 years, 61.7% women). Memory-only and overall cognitive composites were created from scores on Spanish versions of the CERAD Memory Test, Logical Memory, Animal Fluency, and Trail-Making A. The Geriatric Depression Scale (GDS) and a five-item SCD questionnaire were also completed. Participants with frank cognitive impairment (MMSE<24) were excluded.

**Results:** Multiple linear regression analyses showed little association between SCD and overall cognitive scores ( $B=.039$ ;  $p=.287$ ) or memory-only composite scores ( $B=.001$ ;  $p=.982$ ) after adjusting for age, education, and GDS score. In contrast, there was a significant association between GDS and SCD ( $B=.214$ ;  $p=.001$ ) after adjusting for age, education, and overall ( $B=.214$ ;  $p=.001$ ) or memory-only composite scores ( $B=.213$ ;  $p=.001$ ).

**Conclusions:** These results suggest that SCD does not accurately reflect current cognitive status in non-demented elderly Hispanic adults. Clinical interpretation of SCD in this population should be made in the context of information about symptoms of depression. The prognostic value of SCD for future cognitive decline or neurodegeneration in this population remains unknown.

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**S. OLESON, D. EAGAN, S. KAUR, M.E. PEARMAN, H. TANAKA & A. HALEY. Apolipoprotein E Genotype Moderates the Relationship Between Carotid Atherosclerosis and Executive Function in Middle-Aged Adults.**

**Objective:** Increased carotid artery intima-media thickness (IMT) is an indicator of systemic arterial disease and has been linked with detriments in cognitive performance and risk for future cognitive decline. However, the role of genetic factors in moderating these relationships is still unknown. A potential candidate gene of interest is the Apolipoprotein E (ApoE) gene, as the  $\epsilon 4$  allele of this gene is a known risk factor for atherosclerosis as well as Alzheimer's disease and vascular dementia. Previous work has suggested that the presence of both the ApoE  $\epsilon 4$  allele and increased IMT may accelerate the progression of dementia. The purpose of the present study was to investigate whether the ApoE genotype moderates the relationship between IMT and cognitive performance in cognitively healthy middle-aged adults.

**Participants and Methods:** Seventy-two middle-aged adults were grouped according to ApoE genotype ( $\epsilon 4$  carrier or  $\epsilon 4$  non-carrier) and underwent a neuropsychological assessment and B-mode ultrasound of the common carotid artery. The distance between the luminal-endothelial interface and the junction between the media and adventitia was used to quantify IMT.

**Results:** An analysis of covariance (ANCOVA) revealed a significant interaction between ApoE genotype and IMT when controlling for age, gender, education level, and body mass index, suggesting that greater IMT was associated with significantly lower executive-attention function in  $\epsilon 4$  carriers, but not in  $\epsilon 4$  non-carriers,  $F(1,64) = 8.60$ ,  $p = .005$ .

**Conclusions:** Increased IMT was associated with poorer executive function in cognitively healthy middle-aged adults who were positive for the ApoE  $\epsilon 4$  allele, but not in ApoE  $\epsilon 4$  non-carriers. Interventions targeting the treatment of early atherosclerotic changes may be particularly important for supporting cognitive functioning in ApoE  $\epsilon 4$  carriers. Supported by R01 NS075565 from NINDS to APH.

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**C.E. PERRY, D.W. HEDGES, S.D. GALE, E. WILSON, J.S. KAUWE & L. ERICKSON. Latent Toxoplasmosis Association with Executive Function in Older Adults.**

**Objective:** Objective: While latent infection with the intraneuronal protozoal parasite *Toxoplasma gondii* (*T. gondii*) has been associated with cognitive changes humans, little is known about its relationship with specific domains of cognitive functioning in older adults. We examined the effect of latent toxoplasmosis on executive functioning in non-demented older adults.

**Participants and Methods:** Participants and Methods: We received serum and cognitive data from 114 older adults from Washington University's ADRC project. To determine latent toxoplasmosis status, we used micro-enzyme-linked immunosorbent assay (ELISA) analysis. Executive functioning was determined by standardized cognitive tests (Trails B, WMS Mental Control, Word Fluency Letter S, Category Fluency – Animals & Vegetables), which we combined into an executive functioning domain z-score. To determine if latent toxoplasmosis predicted executive functioning scores, we used multiple regression controlling for age, socioeconomic status, education and ApoE status.

**Results:** Results: In women, latent toxoplasmosis predicted a lower executive functioning domain score. In the overall sample, the presence of the ApoE4 allele predicted poorer performance on the executive functioning domain score. In addition, scores on the WMS Mental Control measure were higher in those positive for latent toxoplasmosis and those without ApoE E4, whereas Category Fluency scores were significantly higher in those without latent toxoplasmosis and without ApoE E4. Finally, scores on WMS Letter Number Sequencing were significantly higher for those with latent toxoplasmosis but without ApoE E4.

**Conclusions:** Conclusions: The presence of latent toxoplasmosis was associated with poorer executive functioning in older women but not in men, suggesting a sex difference. Latent toxoplasmosis may also interact with ApoE E4 status to affect performance on some tasks of executive functioning with latent toxoplasmosis associated with worse performance on some tasks and better performance on others.

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**C.E. PERRY, D.W. HEDGES, S.D. GALE, E. WILSON, J.S. KAUWE & L. ERICKSON. Association between Memory Functioning and Latent Toxoplasmosis in Older Adults.**

**Objective:** Objective: Latent infection with the intraneuronal protozoal parasite *Toxoplasma gondii* (*T. gondii*) has been associated with cognitive changes in rodents and humans. Little is known about its effect on memory in older adults. We investigated the association between latent toxoplasmosis and memory in non-demented older adults.

**Participants and Methods:** Participants and Methods: From Washington University's ADRC project, we obtained serum and cognitive data from 114 healthy older adults (average age 79.7 years). We evaluated latent toxoplasmosis status with micro-enzyme-linked immunosorbent assay (ELISA) analysis and memory function obtained from



standardized cognitive tests (WMS-R Logical Memory IA & IIA, WMS-R Associate Learning, Free and Cued Selective Reminding Test) combined into a memory domain z-score. We used t-tests and multiple regressions to determine if latent toxoplasmosis predicted memory scores while controlling for age, socioeconomic status, education and ApoE status.

**Results:** Results: Thirty-three percent of the sample was positive for latent Toxoplasmosis. In males, higher antibody titers of latent *T. gondii* predicted better performance on the memory domain score. The interaction between antibody titers and age also predicted performance on the domain score for males. No associations were seen in the female samples. Additionally, carriers of the ApoE E4 allele positive for latent toxoplasmosis did not have significantly different memory domain scores or individual memory test scores than did non-carriers and/or negative for latent toxoplasmosis.

**Conclusions:** Conclusions: Latent toxoplasmosis may be associated with better memory in non-demented older men but not in older women. Additionally, ApoE E4 status did not affect memory performance in either those with or without latent toxoplasmosis. This sample has the oldest participants to date to test the association between latent toxoplasmosis and memory functioning.

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**L.J. RADIGAN, E. LERITZ, M.E. ROBINSON, L.J. GRANDE, C.B. FORTIER, W.P. MILBERG & R. MCGLINCHEY. Cardio-metabolic Outcomes Following Close-Range Blast Exposure.**

**Objective:** Veterans returning from Iraq and Afghanistan are at risk for a variety of physical and psychological ailments. This population of Veterans has previously shown early signs of aging, such as poor cardiovascular health, hypertension, and metabolic syndrome (Lohr et al 2015). Recent findings also reveal that close-range blast exposure (CBE), even without concussion, is associated with neurological abnormalities, memory deficits, and risk for psychological illness. This study specifically addresses whether CBE is associated with increased risk for cardio-metabolic dysfunction and indices of psychological health and well-being.

**Participants and Methods:** Veterans in the TRACTS study (mean age=31.68) who reported being within 10 meters of a blast (CBE, n=146) were compared to those who had not (noCBE, n=183) on empirically-derived cardio-metabolic factors such as blood pressure, cholesterol, glucose, and obesity, as well as other health and psychological variables including pain, sleep, anxiety, stress, depression, and overall well-being. All analyses were completed while controlling for age, gender, education, number of mTBIs, and current PTSD diagnosis.

**Results:** The CBE group demonstrated significantly elevated scores on a blood pressure factor (indicative of higher BP) as well as on a physical health factor consisting of obesity and cholesterol variables (indicative of poorer health). The CBE group also reported worse sleep and higher anxiety. There were no differences between the groups on measures of pain, stress, depression, or overall well-being.

**Conclusions:** CBE is associated with poorer cardio-metabolic health, including higher blood pressure, higher cholesterol, and obesity, as well as worse psychological functioning. Future research is needed to better understand the relationships between blast exposure and physical and mental health.

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**E. RHODES, K.N. DEVLIN, L. STEINBERG & T. GIOVANNETTI. Grit Is Protective of Late-Life Cognition: Non-Cognitive Factors as Cognitive Reserve.**

**Objective:** Early-life factors may protect against late-life cognitive impairment by promoting cognitive reserve. While factors such as educational attainment and IQ are well-established as markers of cognitive reserve, non-cognitive psychological factors (e.g., grit) have not been

studied in this regard. To investigate the role of non-cognitive factors to late-life cognition and decline, we examined the contribution of adolescent academic achievement, controlling for IQ, to late-life cognition and its decline in a general population sample.

**Participants and Methods:** Participants included 3,826 respondents in the Wisconsin Longitudinal Study, a random sample of Wisconsin high school graduates followed from 1957 to 2011. Immediate and delayed word list recall at ages 64 and 71 were examined as a function of high school class rank, controlling for IQ, an index of non-cognitive influences on achievement.

**Results:** Controlling for IQ, high school class rank significantly predicted immediate and delayed recall at age 64. While the relative contributions of adolescent IQ and class rank to immediate memory were comparable, class rank was the only significant predictor of delayed memory. Controlling for performance at age 64, adolescent IQ and class rank were both predictive of immediate and delayed recall at age 71. However, IQ was more strongly associated with memory performance longitudinally.

**Conclusions:** These results suggest that non-cognitive influences on achievement in adolescence are equally, if not more, predictive of late-life cognitive functioning than IQ.

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**G.D. SANTORELLI, S.M. CANNON, F.M. ROMANO, R. READY, B. BARAN & R. SPENCER. Neuroanatomical Correlates of Alexithymia in Younger and Older Adults.**

**Objective:** Alexithymia is defined by difficulty identifying and verbalizing one's emotions; it is associated with volumetric differences in brain structures linked to emotion processing in young adults (e.g., Borsci et al., 2009). There are few data on differential neuroanatomical substrates of alexithymia in older and younger adults but this is important to study because age-related atrophy may differentially impact emotion processing regions. This study determined the neuroanatomical correlates of alexithymia in younger and older adults.

**Participants and Methods:** Participants were healthy, right-handed young (n = 11, aged 21–29) and older adults (n = 10, aged 62–74) who completed the Toronto Alexithymia Scale. Brain imaging data were acquired using a 3T Philips Achieva scanner. Scans were high resolution T1 weighted magnetization-prepared rapid acquisition with gradient echo volumes.

**Results:** In young adults, alexithymia was correlated with volume of the left isthmus of the cingulate gyrus (r = .62), left lateral occipital cortex (r = .71), and left transverse temporal gyrus (r = .70; ps < .05). In older adults, alexithymia was correlated with volume of the right caudal ACC (r = -.79), right pars orbitalis (r = .76), right pars triangularis (r = .64), left caudal middle frontal region (r = .63), and right paracentral lobule (r = .86, ps < .05).

**Conclusions:** These were the first data to look separately at neural correlates of alexithymia in older and younger adults. In young adults, alexithymia was associated with diffuse brain structures in the temporal, occipital, and limbic regions; in older adults, alexithymia was more localized to prefrontal/frontal regions. Positive correlations between frontal structures and alexithymia in older adults may indicate a need for additional resources to execute emotion processing with greater alexithymia (Goerlich-Dobre et al., 2014). These preliminary results suggest potentially different neural underpinnings of alexithymia in older and younger persons.

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**J. SAURMAN, S.E. JOHN, A. GURNANI, C.A. BUSSELL, K. GRAJZEL, J.W. GRIFFIN & B.E. GAVETT. Measurement Invariance of Dementia Severity in ( $\delta$ ).**

**Objective:** Royall and colleagues identified the latent dementia phenotype,  $\delta$ , which represents the concomitant cognitive and functional changes of dementia severity; it was supported in numerous samples using various cognitive tests as indicators. However, it requires a formal study of its measurement invariance (MI) to establish equivalency across clinical groups.

**Participants and Methods:** From 24660 participants in the National Alzheimer's Coordinating Center (NACC), overall model fit of  $\delta$  was assessed within initial visit assessment data across clinical diagnostic categories: healthy controls (n=10670), mild cognitive impairment (n=3343), Alzheimer's Disease (n=8840), Dementia with Lewy Bodies (DLB; n=641), Vascular Dementia (VaD; n=362), Frontal Temporal Dementia (FTD; n=804), and all categories combined. The fit of a previously published measurement model for  $\delta$  was examined after imposing increasingly rigid structural constraints across the six diagnostic groups to assess for MI.

**Results:** In this cross-sectional sample,  $\delta$  fit the data well overall (CFI=0.978, RMSEA=0.068) and achieved configural invariance (CFI = 0.973, RMSEA = 0.053). Significant reductions in fit were observed when comparing weak invariance to configural invariance ( $\chi^2 = 1239.5$ ,  $p < .01$ ), strong invariance to weak invariance ( $\chi^2 = 704.8$ ,  $p < .01$ ), and "strong-plus" invariance to strong invariance ( $\chi^2 = 488.7$ ,  $p < .01$ ). However, the "strong-plus" model remained a good fit for the data when judged by other fit statistics (CFI = 0.952, RMSEA = 0.055).

**Conclusions:** Results indicate that  $\delta$  possesses configural invariance across six diagnostic groups. Although increasing constraints significantly reduced model fit, this is expected with a large sample size and associated power. Additional research may support the "strong-plus" invariance of  $\delta$ , providing more evidence for its value as a measure of dementia severity.

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**P. SEEWALD, P. TAYLOR, S. Y. DEJESUS, L. MACDONNELL, C. MORENO & P. GILBERT. Age-Related Differences on a New Test of Temporal Order Memory for Everyday Tasks.**

**Objective:** Aging is known to have detrimental effects on memory for the order of items or events in a sequence. We designed a new test to examine age-related differences in incidental temporal order memory for a self-generated sequence of tasks one might complete in everyday life.

**Participants and Methods:** Young (18-25 years; n=45) and older (65+ years; n=30) adults completed a memory task assessing immediate free recall, delayed free recall, and delayed cued recall for the temporal order of events in a sequence. Participants were given 10 cards, each listing a task one might accomplish in a typical day (e.g. Going to the ATM). Participants were asked to self generate a "to do" list by placing the 10 cards in a temporal sequence representing the order in which they would accomplish the tasks. Participants were not informed of a subsequent memory test during generation of the sequence (encoding). Immediate recall was assessed by asking participants to verbally list the tasks in the same order as the sequence generated during encoding. Following a 20 min delay, delayed recall was assessed using the same procedure. Finally, cued delayed recall for the sequence and recognition memory for the individual items in the sequence were assessed.

**Results:** Older adults were significantly impaired relative to young adults on immediate recall ( $p < .05$ ), delayed recall ( $p < .01$ ), and cued delayed recall ( $p < .001$ ) of the sequence. However, all participants correctly recognized 90% or more of the events from the sequence.

**Conclusions:** We found evidence for age-related deficits in temporal order memory for a self-generated sequence (with incidental encoding) consistent with an encoding profile (poor immediate, delayed, and cued recall), in the context intact recognition for items in the sequence. Our

task can be rapidly administered in a laboratory setting and may assess aspects of temporal order memory important in everyday life.

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**T. SEIDER, R.A. COHEN & A. WOODS. Cognitively Engaging Activity is Associated with Preserved Cortical and Subcortical Volumes.**

**Objective:** As the population ages and dementia becomes a growing healthcare concern, it is increasingly important to identify targets for intervention to delay or attenuate cognitive decline. Research has shown that the most successful interventions aim at altering lifestyle factors. Thus, this study examined how involvement in physical, cognitive, and social activity is related to brain structure in older adults.

**Participants and Methods:** Sixty-five adults (mean age = 71.4 years, standard deviation = 8.9) received the Community Healthy Activities Model Program for Seniors (CHAMPS), a questionnaire that polls everyday activities in which older adults may be involved, and structural MRIs. Stepwise regression with backwards selection was used to predict weekly time spent in either social, cognitive, light physical, or heavy physical activity from cortical and subcortical volumes (corrected by total intracranial volume) as well as age, education, and gender as control variables.

**Results:** Regressions revealed that more time spent in cognitive activity was associated with larger volumes of all brain regions studied: total cortex ( $\beta = .289$ ,  $p = .014$ ), frontal ( $\beta = .276$ ,  $p = .019$ ), parietal ( $\beta = .305$ ,  $p = .009$ ), temporal ( $\beta = .275$ ,  $p = .020$ ), and occipital ( $\beta = .256$ ,  $p = .030$ ) lobes, and thalamus ( $\beta = .310$ ,  $p = .010$ ), caudate ( $\beta = .233$ ,  $p = .049$ ), hippocampus ( $\beta = .286$ ,  $p = .017$ ), and amygdala ( $\beta = .336$ ,  $p = .004$ ). These effects remained even after accounting for the positive association between cognitive activity and education. No other activity variable was associated with brain volumes.

**Conclusions:** Results indicate that time spent in cognitively engaging activity is associated with preserved cortical and subcortical brain volume. Findings suggest that interventions aimed at increasing levels of cognitive activity may delay cognitive consequences of aging or decrease risk of developing dementia.

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**S.C. SELIGMAN, T. GIOVANNETTI, J. HULSWIT, R. DIVERS & J. REILLY. Effects of Goal and Cognitive Load on Eye Movements to Everyday Objects in Healthy Older Adults.**

**Objective:** Subtle functional changes occur in normal and pathological aging, but little is known about the nature of these changes and their relevance to future decline. This pilot study used a novel computer task to examine eye movements in healthy older adults while viewing everyday objects during goal-driven behavior and under variable cognitive load. We expected more efficient fixation patterns in goal-driven viewing with lower cognitive load.

**Participants and Methods:** 4 non-demented older adults (ages 67-75, TICS>32) viewed an array of everyday objects under two instructions manipulating goal-driven visual behaviors: 1) simply view and 2) view while verbalizing the steps to complete an everyday task with the objects. Both conditions were completed for a simple (instant coffee) and complex (lunch) task, designed to manipulate cognitive load. An SMI RED-m remote eye tracker was used and proportions of fixations on targets, distractors (e.g., razor), and white space were coded. Repeated-measures ANOVAs were conducted to examine the effects of goal and cognitive load on fixation patterns.

**Results:** There was a significant effect of both goal ( $F > 22.38$ ,  $p < 0.02$ ) and cognitive load ( $F > 54.56$ ,  $p < 0.01$ ) on target and distractor fixations, with participants looking at target objects more often and distractor objects less often when engaged in a goal-driven task and when cognitive load was high. There was an effect of cognitive load on fixations

to white space ( $F=10.15$ ,  $p=0.05$ ), with more fixations to white space in the complex task.

**Conclusions:** Results suggest that healthy older adults fixate on targets and away from distractors during goal-oriented object viewing. This effect was largest for high cognitive load. However, increased cognitive load produced vulnerability to distraction to neutral space. These initial findings reveal reliable visual patterns on a novel task in healthy older adults and provide preliminary support for this method. Identifying deviations in these patterns may help improve detection of risk for dementia.

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**T. SOLOMON, J. LEECH, G.B. DEBROS, C. MURPHY, A. BUDSON & P. SOLOMON. Cognitive Outcomes in a Randomized, Double-Blind, Placebo Controlled, Parallel Group, Efficacy Study of Alpha BRAIN® Administered Orally.**

**Objective:** Alpha BRAIN® is a nootropic supplement that purports to enhance cognitive functioning. The goal of this preliminary study was to investigate the efficacy of this self-described cognitive enhancing nootropic, utilizing a standard battery of cognitive tests as an outcome measure, in a group of healthy adults by utilizing a randomized, double-blind, placebo controlled design.

**Participants and Methods:** A total of 66-treatment naïve individuals between 18-35 years of age participated. All participants completed a two-week placebo run in. Participants then followed the manufactures recommended instructions for use for six weeks. Participants undertook a battery of neuropsychological tests at randomization, (day +15), and again approximately six weeks later at study completion. Primary outcome measures included neuropsychological tests from the WMS-IV, DKEFS in addition to CVLT-II, Trails A & B and PSAT and measures of wakefulness and dreams.

**Results:** Bivariate analysis indicated no significant differences between groups on any demographic variables. Following the two-week placebo run in, no significant differences were found between groups on any cognitive measure. At six weeks, significant improvement was noted in tasks of delayed verbal recall task and executive functioning for the Alpha BRAIN® group compared to placebo ( $p < .05$ ). Analysis of variance (ANOVA) was utilized to assess the impact of randomization on neuropsychological outcome measures across time points. Results indicated significant interaction effects for improvement in delayed verbal recall for the Alpha BRAIN® group.

**Conclusions:** The use of Alpha BRAIN® for 6-weeks significantly improved recent verbal memory when compared with controls, in a group of healthy adults. While the outcome of the study is encouraging, this is the first randomized controlled trial of Alpha BRAIN® and the results merit further study.

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**H. SONG & J. CHEY. Fronto-parietal Network Mediates the Education Effects on Reasoning Ability in Healthy Elderly People.**

**Objective:** Reasoning is used to solve problems in novel situations by finding logical relations. It declines with age which appear to be moderated by education. It was expected that variations in the connectivity strength within a network, possibly induced by education, contribute to individual difference in reasoning ability in older adults. In this study, we purported to investigate how the moderating effect of education (EOE) on reasoning ability was implemented in the brain examining the resting state functional connectivity of major cortical networks in aging subjects.

**Participants and Methods:** Thirty healthy older adults (age  $m=62.7$ ;  $YOE m=7.1$ ) participated. The Perceptual Reasoning Index score in WAIS-IV was obtained, followed by a resting state BOLD fMRI

data acquisition (6 min.) The strength of intra-network connectivity was investigated utilizing the ICA and power spectra analysis. Mediation analysis was used to examine the EOE on reasoning ability with temporal coherence of spontaneous activity.

**Results:** We found that the EOE on reasoning ability in aging adults were statistically significant, and was mediated by the power spectra of spontaneous activity of the right fronto-parietal regions. More specifically, right fronto-parietal network (IC 27), including middle frontal gyrus, inferior and superior parietal lobules, posterior cingulate, and middle temporal gyrus, showed significant mediating effect.

**Conclusions:** This study illustrated that fronto-parietal network temporal coherence mediate the EOE on reasoning ability in aging subjects. It appears that greater years of education are responsible for relatively preserved reasoning ability in healthy elderly adults possibly via greater temporally coherent spontaneous activity in brain regions involved in reasoning. Intra-network connectivity strength could be a neural basis underlying education-related cognitive reserve which has protective effects against the dementias.

**L. STRANGE, R. KAPLAN, K.J. MANNING, D. WAKEFIELD & L. WOLFSON. Processing Speed, but Not Memory, Predicted Attrition in a Longitudinal Study of Health Elderly.**

**Objective:** Cognitive impairment has been associated with attrition in longitudinal research with the elderly. The current investigation examined baseline neuropsychological functioning as a predictor of attrition in a 4-year study of hypertension, mobility, and cognition in the healthy elderly.

**Participants and Methods:** 107 adults between the ages of 75 and 90 were evaluated at baseline, two years and four years. Processing speed was assessed using the Trail Making Test, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Coding task, and the Stroop Test. Memory was tested with three RBANS memory measures.

**Results:** Of the 107 who completed baseline testing, 81 received follow-up testing at 2 years (75.7%) and 58 (54.2%) completed the study. Participants who dropped out at time 2 and 3 were compared to those who completed the study using a one-way ANOVA. Participants tested at time 2 performed better on Coding ( $p < .001$ ); Stroop Word Reading ( $p < .001$ ) and Trails A ( $p = .004$ ) than those who dropped out. Those who completed the study performed significantly better on the Coding and Stroop Word tasks compared to individuals who dropped out after Time 1 or Time 2, and better on the Trails A task than those who left the study after Time 1. There were no significant differences in verbal memory scores at baseline between any of the groups; however, memory for the complex figure was better in the group that completed the study ( $p < .02$ ).

**Conclusions:** Among the healthy elderly, attrition in longitudinal studies study is related to cognitive functioning with better baseline performances in processing speed predictive of continued participation. In contrast, baseline memory scores did not predict continued participation. Correspondence: Lauren Strange, Psychiatry, University of Connecticut Health Center, Department of Psychiatry, UConn Health, 263 Farmington Avenue, MC1410, Farmington, CT 06030-1410. E-mail: lauren.strange@uconn.edu

**P. SÉVIGNY DUPONT, C. BOCTI, H. CHERTKOW, B. MASSE, M. JOANNETTE, R. PILON, J. NIKELSKI, C. MCHENRY & S. JOUBERT. Impact of Amyloid Burden and White Matter Hyperintensities on Cognition in Normal Aging.**

**Objective:** Beta-amyloid ( $A\beta$ ) deposition, a key marker of Alzheimer's Disease (AD), and white matter hyperintensities (WMH) are believed to contribute to cognitive decline that occurs in normal aging. The goal of this study was to assess the impact of ( $A\beta$ ) deposition and WMH on cognitive functioning in healthy elderly adults.

**Participants and Methods:** Seventy-six healthy older adults (mean = 73 years) completed a range of neuropsychological tests. Performance on tests of episodic memory, semantic memory, working memory, executive

functions and processing speed was examined. A $\beta$  deposition was measured using Positron emission tomography (PET) with the amyloid tracer [<sup>11</sup>C] Pittsburgh compound B (PiB). We assessed WMH burden using the ARWMC visual rating scale on FLAIR MRI. Linear regression analyses were performed to assess the relationship between biomarkers and performance scores across cognitive domains.

**Results:** A multiple linear regression model using WMH, SUVR values and age as the input variables and cognitive performance as the output variables showed a negative relationship between WMH and working memory and mental flexibility, while PIB SUVR was negatively associated with performance on working memory and verbal episodic memory. A forward linear regression analysis yielded an additive effect of SUVR and WMH burden on a measure of executive control.

**Conclusions:** These preliminary results suggest that executive functioning and working memory are vulnerable to both amyloid burden and WMH while episodic memory appears to be particularly vulnerable to amyloid burden. Distinct cognitive/biomarker profiles may reflect separate neuropathological trajectories.

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#### **J.W. TAM & M. SCHMITTER-EDGEcombe. A Video-based Intervention to Increase Aging Services Technologies Awareness and Promote Functional Independence.**

**Objective:** Research has identified lack of awareness as a primary barrier to aging services technologies (ASTs) that can compensate for age-related cognitive and physical changes to facilitate functional independence. This study evaluated the effectiveness of a video-based intervention to increase AST awareness among older adults with and without subjective medical and/or cognitive complaints (MCC).

**Participants and Methods:** Age, education, and gender matched individuals, age 50 and older, with MCC (N = 88) and without MCC (N = 88) completed questionnaires and a tool identification task before (T1) and after (T2) viewing educational videos on tools to assist with memory (e.g., talking calendars), medication management (e.g., pill boxes with alarms), and daily living (e.g., large grip utensils). Information regarding health status, AST knowledge, attitude, stigma, as well as program satisfaction was gathered.

**Results:** Group (MCC, without MCC) by condition (T1, T2) mixed ANOVAs revealed improved tool identification task performance post-intervention,  $F(1,161) = 573.83$ ,  $p < .001$ . In addition, improved knowledge,  $F(1,148) = 70.05$ , more positive attitudes,  $F(1,148) = 13.45$ , and lower levels of stigma,  $F(1,148) = 32.02$ , were self-reported post-intervention ( $ps < .05$ ). Individuals without MCC endorsed a significant higher level of AST knowledge than those with MCC,  $F(1,148) = 3.99$ ,  $p < .05$ . A significant interaction,  $F(1,148) = 5.82$ ,  $p = .02$ , revealed a greater level of reduction in stigma post-intervention for individuals without MCC (T1:  $M = 3.77$ ,  $SD = .10$ ; T2:  $M = 4.21$ ,  $SD = .09$ ) than individuals with MCC (T1:  $M = 4.08$ ,  $SD = .10$ ; T2:  $M = 4.26$ ,  $SD = .09$ ). Participants provided positive feedback and would recommend the intervention to others (>95%).

**Conclusions:** Study findings demonstrated that the video-based intervention is efficacious in improving AST outcomes. Implications for using AST videos with patients are discussed.

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#### **K.R. THOMAS, D. BOWERS & M. MARSISKE. Complex Everyday Task Error Types and the Association with Neuropsychological Measures.**

**Objective:** The goals of this study were to a) describe the type and frequency of errors that older adults made during complex medication management and bill paying tasks and to b) examine the relationship between the specific error types and neuropsychological tasks.

**Participants and Methods:** Older adult participants ( $n=101$ ; mean age=80.49 years; mean education=16.07 years) were administered a performance-based measure of complex everyday tasks and neuropsychological measures. Two of the everyday tasks—loading a pill box and paying bills—were coded to examine three specific types of errors: task-general (clearly has real world implications) vs. task-specific (specific to the novel instructions of the task); omission (forgot to perform) vs. commission (incorrectly performed); critical (would result in serious real world consequences) vs. non-critical (would not result in serious consequences).

**Results:** Descriptive analyses showed that participants made an average of 6.66 total errors and 55.4% of the sample made five or more errors across the two tasks. On average, participants made more task-specific than task-general errors [ $t(100)=-6.46$ ,  $p<.001$ ], more commission than omission errors [ $t(100)=-1.92$ ,  $p=.058$ ], and more non-critical than critical errors [ $t(100)=-1.72$ ,  $p=.089$ ]. Measures of working memory (Letter-Number Sequencing, Reading Span), reasoning (Word Series), Memory (Logical Memory, BVMt), and prospective memory (MIST) were strongly associated ( $r>.5$ ) with task-specific, commission, critical, and non-critical error types.

**Conclusions:** In a highly educated sample of elders living independently, there were high error rates on the complex everyday tasks of loading a pill box and paying bills. The high rate of task-specific errors suggested that participants were more likely to experience failures when tasks diverged from their routine daily experience, showing that novelty and unfamiliarity may increase risk of everyday task failure. Error types were strongly related to several neuropsychological domains. Correspondence: *Kelsey R. Thomas, MS, Clinical and Health Psychology, University of Florida, 3350 La Jolla Village Drive (116B), San Diego, CA 92161. E-mail: krthomas@phhp.ufl.edu*

#### **J. THOMPSON & S.D. GALE. Sex Differences in Memory Decline in Mild Cognitive Impairment and Alzheimer's Disease.**

**Objective:** To investigate potential sex differences longitudinally in memory and learning in men and women with mild cognitive decline (MCI) and Alzheimer's disease (AD).

**Participants and Methods:** Seventy-five patients with a diagnosis of MCI ( $n=46$ ; males=25) or AD ( $n=29$ ; males=13) and 75 healthy controls (i.e. non-demented; males=36) were evaluated with the Rey Auditory Verbal Learning Test (RAVLT) and the Brief Visuospatial Memory Test-Revised (BVMT-R) at least 3 times over a five year period. Latent-growth curve modeling was used to determine whether there were sex differences in total learning scores, delayed recall memory scores, and diagnosis (i.e. MCI vs. AD) longitudinally.

**Results:** Female participants in both the AD and MCI groups tended to start at a lower initial score, show decreased scores over time on measures of both the RAVLT and the BVMT delayed recall trial, and have an overall worse decline when compared to male participants with AD ( $p<0.001$ ). Female scores on total learning showed a similar path; however, females tended to begin at a slightly higher initial score, but showed a more rapid decline over the three epochs, ending with significantly lower scores than male counterparts ( $p<0.05$ ). Therefore, although women in the MCI and AD groups initially performed better than the men, by the third visit, scores had dropped significantly lower than male scores in the third epoch.

**Conclusions:** Sex differences over time in both total learning and delayed recall were demonstrated in the MCI and AD groups when compared with healthy controls, suggesting that, in general, women in the clinical groups achieved lower average scores and declined more rapidly over the 3-year interval than both the AD males and the healthy controls. Results have implications for diagnosis and treatment.

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**S.M. TIERNEY, R.S. BUCKS, M. WEINBORN, E. HODGSON & S. WOODS. Retrieval Cue and Delay Interval Influence the Relationship Between Prospective Memory and Activities of Daily Living in Older Adults.**

**Objective:** Older adults commonly experience mild declines in everyday functioning and the strategic aspects of prospective memory (PM). This study used Multiprocess Theory to examine whether the strategic demands of retrieval cue type (event- vs. time-based) and delay interval length (2- vs. 15-minute) influence the relationship between PM and activities of daily living (ADL) in older adults.

**Participants and Methods:** Participants included 97 community-dwelling older adults recruited from the Western Australia Participant Pool. Participants were administered the Memory for Intentions Screening Test (MIST) and Prospective and Retrospective Memory Questionnaire (PRMQ) as part of a larger neurocognitive assessment. A knowledgeable informant completed the Activities of Daily Living Questionnaire (ADLQ), from which a cutpoint of  $\geq 1$  was used to classify participants into “ADL Normal” ( $n = 37$ ) or “Mild ADL Problems” ( $n = 60$ ) groups. Separate repeated-measures MANOVA controlling for age, other cognitive functions, and negative affect were conducted with ADL group as the between-subjects factor and either MIST or PRMQ cue and delay scores as the within-subjects factors.

**Results:** Results revealed a significant ADL Group by PM interaction, such that the Mild ADL problems group performed worse than ADL normal participants on the 15-minute time-based scale of the MIST ( $p < .001$ ; Cohen’s  $d = 0.71$ ). No other MIST or PRMQ variable differed between the two ADL groups ( $ps > .10$ ).

**Conclusions:** Findings indicate that decrements in strategically demanding cue monitoring and detection over longer PM delays may partly explain older adults’ mild problems in everyday functioning. Findings may inform neuropsychological interventions aimed at maintaining ADL independence and enhancing quality of life in older adults.

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**E. TRIFILIO, L.C. BUTTERFIELD, P. MANGAL, K.R. THOMAS, J. JONES, M. MARSISKE & D. BOWERS. Cognitive Correlates of Consummatory vs. Anticipatory Anhedonia in Older Adults.**

**Objective:** Anhedonia comprises two components: consummatory anhedonia, the inability to experience pleasure directly, and anticipatory anhedonia, the inability to look forward to pleasure. Behavioral and imaging studies suggest each is associated with distinct neural circuitries—consummatory with limbic (i.e. nucleus accumbens, ventral pallidum, hippocampus, amygdala) and anticipatory with frontal (i.e. dorsolateral prefrontal cortex, anterior cingulate, insula) regions. Few studies have examined the relationship between anhedonia and neurocognition in older adults based on presumed neural circuitry of each component. In this study, we tested that hypothesis that anticipatory anhedonia would associate with poorer executive function whereas consummatory anhedonia would associate with poorer recent memory.

**Participants and Methods:** 80 nondemented independent living older adults (mean age: 78, range: 60-93) completed questionnaires, including the Temporal Experience of Pleasure Scale (TEPS), and a multi-domain battery of neuropsychological tests. Linear regressions were conducted, controlling for age.

**Results:** Consummatory anhedonia negatively predicted both immediate ( $\beta = -0.227$ ,  $R^2 = 0.052$ ,  $p = 0.061$ ) and delayed memory ( $\beta = -0.344$ ,  $R^2 = 0.086$ ,  $p = 0.015$ ) composites when controlling for age. No relationship was found between anticipatory anhedonia and executive function or attention/working memory composites.

**Conclusions:** We found partial support for our hypothesis, namely worse memory was associated with greater consummatory anhedonia. The lack of relationship between anticipatory anhedonia and executive function may be due to aspects of measurement. Future analyses may consider using executive tasks more sensitive to DLPFC functioning (i.e. gambling tasks) and physiological measures of anhedonia (e.g.

EEG, SCR). Consummatory and anticipatory anhedonia appear to be differentially related to cognitive outcomes.

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**U.M. VENKATESAN, N.A. DENNIS, K.A. KURKELA & R. CABEZA. Neuroimaging Source Memory in Aging: Putting the Context Memory Deficit in Context.**

**Objective:** Normal aging commonly results in diminished memory functioning for contextual details of events and experiences (source memory; SM). Previous work has postulated that observed SM deficits in aging result from either a generalized reduction of cognitive resources, a specific problem in encoding contextual representations (“binding”), or both. However, because binding itself relies on multiple functional systems, the functional neuroanatomy of age-related SM decline remains unclear. To more completely capture this phenomenon, we investigated differences in both regional fMRI activation and network connectivity during SM retrieval between young and older adults.

**Participants and Methods:** Fourteen young and 14 older adults (YA, OA) underwent fMRI while completing an event-related behavioral paradigm for encoding and retrieving faces and scenes (item conditions), and face-scene pairs (source condition). For our purposes, only retrieval trials were examined. Data were analyzed in SPM8, where within-group activation contrasts were created for source vs. item trials and compared between groups. Retrieval-modulated functional connectivity was examined using the generalized psychophysiological interaction (gPPI) toolbox (McLaren et al., 2012).

**Results:** Reduced parahippocampal activation but increased fronto-parieto-occipital activation (most prominently in the precuneus) was observed in OAs compared to YAs, supporting a specific context memory deficit and the adoption of a less specialized neural strategy in OAs. Paradoxically, OAs demonstrated reduced task-modulated connectivity between the precuneus and the rest of the brain, but increased connectivity between the parahippocampal gyrus and key regions of the default network.

**Conclusions:** Findings highlight the potential consequences of localized functional compromise on network functioning in aging, and underscore the importance of examining altered activation and connectivity patterns conjointly in the functional neuroimaging of age-related SM deficits.

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**L.C. WALZAK & W.L. THORNTON. Investigating Illness Burden as a Risk Factor for Cognitive and Affective Theory of Mind in Older Adults.**

**Objective:** Theory of Mind (ToM) is the ability to reason about mental states in order to understand and predict behavior. Past research has identified strong links between increased pulse pressure, a measure of vascular health, and reduced ToM in older adults. Furthermore, past findings suggest that cognitive ToM is particularly vulnerable to increased pulse pressure. However, to date, the relationship between other health risks and reduced ToM is unknown. We aimed to investigate the effects of vascular and nonvascular illness burden on ToM in older adults.

**Participants and Methods:** 85 older adults (59 females; 26 males,  $M = 72$  years) completed measures of verbal knowledge, affective ToM (Reading the Eyes in the Mind task and YONI-A) and cognitive ToM (Strange Stories task and YONI-C). Participants also completed an inventory of vascular conditions (hypertension, type II diabetes, high cholesterol, stroke, heart attack) and nonvascular conditions (osteoporosis, osteoarthritis, rheumatoid arthritis, thyroid dysfunction). Illnesses were indexed with standardized beta weights obtained through linear

regression and summed to create overall illness burden scores, that were entered into separate regression models.

**Results:** Greater severity of vascular illness burden was associated with poorer cognitive ToM ( $\beta = -.26$ , 95% CI =  $[-1.90, -.25]$ ,  $p < .01$ ), but not affective ToM ( $\beta = -.12$ , 95% CI =  $[-2.28, .51]$ ,  $p = .21$ ) after controlling for language ability, age and gender. Nonvascular illness burden did not predict cognitive or affective ToM.

**Conclusions:** Our findings highlight the specific importance of considering vascular health as a risk factor for declines in ToM in later life. Further elucidation of how illness burden differentially impacts cognitive and affective ToM will be valuable in developing effective interventions for older adults. Given the high prevalence of vascular illness in later life, these findings underscore the need to determine the clinical relevance of social cognitive skills in older adults.

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#### **A.B. WATERS, A. MACKAY-BRANDT & S.A. BEAUDREAU. The Relationship Between Worry and Executive Functioning in Older Adults.**

**Objective:** Evidence suggests that anxiety predicts cognitive impairment or decline (Beaudreau, & O'Hara, 2008). Less is known, however, regarding the role of worry on cognition. Elevated anxiety and poorer executive functioning are consistently correlated (Beaudreau, MacKay, & Reynolds, 2013), but relations between worry and executive functioning are less clear. The goal of this study was to examine whether worry severity predicted executive functioning performance in community-residing older adults. We hypothesized that, similar to anxiety, elevated worry would be associated with poorer executive functioning.

**Participants and Methods:** Participants 60 to 85 years old ( $N = 127$ ) completed the Older Adult Self-Report measure (OASR). Worry was measured by the OASR Worries subscale. Participants also completed a neuropsychological battery from which composite scores for executive functioning and simple motor speed were generated.

**Results:** More worry was significantly correlated with lower executive functioning ( $r = -.21$ ,  $p < .01$ ). In a multiple linear regression, worries significantly accounted variance in executive functioning after adjusting for age, sex, highest grade completed, and motor speed, ( $\beta = -.18$ ,  $p < .05$ ,  $R^2 = .13$ ). We then split the sample into young-old (60-72 years,  $n = 64$ ) or older-old (68-85 years,  $n = 63$ ) age groups and analyzed them separately. This association remained significant in the young-old group ( $\beta = -.33$ ,  $p < .01$ ,  $R^2 = .33$ ), but was no longer significant in the older-old group.

**Conclusions:** Findings suggest that worry has a potentially negative impact on executive functioning, but only in young-old adults. Though speculative, it is possible that the cumulative effect of age-related declines in executive functioning may wash out associations with worry in older-old individuals.

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#### **M. WILLIAMS, J. JONES, J. DZIERZEWSKI, J. PA & R. JONES. Computerized Speed Training Reduces Falls in Older Adults.**

**Objective:** Falls among older adults are very dangerous as the consequences of falls range from mild orthopedic injuries to severe traumatic brain injuries that are irreversible. Cognitive impairment is a risk factor for falls. The relationship between cognitive functioning and falls may be due to gait utilizing/relying on certain aspects of cognition (such as processing speed). The study objective was to determine if cognitive training for speed of visual processing reduces risks for falls in older adults.

**Participants and Methods:** These analyses utilized data from the ACTIVE randomized controlled trial of 10-weeks of cognitive training in

three areas (logical reasoning, memory, and speed of visual processing). We assessed the impact of training on the number of falls reported in the two months preceding the baseline (pre-training) and at 1-year follow-up. Comparisons were restricted to speed trained group ( $n = 335$ ) vs. control ( $n = 695$ ), because randomization failed to return groups with comparable self-reported history of falls at baseline for reasoning trained and memory trained groups with control group ( $p < .001$ ). Negative binomial regressions were used to assess for differences in rates of falls between groups at 1 year post training/baseline.

**Results:** The falls rate in the control group was 0.45 at baseline and 0.47 at 1-year follow-up ( $p > .05$ ). However, in the speed trained group, there was a significant reduction in falls rate from 0.45 at baseline to 0.17 at 1-year follow-up ( $\beta = 0.45$ ,  $p < .001$ ).

**Conclusions:** The findings of this study demonstrate that speed of visual processing training reduces risks of falls in older adults 1 year post training to about half the risk of those without training (control group). This study adds to the literature support of a computerized cognitive training module to produce robust benefits in safety of older adults.

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#### **Z.Z. ZLATAR, M.C. MUNIZ, D. GALASKO & D.P. SALMON. Cognitive Complaints Are Associated with Depressive Symptoms and Not with Concurrent Cognitive Performance in A Clinic-Based Sample of Older Adults.**

**Objective:** Complaints of cognitive decline are common in older individuals and have been associated with neurodegeneration; however, the association between subjective cognitive decline (SCD) and concurrent objective cognitive performance remains unclear. Previous research showed that SCD was related to symptoms of depression and not to objective cognitive decline in a randomly-selected sample of older adults. However, the association between SCD and objective cognitive performance in clinic-based samples remains unknown.

**Participants and Methods:** The current study examined cognitive screen data and Beck Depression Inventory (BDI) scores from 586 adults between the ages of 60 and 95 (mean age=76, mean education=15 years, 59% women) who were referred by community health clinics for screening of possible cognitive impairment. Individuals with frank dementia were excluded (MMSE  $< 24$ ). A cognitive composite was created based on performance on the Trail Making Test, WMS Logical Memory, Clock Drawing Test, and Animal Fluency.

**Results:** Multiple linear regression analyses indicated that SCDs did not predict cognitive composite scores after correcting for age, education, and depressive symptoms ( $B = .028$ ,  $\beta = .056$ ,  $p = .164$ ). In contrast, scores on the BDI were significantly associated with SCD after adjusting for age, education, and cognitive performance ( $B = .057$ ,  $\beta = .327$ ,  $p = .001$ ).

**Conclusions:** These results are consistent with those from a community-based, random sample and extend them to show that SCDs do not accurately reflect current cognitive status in a clinic-based sample. Thus, depressive symptoms represent one factor that needs to be taken into consideration when interpreting cognitive test scores in individuals with SCD. Future studies should investigate if SCD predicts cognitive performance and neural degeneration over time after controlling for the effects of depressive symptoms and explore which other factors may contribute to SCD (i.e., medical illness and medications with cognitive side effects).

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## MCI (Mild Cognitive Impairment)

**L. ACOSTA, D. LIU, L. SAMUELS, K. GIFFORD, L. LOGAN, K.M. WISNIEWSKI, M. WIGGINS & A.L. JEFFERSON. Error in Category Fluency Among Individuals with Mild Cognitive Impairment: The Vanderbilt Memory & Aging Project.**

**Objective:** Animal Naming is a popular category fluency tool assessing semantic knowledge. In dementia, category fluency errors increase. We researched if Animal Fluency errors were associated with mild cognitive impairment (MCI), namely total errors and the mean distance (number of intervening responses) between repetition errors.

**Participants and Methods:** Participants were from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging. Participants were diagnosed as cognitively normal (NC,  $n=166$ ,  $73\pm 7$  years, 40% female) or MCI ( $n=168$ ,  $73\pm 7$  years, 42% female) via consensus conference. Clinicians further subdivided MCI participants into 3 severity subtypes: mild ( $n=48$ ,  $73\pm 7$  years, 40% female), moderate ( $n=100$ ,  $72\pm 7$  years, 42% female), and severe ( $n=20$ ,  $79\pm 8$  years, 45% female). Wilcoxon rank sum tests compared NC and MCI in correct animals generated (output), errors, and mean distance between repetition errors; the same measures were compared in the 3 MCI severity subtypes using Kruskal-Wallis tests.

**Results:** Output was lower in MCI ( $17\pm 5$ ) than NC ( $21\pm 5$ ,  $p<0.001$ ). There was no between-group difference in errors (NC  $0.9\pm 1.2$ , MCI  $0.9\pm 1.2$ ,  $p=0.97$ ) or distance between repetition errors (NC  $8.1\pm 5.2$ , MCI  $6.8\pm 3.8$ ,  $p=0.23$ ). Comparing MCI severity subtypes, output differed (mild  $19.5\pm 4.5$ , moderate  $16.6\pm 4.4$ , severe  $11.2\pm 4.6$ ,  $p<0.001$ ) but not errors (mild  $0.9\pm 1.5$ , moderate  $0.9\pm 1.2$ , severe  $1\pm 0.9$ ,  $p=0.29$ ). Mean distance between repetition errors was shorter with increasing severity of MCI (mild  $8.1\pm 3.7$ , moderate  $6.9\pm 3.7$ , severe  $4.7\pm 3.3$ ,  $p=0.04$ ).

**Conclusions:** While errors did not distinguish NC and MCI or MCI subtypes, among MCI participants who committed errors, mean distance between repetition errors was associated with MCI severity. Consideration of the mean number of intervening responses between repetition errors may be predictive of worse MCI status relative to normal cognition.

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**D.S. BROWN, K. KRISHNAN, H.C. ROSSETTI, L.S. HYNAN, M.F. WEINER & L.H. LACRITZ. Use of Cognitive Complaint and the Montreal Cognitive Assessment to Predict Future Mild Cognitive Impairment.**

**Objective:** To examine the ability of self-reported cognitive complaint and the Montreal Cognitive Assessment (MoCA) to predict future mild cognitive impairment (MCI).

**Participants and Methods:** The sample included 139 [M age = 66.81 (5.09) years, range: 58-77; M educ = 14.50 (2.90) years, range: 7-20] individuals from a larger population-based cardiovascular health study subsequently followed at the University of Texas Southwestern Medical Center Alzheimer's Disease Center (ADC). At baseline, participants were asked if they had a cognitive complaint (executive function and/or memory problem), and administered the MoCA. Cognitive diagnosis at baseline was not determined. At follow-up [M = 3.54 (.62) years, range: 2.19-4.94], 64 (46%) participants were deemed cognitively normal, and 75 (54%) were classified as MCI by ADC consensus diagnosis, based on history, neurological exam, and in-depth cognitive assessment (excluding MoCA performance). Separate logistic regression analyses were performed to examine whether self-reported cognitive complaint and total MoCA score at baseline significantly predicted ( $\alpha = .05$ ) MCI at follow-up, controlling for age, education, and gender ( $\alpha = .15$ ).

**Results:** Self-reported cognitive complaint (endorsed by 17.2% of participants) did not predict diagnosis at follow-up ( $p = .56$ ). However, baseline MoCA score [M = 24.62 (3.18)] significantly predicted MCI at follow-up [ $\chi^2$ -square (2) = 44.69,  $p < .001$ ; Nagelkerke R-square = .37] with a correct classification rate of 73.4%, controlling for age.

**Conclusions:** These results provide support for the MoCA, but not self-reported cognitive complaint, in predicting future MCI diagnosis. While the MoCA has been previously validated as a useful tool for discriminating between cognitively normal individuals and those with MCI, this is the first study to our knowledge examining the ability of the MoCA to predict future cognitive diagnosis. Additional studies are needed to further explore the utility of the MoCA as a predictor of future neuropsychological impairment.

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**E.C. EDMONDS, J. EPPIG, M.W. BONDI, K.M. LEYDEN, B. GOODWIN, L. DELANO-WOOD & C.R. MCDONALD. Empirically-Derived MCI Subtypes Show Distinct Patterns of Cortical Atrophy Not Captured By Conventional Diagnostic Criteria.**

**Objective:** Previous research has demonstrated heterogeneity in neuropsychological performance and biomarker profiles within MCI samples. We previously identified four empirically-derived MCI subtypes within the Alzheimer's Disease Neuroimaging Initiative (ADNI) MCI cohort: *amnestic* MCI, *dysnomia* MCI, *dysexecutive/mixed* MCI, and a large *cluster-derived normal group* (34%) that was characterized by intact neuropsychological performance (despite their MCI diagnosis). The current study investigated cortical thickness profiles in these four cognitive subtypes.

**Participants and Methods:** Cortical thickness estimates for 663 ADNI participants (485 MCI and 178 normal controls) were computed for 32 regions of interest per hemisphere. Statistical group maps compared each subtype to normal control participants.

**Results:** A unique pattern of cortical thinning was observed for each MCI subtype, which corresponded to their profile of cognitive dysfunction. Consistent with their isolated deficit in memory, the *amnestic* MCI group showed thinning in medial temporal lobe regions bilaterally. The *dysnomia* MCI group demonstrated lateral temporal lobe atrophy, with greater involvement of the left hemisphere, consistent with their naming deficit. The *dysexecutive/mixed* MCI group exhibited a fairly widespread pattern of atrophy; this reflects their neuropsychological profile, which was characterized by poor performance across multiple cognitive domains. No differences were found between the *cluster-derived normal* subtype and the normal control group.

**Conclusions:** There is substantial variability in cortical atrophy patterns among patients with MCI that underlie their distinct cognitive profiles. This heterogeneity is not captured when patients are grouped by conventional diagnostic criteria. Findings further validate our empirically-derived MCI subtypes and offer support for the premise that the conventional diagnostic criteria for MCI are highly susceptible to false-positive diagnostic errors.

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**J. EPPIG, E.C. EDMONDS, L.M. CAMPBELL, M. SANDERSON-CIMINO, L. DELANO-WOOD & M.W. BONDI. Statistically-Derived Subtypes in MCI: A Latent Profile Analysis.**

**Objective:** Recent research has demonstrated heterogeneous neuropsychological profiles among individuals with Mild Cognitive Impairment (MCI). However, few studies have included visuospatial functioning or used recent advances in latent mixture modeling to statistically identify MCI subtypes. Therefore, the current study investigated unique patterns of neuropsychological impairment across four major cognitive domains in MCI using Latent Profile Analysis (LPA).

**Participants and Methods:** 806 subjects diagnosed via ADNI MCI criteria received a neuropsychological battery. Test scores representing domains of visuospatial ability, language, executive functions, and

episodic memory were adjusted for demographic characteristics using standardized regression coefficients based on the performance of “robust” normal control participants ( $n = 260$ ). Calculated z-scores were subsequently used in the LPA, and CSF-derived biomarkers were evaluated within each MCI subgroup.

**Results:** Model fit indices and likelihood ratio testing revealed a 3-class LPA was significantly better than a 2-class solution, while 4-classes was suggestive of possible over-fitting of the data. The 3-class LPA consisted of a mild-to-moderately impaired mixed class ( $n = 106$ ), a purely amnesic class ( $n = 455$ ), and a cognitively normal class ( $n = 245$ ). Additionally, the amnesic and mixed classes were more likely to be APOE  $\epsilon 4+$ , have lower A $\beta$ <sub>1-42</sub>, higher tau, p-tau<sub>181</sub>, and p-tau<sub>181</sub>/A $\beta$ <sub>1-42</sub> ratios than LPA-derived normal subjects, whom did not statistically differ from the ‘robust’ normal controls across biomarkers.

**Conclusions:** This study further supports the notion of heterogeneous neuropsychological profiles in MCI samples. Consistent with previous work, a large minority of MCI individuals (30%) appear to represent “false-positives” that are statistically similar to ‘robust’ normal controls. Future research should employ latent mixture modeling to exhibit unique, longitudinal neuropsychological profiles in conjunction with biomarker, genetic, and imaging outcomes.

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#### **D. FARRAR, M. MOSS & R. KILLIANY. Structural Network Differences in Individuals with High versus Low Executive Abilities in Mild Cognitive Impairment.**

**Objective:** To determine if individuals with the amnesic form of Mild Cognitive Impairment classified as having low or high executive abilities show differences in structural brain network connectivity.

**Participants and Methods:** From the Alzheimer’s Disease Neuroimaging Initiative database, 15 subjects classified as high executive functioning (aMCI-highEF) with an EF score  $> .91$  and 17 subjects classified as low executive functioning (aMCI-lowEF) with an EF score  $< -0.61$  were selected. Criteria included a diagnosis of aMCI (CDR score=0.5) and performance of a diffusion tensor imaging scan. Networks of 93 regions of interest were constructed, and network measures including network size, node degree, clustering coefficient, and local efficiency were calculated for each group. In addition, measurements of the major white matter tracts of the brain were performed in both groups. Non-parametric permutation testing was performed to assess significance.

**Results:** aMCI-highEF subjects showed network measures indicating greater nonspecific connectivity, including increased network size, greater node degree of many regions of interest, increased clustering coefficient of various ROIs and greater global efficiency. aMCI-highEF individuals also had greater white matter volume and higher fractional anisotropy of a number of white matter tracts, while aMCI-lowEF individuals had greater radial diffusivity of a number of white matter tracts.

**Conclusions:** These differences in network parameters appear to reflect greater white matter integrity and more efficient processing in individuals with aMCI-highEF than those with aMCI-lowEF.

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#### **A.T. FLOWERS, S. MICHEL, L. APOSTOLOVA, E. WOO, J. RINGMAN, P. LU & J. RAZANI. Neuropsychological Tests and Functional Ability.**

**Objective:** Mild Cognitive Impairment (MCI) represents cognitive impairment beyond that observed in normal aging, and in many cases precedes the onset of dementia. Nonetheless, little research has been conducted to determine if commonly used neuropsychological tests can predict functional ability. The purpose of this study was to determine how well standard neuropsychological measures of attention, language,

memory, and executive functioning predict aspects of functional ability in MCI.

**Participants and Methods:** 46 individuals recruited from medical centers in the Greater Los Angeles area diagnosed with MCI according to the Petersen et al., (2001) research criteria served as participants. They were administered the following neuropsychological tests: Digit Span, phonemic verbal fluency (FAS category; animals), CVLT-II free-delay, Rey-O copy, and The Wisconsin Card Sorting Test; (WCST). They were also administered the Direct Assessment of Functional Status (DAFS), an observation-based functional test which assesses domains of orientation, communication, transportation, finance, and shopping.

**Results:** Stepwise regression, was conducted to evaluate which neuropsychological tests best predicted these 5 areas of functional ability. Results indicated that CVLT-free delay was the single best predictor of DAFS orientation (accounting for 45% of the variability). Rey-O Copy was the single best predictor of DAFS transportation (accounting for 64% of variability). Rey-O Copy, followed by Digit Span, were the two best predictors of DAFS finance performance, (accounting for 91% of the variability). WCST total errors were the single best predictor of DAFS shopping (accounting for 50% of the variability). Lastly, no single neuropsychological measure predicted DAFS communication.

**Conclusions:** Overall, these results suggest that specific cognitive domains best predict areas of functioning in MCI individuals. Furthermore, neuropsychological tests may be useful for understanding functional ability in MCI.

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#### **T. GIOVANNETTI, I. LAWRENCE, S.C. SELIGMAN, D.J. LIBON, E. ROLL, B.L. DECK, J. KURCZEWSKI & E. SCHELL. Subtypes of Functional Impairment in People with MCI.**

**Objective:** Distinct performance patterns have been reported on everyday tasks in dementia; some show a tendency to omit major task steps whereas others complete most steps, but do so inaccurately. This study examined functional performance patterns in MCI.

**Participants and Methods:** Participants with MCI ( $n = 24$ ) and healthy elderly ( $n = 6$ ) were videotaped as they performed everyday tasks. Errors were identified and classified as Omission, Commission, or Microerror (e.g., subtle commissions that are immediately corrected). Total errors and error distributions (i.e. proportion of each error type out of total errors) were compared across groups and correlated with cognitive tests (MMSE, episodic/working memory, language).

**Results:** MCI participants committed twice as many errors as controls. Differences were significant for Omissions ( $p < .01$ ,  $d = .98$ ), but did not reach statistical significance for Commissions ( $p = .09$ ,  $d = .69$ ) or Microerrors ( $p = .08$ ,  $d = .67$ ). Controls’ error distributions showed large proportions of Microerrors (71%) and Commissions (27%) but few Omissions (2%). A subset of MCI participants ( $n = 7$ ; 30%) showed distinct error distributions, with Omission proportions +1.5 SD greater than controls (e.g., 54% Microerrors; 17% Commissions; 29% Omissions). The remaining MCI participants’ (70%) error distributions were nearly identical to controls, but they made more errors than controls ( $p = .05$ ,  $d = .91$ ). Correlations with cognitive tests showed Microerrors/Omissions were associated with episodic memory ( $r > -.38$ ,  $p < .03$  for all).

**Conclusions:** Similar to past dementia research, MCI participants showed meaningful differences in functional performance patterns. Some showed a qualitatively different error pattern than controls (e.g., omitters); others showed a qualitatively similar error pattern but more total errors than controls (e.g., committers). Correlation analyses suggest MCI functional deficit patterns may be attributed to different cognitive mechanisms.

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**M. WIGGINS, J. NEAL, D. LIU, K. GIFFORD, T. HOHMAN, E.M. LANE, M. BABICZ, C. DUNIFON, L. LOGAN, R. MARTIN-WILLET, C. SEABOLT, M. THURSBY, K.M. WISNIEWSKI, D.J. LIBON & A.L. JEFFERSON. Assessing performance on the Philadelphia (repeatable) Verbal Learning Test in non-demented older adults: The Vanderbilt Memory & Aging Project.**

**Objective:** The Philadelphia (repeatable) Verbal Learning Test (PrVLT) is a serial list learning test developed to assess episodic memory in older adults. The 9-word PrVLT has been shown to differentiate performance between cognitive normal (NC) and mild cognitive impairment (MCI). The current study assessed performance on the 12-word PrVLT across learning, recall, and recognition trials between NC and MCI.

**Participants and Methods:** Participants were drawn from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging. At enrollment, NC participants ( $n=163$ ,  $73\pm 7$  years, 31% female) and MCI participants ( $n=165$ ,  $73\pm 8$  years, 31% female) completed the PrVLT. PrVLT was not used to determine diagnostic status. Wilcoxon tests assessed for PrVLT performance differences between NC and MCI.

**Results:** NC performed better on PrVLT learning trials (Trials 1-5), total learning, immediate free and cued recall, delayed free and cued recall, and recognition (all  $p$ -values $<0.001$ ) compared to MCI. MCI individuals endorsed more semantically related words and List B foils during recognition than NC ( $p<0.001$ ). NC individuals demonstrated less intrusions overall ( $p$ -values $<0.04$ ) and less List B intrusions ( $p<0.001$ ) compared to MCI. MCI individuals were more likely to intrude List A words during List B recall ( $p>0.001$ ). MCI participants evidenced a larger recency effect than NC ( $p<0.001$ ) whereas NC individuals evidenced more responses from the middle of the list than MCI ( $p<0.001$ ).

**Conclusions:** NC performed better than MCI on multiple aspects of the PrVLT. Performance patterns in MCI suggested impairment with encoding and source memory. Results highlight the clinical utility of this measure for early identification of a memory disorder. Further validation of this measure is needed with longitudinal studies and work linking PrVLT performance with biomarkers of unhealthy brain aging. Correspondence: *Katherine Gifford, PsyD, Vanderbilt University, 2525 West End Ave, 12th Floor, Suite 1200, Nashville, TN 37203. E-mail: katie.gifford@vanderbilt.edu*

**J. PARK, B. KIM, M. SONG & Y. KANG. A Validity Study of the Korean-Subjective Cognitive Decline Questionnaire (K-SCD-Q).**

**Objective:** The Subjective Cognitive Decline Questionnaire was developed as a screening tool for the perceived subjective cognitive decline over the last two years (Rami et al., 2014). This study was conducted to examine the validity of the Korean version of Subjective Cognitive Decline Questionnaire (K-SCD-Q).

**Participants and Methods:** We administered the K-SCD-Q to 268 healthy normal elderly (NE), 133 amnesic MCI, 76 mild AD, and their informants ( $n=477$ ). All the subjects were given the MMSE, MoCA, and Geriatric Depression Scale. The Seoul Neuropsychological Screening Battery (SNSB) was also administered to the MCI and AD. The K-SCD-Q consisted of subject rating (MyCog) and informant rating (TheirCog).

**Results:** Both the MCI and AD scored higher than NE in the MyCog as well as TheirCog. Although there was no difference between the MCI and AD in the MyCog, the AD showed significantly higher scores in TheirCog than the MCI. Significant correlations between the MyCog and TheirCog scores were found in NE ( $r=.49$ ,  $p<0.001$ ) and AD ( $r=.45$ ,  $p<0.001$ ) but not in MCI. The MyCog scores of all groups correlated significantly with depression level ( $r=.50$ ,  $.37$ ,  $.47$ ,  $p<0.001$ ). Only the NE showed a significant correlation between the MyCog score and age ( $r=.20$ ,  $p<0.01$ ). The MyCog scores of three groups did not show any correlations with the MMSE and MoCA after controlling depression level and age as covariates. Unlike the MyCog, only the NE showed a significant correlation between the TheirCog score and depression level ( $r=.33$ ,  $p<0.001$ ). The TheirCog scores of MCI and AD correlated significantly with memory ( $r=-.32$ ,  $p<0.001$ ) and language ( $r=-.18$ ,  $p<0.05$ )

domain scores of the SNSB. The ROC curve analysis showed that both the MyCog and TheirCog scores could differentiate MCI and AD from NE (AUC=.73, .77,  $p<0.001$ ).

**Conclusions:** These results indicated that the TheirCog is a more reliable measure of subjects' cognitive states, while the MyCog is more associated with psychological factors such as depression.

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**K. KAUZOR. Daily Functioning in MCI Patients With and Without Caregivers.**

**Objective:** Mild cognitive impairment (MCI) is a diagnostic construct characterized by cognitive deficits in the absence of general intellectual or functional decline. MCI often represents a prodromal state between normal aging and dementia. The purpose of this study was to characterize the performance of MCI individuals with and without caregivers on an observation-based, activities of daily living test

**Participants and Methods:** A total of 46 MCI participants were included in this study, of which, 18 had caregivers and 28 did not. All participants were administered the Direct Assessment of Functional Status (DAFS), as part of a larger test battery.

**Results:** Mann-Whitney U Tests were used to determine if a difference in performance on the DAFS could be determined, depending upon whether or not the individual had a caregiver. The analysis revealed significant differences in performance on 3 sub-scales of the DAFS, Orientation to Date,  $U=182.000$ ,  $p=.040$ , Shopping Free Recall,  $U=116.000$ ,  $p=.020$ , and Shopping Recognition,  $U=111.000$ ,  $p=.013$ . On these 3 sub-scales, MCI participants with a caregiver performed significantly worse than those without.

**Conclusions:** Our results indicate that individuals with mild cognitive impairment who have designated caregivers, as opposed to those who do not, have poorer daily functioning on tasks which depend on memory (such as shopping).

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**J.C. SHERMAN, M. HARRISON, C. HENDERSON, S. FLYNN, J. GAIR, L. SHABO & B.C. LUST. Interdisciplinary Studies Begin to Reveal Language Deficit in Prodromal AD and to Predict Corollary Neural Degeneration in Brain Network Connectivity.**

**Objective:** We seek to identify linguistic deficits in prodromal Alzheimer's disease to determine if this can contribute to disease detection before clinical manifestation. We investigate whether such linguistic deficits can be linked to potential biomarkers such as provided by structural MRI.

**Participants and Methods:** We combined interdisciplinary cross-institutional expertise in linguistic, psycholinguistic, experimental and clinical neuropsychology to test 3 groups- MCI ( $N=21$ ), age matched Healthy Aging (HA) ( $N=24$ ) and Healthy Young (HY) ( $N=10$ ) on elicited imitation of 3 complex sentence types which varied in syntactic and semantic factors. Standardized administration and behavioral coding provided data analyzed by logistic-linear mixed models. Pilot investigation of brain MRIs from 5 MCI subjects were analyzed by Voxel Based Morphometry and compared to 18 HA matched scans (ADNI) with regard to grey matter integrity in a multivariate mixed model which included ROI for proportion of grey matter for Inferior Parietal Lobe (IPL) and Broca's Area (BA) relative to a HA template.

**Results:** Comparison of language production behaviors across all 3 sentence types revealed (i) significant deficit in MCI compared to HA and HY; (ii) the source of this deficit as particular to linguistic phenomena, viz., involving an interface between syntax and semantics while sparing syntax per se. Initial brain scan analyses revealed (iii) greater mean difference between IPL (Default Network connectivity hub) and BA (syntax related) neurodegeneration in MCI than HA scans, lower IPL

integrity in MCI than HA and similar BA integrity between MCI and HA. Regressions of syntactic performance on ROI IPL were stronger for structures requiring reference resolution.

**Conclusions:** Results support current structural and functional models of language knowledge and processing, and neurodegeneration in progressive development of AD. They argue for the feasibility of a new interdisciplinary methodology for brain-behavior analyses in the area of language.

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#### **N. MAHENDRA & M. IFAH. Effects of Mild Cognitive Impairment on Linguistic Communication.**

**Objective:** Mild cognitive impairment -MCI is a nosological entity thought to be a prodrome of dementia. As distinct types of MCI have been identified, it is recognized that other cognitive functions besides memory also are impaired. Linguistic communication measures are important cognitive biomarkers. Our objective was to study the performance of persons with MCI on a standardized language battery. Our secondary objective was to identify which language tasks have greater clinical utility in identifying and quantifying MCI.

**Participants and Methods:** After obtaining informed consent, we assessed 10 persons with MCI and compared their performance to healthy young and older controls as well as published norms for persons diagnosed with Alzheimer's disease. Participants' medical history was obtained; hearing, vision and affect screened; cognitive function assessed and a standardized language battery administered- the Arizona Battery for Communication Disorders of Dementia (ABCD; Bayles & Tomoeda, 1993). This test has been validated for distinguishing between the linguistic communication profile of healthy controls (young and old) and persons with AD.

**Results:** Performance of persons with MCI was documented on 14 subtests of linguistic communication, mapping onto 5 constructs of Mental Status, Memory, Language Expression, Language Comprehension and Visuospatial Construction.

**Conclusions:** Our results demonstrated that linguistic communication tasks that require episodic recollection (e.g. word learning, story recall), and more generative and narrative responses on discourse tasks (e.g. tasks requiring object description and concept definition) were especially sensitive to language changes accompanying MCI. Simpler tasks of linguistic communication (e.g. reading comprehension of words and sentences; confrontation naming) did not reveal any differences from healthy older controls. Implications of these results for clinical assessment in MCI will be discussed.

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#### **C. MOORE, J. MYERS, J. YESAVAGE & K. FAIRCHILD. Ventilatory Efficiency and Memory Decay in Older Adults with amnesic MCI.**

**Objective:** We examined the relationship between cardiorespiratory fitness and cognition in older adults with amnesic mild cognitive impairment (aMCI).

**Participants and Methods:** Fifty-six men and women aged 55–88 years with aMCI underwent cardiorespiratory exercise testing and neuropsychological assessment.

**Results:** Lower cardiorespiratory fitness (CRF) was significantly associated with memory decay but not working memory. Ventilatory efficiency was a stronger predictor of better memory performance than maximal oxygen uptake. Participants with lower CRF forgot approximately 70% more information than individuals with higher CRF. Furthermore, those with lower CRF were 12x more likely to fall in the "High Memory Loss" group compared to those with higher CRF.

**Conclusions:** Results reveal that CRF is significantly associated with memory retention in older adults with aMCI. Additionally, results

suggest that ventilatory efficiency is a stronger predictor of memory performance than maximal oxygen uptake, which has long been considered the gold standard exercise outcome variable.

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#### **J. NOVITSKI & M. SEIDENBERG. Autobiographical and Spatial Fluency in Healthy Older Adults and Mild Cognitive Impairment.**

**Objective:** Recent fMRI findings report increased medial temporal lobe (MTL) activation for semantic fluency performance for categories that engage spatial (e.g. items in your living room) or autobiographical features (e.g., television shows you've watched) (Sheldon & Moscovitch, 2011; Greenberg et al., 2009; Ryan et al., 2008). This study examined performance of healthy control (HC) and Mild Cognitive Impairment (MCI) groups on three semantic fluency categories: autobiographical (books/magazines you read, movies you saw, television shows you watched), spatial (items in your living room, bedroom, and kitchen), and non-episodic (animals, fruits and vegetables, musical instruments). Based on the recent fMRI findings, we expected to see greater impairment in the MCI group for the spatial and autobiographical categories than for non-episodic categories.

**Participants and Methods:** Forty-four participants, 27 healthy controls (mean age = 78, education = 15 years) and 17 individuals with MCI or mild Alzheimer's disease (mean age = 81, education = 15 years) were recruited for this study. All participants were given 60 seconds to generate items from three different categories of semantic fluency. A 2 x 3 repeated measures ANOVA was used to assess group differences by fluency category, and independent samples t-tests were used to compare group performances for each category.

**Results:** The MCI group produced less total words than the HC group for all three semantic categories. In addition, non-episodic fluency performance proved to be the strongest predictor distinguishing the HC and MCI groups, followed by spatial fluency; autobiographical fluency showed the least group discrimination.

**Conclusions:** Our findings are not consistent with the proposal that spatial and autobiographical features of a semantic fluency category are more disrupted in MCI, typically characterized with MTL damage. Potential reasons for these findings are discussed.

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#### **D. PUTCHA & G. TREMONT. Neuropsychological Predictors of Instrumental Activities of Daily Living in Mild Cognitive Impairment.**

**Objective:** Individuals with mild cognitive impairment (MCI) demonstrate deficits in instrumental activities of daily living (IADL) that place them at higher risk of functional decline. This study aims to determine whether screening tools known to predict IADL dysfunction in healthy control (Hopkins Verbal Learning Test-R) and dementia groups (MMSE, DRS-2) are also useful in MCI.

**Participants and Methods:** Seventy individuals diagnosed with amnesic plus MCI (mean age = 72.9, 39 F, MMSE = 26.3) and 59 individuals diagnosed with dementia (mean age = 73.8, 37 F, MMSE = 24.2) were evaluated on a standard neuropsychological assessment battery. Controlling for age and education, we investigated the ability of performance on the MMSE and HVL-T-R to predict IADL dysfunction, as defined by informant-report on the Lawton-Brody IADL scale, in each group separately.

**Results:** MMSE performance was related to IADL independence in the dementia group ( $r=0.42$ ,  $p=0.001$ ) but not in MCI ( $p>0.9$ ). In contrast, list learning (HVL-T-R) significantly predicted IADL dysfunction in MCI individuals ( $r=0.33$ ,  $p=0.005$ ), but not in dementia ( $p=0.07$ ). DRS-2 performance predicted IADL functions in both groups (MCI:  $r=0.36$ ,  $p=0.003$ ; AD:  $r=0.32$ ,  $p=0.02$ ).

**Conclusions:** These results suggest that neuropsychological predictors of IADLs differ between individuals with MCI and dementia. Performance on the HVLTR can be informative to clinicians in assessing functional independence in MCI individuals, rather than relying solely on screening measures, which are more predictive in dementia groups. Future work should investigate if these measures can predict change in IADL function over time.

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**A.D. ROCHETTE, M. SPITZNAGEL, G. STRAIN, M. DEVLIN, R.D. CROSBY, J.E. MITCHELL, A. COURCOULAS & J. GUNSTAD. Mild Cognitive Impairment is Prevalent in Persons with Severe Obesity.**

**Objective:** Severe obesity (BMI $\geq$ 35) is prevalent in the U.S. and is associated with an increased risk for cognitive impairment. However, the prevalence of mild cognitive impairment (MCI) has not been examined in a severely obese sample. This study did so and examined possible changes in cognitive function in a subset of patients that underwent bariatric surgery.

**Participants and Methods:** A total of 166 adults (43 $\pm$ 11.10 years, range=20-68; BMI=44.54 $\pm$ 6.47; 79.5% female) completed medical history questionnaires, computerized Integneuro cognitive testing, and subjective ratings of cognitive difficulties. A subset of the participants (n=99) underwent bariatric surgery as part of a larger project and were re-assessed 12 months post-surgery. Objective cognitive decline was established using the comprehensive criteria for MCI established by Jak and colleagues ( $\geq$ 1 SD below the normative mean on 2+ tasks in a cognitive domain).

**Results:** MCI was found in a majority of participants (53%) and prevalent even in young and middle-aged participants (age 19-29=47%). In the bariatric surgery subset, MCI prevalence was reduced from 51.5% at baseline to 24.2% at the 12-month follow-up. When comparing the subset of surgery patients that saw a resolution in MCI from pre- to post-surgery to those that did not, no differences in resolution rates were found for hypertension [ $\chi^2(5)=7.2$ ,  $p=.20$ ], sleep apnea [ $\chi^2(4)=2.1$ ,  $p=.71$ ], or diabetes [ $\chi^2(4)=.7$ ,  $p=.94$ ]. The groups also did not differ in age [ $t(49)=.5$ ,  $p=.62$ ], BMI at baseline [ $t(49)=-1.0$ ,  $p=.32$ ], or BMI change from baseline to 12 months [ $t(34)=-.4$ ,  $p=.66$ ].

**Conclusions:** Findings indicate that MCI is prevalent in individuals with severe obesity, regardless of age, and often improves following bariatric surgery. Further investigation of the mechanisms connecting severe obesity and cognitive function is much needed, particularly studies that examine cerebral perfusion and metabolism.

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**C.P. WILLIAMS, K. ZIDEK, J. NOVITSKI & M. SEIDENBERG. Semantic Fluency Performance in MCI for Different Categories.**

**Objective:** Semantic fluency performance provides information about semantic processes and the organization of semantic representations. In older adults, it is sensitive to cognitive difficulties in the early prodromal stage of Alzheimer's disease and in Mild Cognitive Impairment (MCI). In both practice and research, several different semantic categories have been used, but there is limited systematic study about their comparability. Here, we examined the performance of an MCI group and healthy controls (HC) on three different semantic categories: animals, fruits and vegetables, and musical instruments.

**Participants and Methods:** Seventeen MCI (mean age 81, 15 years of education) and 27 HC (mean age of 78, 15 years of education) participants were given sixty seconds to provide items for three categories. Each category was scored for total words provided, number of subcategory switches, and semantic clusters for each fifteen-second

interval. A 2 x 4 (Group x Interval) ANOVA was conducted for each semantic category.

**Results:** For each category, the MCI group produced fewer total words, switches, and clusters than the HC group, and large effect size differences were found. There was a consistent pattern of significantly better performance in the first 15 seconds compared to the final 15 seconds for both groups across all three categories.

**Conclusions:** Findings suggest a similar pattern of impairment across semantic categories in the MCI group as compared to the HC group. The more pronounced difficulty in the initial time period of performance may reflect the need for additional resources (e.g., strategy deployment, working memory) associated with the engagement of semantic retrieval processes. These findings have implications for the use of alternative categories in clinical practice and research.

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**J.C. SHERMAN, C. HENDERSON, S. FLYNN, J. GAIR, S. MANCUSO, A. JANMOHAMMED & B.C. LUST. Language in Prodromal Alzheimer's Disease: Advancing Clinical Examination.**

**Objective:** A recent report assessing the clinical utility of language evaluation in probable AD concludes that language screening measures, particularly, semantic fluency and confrontation naming help track dementia severity (Weiner, 2008). Other aspects of language, specifically word repetition and articulation were not impacted. In this study, We ask whether more complex aspects of language production assessed with easily administered and scored tasks detect changes prior to dementia diagnosis, when treatment is likely to be most effective and thus advance the clinical utility of language testing in AD development.

**Participants and Methods:** 21 MCI subjects (mean age 75) and 24 healthy age (HA) matched subjects were administered an extended dementia screen, the Addenbrooke's Cognitive Estimation Test-Revised (ACE-R), which includes a 'language' domain, and two novel tests involving more complex aspects of language: an Elicited Imitation test that required subjects to repeat sets of 3 different types of complex sentences and a test that required them to create a sentence based on 3 words, including semantically related and unrelated words.

**Results:** MCI subjects were significantly deflected compared to HA on these extended language tests, and their errors suggest specific difficulty with syntax-semantic integration required at more complex levels of language computation. Although total ACE-R scores differentiated these two groups, their total language domain scores did not. The only components of the ACE-R Language measures which significantly differentiated MCI from HA were semantic fluency and naming; repetition, phonemic fluency, comprehension, reading and writing did not.

**Conclusions:** We discuss our findings in terms of implications for understanding aspects of language beyond the single word level that change prior to clinical diagnosis of AD and our tasks as potentially useful for detecting these changes at early prodromal stages. We argue that more sensitive language measures may aid in early detection of AD. Correspondence: *Janet C. Sherman, Ph.D., Psychiatry, Mass General Hospital, 1 Bowdoin Square, 7th Floor, Boston, MA 02114. E-mail: jsherman@partners.org*

**S.S. SIMON, B.M. HAMPSTEAD, M. SILVA, L. FONSECA, M. MARTIN, R.T. ÁVILA, F.L. SOUZA-DURAN, C.B. MARTINS, E. AMARO JUNIOR, G. BUSATTO & C. BOTTINO. Cognitive and Activation Changes After Memory Training in Amnesic Mild Cognitive Impairment: Preliminary Results of a Randomized, Single-Blind Study.**

**Objective:** To evaluate the efficacy of memory training in patients with amnesic mild cognitive impairment (MCI).

**Participants and Methods:** aMCI participants were randomized to memory training or to an active control condition (psychoeducation). All sample completed 4 individual 1-hour sessions, twice a week. In

experimental condition, patients were trained in a mnemonic strategy to improve memory for face-name association, while in control condition they were exposed to content on memory and aging. Cognitive evaluations and fMRI exams were conducted before and after interventions. **Results:** Nineteen aMCI participants (mean age  $72.6 \pm 6.4$ ) were included in data analysis, 10 in experimental group (EG) and 9 in control group (CG). After interventions, EG showed significant improvements in target measures (related to training), such as number of hits (EG:  $27.4 \pm 5.2$  and CG:  $14.3 \pm 3.6$ ;  $p < 0.001$ ) and confidence level of response (EG:  $3.3 \pm 0.5$  and CG:  $2.3 \pm 0.0$ ;  $p < 0.001$ ), which was not seen in CG. On the other hand, CG showed a significant faster performance than EG for untrained stimuli (EG:  $14.6 \pm 6.8$  and CG:  $10.4 \pm 2.9$ ;  $p < 0.001$ ). Regarding the transfer measures (not related to training), EG showed significant improvements in trained strategy use in a face-name association task (EG:  $4.5 \pm 2.0$  and CG:  $2.6 \pm 1.5$ ;  $p < 0.001$ ), as well as in measures of episodic memory (Hopkins Verbal Learning Test and Short Cognitive Test - SKT) and subjective memory (Multifactorial Memory Questionnaire). There was no difference in attention tasks (SKT) and mood scales (Beck Inventories) after interventions. Moreover, fMRI data showed a significantly BOLD effect/response in left angular gyrus and precuneus in EG, but not CG.

**Conclusions:** These preliminary data suggest memory training-specific effects comprising significant improvements in target and transfer cognitive measures, associated with activation in brain areas involved in episodic memory.

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#### **A.R. STABLER & J. MORRIS. Conversion to mild cognitive impairment at follow-up among baseline cognitively normal, older adult research participants and clinic patients with subjective cognitive impairment.**

**Objective:** Early detection of decline from normal cognition to mild cognitive impairment (MCI) is imperative to investigating emerging treatments for prevention of cognitive decline (Petersen, 2004). Clinicians often encounter patients with subjective memory complaints who perform within normal limits on objective neuropsychological testing at baseline (Mitchell et al., 2014). These patients are likely at an increased risk for decline to MCI at repeat evaluations. The aim of the present investigation is to examine conversion to MCI at a follow-up evaluation among baseline cognitively normal yet subjectively impaired older adults (>65 years) within the research and clinic setting.

**Participants and Methods:** Older adult (>65 years) subjects were selected from the National Alzheimer's Coordinating Center's Uniform Data Set (NACC-UDS; Weintraub et al., 2009), including healthy controls (N=103) without baseline cognitive complaints, and both research volunteers (N=103) and clinic patients (N=103) with baseline subjective memory complaints. All subjects received a consensus diagnosis of normal cognition at a baseline evaluation. Chi-Square ( $X^2$ ) statistics were utilized to examine between-group differences in proportion of patients converting to MCI at the time of follow up evaluation.

**Results:** Twenty-eight clinic patients (27.2%), 14 research participants (13.6%), and 4 healthy controls (3.9%) converted to MCI over a 3-year time period. Proportionately, clinic patients were significantly more likely to convert to MCI at follow-up in comparison to both research patients ( $X^2 = 5.862$ ,  $p = .015$ ) and healthy controls ( $X^2 = 21.310$ ,  $p < .001$ ). Additionally, research patients were more likely to convert in comparison to controls ( $X^2 = 6.087$ ,  $p = .014$ ).

**Conclusions:** Older adult clinic patients with subjective memory complaints in the absence of objective impairment at baseline are at an increased risk for future cognitive decline, highlighting the need for repeat evaluations with these intact yet subjectively impaired individuals. Correspondence: *Anthony R. Stabler, Doctoral, Roosevelt University, 1445 W Augusta Blvd., Chicago, IL 60642. E-mail: astabler@mail.roosevelt.edu*

#### **M.L. WERHANE, K.J. BANGEN, C.R. MCDONALD, A.L. CLARK, E.C. EDMONDS, M.W. BONDI, N.D. EVANGELISTA & L. DELANO-WOOD. The Role of White Matter Lesions and APOE Genotype in Reduced Cortical Thickness in Older Adults with Mild Cognitive Impairment.**

**Objective:** We investigated the relationship between apolipoprotein E (APOE)- $\epsilon 4$  genotype, white matter lesions (WML), and cortical thickness in an empirically-derived group of older adults with mild cognitive impairment (MCI) who were drawn from the Alzheimer's Disease Neuroimaging Initiative (ADNI). We also examined whether the association between WML and cortical thickness is modified by APOE- $\epsilon 4$  genotype.

**Participants and Methods:** ADNI participants were classified as having MCI ( $n = 49$ ) via cluster analysis of neuropsychological scores (Edmonds et al., 2015) which yielded a robust sample given removal of false positive diagnostic errors. Participants underwent MR imaging and APOE genotyping. Surface maps of cortical thickness were generated from T1-weighted images using FreeSurfer. We excluded individuals with an APOE- $\epsilon 2$  allele given the possible protective role of this particular allele.

**Results:** Regression analyses adjusting for age and sex revealed that the presence of the APOE- $\epsilon 4$  allele was significantly associated with reduced thickness in frontal and parahippocampal regions. Greater WML volume was associated with reduced cortical thickness in insula, frontal cortex, and cingulate regions. Additionally, results revealed significant interactions between APOE- $\epsilon 4$  positivity and WML changes on several brain areas, most prominently in frontal and cingulate regions.

**Conclusions:** Results demonstrate that the presence of the APOE- $\epsilon 4$  allele and greater WML volume were independently associated with reduced cortical thickness in an empirically-derived group of ADNI older adults with MCI. Additionally, the presence of the APOE- $\epsilon 4$  allele modified the relationship between WML volume and cortical thickness in regions vulnerable to Alzheimer's disease. These findings provide further support for the influence of APOE genotype and WML in neurodegenerative processes later in life, and further highlight the complex interplay between genetic risk and modifiable health-related risk factors in early stages of cognitive decline.

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#### **Visuospatial Functions/Neglect/Agnosia**

##### **G. ALVAREZ, S.T. LI & B. NAGEL. Sleep/Wake Problems Are Associated With Reduced Visuospatial Performance During Adolescence.**

**Objective:** Adolescents face unique barriers to adequate sleep, contributing to a variety of academic, emotional, and behavioral impairments. Insufficient sleep has been inconsistently associated with neurocognitive deficits, resulting in a lack of clarity regarding its functional impact. The purpose of this study was to further investigate the influence of adolescent sleep adequacy on neurocognitive functioning.

**Participants and Methods:** Participants ( $n = 129$ ) were typically developing, right-handed adolescents, ages 12-17. All youth completed the School Sleep Habits Survey (SSHS) and several neuropsychological tests. The SSHS Sleep/Wake Problems scale, a self-report measure of erratic sleeping and waking behaviors, was examined as a predictor of age-corrected neurocognitive test performance.

**Results:** Three linear regression analyses were used to evaluate the relationship between SSHS Sleep/Wake Problems and scores on composite measures of memory (Rey Auditory Verbal Learning Test; Wide Range Assessment of Memory and Learning-2 (WRAML-2) Design Memory), attention/executive functions (WISC-IV Digit Span; Conners Continuous Performance Test-2; D-KEFS Color-Word Interference), and visuospatial ability (WASI Block Design & Matrix Reasoning; WRAML2 Design Memory). Higher scores on the SSHS Sleep/Wake Problems scale were associated with significantly poorer visuospatial performance,

$F(1,127) = 9.60, p < .01, R^2 = .07$ . Sleep/wake problems were not significantly associated with performance on composite measures of attention/executive function or memory ( $p$ 's  $> .05$ ).

**Conclusions:** These findings may be suggestive of a distinct relationship between sleep/wake problems and visuospatial dysfunction, which could have adverse implications for school performance, spatial awareness, and nonverbal communication. Future research may consider the role of adequate sleep and erratic sleep/wake behaviors on right hemisphere functions and associated brain networks.

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**K.T. BALAVAGE, D. LAMB, L. KNIGHT, D. BIELICK, K.J. KINCAID & K.M. HEILMAN. The Effects of the Allocation of Focal Attention and Habituation on the Line Bisection Task.**

**Objective:** Due to limited neurological processing resources, humans often restrict the processing of their sensory input. In the visual domain, certain spatial locations are attended to over others and attended locations appear to have a greater magnitude than less attended locations. An additional aspect of attention is habituation, in which a stimulus loses its importance or novelty, and the amount of attentional resources allocated to it decreases over time. Line bisections are a commonly used method to assess allocation of attention. The objective of this study is to determine if visual habituation influences horizontal line bisection performance in neurologically normal individuals.

**Participants and Methods:** Participants were 36 neurologically normal, right-handed subjects (mean age = 23.2; 19 women). The stimuli were 24cm x 2mm black lines, presented in a horizontal orientation. The participants were asked to focus either on the entire line, or the left side, or right side of the line, and then were asked to bisect the line immediately or after a 20 second delay in which they remained focused on the portion of the line that they were assigned. Deviation from the center was measured in millimeters.

**Results:** There was a significant main effect of attentional focus (left side, right side, or whole line) and an interaction between attentional focus and delayed viewing, but no main effect of delay. Viewing a certain portion of the line resulted in a significant deviation towards the attended side. In addition, delayed line bisection significantly enhanced the degree of deviation towards the portion of the line that was attended.

**Conclusions:** Overall, directing the participants to focus on a portion of the line caused deviation towards that portion. Prolonged allocation of attention increased bias toward the attended portion. This change may have been related to habituation to the unattended portion of the line or enhanced allocation of attention to the targeted portion of the line.

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**D. BIELICK, D. LAMB, K.J. KINCAID, K.T. BALAVAGE, L. KNIGHT & K.M. HEILMAN. Hemispheric Lateralization of Attentional Background Distraction.**

**Objective:** During line bisection, when a line is placed eccentrically on a page normal people deviate toward the center of the page. This whole page deviation may be related to the activation of the global attentional system. Monocular eye viewing can increase activation of a contralateral hemisphere (the Sprague effect). Since the left hemisphere mediates focal attention and the right global attention, monocular viewing with the left (versus right) eye, may increase global attention and thereby increase deviation to the center of the page.

**Participants and Methods:** 36 healthy participants (17 men, mean age = 23.2) were asked to bisect twelve vertical lines (2mm x 210mm) with 6 displaced upward on the page and 6 downward. The sheets of paper were presented in portrait orientation over a black board. These conditions were repeated with left eye patching, right eye patching, and binocular viewing.

**Results:** A linear mixed effect model was used for preliminary analysis. We found a main effect of eye viewing and line deviation, but not of page placement relative to eye level. We found an interaction between eye viewing and visual space and an interaction between eye viewing and line placement. Left eye viewing resulted in higher bisections relative to right eye and binocular viewing.

**Conclusions:** Directing focal and global attention is in part dependent on a specialized lateralization between hemispheres. Monocular occlusion had an effect on the disparity between the two, in which global distraction causes line bisections to deviate towards the center of the page. Correspondence: *David Bielick, University of Florida, 1043 NE 2nd St., Gainesville, FL 32601. E-mail: dkbielick@ufl.edu*

**N.T. BOTT, E.T. JOHNSON, S. DUTT, J.H. KRAMER & K.L. POSSIN. Left Entorhinal Cortex is Associated with Route Learning Based on Self-motion and Local Cues.**

**Objective:** The hippocampus and entorhinal cortex play complementary roles in spatial navigation. Whereas place cells in the hippocampus represent locations "allocentrically" based on boundaries and landmarks, irrespective of the subject's position, recent investigations suggest that grid cells in the entorhinal cortex dynamically update where a subject is in space based on self-motion cues, a process important for path integration. We investigated the contributions of these structures to performance on a virtual route learning task that emphasizes learning based on self-motion and that provides no allocentric cues.

**Participants and Methods:** Sixty-six cognitively healthy older adults (mean age:  $72 \pm 6.5$ ) learned a defined route through a virtual neighborhood via trial and error using a driving simulator. No allocentric cues were available, only local cues and the subject's virtual position. The task included 15 sequential trials of a 15-turn route, with performance quantified as the sum of correct turns for trials 2-15. Each subject also underwent 3T MRI analyzed using Freesurfer to calculate bilateral grey matter volumes of hippocampus and entorhinal cortex.

**Results:** Partial correlations controlling for age and intracranial volume revealed that only left entorhinal cortex ( $p < .05$ ) was significantly associated with total accuracy. Partial correlations with right entorhinal cortex and bilateral hippocampus were not significant.

**Conclusions:** These findings support the view that the left entorhinal cortex is important for route learning based on self-motion and local cues, and contrasts the established role of the hippocampus in allocentric navigation.

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**C. CHIU, M. ESTERMAN & J. DEGUTIS. Tablet-based visuospatial battery briefly assesses a wide range of hemispatial neglect symptomatology.**

**Objective:** Current batteries for diagnosing hemispatial neglect typically rely on paper-and-pencil tests or long computer-based tasks, which can be time consuming and challenging to analyze. We developed a brief iPad battery to both quickly and reliably detect attentional and, using kinematic information, motoric aspects of neglect. We sought to characterize lateralized target detection, lateralized hypokinesia, visual search, memory for searched locations, and egocentric/allocentric bias.

**Participants and Methods:** We administered a 15-min iPad battery of 4 tasks to 9 chronic left neglect patients (diagnosed via a 45-minute paper-and-pencil and computerized battery) and 5 right-brain-injured controls. Our battery included apples cancellation (one with visual feedback and one without), character line bisection, a find-the-dot task where subjects touch 48 serially-presented dots at various locations, and a follow-the-dot task which required continuously tracking a moving dot for 2.5 mins.

**Results:** The most robust differences between those with and without neglect were leftward hypokinesia in the follow-the-dot task ( $p = .0031$ ) and leftward hypokinesia/target detection failures in the find-the-dot

task ( $p=.011$ ). Memory for searched locations (difference between search accuracy with and without feedback) was also significantly worse in neglect patients across hemifields ( $p=.018$ ). Finally, we found significant allocentric bias differences between neglect and controls in the apples task ( $p=.019$ ) and egocentric bias differences on the character line bisection task ( $p=.047$ ).

**Conclusions:** A brief iPad battery can detect several attentional and motoric aspects of hemispatial neglect. Interestingly, kinematic information, which can only be gleaned from touch screens, most robustly differentiated those with and without neglect. These findings have implications for more efficiently diagnosing neglect as well as tracking neglect recovery/rehabilitation.

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**M. CLAESSEN, J. VISSER-MEILY, N. DE ROOIJ, A. POSTMA & I. VAN DER HAM. Navigation Ability After Stroke: An Analysis of Types of Navigation Impairment in Chronic Stroke Patients.**

**Objective:** Recent research has stressed the complex cognitive nature of navigation ability. This ability relies on multiple neural structures and networks and is evidently vulnerable to brain damage. More specifically, nearly 30% of stroke patients complain about difficulties with navigation after their stroke event. The aim of this study was to systematically analyse both group and individual performance of stroke patients on a test that captures the complexity of this ability.

**Participants and Methods:** The Virtual Tübingen navigation test was administered to a heterogeneous group of 77 chronic stroke patients, and 60 healthy controls. This test contains twelve subtasks that address multiple aspects of landmark, route and survey knowledge of a virtual route.

**Results:** At group level, a series of ANOVAs showed that healthy controls performed significantly better on five subtests compared to the patients. These performance differences were found for scene recognition, map drawing and three route knowledge subtasks.

As stroke patients are not a neurologically uniform group, we also analyzed their individual patterns of subtask performance using z-scores. Impairment patterns (i.e.  $z \leq -1.65$ ) ranged from highly selective (e.g. inability to derive directional information from landmarks) to more general (e.g. impaired route knowledge). None of them was impaired on more than five of the twelve subtasks.

**Conclusions:** Overall, patients had more difficulties with the navigation test than healthy controls. At the individual level, analyses of performance patterns showed that nearly all patients have relative strengths and weaknesses in their performance on the subtasks. These individual patterns of impaired and intact performance are informative in two ways. Firstly, associations and dissociations between the subabilities could offer further insight in the neurocognitive architecture of navigation. Furthermore, these patterns provide a starting point for a training that teaches them to rely on their intact navigation abilities.

**J. GRAVANO, A.Y. STRINGER & S. PENNA. A Case Study of Simultagnosia in an Anoxic Brain Injury.**

**Objective:** Anoxic brain injuries are typically associated with severe anterograde memory deficits in the context of diffuse cognitive dysfunction. We report a case (Ms. B) of anoxic brain injury who presented 6 months post injury with relative improvements in global cognitive functioning and memory, but persistent visuospatial deficit, such that rehabilitation efforts were suspended pending further evaluation.

**Participants and Methods:** Ms. B is a 55 year old Caucasian woman with history of Bipolar disorder. The anoxic injury was associated with cardiac arrest secondary to possible overdose of psychiatric medications. She was admitted to the ED with a GCS of 3 and was amnesic for the several weeks prior to and following the injury. Ms. B was administered a broad neuropsychological battery to examine the nature of her cognitive deficits, with specific emphasis on visuospatial and visuo-perceptual processing.

**Results:** Ms. B showed awareness of moving stimuli in all visual fields; however, marked visuo-perceptual disturbance was noted on the examination. Performance on visual scanning and cancellation tests was highly suggestive of simultagnosia, as were behavioral observations. She did not show significant optic apraxia, or optic ataxia, suggestive of relative sparing of aspects of visual dorsal stream function. While Ms. B demonstrated severe verbal memory difficulty she was not completely amnesic, which is atypical for anoxic brain injury. MRI showed occipital/parietal anoxic injury.

**Conclusions:** We report a case of simultagnosia secondary to anoxic brain injury, in the context of global cognitive dysfunction. Ventral vs. dorsal contributions to Ms. B's presentation will be discussed. Recommendations for continued rehabilitation services and accommodations in light of her deficits will also be discussed.

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**K.J. KINCAID, D. LAMB, D. BIELICK, L. KNIGHT, K.T. BALAVAGE & K.M. HEILMAN. Influence of Viewing Eye on Altitudinal Attentional Bias.**

**Objective:** It has been posited that whereas the right hemisphere has a relatively upward attentional bias, the left may have a downward bias. Since monocular viewing primarily activates the contralateral hemisphere (Sprague effect) the goal of this study was to learn if right versus left monocular eye viewing would differentially alter vertical attentional bias as determined by the vertical line bisection task.

**Participants and Methods:** 36 right-handed healthy participants (19 women, mean age=23.2 years,  $STD=2.68$ ) performed the vertical line (2mm x 210mm) bisection tasks with the line presented in the participants' mid-sagittal plane at varying altitudes in extracorporeal visual space while wearing an eye patch over their right, left, or neither eye. There were six trials in each of the nine conditions for a total 54 bisections per subject.

**Results:** Analysis reveals an overall mean upward deviation (vertical pseudoneglect) in attempted vertical line bisections independent of stimuli position and subjects' viewing conditions. Furthermore, monocular viewing with the left or right eye induced a greater upward bias than binocular viewing.

**Conclusions:** Left monocular viewing when compared to right monocular viewing did not result in greater upward deviation as predicted, but monocular viewing with either eye induced a greater deviation than binocular viewing; however, the reason for this difference is not known. Correspondence: *Keith J. Kincaid, Bachelor of Science, Neurology, University of Florida, 2765 Westbrook Ct., Tallahassee, FL 32303. E-mail: kjk14b@med.fsu.edu*

**L. KNIGHT, D. LAMB, K.T. BALAVAGE, D. BIELICK, K.J. KINCAID & K.M. HEILMAN. Effects of Focal and Global Spatial Attention on Compound Line Bisection Tasks.**

**Objective:** When healthy participants attempt to bisect horizontal compound lines (made of two segments of different thickness) they tend to deviate to the longer segment and when attempting to bisect one segment of a compound line they deviate toward the center of the entire compound line. Bisecting the entire line requires global attention and bisecting a segment requires focal attention, but in each of these tasks the allocation of global versus focal attention is incomplete and there is a deviation induced by activation of the alternative network. The goal of this study was to learn if there is greater deviation when the distracting element is on the top or bottom of the line with vertical line bisections, as well as to learn if there are differences with right versus left eye monocular viewing.

**Participants and Methods:** 36 neurologically healthy right-handed subjects performed vertical line or line segment bisection tasks requiring either global or focal processing with left and right eye monocular viewing. Compound lines, made up of two line segments of different lengths

and thicknesses were marked either at the midpoint of the whole line (global) or at the midpoint of the longer line segment (focal).

**Results:** In the global compound line bisection task participants significantly deviated towards the longer segment and in the focal segment task towards the midpoint of the entire line. In addition, when the longer segment was on the top there was greater deviation than when on the bottom. When attempting to just bisect the longer segment there was also a greater distraction by the short segment when it was on top than on the bottom. There were no significant differences between monocular versus binocular viewing or viewing with the right versus the left eye.

**Conclusions:** These results suggest that when bisecting the entire compound line or the longer segment of a compound line there is more distraction by the upper than lower segment. This asymmetry may be related to the ventral stream's mediation of focal attention.

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#### **J. FISHER & S. ROGERS. How Important is it to Distinguish between Specific Visuospatial Abilities in PD and AD?**

**Objective:** While research has supported a relationship between declining visuospatial abilities and both Alzheimer disease (AD) and Parkinson's disease (PD), there is a lack of specificity regarding the particular areas of visuospatial degeneration that are involved. This study examines specific visuospatial differences within and between those afflicted with AD and PD.

**Participants and Methods:** A total of 214 adults (121 men; M age = 73.61; M education = 14.84 years) with mixed ethnicity participated in comprehensive neuropsychological assessment as part of outpatient neurology evaluations. Specific visuospatial measures included the Rey-Osterrieth Complex Figure Test (RCFT) and WAIS-IV Block Design and Picture Completion.

**Results:** Those with PD performed worse on WAIS-IV Block Design,  $t(174) = 3.16, p < .001$ , and RCFT Copy,  $t(169) = 2.36, p < .02$  than those without. Those diagnosed with AD performed worse on WAIS-IV Picture Completion than those without,  $t(201) = 2.89, p < .01$ , but there were no significant differences in WAIS-IV Block Design or RCFT. Those with PD performed worse on WAIS-IV Block Design,  $t(167) = 3.71, p < .001$ , and RCFT Copy,  $t(163) = 2.39, p < .02$  than those with AD.

**Conclusions:** Results suggest unique visuospatial differences between and within PD and AD. A Parkinson's pathology appears to differentially and adversely affect visual construction and drawing. Deficits appear in visual discrimination/perception among those with AD, but their visual construction and drawing seem to be less affected. Visual construction and drawing seem to be significantly more impacted by Parkinson's than Alzheimer's pathologies, whereas visual discrimination/perceptual skills seem to be similarly impacted by both pathologies. This suggests that not all visuospatial abilities are equally affected by AD and PD, intimating unique biochemical, neural, and connectivity substrates for visuospatial functioning within/between each condition. Correspondence: *Jillian Fisher, University of California, Irvine, 438 Cinderella Lane, Santa Barbara, CA 93111. E-mail: jilliamf@uci.edu*

#### **D.A. THOMPSON, J. MOSES & M.E. ENG. Judgment of Line Orientation: Verbal and Non-Verbal Mediation.**

**Objective:** Previous research demonstrated a model with two orthogonal and independent components of Judgment of Line Orientation (JLO). The current study aimed to investigate: (1) How two independent factorial components of JLO relate to performance level variables of age and education; (2) How demographically-related components of visuospatial functioning on JLO are related to modular performance pattern components of intelligence on the Wechsler Adult Intelligence Scale-III (WAIS-III).

**Participants and Methods:** Exploratory factor analyses were conducted using archival data of 138 veterans at the Palo Alto Veteran's

Affairs Hospital. A two-factor solution of Benton's JLO that showed independent performance on early and late items was combined with age and education. Age and early items of JLO loaded together while education and late items of JLO loaded together. The age\_early JLO factor and the education\_late JLO factor was combined with the WAIS-III.

**Results:** The age\_early JLO component loaded with Perceptual Organization (PO) and Processing Speed (PS), while the education\_late JLO component loaded with Verbal Comprehension (VC) explaining 84.45% of the shared variance.

**Conclusions:** The four-factor solution demonstrated that there is an age-related component of visuospatial perception, which is related to nonverbal conceptual reasoning and speed of mental processing. There is also an independent education-related aspect of visuospatial functioning, which is verbal mediated. Both verbal and nonverbal components were independent of attention and working memory.

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### **Symposium 9. Social Cognition and Function After Child TBI: Relation to Imaging**

**Chair: Harvey S. Levin**

**12:45–2:05 p.m.**

#### **H.S. LEVIN, N.P. RYAN, B. BIEKMAN, M.H. BEAUCHAMP, T. BABIKIAN & V. ANDERSON. Social Cognition and Function After Child TBI: Relation to Imaging.**

**Symposium Description:** The neural mechanisms of altered social cognition, social function and neurobehavioral outcome after TBI in children is the central issue. Longitudinal studies have shown that that social and neurobehavioral domains often remain impaired despite cognitive recovery after child TBI. However, the neural underpinnings of these persistent sequelae are poorly understood. The presenters will show results in multimodality imaging that support altered brain structure and function in multiple regions including the social brain network and its connections. The role of each symposiast:

Talin Babikian: Neurobehavioral and social cognitive functioning in relation to neuroimaging

Miriam Beauchamp: Impaired moral reasoning and fMRI evidence of reorganization.

Brian Biekman: Problems with friendships in relation to structural connectivity on DTI

Nicholas Ryan: Theory of mind and structural changes on MRI.

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#### **T. BABIKIAN, E. DENNIS & R. ASARNOW. Neuroimaging correlates of long-term neurobehavioral outcomes in pediatric traumatic brain injury.**

There is significant literature supporting various degrees of long-term neurobehavioral deficits, including neurocognition and social cognition, following a traumatic brain injury (TBI) in childhood. The extent of deficits is moderated by a number of factors, including nature and severity of injury, in addition to personal and premorbid factors. The injury related pathophysiology following a brain injury that underlies neurobehavioral morbidity has been characterized by a number of both functional/metabolic and structural brain imaging studies, allowing us to better understand the course of repair and recovery that follows a TBI in childhood. These pathophysiological changes include permanent or transient disruptions in network connections that allow for higher order cognitive functions, volumetric changes in key brain structures

that support social and cognitive functions, as well as metabolic or structural abnormalities that suggest inflammatory responses. In this paper, neuroimaging markers that help explain the nature of long term neurobehavioral deficits related to injury related variables will be reviewed, and results from the UCLA longitudinal study of multi-modal neuroimaging in pediatric TBI will be presented.

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**M.H. BEAUCHAMP, J. ANSADO, E. VERA-ESTAY, J. COOPER, V. ANDERSON & J. DOOLEY. Moral Reasoning after Pediatric TBI: A Brain-Behavior Perspective.**

**Objective:** Adolescents who sustain TBI are at particular risk for developing socially maladaptive behaviors as a consequence of the cognitive and neural disruptions associated with their injuries, which occur at a crucial time for social maturation. Deviations in the way individuals think about the conventions that govern their social interactions (i.e., moral reasoning, MR) can lead to problematic behaviors, yet few studies have addressed the putative link between TBI and MR. We investigated both the brain and behavioral manifestations of MR in adolescents with TBI.

**Materials and Methods:** In Study 1, we documented MR in 47 adolescents (14.6 years  $\pm$  1.7) with TBI of all severity levels using the So-Moral task, which consists of visual, first-person socio-moral dilemmas (Beauchamp et al., 2013). In Study 2, 12 adolescents with TBI and 11 controls (15.9 years  $\pm$  1.6) completed the So-Moral task during fMRI in a Siemens 3T Trio scanner. MR conditions were compared to neutral social decision-making conditions.

**Results:** Adolescents with TBI had significantly poorer MR ( $p < .001$ ), with greater injury severity associated with less mature reasoning and more inappropriate decision making ( $p < .01$ ). fMRI analyses revealed clusters of both hyper- and hypo-activation after TBI in areas commonly associated with socio-affective functioning, including the medial prefrontal cortex, cingulate and amygdala.

**Conclusion:** MR appears to be reduced after TBI in adolescents and less mature MR is associated with changes in the activity of brain regions responsible for social and emotional functioning. Understanding the brain-behavior relationships surrounding MR after TBI has potential for improving early identification of youth at risk for social decision-making difficulties and problem behaviors.

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**B. BIEKMAN, E.A. WILDE, X. LI, G. HANTEN, A. VASQUEZ, A. SCHMIDT, J. HUNTER, Z.D. CHU & H.S. LEVIN. DTI and Peer Relationships Following Pediatric TBI.**

**Objective:** Traumatic brain injury (TBI) may have important consequences for peer relationships, particularly in children, but investigation of TBI-altered neural correlates of social functioning is limited. We assessed white matter (WM) integrity using diffusion tensor imaging (DTI) and examined its relation with two salient features of peer relationships: closeness of peer friendships and level of a child's loneliness. **Participants and Methods:** Forty children with complicated mild to severe TBI and 26 children with orthopedic injury (OI) with comparable demographics (sex, race, SES) were recruited. Age was controlled. Participants completed the Berndt & Keefe Friendship Questionnaire and the Asher Children's Loneliness Survey. In addition, each participant underwent DTI at 12 months post-injury. Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) of the corpus callosum (CC), genu of the CC, cingulum bundles (CB), inferior fronto-occipital fasciculi (IFOF), and frontal WM were calculated using quantitative tractography.

**Results:** The TBI group exhibited lower FA and higher ADC (all  $p < .01$ ) for all WM regions except the CB. Contrary to expectation, groups did

not differ on loneliness or friendship. In the OI group, loneliness correlated with FA of the genu (Spearman's partial  $\rho = -.45$ ), and right and left frontal regions ( $\rho = -.56$  and  $\rho = -.48$ , respectively), and ADC of the genu ( $\rho = .43$ ) and right frontal regions ( $\rho = .44$ ). In the TBI group, loneliness correlated with FA of the CC ( $\rho = -.34$ ), and left IFOF ( $\rho = .39$ ), such that lower WM integrity indicated more loneliness. Only FA of right and left CB of the OI group correlated with friendship ( $\rho = .49$  and  $\rho = .52$ , respectively).

**Conclusion:** These findings indicate that WM injury may contribute to social relationships in children. Further research is needed to address additional aspects of social functioning and how alteration of brain structure may contribute to these important deficits.

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**N.P. RYAN, C. CATROPA, R. BEARE, T. SILK, L. CROSSLEY, M.H. BEAUCHAMP, K.O. YEATES & V. ANDERSON. Theory of Mind Mediates the Prospective Relationship Between Abnormal Social Brain Network Morphology and Chronic Behavior Problems after Pediatric Traumatic Brain Injury (TBI).**

**Objective.** Childhood and adolescence coincide with rapid maturation and synaptic reorganization of distributed neural networks that underlie complex cognitive-affective behaviors. These regions, referred to collectively as the 'social brain network' (SBN) are commonly vulnerable to disruption from pediatric TBI; however, the mechanisms that link morphological changes in the SBN to behaviour problems in this population remain unclear. This study aimed to evaluate the sub-acute effect of pediatric TBI on SBN morphology, and evaluate prospective relationships between sub-acute magnetic resonance-based morphometry, ToM, and long-term behavioral problems.

**Participants and Methods.** In 98 children with mild to severe TBI, we acquired 3D T1 weighted MRIs at 2-8 weeks post injury. For comparison, 33 typically developing controls of similar age, sex and education were scanned. All participants were assessed on measures of Theory of Mind (ToM) six months post-injury and parents provided ratings of behavior problems 24-months post-injury.

**Results.** Participants with severe TBI showed abnormal SBN morphology, as well local gray matter structural change in multiple component cortical regions of the SBN. Compared to controls and children with milder injuries, the severe TBI group had significantly poorer ToM, which was associated with more frequent behavior problems and abnormal SBN morphology. Mediation analysis indicated that impaired ToM mediated the relationship between structural change in the SBN and more frequent behavior problems.

**Conclusions.** Global and local structural changes in the SBN are present as early as 2-months post-severe TBI. These sub-acute alterations in SBN morphology indirectly contribute to long-term behavior problems via their influence on ToM. Structural change in the SBN and its putative hub regions may represent a useful imaging biomarker for prediction of post-acute ToM impairment, which may in turn elevate risk for chronic behaviour problems.

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### Invited Symposium 3. Genes, Environments and Their Interplay in Cognitive Aging and Dementia

Chair: Nancy Pedersen

Discussant: Sudha Seshadri

12:45–2:15 p.m.

**N. PEDERSEN, W.S. KREMEN, M. MCGUE, M. GATZ, N. PEDERSEN & S. SESHADRI. Genes, Environments and Their Interplay in Cognitive Aging and Dementia.**

**Symposium Description:** Behavior genetics has provided us with a great deal of information on the relative importance of genetic and environmental factors for brain and cognitive aging. Much of the evidence has been based on twin studies of aging and focused on establishing the heritability of cognitive abilities and trajectories, brain development, morphology and function. Few studies have taken the next step, i.e., to explore the extent to which there is interplay between genes and relevant environments for brain and cognitive aging. The purpose of this symposium is to provide examples of how behavioral genetic approaches can help us explore how genes, environments and their interplay are important for cognitive aging and dementia. To begin this symposium, Dr. Kremen will provide an overview of the contribution of behavioral genetics to an understanding of cognitive and brain aging, including recent findings from MRI studies in twins. Dr. McGue will follow with examples of gene-environment interplay involving education, intellectual engagement and late-life cognitive functioning. Next, Dr. Gatz will discuss evidence for sex differences in genetic influences on dementia. Finally, Dr. Pedersen will discuss how epigenetics, i.e. DNA methylation patterns, may contribute to gene-environment interplay in cognitive aging and dementia. The discussant will explore application of findings for neuropsychology and brain health.

**W.S. KREMEN, M. PANIZZON, J.A. ELMAN, M. LYONS & C. FRANZ. Contributions of Behavior Genetics to Cognitive and Brain Aging.**

**Objective:** In the 21st century, it is becoming increasingly important for neuropsychologists to have some familiarity with genetics. Here we provide an overview of behavior genetic findings about brain structure and its relationship to cognition.

**Participants and Methods:** 550 twins from the Vietnam Era Twin Study of Aging (VETSA): ages 51-60 at VETSA 1; ages 56-66 at VETSA 2. Primarily 3D structural MRI analyzed with FreeSurfer. Focus for this presentation is on general cognitive ability based on the Armed Forces Qualification Test.

**Results:** We describe the genetic relationship between cortical thickness and cortical surface area, and the complex relationship between those phenotypes and cognition. We describe behavior genetic findings with regard to age-related changes in brain structure. We also describe some findings of interest with regard to APOE genotype and its relationship to brain and cognition.

**Conclusions:** It is only relatively recently—following the development of semi-automated methods for image post-processing—that large-sample MRI studies have been possible. Twin studies require very large sample sizes, so it is also only relatively recently that it has been possible for substantial progress to have been made in twin studies of brain structure. Both brain and cognition are highly polygenic phenotypes. That is, they are influenced by many genes, each of very small effect. That lack of large single-gene effects can make it very difficult to identify specific genes in genetic association studies. Although twin studies do not identify specific genes, they do account for the total aggregate influence of genes. The work presented demonstrates how twin studies constitute an important complement to molecular genetic studies for understanding the genetic underpinnings of brain and cognition.

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**M. MCGUE. Late-Life Change in Cognitive Function: Evidence from Longitudinal Twin Research.**

: One of the most robust observations from psychological gerontology is the aging of cognitive abilities. On average cognitive function declines in late life, although the magnitude of decline and when it first emerges vary across ability domains. Significantly, there are marked individual differences in rate of cognitive decline, with some individuals experiencing little if any cognitive impairment as they get older while other individuals are especially sensitive to the effects of aging. Behavioral genetic methodology and specifically twin studies can help to characterize the nature and origin of individual differences in behavior. Results from two large-scale Danish longitudinal twin studies will be described to illustrate the utility of behavioral genetic methodologies in psychological gerontology. The first is the Longitudinal Study of Aging Danish Twins (LSADT), a cohort sequential study of 4371 Danish twins age 70 and older, whose cognitive function was assessed every two years for up to six times. The second is the Middle Age Danish Twin study (MADT), which consists of a sample of more than 4000 twins, whose cognitive function was assessed initially at mid-life (mean [SD] age of 56.9 [6.3]) and then again approximately 10 years later (66.7 [6.1]). Results from analysis of the LSADT and MADT longitudinal datasets will be presented to show the extent to which genetic and environmental factors contribute to late-life cognitive change. In addition, we will show how twin studies can be used to address the confounding that complicate causal inference in observational gerontology, using as examples the relationships of education and intellectual engagement with late-life cognitive function. Correspondence: *Matt McGue, 75 E River Rd, Minneapolis, MN 55455. E-mail: mcgue001@umn.edu*

**M. GATZ & C.R. BEAM. Contributions of Twin Studies to Discerning Sex Differences in Dementia.**

**Objective:** Research supports that there are more women than men with Alzheimer's disease and with dementia in general. The aim of our study was to apply a twin design toward ascertaining the role of gene and environment interplay in accounting for sex differences in dementia. **Participants and Methods:** Participants were 15,634 twins from the population-based Swedish Twin Registry. Subsets of the population were enrolled in longitudinal studies of cognition, and in 1998-2001 the entire registry was screened for cognitive dysfunction. Dementia diagnoses were made based on clinical evaluations and through national hospitalization and cause of death registries. **Results:** Among twins aged 65+, prevalence of dementia was 11% for men; 16% for women. Incidence was similar until age 85+ after which more women than men developed dementia. Genetic correlations were .15 for monozygotic male pairs, .18 for dizygotic male pairs, .35 for MZ female pairs, .17 for DZ female pairs, and .07 for unlike sex pairs. Within opposite sex pairs, women were 21% more likely than men to be diagnosed with dementia. For women, youngest age of onset was among those with two e4 alleles, intermediate for those with one e4 allele, and oldest for those with no e4. For men, having one e4 allele had little effect on age of onset, but having two e4 alleles was significantly associated with a younger age of onset. **Conclusions:** Sex differences in dementia prevalence seem largely a function of women's greater longevity, although there is some evidence of higher incidence among oldest old women, possibly reflecting competing risks and survival bias. Additive genetic influences may be relatively more important for women in accounting for risk of dementia, while environmental factors—including environments shared between members of the twin pair—may be relatively more important for men's risk for dementia.

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**N. PEDERSEN, I.K. KARLSSON & S. HÄGG. Epigenetic processes: A Potential Mechanism for Gene Environment Interplay?**

There are a number of types of gene-environment interplay, such as active gene-environment correlation (niche picking) in which individuals create or select their own environments as a function of their genetic propensities, or gene-environment interaction, in which the effect of genetic variants differs as a function of the “environment”. Gene-environment correlation, be it active or passive, may be tractable by evaluating the extent to which genotypes are unevenly distributed among environments. Gene-environment interaction, on the other hand, may be a function of an environmental “trigger” that may turn on or turn off gene expression. Epigenetic processes may represent one such mechanism resulting in gene-environment interaction. In this presentation, evidence of DNA methylation as a potential source of gene-environment interaction for cognitive aging and dementia will be provided.

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**Paper Session 7. Imaging and Neuropsychology**

**Moderator: Derin Cobia**

**12:45–2:15 p.m.**

**T. MEREDITH-DULIBA, J. WILLIAMS & K. OSIPOWICZ. Multi-Modal Neuroimaging Approach to the Developing Human Brain: Infancy Through Early Adulthood.**

**Objective:** Map normal brain development using volumetric MRI measures of gray and white matter, magnetic resonance spectroscopy (MRS) and diffusion tensor imaging (DTI). These methods allow for the assessment of structural maturation and a set of brain metabolites that change over the course of growth and development. These normal developmental changes can be contrasted with patterns associated with neurological disorders.

**Participants and Methods:** The study consisted of 452 normal children ranging in age from birth to 18 years. All were administered a standard MRI protocol consisting of T1 scans, DTI scanning and MRI Spectroscopy of N-acetylaspartate (NAA) choline, creatine, and unsuppressed water. For full details of the scanning methods see The MRI Study of Normal Brain Development (<http://pediatricmri.nih.gov>). Developmental trends were plotted for all measures and nonlinear regression procedures were applied to determine trend lines and variance accounted for by the resulting equations.

**Results:** The analyses showed clear patterns of change in brain volumes and metabolites over the years. Development patterns revealed that white matter tracts have highest initial DTI Fractional Anisotropy and MRS measures with moderate development ( $R^2 \approx .31$ ). Peri-cortical white matter areas, such as the precentral gyrus, association areas, and frontal lobes developed at a moderate rate ( $R^2 \approx .49$ ). The cerebellum and archicortex developed least ( $R^2 \approx .17$ ). A consistent acute pattern of growth presented during the first five years of brain development that tapered off across subsequent years; similar to the pattern previously established using volumetric measures.

**Conclusions:** This is the first study to examine DTI and MRS measures from birth through adolescence. Developing a cohesive and integrated model of development is key to identifying developmental disorders involving the CNS.

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**E.D. BIGLER & T.J. ABILDSKOV. Clinical Application of Individualized Quantitative Neuroimaging for Neuropsychology – Precision Medicine Meets Neurocognitive Assessment.**

**Objective:** Recently President Obama and NIH launched the Precision Medicine Initiative. Two components of this initiative have critical importance for neuropsychology: (1) improved technologies for biomedical analysis and (2) new tools for using large scale datasets. Excellent, reliable and quantitative MRI methods are now universally available that provide volume, cortical thickness, surface area and other measures of brain structure, but neuropsychology has been slow to take advantage of these advances. Large scale single and multi-site MRI databases exist in the public domain that can be used for both normative and pathological comparisons of individual scan findings. Since neuroanatomical integrity as well as pathology relate to neurocognitive functioning, 21st Century neuropsychology should incorporate neuroimaging technology into the assessment process. Herein we demonstrate a straightforward method to integrate quantitative neuroimaging in the service of neuropsychological assessment. An interactive 3-D portable document format (PDF) method that utilizes individual patient FreeSurfer ([free-surfer-software.org/](http://free-surfer-software.org/)) quantitative findings but compared to a normative (adjusted for age and sex) dataset is demonstrated.

**Participants and Methods:** From the individual patient or research subject, a volume acquisition T1-weighted sequence is processed through the FreeSurfer pipeline. The aseg and aparc output is used for cortical as well as subcortical ROI comparisons to a large normative data base displayed in 3-D images.

**Results:** Examples from individual participants who were either controls, cases with various degenerative diseases as well as TBI will be used to demonstrate how volumetric MRI can be interfaced with quantitative 3-D neuroimaging and neuropsychological test findings.

**Conclusions:** These new technologies enhance ‘precision’ patient care in neuropsychology. When the proper imaging has been done, neuropsychology should embrace these developments and incorporate quantitative 3-D imaging analyses as routine.

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**A.M. BUTTS, M.M. MACHULDA, J.L. WHITWELL, J.R. DUFFY, E.A. STRAND, S. PRZYBELSKI, R.C. PETERSEN, C.R. JACK JR., V. LOWE, K. KRISHNAN & K.A. JOSEPHS. Cortical and Hippocampal Volume Differences in Typical and Atypical Variants of Alzheimer’s Disease.**

**Objective:** Alzheimer’s disease (AD) pathology can be detected using Pittsburgh Compound B (PiB) PET imaging. Typical AD (DAT) presents as a primary amnesic syndrome, and at least two “atypical” variants are now recognized. The logopenic variant of primary progressive aphasia (lvPPA) presents with primary language disruption and posterior cortical atrophy (PCA) presents with visual deficits, both of which are also commonly due to Alzheimer’s disease pathology. Here, we compare these AD variants on measures of memory, as well as cortical and hippocampal volumes.

**Participants and Methods:** We matched twenty seven PCA, 50 lvPPA, and 77 DAT patients on age, disease duration, and gender. All subjects showed positive beta-amyloid deposition on PiB PET, defined using a standardized uptake value ratio (SUVR) of  $\geq 1.5$ . PiB PET status was not known at time of diagnosis. A priori regions of interest included the hippocampus (Hipp) and left/right superior temporal (ST), supramarginal (SM), inferior parietal (IP), superior parietal (SP), and lateral occipital (LO) regions. All volumes were segmented using FreeSurfer and adjusted for total intracranial volume. Subjects also completed memory tests.

**Results:** DAT subjects had poorer memory and smaller hippocampi than lvPPA and PCA subjects. The left ST was smaller in lvPPA compared to DAT and PCA. Relative to those with lvPPA and DAT, PCA patients had smaller right IP and bilateral SP and LO volumes.

**Conclusions:** Findings from these extremely well matched groups show that topographic brain changes correspond to the clinical presentation. Correspondence: *Alissa M. Butts, Ph.D., Psychiatry and Psychology, Mayo Clinic, 62 Grandville Rd SW, Unit 1521, Rochester, MN 55902. E-mail: Alissa.m.butts@gmail.com*

**A. ROY, R.A. BERNIER, N. GILBERT & F.C. HILLARY. Examining Network Strength and Cost during Recovery from Moderate and Severe Traumatic Brain Injury.**

**Objective:** The objective of this study is to examine the local and global functional connectivity changes that occur following traumatic brain injury (TBI) using resting state BOLD fMRI data. We use graph theoretical methods to examine changes in network strength and cost during recovery and the relationship these metrics have to cognitive outcome. **Participants and Methods:** Subjects included 14 individuals with moderate and severe TBI between the ages of 21 and 54, and 12 healthy adults with comparable age and education. Individuals with TBI were examined using fMRI at 3, 6, and 12 months following resolution of post traumatic amnesia. The healthy controls (HCs) were examined at 2 time points separated by 3 months. Standard preprocessing steps were implemented using SPM8/Artrepair. Power's 264 anatomical locations were used as regions of interest (ROIs) to develop functional connectivity network. Strength was defined as the absolute correlation between two regions and network "cost" was determined as the sum of (weight \* physical distance) for each link.

**Results:** Individuals with TBI showed increased network strength for all connection distances, resulting in increased network cost which peaked at 6 months post injury, but remained elevated at 12 months. High cost connections were most prevalent in the default mode network and fronto-parietal task control regions of the brain. Total network strength correlated to cognitive tests of speed of information processing and working memory with r-values ranging from -0.57 to 0.67. Total network cost correlated to cognition with r-values ranging from -0.46 to 0.475.

**Conclusions:** Using 3 time-point BOLD-fMRI data we were able to examine functional connectivity changes during the first year after TBI. Heightened network connectivity was found to be the brain's proactive response to injury, and correlated well with cognitive performance after controlling for total gray matter volume.

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**R.M. BILDER, K.S. KNUDSEN & K. JAPARDI. White Matter Volume is Associated with Exceptional Creativity: Preliminary Findings from the "Big C" Project.**

**Objective:** Prior research suggests that creativity is associated with differences in brain structure or function but so far findings are inconsistent, and few studies have examined the brains of exceptionally creative or "Big C" individuals. We aimed to determine if Big C individuals differ from a large healthy reference group in major brain tissue compartments.

**Participants and Methods:** The "Big C Project" examines brain structure and function in visual artists and scientists who have creative achievement above the 99th percentile relative to large comparison groups. We examined high-resolution MRI of Big C participants (n=20) relative to data released from the Human Connectome Project (HCP, n = 511). Brain MRI for Big C participants were acquired at 3T with 1 mm isotropic voxels. Segmented volumes were extracted following HCP protocols for cortical gray, subcortical gray, cortical white, and total intracranial contents.

**Results:** Multivariate analysis revealed a group effect ( $F(4,531)=32.7, p<.001$ ). Big C and HCP participants did not differ in intracranial contents or subcortical gray matter, but Big C participants had more white matter ( $F(1, 534)=13.6, p<.0005$ ) and less cortical gray matter ( $F(1,534) = 10.7, p < .001$ ). Post-hoc tests (corrected) showed that white matter volumes were greater in visual artists ( $p=.031$ ) and

scientists ( $p=.026$ ) relative to the HCP group but that gray matter volume reductions were significant only in artists ( $p=.047$ ), not scientists.

**Conclusions:** Findings suggest that exceptional creativity is associated with greater white matter volume. The findings are of high interest given hypotheses that exceptional creativity may be mediated by inter-regional connective anatomy that relies on white matter. Limitations include modest sample sizes in Big C groups, reliance on the HCP data, and use of automated segmentation alone. Important next steps include determining if findings are consistent with tractography, and applying graph theoretic measures to both diffusion and functional images.

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**L.M. JENKINS, A.M. BARBA, M. CAMPBELL, M. LAMAR, S. SHANKMAN, A. LEOW, O. AJLORE & S.A. LANGENECKER. Similarities in White Matter Integrity across Internalizing disorders: A Voxel-Based Meta-Analysis of Fractional Anisotropy.**

**Objective:** White matter (WM) impairments have been identified in numerous mood and anxiety disorders. We aimed to understand the effect of WM pathology across multiple mood disorders (any mood disorder, AMD), consistent with the RDoC approach.

**Participants and Methods:** Web of Science was systematically searched in September 2014 using terms DTI or diffusion tensor and anxiety or depress\* or bipolar or mania. Inclusion criteria were: original data from whole brain or whole WM analysis of fractional anisotropy (FA) in humans aged 18-65, including healthy controls (HCs), reported in standardized space, in English, in a peer-reviewed journal. We identified 25 AMD studies that used voxel based analysis (12 major depression, 10 bipolar and 3 anxiety disorder) for a total of 761 AMD and 675 HCs. We extracted peak coordinates from each study, then conducted a meta-analysis using seed-based d Mapping v. 4.13. Jackknife analyses established reliability.

**Results:** The AMD group had reduced FA compared to HCs in all 6 clusters. The largest cluster peaked in the left inferior fronto-occipital fasciculus, and incorporated the corpus callosum, left anterior thalamic projections, striatum, fronto-orbital polar tract and uncinate fasciculus. The next largest peaked in the left superior longitudinal fasciculus (SLF) and involved the inferior parietal gyri and arcuate network. The third largest cluster peaked in the left hemisphere corpus callosum, and extended to the left SLF and cortico-spinal projections.

**Conclusions:** We found shared WM pathology across AMD, particularly in the left hemisphere. Reduced FA occurred in tracts that connect limbic regions including the OFC, amygdala, subcallosal cingulate, hippocampus and hypothalamus, to regions of the PFC involved in inhibitory control. These results suggest that microstructural WM abnormalities may underlie a disconnection between frontal, limbic and other regions that are involved in processing and regulating emotions.

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**A. AILION, T.Z. KING, L. WANG, M.E. FOX, H. MAO, R. MORRIS & B. CROSSON. Interaction between Age at Diagnosis and Radiation Therapy is related to Cerebellar Atrophy in Long-Term Survivors of Pediatric Brain Tumors.**

**Objective:** The cerebellum (CB) helps to automate learned processes and thus is related indirectly to the speed of processing. The CB often sustains damage from treatment and resection in patients with posterior fossa tumors. Researchers have suggested that young age at radiation treatment is correlated with CB atrophy. The purpose of the study was to measure cerebellar atrophy to determine its relationship to treatment factors and speed of processing.

**Participants and Methods:** Brain MRIs were collected from 25 adult survivors of CB tumors and age and gender matched controls (M=24 years (SD=5), 52% female). Average age at diagnosis was 9 years (SD=5) and average time since diagnosis was 15 years (SD=5).

Processing speed (PS) was measured by the Symbol Digit Modality Test. To quantify atrophy, an objective formula was developed based on prior literature, in which atrophy = [(CB White+CB Grey Volume)/ Intracranial Vault (ICV)] of controls minus [(CB White+CB Grey+Lesion Size Volume)/ICV] of survivors.

**Results:** A three predictor regression model, which included the simultaneous entry of age at diagnosis, presence of radiation, and an interaction term (age\*radiation) as predictors, accounted for 44% of the variance in cerebellar atrophy, Adj R<sup>2</sup>=.44, F(3,21)=7.30, p<.01 Presence of radiation was associated with higher CB atrophy. The interaction term indicated that for individuals treated with radiation, younger age at diagnosis was associated with higher CB atrophy. An interaction between atrophy and lesion size also was detected and accounted for 33% of the variance in oral PS and 48% of the variance in written PS. Both interactions suggest that individuals with smaller CB lesion size but a greater degree of CB atrophy had slower processing speed, whereas individuals with a larger CB lesion size and less CB atrophy were less affected.

**Conclusions:** The results of the current study suggest that young age at radiation is related to CB atrophy, which negatively impacts PS to a greater degree than does CB lesion size.

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## Symposium 10. Risk and Protective Factors for Outcomes in MS and Sports-Related mTBI

Chair: Peter Arnett

1:00–2:20 p.m.

**P. ARNETT, D. UKUEBERUWA, M. CADDEN, J. MEYER & V.C. MERRITT. Risk and Protective Factors for Outcomes in MS and Sports-Related mTBI.**

**Symposium Description:** Knowledge of risk and protective factors for outcomes in neurological conditions can be extremely valuable in guiding prevention efforts and treatment. An important outcome in multiple sclerosis (MS) shown to be associated with quality of life and medication adherence, among other factors, is depression. In sports-related mTBI, important outcomes include post-concussion symptoms and cognitive functioning, domains that can substantially impact athletes' daily functioning and readiness to return to play. In this symposium, we present data from studies on MS and mTBI that examine predictors of the above outcomes that involve: 1) The evaluation of coping and cognitive reserve (CR) as moderators of disease burden and depression in MS; and 2) the evaluation of injury-related variables involving loss of consciousness (LOC) and amnesia in predicting symptom and neurocognitive profiles in sports-related mTBI. Peter Arnett will begin by providing a brief overview of the symposium. Dede Ukuieberuwa will then demonstrate that measures of microstructural brain integrity predict depression in MS only when moderated by coping strategies; when patients have compromised microstructural brain integrity, only those who use maladaptive coping strategies also show depression. Margaret Cadden will then review data showing that CR moderates the relationship between MS disability and depression; when patients have high levels of disability, only those with low levels of CR show significant depression. Next, Jessica Meyer will present data illustrating that several injury and post-injury variables predict impairments in specific cognitive domains in mTBI. Finally, Victoria Merritt will demonstrate that athletes with mTBI's who experience LOC and PTA have an elevated risk for a range of post-concussion symptoms within two weeks post-injury. A discussion moderated by Peter Arnett exploring how these findings might be translated into clinical practice will then ensue.

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**D. UKUEBERUWA & P. ARNETT. Coping Style is a Protective Factor for Emotional Consequences of MS Neuropathology.**

**Objective:** In MS, depression symptoms could be a direct consequence of neurophysiological changes or a secondary consequence of coping with disability. We hypothesized that white matter microstructural integrity in regions of interest would interact with coping style to predict depression and, specifically, that greater adaptive coping would be protective for patients with compromised white matter.

**Method:** 48 participants (33 female) with MS completed self-report measures, including the Beck Depression Inventory-Fast Screen (BDI-FS) and the COPE Inventory, a validated measure with Active (more adaptive) and Avoidant (less adaptive) coping factors. Participants also completed a diffusion tensor imaging scan, from which voxel-wise fractional anisotropy (FA) was calculated to assess integrity in these tracts: anterior thalamic radiation, cingulum-cingulate gyrus, cingulum-hippocampus, inferior frontal-occipital fasciculus and uncinate fasciculus. Separate regression models analyzed the interaction of regional FA and coping style to predict depression.

**Results:** Analyses did not indicate a main effect of FA. However, significant regional FA and Active Coping interaction effects for predicting BDI-FS scores were found with the anterior thalamic radiation ( $\Delta R^2=.08$ ,  $p<.05$ ) and uncinate fasciculus ( $\Delta R^2=.11$ ,  $p<.05$ ). One significant interaction of FA and Avoidant Coping was found with the cingulum-hippocampus ( $\Delta R^2=.11$ ,  $p<.01$ ).

**Conclusions:** This study demonstrated a protective effect of coping style in the experience of depression among people with MS who showed compromised integrity of white matter tracts that connect subcortical to frontal regions. For patients with decreased integrity of the anterior thalamic radiation and uncinate fasciculus, use of more Active Coping strategies was associated with relatively lower depression. Similarly, use of less Avoidant Coping was associated with lower depression for patients with decreased integrity of the cingulum-hippocampus.

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**M. CADDEN & P. ARNETT. Cognitive Reserve Attenuates the Effect of Disability on Depression in Multiple Sclerosis (MS).**

**Objective.** High education appears to be protective against depression in healthy adults; theories exploring stress, coping style, and cognitive resources have been examined with fruitful results. Cognitive reserve, a construct closely related to education, has been found to attenuate the impact of brain pathology on daily function. The goal of the current study was to explore the relationship of cognitive reserve and disability with depression in a sample of individuals in which brain pathology is thought to contribute to depression (multiple sclerosis - MS).

**Participants and Methods.** Fifty-four individuals with MS participating in a neuropsychological research study of MS-related factors were examined. Depression was measured using the Beck Depression Inventory-Fast Screen (BDI-FS). Demographic (education) and disease (EDSS) related variables were collected. Cognitive reserve (CR) was operationalized as the sum years of education and a measure of crystallized intelligence (Shipley Vocabulary). A regression on BDI-FS examining CR, EDSS, and their interaction were explored. Models of mediation were also investigated.

**Results.** The interaction between EDSS and CR was significant,  $t(50) = -2.2$ ,  $p=.035$ . Simple effects testing revealed that EDSS predicted depression in those with low CR,  $t(50)=2.9$   $p=.01$ , but not in those with high CR ( $p=.7$ ). Further analyses revealed that the relationship between CR and depression was mediated, in part, by daily uplifts (The Hassles and Uplifts Scale) and fluid cognitive skills (Shipley Abstraction). The relationship was not mediated by daily hassles (The Hassles and Uplifts Scale) or coping style (The Cope Inventory).

**Conclusions.** CR moderates the relationship between disability and depression in MS; disability does not appear to predict depression in those with high CR. The relationship between CR and depression appears to be mediated, in part, by measures of daily uplifts and fluid processing.

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**J. MEYER, V.C. MERRITT & P. ARNETT. Risk Factors for Domain-Specific Post-Concussion Cognitive Deficits.**

**Objective:** The idiosyncratic nature of concussive injuries and their recovery trajectories has complicated the development of an expected profile of post-concussion cognitive functioning. Neuropsychologists therefore face the difficult task of efficiently evaluating for decline in all possible cognitive domains. The present study evaluates risk factors for domain-specific cognitive changes.

**Method:** 86 participants from a university-based sports concussion program received baseline and post-concussion assessments including both paper-and-pencil and ImPACT measures. All post-concussion evaluations were performed within 2 weeks post-injury. Three neurocognitive composite scores (processing speed, verbal memory, visual memory) were created using Principal Components Analysis and confirmed with Cronbach's Alpha. Mean post-concussion performance of athletes who did or did not report loss of consciousness, and athletes who did or did not report retrograde amnesia were compared. Comparisons were also made between athletes who engaged in physical exercise since their concussion and those who did not.

**Results:** Loss of consciousness post-concussion ( $n=19$ ) resulted in significantly worse performance on tests of verbal memory ( $t=-2.62$ ,  $p=.01$ ). Retrograde amnesia ( $n=13$ ) resulted in significantly worse performance on tests of visual memory ( $t=-2.26$ ,  $p=.026$ ). Athletes who reported that they engaged in physical activity following their concussion ( $n=11$ ) performed significantly worse on tests of processing speed ( $t=-2.12$ ,  $p=.039$ ) and verbal memory ( $t=-2.27$ ,  $p=.028$ ).

**Conclusion:** Our findings suggest that evaluation of injury and post-injury information may help to guide the development of expected post-concussion cognitive profiles. This could help clinicians develop appropriate individualized test batteries that balance efficiency and thoroughness. These results further support the recommendation of physical rest following a concussion.

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**V.C. MERRITT & P. ARNETT. Relationship Between Traditional Markers of Injury Severity and Post-Concussion Symptom Clusters in Concussed Collegiate Athletes.**

**Objective:** Loss of consciousness (LOC) and post-traumatic amnesia (PTA) are commonly used metrics to classify brain injury severity. However, little is understood regarding how these variables relate to functional outcomes post-injury, especially within the realm of sports-related concussion. The purpose of this study was to determine whether post-concussion symptom reporting patterns vary as a function of LOC and PTA.

**Participants and Methods:** Participants included 84 collegiate athletes (82.1% male) who were evaluated within two weeks post-injury. The main outcome measures were the Post-Concussion Symptom Scale (PCSS) and an interview querying athletes about whether they experienced LOC and PTA.

**Results:** Dependent variables included four PCSS symptom clusters (physical, cognitive, affective, and sleep). Athletes were divided into two groups based on LOC status (21.4% LOC+). Mann-Whitney U tests revealed significantly higher scores for LOC+ athletes compared to LOC- athletes on the physical and sleep symptom clusters (all  $p<.05$ ). Athletes were also divided into two groups based on PTA status (34.5% PTA+). Mann-Whitney U tests revealed significantly higher scores for PTA+ athletes compared to PTA- athletes on the physical, cognitive, and sleep symptom clusters (all  $p<.05$ ). Finally, logistic regression analyses showed that the four PCSS symptom clusters reliably distinguished between athletes who did and did not experience LOC ( $\chi^2(4, N=84)=12.03$ ,  $p=.017$ , Nagelkerke's  $R^2=.21$ ) and PTA ( $\chi^2(4, N=84)=10.72$ ,  $p=.030$ , Nagelkerke's  $R^2=.17$ ).

**Conclusion:** These findings suggest that athletes who experience LOC and PTA surrounding a concussive event tend to report greater post-concussion symptoms within two weeks post-injury compared to athletes who do not experience these traditional injury severity markers. Knowledge of such risk factors has implications for the safety and well-being of athletes, and may inform the management and treatment of sports-related concussions.

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**Symposium 11. Neurotoxicants and the Etiology of Neurodevelopmental Disorders: A Multidisciplinary Approach**

**Chair: Amy E. Margolis**

**Discussant: Larry J. Seidman**

**2:15–3:30 p.m.**

**A.E. MARGOLIS, V. RAUH & J. HERBSTMAN. Neurotoxicants and the Etiology of Neurodevelopmental Disorders: A Multidisciplinary Approach.**

**Symposium Description:** The environment is now known to be a powerful determinant of child health, with increasing evidence that some chemicals are particularly toxic to the human brain. The developing brain is particularly vulnerable to toxic chemical exposures and this sensitivity is likely greatest in utero and throughout early childhood. Prospective cohort studies incorporating neurodevelopmental outcome measures provide opportunities to map developmental trajectories. Research showing the effects of exposure to neurotoxicants is critical for the design of primary prevention programs that can reduce exposure. In this symposium, we present findings from three studies examining neurodevelopmental outcomes following exposure to three neurotoxicants: Polycyclic Aromatic Hydrocarbons (PAHs), an air pollutant, Chlorpyrifos, an organophosphate pesticide, and Polybrominated Diphenyl Ethers (PBDEs), an organobromine compound used as a flame retardant. Exposure to these neurotoxicants causes damage that may be apparent in the neonatal period and extending through childhood. Dr. Margolis will present evidence demonstrating the association between prenatal exposure to PAH and academic skill acquisition is mediated by inhibitory control deficits. Dr. Rauh will present evidence that prenatal exposure to Chlorpyrifos is associated with a unique neuropsychological profile characterized by impaired auditory attention and fine motor dexterity. Dr. Herbstmann will present evidence that PBDE exposure is associated with lowered attention and cognition.

1. Amy Margolis (Co-Chair): Effects of Prenatal Exposure To Air Pollutants (Polycyclic Aromatic Hydrocarbons) on Inhibitory Control And Academic Achievement

2. Virginia Rauh (Co-Chair): Signature Neuropsychological Profile of Children with Prenatal Exposure to a Common Organophosphate Pesticide

3. Julie Herbstman: Prenatal Exposure to Brominated Flame Retardants (PBDE) and Problems with Attention and Cognition: Results from a Longitudinal Birth Cohort

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**A.E. MARGOLIS & V. RAUH. Effects of Prenatal Exposure To Air Pollutants (Polycyclic Aromatic Hydrocarbons) on Inhibitory Control And Academic Achievement.**

**Objective:** PAHs readily cross the placenta. Prenatal exposure to PAH is associated with neurodevelopmental disorders characterized by dysfunction of self-regulation, such as autism and ADHD. Self-regulatory

behavior is important for acquisition of academic skills. We investigated whether prenatal exposure to PAH is associated with inhibitory control (IC), and whether IC mediated the association of prenatal exposure to PAH and academic achievement.

**Participants and Methods:**

Mothers recruited were nonsmoking, aged 18–35, African American or Dominican, free of diabetes, hypertension, known HIV, and drug abuse. Personal air sampling was conducted for the mothers for 48 hours at 4 L/min. NEPSY Inhibition measured IC at age 10. Woodcock Johnson Test of Achievement – 3rd edition measured Reading Achievement (RA) and Math Achievement (MA) at age 14.

Multivariate linear regression tested associations of prenatal PAH exposure with IC and MA and RA. PAH and IC data were available for 116 children, and 74 children had data available on PAH, IC RA, and MA. The Sobel test evaluated whether IC mediated prenatal exposure to PAH and academic achievement. Covariates included were gender, age at test, maternal education in years, and ethnicity.

**Results**

Prenatal exposure to PAH was associated with IC,  $p < .03$  and MA,  $p < .009$ . Prenatal exposure to PAH was not associated with RA,  $p < .5$ . IC was associated with MA,  $p < .002$ . IC mediated the association of prenatal exposure to PAH and MA,  $p < .05$ .

**Conclusion**

Prenatal exposure to PAH is associated with poor inhibitory control at age 10; this deficit is on the causal pathway to problems in math achievement at age 14. Idiopathic deficits in academic skills may be attributed to a child's poor motivation or mis-match between the child and classroom environment, but the results from this study suggest that the chemical environment may be an important factor in determining cognitive development and subsequent academic skill achievement.

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**V. RAUH, A.E. MARGOLIS, S. ARUNAJADAI & B. PETERSON. Signature Neuropsychological Profile of Children with Prenatal Exposure to a Common Organophosphate Pesticide.**

**Objective:** Chlorpyrifos (CPF) is known to cross the placenta, posing a threat to the unborn child during a period of rapid brain development. Previous studies show cognitive and behavioral deficits in early childhood related to prenatal CPF exposure, across both agricultural and urban populations. The present study examines whether such deficits persist into later childhood.

**Participants and Methods:** We analyzed neuropsychological test data from 237 children (9–11 years) who are part of a prospective cohort study of inner-city children, followed since the prenatal period. Participating children had complete data on the following: (1) prenatal maternal interview; (2) biomarkers of prenatal CPF exposure level from maternal and/or cord blood samples at delivery; (3) postnatal covariates; and (4) neuropsychological assessments at 9–11 years. Data analysis involved data reduction by factor analysis of all neuropsychological measures, followed by linear regression analysis to determine associations between prenatal CPF exposure and performance on each neuropsychological domain.

**Results:** Highly exposed children performed significantly worse than less exposed children in the domains of sustained auditory attention ( $p < 0.01$ ) and finger dexterity ( $p < 0.01$ ), as measured by the NEPSY-II. Highly exposed children showed intact inhibitory control, visual sustained attention, verbal memory and visual memory, revealing a pattern of better performance on complex versus simple tasks in the presence of fine motor control deficits.

**Conclusions:** This signature profile of neuropsychological performance among children with high prenatal exposure to CPF suggests difficulty with functions requiring low levels of arousal, and more success with tasks that require more active engagement, reflecting the effects of their difficulty sustaining attention. The implications of this profile for academic and social adjustment are discussed.

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**J. HERBSTMAN & W. COWELL. Prenatal Exposure to Brominated Flame Retardants (PBDE) and Problems with Attention and Cognition: Results from a Longitudinal Birth Cohort.**

**Objective:** Polybrominated Diphenyl Ethers (PBDE) are used as flame retardant chemicals resulting in nearly ubiquitous human exposure. We investigated whether prenatal exposure to PBDE is associated with problems with attention and cognition across early childhood.

**Participants and Methods:** The sample consists of white, black and Chinese women. 210 Maternal-child pairs were followed through age 7 years. PBDE plasma levels were analyzed by the U.S. Centers for Disease Control and Prevention. The Child Behavior Checklist was administered annually between the ages of 3 and 7 years. The Bayley Scales of Infant Development at ages 1, 2, and 3 years and the Wechsler Preschool and Primary Scale of Intelligence-Revised at 4 and 6 years was used to assess cognition. We analyzed the association between natural log-transformed and dichotomized (low vs. high) PBDEs and attention and cognitive problems using multivariable adjusted regression.

**Results:** We detected 4 PBDE congeners in more than 50% of samples, with concentrations highest for BDE-47 (median±IQR: 11.2±19.6 ng/g). In adjusted analyses, we detected associations between BDE-47 (1.21, 95% CI: 1.00, 1.47), and BDE-153 (1.18, 95% CI: 1.00, 1.39) in cord plasma and increased attention problems among children at age 4 ( $n=109$ ) but not 6 ( $n=107$ ) years. We detected significant associations for 24-month Mental Development Index (MDI) (BDE-47, 99, and 100), 36-month MDI (BDE-100), 48-month full-scale and verbal IQ (BDE-47, 99, and 100) and performance IQ (BDE-100), and 72-month performance IQ (BDE-100).

**Conclusions:** Our findings demonstrate a positive association between prenatal PBDE exposure and early childhood attention problems and cognition, and are consistent with previous research reporting associations between prenatal PBDE exposure and disrupted neurodevelopment. Correspondence: *Julie Herbstman, 722 W. 168th Street, New York City, NY 10032. E-mail: jh2678@cumc.columbia.edu*

**Poster Session 7. Imaging (Functional & Structural) and Medical/Neurological Disorders (Adult)**

**2:15–3:45 p.m.**

**Imaging (Functional)**

**R.A. BERNIER, A. ROY & F.G. HILLARY. Loss of Long-distance Functional Connections in Chronic TBI.**

**Objective:** The goal of this study is to examine the influence of time post injury on functional brain connectivity (FC) in traumatic brain injury (TBI) many years after recovery. Given growing concern about neurodegeneration after TBI, we use network theory to examine brain connectivity with focus on connection strength and distance in neural networks. We correlate metrics of network connectivity with cognitive outcome.

**Participants and Methods:** Participants were 8 individuals with chronic TBI with moderate and severe injury (24-hour Glasgow Coma Scale between 3–12, or positive neuroimaging findings, mean 14 years post injury) and 12 healthy controls (HCs). All data underwent thorough standard preprocessing prior to graph theoretical analysis. Power's 264 anatomic locations were used for defining regions of interest (ROIs). For each ROI, we examined the overlap between the TBI and HC distributions for nodal weight and distance using receiver operator characteristic (ROC) values.

**Results:** The chronic TBI group demonstrated heightened FC strength in core subnetworks compared to HCs. However, examining the ROIs with high ROC values (i.e. 5/264 ROIS) based on the mean physical distance of edges revealed loss of connection length in 4/5 ROIs in TBI. ROIs that differentiated individuals with chronic TBI and HCs included the precuneus BA7, inferior parietal lobule, and superior parietal lobule. Longer distance was observed in superior frontal region (BA10). After controlling for gray matter volume, time post injury was correlated with connection-distance gain in frontal connections, but distance-connectivity loss in posterior regions (e.g., parietal, precuneus). Loss of longer distance connections in the precuneus, and inferior and superior parietal lobules was significantly associated with decreased performance on several cognitive tests.

**Conclusions:** These results show that connectivity is associated with time post injury, where posterior connections are lost while frontal connections are maintained or even enhanced.

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**L.D. DRISKELL, J.S. LINK, J. MESSERLY, M. PINJALA, D. AMEN & C. GOLDEN. The Relationship Between Somatic Symptoms and Regional Cerebral Blood Flow in Individuals with Generalized Anxiety Disorder.**

**Objective:** The current study sought to assess the differences in regional cerebral blood flow (rCBF) between individuals with generalized anxiety disorder (GAD) who scored in the upper and lower quartiles of somatic anxiety symptomatology.

**Participants and Methods:** Participants diagnosed with GAD were selected from a large de-identified ongoing database. Then, separated into quartiles (lower 25th [ $n=1,053$ ]; upper 75th [ $n=1,008$ ]) based upon their scores on a self-report scale measuring somatic anxiety symptomatology (e.g., appetite changes, muscle tension, heart rate, trouble breathing, faintness, nausea, sweating, hot flashes, headaches). Participants were made up of 56.3% males and 43.6% females, and had a mean age of 38.31 years ( $SD=14.77$ ).

**Results:** A MANOVA was conducted at the .05 level for Baseline measures and for Concentration measures (data acquired while clients completed the Conners CPT 3). Both Baseline (Wilks'  $\lambda=.974$ ;  $F(17, 1777)=2.831$ ,  $p=.000$ ) and Concentration (Wilks'  $\lambda=.965$ ;  $F(17, 1970)=4.235$ ,  $p=.000$ ) MANOVA's provided significant differences between the upper and lower quartiles of the clients with somatic anxiety symptoms. Individuals in the upper quartile yielded significantly greater amounts of rCBF relative to the lower quartile for both Baseline and Concentration in the following areas: bilateral limbic structures, bilateral basal ganglia, and the vermis.

**Conclusions:** These results indicate that at rest, and during a task that requires concentration, the physiological symptoms associated with anxiety may be dictated by hyper-perfusion in the subcortical regions such as the thalamus, amygdala, fornix, striatum, globus pallidus, substantia nigra, and nucleus accumbens. These findings support the current literature on the limbic and basal ganglia regions. The hyper-perfusion of the vermis may be due to proprioceptive information received via the spinocerebellar tract. Lastly, these findings indicate neurological differences between individuals with GAD that experience somatic symptoms and those who do not.

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**J.C. DUPEROUZEL, A.R. LAIRD, M. SUTHERLAND, J.M. ROSS & R. GONZALEZ. Functional Neuroimaging Consensus Regarding Executive Function Alterations Among Cannabis Using Adolescents and Young Adults.**

**Objective:** A growing body of neuroimaging studies has identified functional brain abnormalities among young and heavy cannabis users.

Although single neuroimaging studies are essential for delineating the neurobiological impact of cannabis on the developing brain, modern meta-analytic tools for functional neuroimaging data have not yet been applied to identify consensus across studies. Here, we meta-analyzed findings from fMRI studies characterizing differences between cannabis using adolescents/young adults and healthy controls during executive function task performance.

**Participants and Methods:** We conducted a meta-analysis of adolescent/young adult fMRI studies within the activation likelihood estimation (ALE) framework (19 studies). We excluded studies whose participants had neurological confounds, met abuse or dependence for substances other than nicotine or cannabis, and had a mean age greater than 26 years. All coordinate foci were converted to Talairach space and the ALE meta-analysis was performed via BrainMap's GingerALE software ( $P<0.05$ , FWE corrected).

**Results:** ALE meta-analysis was performed for coordinates reporting brain between-group differences in adolescent/young adult cannabis users and healthy participants during executive function tasks. Convergence in hyperactivation was observed in numerous frontal structures in cannabis users when compared to matched-controls. Specifically, convergence was observed in the precentral, medial, and superior frontal gyrus, as well as the insula.

**Conclusions:** The effects of acute cannabis administration on the brain are known to alter cognitive abilities. In the present meta-analysis, cannabis users demonstrated greater activation that converged within insula and medial frontal gyrus, indicating alterations within the salience network (Seely et al 2007). These findings suggest reports of poorer executive function among young cannabis users may be due to difficulty disengaging neural systems that are task irrelevant and failure to generate appropriate behavioral responses.

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**F. FORTENBAUGH, V. CORBO, V. POOLE, R. MCGLINCHEY, W.P. MILBERG, D.H. SALAT, J. DEGUTIS & M. ESTERMAN. Early Life Trauma Impairs Sustained Attention Ability and Alters Functional Connectivity in OEF/OIF/OND Veterans.**

**Objective:** Early life trauma (ELT) is known to impact cognitive processing abilities in tasks involving emotional stimuli, but the cognitive and neural mechanisms of how ELT impacts neuropsychological functioning in non-emotional contexts remains incompletely characterized. The present study examined how ELT impacts performance and neural functioning on a non-emotional sustained attention task.

**Participants and Methods:** Sixty-six veterans from the Translational Research Center for TBI and Stress Disorders (VA Boston Healthcare system) were assessed for ELT and performed the gradual onset continuous performance task (gradCPT, go/no-go CPT) while in the MRI scanner.

**Results:** Behavioral results show reduced sustained attention ability in veterans with ELT, as indexed by lower  $d'$  values ( $p=0.003$ ), higher error rates ( $p=0.001$ ), greater increases in error rates over the duration of the block ( $p=0.001$ ), and increased reaction time variability ( $p=0.02$ ). Using anatomically defined amygdala ROIs, we conducted whole-brain functional connectivity analyses on the time series during the task block as well as a resting-state run collected during the same scanning session. Results showed increases in functional connectivity between the amygdala and the right middle frontal gyrus for veterans with ELT compared to those without ELT and the strength of connectivity between these regions was correlated with task performance ( $d'$ ). Interestingly, group-level differences in connectivity were only observed during the sustained attention task and not during the resting-state scan, suggesting that group differences may only be present during attention-demanding tasks.

**Conclusions:** These results suggest that ELT is associated with reduced sustained attention ability in non-emotional contexts in adulthood, which may result from dysfunctional communication between (or

interference from) emotional processing in the amygdala and prefrontal cognitive control areas.

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**A. GARCIA, T. SEIDER, E. PORGES & R.A. COHEN. The Relationship between DMN Activation and Intelligence in Older Adults.**

**Objective:** The Default Mode Network (DMN) of the brain has been described as a network that is most active when the brain is at rest. Studies of the DMN in older adults suggest alterations in both activation and connectivity. The current study aimed to examine DMN activation in older adults during a task of visual memory, specifically during the interstimulus interval. Activation during this period was then correlated with cognitive variables. We hypothesized that greater “off-task” DMN activation would be positively correlated with cognition.

**Participants and Methods:** Sixty nine older adults (M age = 73) completed the NIH toolbox cognitive battery as well as an fMRI visual memory task.

**Results:** As expected, a whole brain t-test revealed significant activation of traditional default mode network regions, including medial prefrontal cortex (MPFC), posterior cingulate cortex (PCC), and both left and right posterior perisylvian cortex (PPS), while off-task. Contrary to our hypothesis, greater activation of the PCC significantly negatively correlated with NIH Toolbox Crystallized Intelligence ( $R = -.267, p < .05$ ) and NIH Toolbox Fluid Intelligence measures ( $R = -.37, p < .05$ ). No other areas of activation were significantly correlated with cognitive variables.

**Conclusions:** In line with previous findings, older adults engage the DMN while off-task. However, those with higher performance on measures of intelligence had less PCC activation. This finding suggests that both intelligent and cognitively intact individuals remained engaged in the task even during “rest” periods.

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**E.S. HALLOWELL, M.M. OWENS, J.C. GRAY, J. MACKILLOP, C.H. BRODY & L.H. SWEET. Substance Use Effects and Insula Response during a functional MRI Working Memory Task in Rural African Americans.**

**Objective:** Rural African American populations experience disproportionately high levels of chronic stress. This has been associated with increased risk behavior, including substance use, which has in turn been linked to changes in brain regions associated with working memory (WM). As it has not previously been reported we examined this relationship in this high-risk population.

**Participants and Methods:** Functional MRI data associated with performance on an n-Back WM paradigm were analyzed among 25 rural African American males (mean age=23.0 years, SD=0.867) reporting frequency of substance use over the past year. MR data were acquired on a GE 3T MRI using a BOLD echoplanar sequence. General linear modeling was used to quantify individual 2-Back response relative to a 0-Back control condition. Whole-brain voxel-wise analyses were used to determine group level activation patterns ( $p < .05$ , FDR corrected), followed by functional region of interest group contrasts.

**Results:** Consistent with prior literature, the voxel-wise analysis revealed greater activity in bilateral middle frontal gyrus and inferior parietal lobule, and relative deactivation in the medial frontal gyrus and posterior cingulate. Unexpected activation of the bilateral anterior insula was examined given prior literature suggesting associations between this region and substance use. Independent-samples t-tests revealed that individuals in a frequent substance use group exhibit significantly lower insula activation (right:  $t = 2.14, p = .043$ /left:  $t = 2.19, p = .039$ ), despite similar behavioral performance (2-Back accuracy  $t = 1.09, p = .285$ ;

0-Back accuracy  $t = 1.67, p = .125$ ; 2-Back reaction time  $t = -.77, p = .499$ ; 0-Back reaction time  $t = -.56, p = .583$ ).

**Conclusions:** Our results provide objective neuroimaging evidence of a link between the insula and substance use in young rural African Americans when challenged with a difficult WM task. Results are discussed as they relate to chronic stress in rural African Americans and whether this may be a marker or consequence of substance use.

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**N. HOSSEINI-KAMKAR. The Neural Correlates of Cognitive and Behavioral Self-Regulation in Preadolescents: A Multidisciplinary Approach.**

**Objective:** Cognitive and behavioral self-regulation (CBSR) is the capacity to select actions that lead to favorable outcomes and avoid actions that lead to unfavorable outcomes. Variability in self-regulation early in childhood predicts social, academic, and health outcomes in adolescence (Mischel & Underwood, 1974). We aim to investigate factors that contribute to individual variability in CBSR early in development. Our hypothesis is that genes and the quality of the early environment have an interactive influence on the calibration of the mesocorticolimbic dopamine pathway (MCLP). In turn, variability in the functional calibration of the MCLP contributes to individual differences in CBSR.

**Participants and Methods:** To investigate this hypothesis, genetic, behavioral, brain imaging (fMRI), and questionnaire data were collected from typically developing 9-12 year old children. The fMRI protocol consisted of an instrumental learning task in which participants were presented with pairs of neutral images and were required to learn to select the stimuli associated with gains and avoid the stimuli associated with losses.

**Results:** Results confirm that the task engages the basal ganglia and will be a useful tool in investigating the functional calibration of the MCLP. Greater blood-oxygen-level dependent (BOLD) responses in ventral striatum (VS) and ventromedial prefrontal cortex (VMPFC) were found when participants received rewards compared to when they missed out on an opportunity to receive rewards. In contrast, greater BOLD responses in anterior insula (AI) and anterior cingulate cortex (ACC) were found when participants received losses compared to when they avoided losing.

**Conclusions:** The strength the current research project is that it interrogate CBSR at multiple levels of analysis, and the goal of this presentation is to summarize the rationale behind each level of phenotypic analysis (behavioral, neural, genetic, and environmental) and to present neuroimaging results from this multidisciplinary project.

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**K. LENGU, T. NYMAN, C. SWICK, A. FLORES, S. BISCONTI, N. WAGLEY, I. KOVELMAN & R. LAJINESS-O'NEILL. Neural Correlates and Predictors of Infant Social-Emotional Development Explored with Functional Near-Infrared Spectroscopy.**

**Objective:** Identifying early indicators for cognitive and social problems is essential for earliest intervention. The advent of neuroimaging technologies for infants, such as fNIRS, has made identifying early neural markers for typical/aberrant neurodevelopment possible. Because eye gaze processing may be the most rudimentary skill in nonverbal social development, this study examined the hemodynamic response of 9-month-olds while processing social and nonsocial gaze stimuli and tested how these neural correlates relate to cognition and behavior.

**Participants and Methods:** Fourteen typically-developing infants (Mage=40.86 (1.47) weeks) underwent fNIRS while engaged in gaze shifts to social and nonsocial stimuli. Kendall tau was used to examine the relationships between brain activation, cognitive testing, (Mullen Scales of Early Learning [MSEL]) and infant behaviors (Infant Behavior



Questionnaire-Revised [IBQ-R]; Brief Infant Toddler Social and Emotional Assessment [BITSEA]) at 9 and 12 mos.

**Results:** Frontal activation during the social tasks was related to higher levels of visual reception, fine motor, and receptive language on the MSEL at 9-mos ( $\tau$ s = .59, .59, .46,  $p$ s < .05, respectively). Higher right temporo-parietal (RTP) activation during averted gaze processing was associated with lower duration of orientation, decreased emotion regulation on the IBQ-R at 9-mos and lower social competency on the BITSEA at 12-mos ( $\tau$ s = -.57, -.73, respectively;  $p$ s < .05).

**Conclusions:** Findings demonstrate a relationship between social and higher-order cognitive processing supported by frontal regions, even early in development. Enhanced activation during averted gaze processing in RTP regions at 9 mos may reflect delayed development and/or compensation by early social communication networks. The fact that duration of orientation and social competency were associated with common activation patterns suggests that they share similar substrates in infancy, and supports the study of gaze processing as an early precursor for later social adaptability.

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#### **J.E. LETZEN & M.E. ROBINSON. Functional Connectivity of the Default Mode Network Under Different Mood States.**

**Objective:** Altered default mode network (DMN) functional connectivity (fcMRI) has been proposed as a neural marker for numerous clinical conditions, including chronic pain. State-dependent factors that might influence or confound conclusions about DMN fcMRI as a marker have not been thoroughly tested, even within healthy individuals, which often act as a control for drawing such conclusions. This study's objective was to measure DMN fcMRI in healthy individuals under different mood states.

**Participants and Methods:** Fifteen participants completed four resting-state fMRI scans. A mood induction occurred before the second and fourth scans. For the inductions, participants recounted happy and sad autobiographical events while listening to music. The sad autobiographical event was specific to a time when acute pain caused sadness. Mood ratings were collected before and after each scan and induction.

**Results:** Following respective mood inductions, participants reported happy ( $\mu$  = 74.3,  $SD$  = 74.3) or sad ( $\mu$  = 32.2,  $SD$  = 32.2) mood. FC-MRI was calculated using bivariate correlations to a key DMN hub [i.e. medial prefrontal cortex (mPFC)]. The DMN was identified across all mood states. Comparing sad to neutral mood, participants had increased DMN fcMRI with pain-related brain regions, such as postcentral gyrus, insular cortex, and fusiform gyrus [ $t(14)$  = 8.14,  $pFDR$  < .000]. Happy DMN did not significantly differ from neutral DMN. Comparing sad and happy mood states, increased DMN fcMRI was observed to the frontal pole, fusiform gyrus, and postcentral gyrus [ $t(14)$  = 6.56,  $pFDR$  < .000].

**Conclusions:** Sad, but not happy, mood states influenced DMN fcMRI, which has implications for use of this network as a marker across clinical disorders. Specifically, the utility of the DMN as a marker for chronic pain is questionable, given the increased DMN fcMRI to pain-related regions after pain-specific sad mood induction. Future work is needed to determine the specificity of mood vs. nociceptive influences on the DMN in chronic pain.

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#### **S. LEVY, K.S. SAWYER, C. WOODRUFF, S. MOSHER RUIZ, G.J. HARRIS, D.A. GANSLER & M. OSCAR-BERMAN. Functional Connectivity in Long-Term Abstinent Alcoholics.**

**Objective:** Research on functional connectivity magnetic resonance imaging (fcMRI) in long-term abstinent alcoholics (LTAA) has found abnormal synchrony in the reward network compared to nonalcoholic controls (NC). To date, only fcMRI studies involving recently abstinent

alcoholics (<6 months) have examined synchrony outside of the reward network. This study's objective was to compare network synchrony between LTAA and NC using a whole-brain analysis. We predicted that LTAA would demonstrate abnormal synchrony compared to NC in four brain networks vulnerable to alcoholism (default-mode, salience, executive-control, and reward).

**Participants and Methods:** Functional and structural MRI scans were obtained on a 3T scanner from a sample of 31 LTAA and 34 demographically similar NC. An independent component analysis (ICA) was performed using FSL's MELODIC program. Dual regression was used to identify between-group differences in synchrony levels. Threshold-free cluster enhancement was used to correct for multiple comparisons. Significant clusters are reported for regions where synchrony differed between groups.

**Results:** The ICA decomposition resulted in 34 components and revealed 20 networks. Between-group differences were found in the four a priori networks, and none of the other 16 comparisons. LTAA showed significantly reduced synchrony in the default-mode network involving the putamen and posterior cingulate cortex. LTAA showed significantly increased synchrony in (1) the salience network involving the supramarginal gyrus, cuneus, and supplementary motor area, (2) the executive control network involving the supramarginal gyrus, and (3) the insula of the reward network.

**Conclusions:** Alcoholism related synchrony anomalies are restricted to brain networks involving self-representation and higher-order aspects of cognition. The inter-relationship of synchrony anomalies of these reciprocal networks, and their relationship to subject variables representing the pathology of alcoholism will be further explored.

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#### **A.X. LI, R. CONSTABLE, R. ALKAWADRI, S. BICKEL, C. HELMSTAEDTER, F.J. MINJA, R. BRONEN, J.M. PETERS, D. REUTENS, D.D. SPENCER, L.J. HIRSCH & C.F. BENJAMIN. A Survey of Clinical Language fMRI Use in Epilepsy in 2015.**

**Objective:** Clinical functional MRI is widely used for pre-surgical evaluation of language, and at many sites has largely replaced Wada testing for this purpose. In spite of this, relatively little is known about actual implementation of fMRI in the clinic, and anecdotally there is marked variation in fMRI methodology between sites. The aim of this study was to document how epilepsy programs currently use fMRI in evaluating patients for epilepsy surgery.

**Participants and Methods:** Through email and phone, we contacted all level 3 and 4 epilepsy programs within the US via the membership directory of the National Association of Epilepsy Centers, and sites beyond the US via a snowball strategy. Measures included an online two-part survey: (i) fMRI use and relationship to surgical outcomes, and (ii) technical questions regarding language fMRI paradigms, processing and reporting procedures. We report initial data from 51 clinicians involved in patient selection for surgery and 35 individuals acquiring and analyzing clinical fMRI data.

**Results:** In mapping language presurgically, patients most frequently received neuropsychological assessment (on average 90% of patients), fMRI (55%), and Wada testing (36%). Of those using fMRI routinely, 100% used language fMRI to determine the dominant hemisphere, while 36% used fMRI to guide surgical margins. Clinical respondents at seven sites reported at least one patient had suffered an enduring (>3 month) postoperative language deficit in spite of preserving all fMRI-positive language sites. More than 16 different paradigms were routinely used to map language, most commonly letter-prompted word generation. Training of those conducting clinical fMRI varies markedly between sites.

**Conclusions:** Epilepsy programs routinely use language fMRI to lateralize but not localize language. The relationship between fMRI activation and clinical outcome is variable and likely relates to significant technical variation in fMRI use.

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**A.E. MARGOLIS, G. TAU, L.S. PAO & R. MARSH. Using Neuroimaging to Understand Brain-Behavior Associations During Cognitive Control.**

**Objective:** Disturbances in cognitive control are central to many neurodevelopmental disorders. Attention Deficit / Hyperactivity Disorder (ADHD) is characterized by inattention and impulsivity, and healthy children and their caregivers may report a range of subclinical symptoms. We used the Simon Spatial Incompatibility Task (Simon task) and fMRI to assess the neural correlates of cognitive control in children. We also examined brain-behavior associations between neural activity during cognitive control and reported attention problems.

**Participants and Methods:** We collected fMRI data during performance of the Simon task from 55 healthy children (7-22 years) and ADHD symptom scale from 39 of these children. We assessed the association of age and number of ADHD symptoms with brain activation during resolution of cognitive conflict (correct responses to conflict versus non-conflict trials).

**Results:** Across conflict trials, age was inversely associated with reaction time ( $p < 0.001$ ), and positively associated with brain activation in bilateral inferior and middle frontal gyri. Number of ADHD symptoms was positively associated with activation in left inferior frontal gyrus, caudate, insula, and bilateral anterior cingulate cortices.

**Conclusions:** We have identified several brain-behavior relationships associated with cognitive control and ADHD symptoms. With increasing age, response times decreased and activation in inferior frontal regions increased during resolution of conflict, suggesting greater activation in frontal cortices supports more efficient resolution of conflict. Activation in regions required for resolution of conflict increased with increasing number of ADHD symptoms, suggesting greater activation is required to accomplish cognitive control in individuals with weaker self-regulation. These findings demonstrate the value of studying the neural correlates of trans-diagnostic neuropsychological behaviors in healthy development. Correspondence: *Amy E. Margolis, PhD, Child and Adolescent Psychiatry, Columbia University Medical Center, 1051 Riverside Drive, New York, NY 10032. E-mail: margola@nyspi.columbia.edu*

**K. MCWILLIAMS, K. OSIPOWICZ & J. WILLIAMS. The Effects of Emotion on Visual Memory Processing Network Connectivity.**

**Objective:** Past research has found the amygdala to have a modulating effect on the hippocampal complex and cortical regions during emotional memory encoding, however a fully constructed network of emotional memory processing has yet to be identified. Our goal was to support the existence of such a network and to show its connections are modified by emotional salience.

**Participants and Methods:** The present study used functional connectivity magnetic resonance imaging (fcMRI) to examine the interactions of a 9 node emotional memory system during the processing of neutral and emotional visual stimuli by 21 one neurologically normal individuals.

**Results:** Contrary to our hypothesis, spectral autoregressive multivariate granger causality modeling revealed that a visual emotional memory network, composed of the Associative Visual Cortex, Inferior Temporal Gyrus, Middle Temporal Gyrus, Primary Visual Cortex, Fusiform gyrus, Somatosensory Association Cortex, Entorhinal Cortex, Parahippocampal cortex, Hippocampus and Amygdala, does not exist. The suggested network was found to be the more robust during neutral encoding than emotional encoding and the least robust during rest.

**Conclusions:** These results do not support amygdalar modulation theories; rather they reflect neuroanatomical findings that separate emotion and memory into two distinct networks. The decreased synchronicity seen during emotional memory encoding may reflect phenomena like the weapons focus effect, attentional window and flashbulb memories, whereby the memory is recollected with great ease and vividness, but

the contextual details are limited and often inaccurate. From a broader view, these findings highlight the need for network connectivity analyses in the examination of emotional memory effects and processing, since they conflict with the majority of results from previous modular analyses of fMRI data.

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**P.T. NGUYEN, H. HUANG, J.J. TANNER, N. SCHWAB, L. HIZEL & C. PRICE. Functional Connectivity of the Frontoparietal Network as a Predictor of Working Memory Performance.**

**Objective:** Regions in the frontal and parietal cortices constitute a specialized functional network supporting working memory processes. The functional connectivity of this frontoparietal network (FPN), as assessed using resting-state functional magnetic resonance imaging (rs-fMRI), may be important in predicting working memory ability. It was hypothesized that greater functional connectivity would correspond with better working memory.

**Participants and Methods:** A prospective correlation design was used on 22 non-demented older adults. Participants completed measures of working memory and underwent neuroimaging (T1 and rs-fMRI). Participants also completed a visuospatial line discrimination task (JLO) to provide a functional dissociation from working memory tasks.

**Results:** FPN functional connectivity had significant negative correlation with performance on the spatial span backwards task,  $r(20) = -.50$ ,  $p = .02$ . FPN did not correlate with performance on the JLO task.

**Conclusions:** Overall, the current results provide support that FPN connectivity is related to working memory performance, although the directionality of this was in the opposite direction as hypothesized. Reduced connectivity at rest may represent improved efficiency and better ability to recruit resources during actual task engagement. Further studies are needed to clarify the role and significance of functional connectivity and cognitive function.

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**T. NYMAN, K. LENGU, A. FLORES, C. SWICK, M. WATSON, T. ANDERSEN, S. BISCONTI, I. KOVELMAN, N. WAGLEY & R. LAJINESS-O'NEILL. Social Communication Explored via Eye Gaze Processing in 9 Month Old Infants: A fNIRS Study.**

**Objective:** Infant eye gaze processing is pertinent to later development of joint attention, nonverbal social communication, and possibly theory of mind, making research on the identification of early neural correlates critical. This study examined the hemodynamic response of typically developing (TD) infants as they attended to social (mutual/averted) and nonsocial stimuli using functional near-infrared spectroscopy (fNIRS). The medial prefrontal cortex and right temporo-parietal cortices are associated with social cognition (Grossman et al, 2010; Lloyd-Fox et al, 2015). We hypothesized that infants would: 1) demonstrate higher frontal activation while attending to mutual compared to averted gaze or nonsocial stimuli, and 2) exhibit increased activation in temporo-parietal regions (Right > Left) during social compared to nonsocial stimuli.

**Participants and Methods:** Fourteen TD infants (MAge = 40.86 (1.47) weeks) underwent fNIRS while engaged in a paradigm requiring eye gaze shifts between social and nonsocial stimuli. A series of paired t-tests were performed to examine task by brain region of interest differences.

**Results:** Contrary to existing preliminary research, there were no significant differences in frontal activation between social and nonsocial conditions. The highest mean activation occurred during the averted condition in bilateral temporo-parietal regions ( $\mu$  [ $\Delta$ HbO]<sub>right</sub> = 0.0306;  $\mu$  [ $\Delta$ HbO]<sub>left</sub> = 0.0297). Significantly higher activation was noted during the social (averted) compared to nonsocial condition in right temporo-parietal regions ( $p < 0.01$ ).

**Conclusions:** First, we can distinguish social from nonsocial correlates in 9-month olds using fNIRS. Second, our finding indicates the importance of bilateral temporo-parietal regions in processing shifts in eye

gaze in early development and suggest that 9 months may be when social attention begins to lateralize to the right hemisphere consistent with the emergence of joint attention.

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**N.A. SCHWAB, H. HUANG, J.J. TANNER, L. HIZEL, S.J. CROWLEY, S. LEVY, A. HORGAS, M. RICE, T. MARECI, H. PARVATENENI, M. DING & C. PRICE. Pre-surgical cognition predicts decline in default mode network after total knee replacement surgery.**

**Objective:** Cognitive changes can occur after major surgery, especially in the elderly. Research examining cognitive changes post surgery suggest memory/learning and executive domains to be most vulnerable to change; other domains (i.e. language and motor performance) are not affected. The etiology of these changes is to be determined; theories of cerebral reserve and current research suggest there may be predictors for cognitive changes after surgery, specifically, baseline cognitive performance. We examined the ability of individual indices of cognition to predict pre- to post-surgery reductions in Default Mode Network (DMN) in older adults electing knee replacement surgery.

**Participants and Methods:** Thirty-five non-demented older adults (age:  $70 \pm 7.62$ ) completed a baseline neuropsychological assessment and pre- and 48 hours post-surgery structural and functional MRI. Indices hypothesized to be predictive of change were analyzed as predictors while indices that were not expected to predict change (e.g. language) were analyzed to demonstrate a dissociation. Regression analyses controlled for age, pain severity, and medication status. Independent component analysis identified DMN. Zero-lag cross correlation assessed changes in functional connectivity pre- and post-surgery.

**Results:** Pre-surgery working memory, verbal memory and reasoning composites predicted change in DMN post-surgically such that those who performed more poorly had greater changes in DMN from pre- to post-surgery ([working memory:  $R^2=0.19$ ;  $\beta=-0.36$ ,  $p=0.03$ ], [verbal memory:  $R^2=0.20$ ;  $\beta=-0.37$ ,  $p=0.02$ ], [reasoning:  $R^2=0.22$ ;  $\beta=-0.39$ ,  $p=0.02$ ]). Indices not expected to be predictive of change, language and motor speed, were not significant predictors.

**Conclusions:** Baseline cognitive performance, specifically, working memory, reasoning and verbal memory indices, predicted decreases in DMN at the post surgical time point in older adults. The study is ongoing. Findings have clinical implications for medical decision-making. Funded by NIH R01NR014181 (CP).

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**M.A. SUGARMAN, M. SEIDENBERG, K.A. NIELSON, J. SMITH, S.M. RAO, S. DURGERIAN, E.Z. GROSS, A.L. NORMAN & J.L. WOODARD. The Semantic Memory Imaging in Late-Life Pilot Study.**

**Objective:** Several functional magnetic resonance imaging (fMRI) studies have analyzed the famous name discrimination task (FNMT), an uncontrolled semantic memory probe requiring discrimination between famous and unfamiliar individuals. Completion of this simple familiarity task recruits a semantic memory network with considerable overlap with the default mode network. Specific semantic memory probes using biographical information associated with famous individuals may build on previous findings and yield a more robust analysis of semantic memory systems.

**Participants and Methods:** Sixteen cognitively intact elders completed the FNMT and two novel tasks during fMRI: Categories (matching famous individuals to occupational categories) and Attributes (matching famous individuals to specific bodies of work or life events).

**Results:** Relative to their respective control tasks, participants recruited brain regions for all three tasks consistent with previous research, including left temporal lobe, left angular gyrus, precuneus, posterior cingulate, and anterior cingulate. Cross-task comparisons revealed that

FNMT generated significantly more activity than the other tasks in anterior cingulate and several posterior regions. Categories had significantly reduced activity compared to the other tasks in inferior parietal lobe, precuneus, and posterior cingulate. Attributes, the most specific semantic memory probe, demonstrated the strongest left lateralization with significantly greater activity in left inferior frontal gyrus and left anterior temporal lobe.

**Conclusions:** This study identified neural correlates of different levels of semantic processing associated with famous names. The FNMT, an uncontrolled probe, demonstrated greater activity across most regions. The Attributes task, which probed for specific semantic memories, had more focused activity in the left hemisphere, including anterior temporal lobe and inferior frontal gyrus.

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**L. ZAJAC & R. KILLIANY. Brain Networks Involved in the Aesthetic Judgment of Visual Stimuli.**

**Objective:** To test the hypothesis that functional activity and connectivity in the human brain differ during aesthetic judgment (AJ) versus passive viewing (PV) of the same set of paintings.

**Participants and Methods:** fMRI data was collected from 12 healthy subjects using a block design. In the first 4 runs (PV), subjects passively viewed each painting. In the second 4 runs (AJ), subjects were shown the same set of paintings and judged whether they found each painting aesthetically pleasing. Painting and condition order was the same for all subjects.

We performed two types of analyses using FEAT in FSL. The first showed activity in  $AJ>PV$  and  $PV>AJ$ . The second was a psychophysiological interactions (PPI) analysis, which showed functional connectivity differences between the paracingulate (PC) cortex and the rest of the brain in  $AJ>PV$  and  $PV>AJ$ . We chose the PC because it has been implicated in decision-making and attention to subjective emotional responses and a large and highly significant cluster in the  $AJ>PV$  results was localized there.

**Results:**  $AJ>PV$  revealed activation in the bilateral PC, anterior and posterior cingulate, insula, thalamus, and middle frontal gyri.  $PV>AJ$  revealed activation in the bilateral ventromedial prefrontal cortices, angular gyri, posterior cingulate, superior temporal gyri, left middle temporal gyrus, left lateral occipital cortex, right precentral gyrus, and right superior parietal lobule.

PPI results showed increased functional connectivity between the right PC and right dorsolateral prefrontal cortex in  $AJ>PV$  and no significant results for the left PC. In  $PV>AJ$ , increased functional connectivity was revealed between the right and left PC and primarily the bilateral posterior cingulate, precuneus, and juxtastriatal lobule cortex.

**Conclusions:** Different sets of brain regions are active when forming aesthetic opinions of visual stimuli compared to passively viewing them, and the strength of functional connections between the PC and the rest of the brain depend on task conditions.

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**Z.Z. ZLATAR, A. BISCHOFF-GRETHER, C. HAYS, L.M. CAMPBELL, M.J. MELOY & C.E. WIERENGA. Interactive Effects of APOE Genotype And Cognition on Brain Perfusion in Normal Aging And Mild Cognitive Impairment.**

**Objective:** Normal aging is associated with decrements in cognitive function and changes in cerebral blood flow (CBF), which have been associated with increased risk for mild cognitive impairment (MCI) and Alzheimer's disease (AD). This study used arterial spin labeling MRI to investigate if the relationship between CBF and cognitive functions

was modified by apolipoprotein (APOE) genotype, a known risk factor for AD, in normal cognitive (NC) aging and in individuals with MCI.

**Participants and Methods:** 80 community-dwelling older adults (mean age=74.5, SD=7.3) participated. 57 had NC and 23 had MCI based on comprehensive diagnosis from neuropsychological testing. Linear mixed effect models investigated the voxel-wise relationship between cognition (memory and executive function composites) and resting CBF, and the interactive effects of cognition and APOE genotype on CBF (adjusting for age) separately for NC and MCI.

**Results:** Spatial correspondence between CBF and cognitive composites was found in MCI in several brain regions, with weaker associations within the NC group (corrected  $p < .01$ ). Cognitive composites had differential effects on voxel-wise resting CBF as a function of APOE genotype. These interactive effects were characterized by negative associations between CBF and memory/executive functions in NC APOE  $\epsilon 4$  carriers ( $B = -10.7$ ,  $p < .01$ ), which was not the case for  $\epsilon 3$  carriers. In MCI, there were positive associations between CBF and memory/executive functions in APOE  $\epsilon 3$  carriers ( $B = 7.3$ ,  $p < .01$ ), with a significant negative CBF/memory correlation for  $\epsilon 4$  carriers ( $B = -3.2$ ,  $p = .02$ ).

**Conclusions:** Results suggest that for those in the NC group who carry the  $\epsilon 4$  allele, higher CBF is associated with worse performance on executive and memory tasks, perhaps reflecting dysregulation within the neurovascular unit. Within the MCI group however, carrying the  $\epsilon 3$  allele seemed to serve a compensatory role, with increased CBF supporting better memory and executive functions while  $\epsilon 4$  was associated with worse memory performance.

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#### **W.D. KILLGORE. Baseline Responsiveness of the Ventral Striatum Predicts Overeating During Subsequent Sleep Deprivation.**

**Objective:** Insufficient sleep contributes to weight gain through several mechanisms, including alterations in appetite-regulating hormones, increased hunger, and increased fat and carbohydrate intake. In addition to altered physiological responses, sleep deprivation (SD) may also affect food intake by altering the functioning of the reward and behavioral control regions of the brain. We hypothesized that some individuals might show greater vulnerability to sleep loss-induced overeating that would be related to baseline differences in the functional responses of reward anticipation regions of the brain (e.g., ventral striatum).

**Participants and Methods:** Thirty healthy participants (15 males) aged 20-43 years completed a series of functional magnetic resonance imaging (fMRI) scans at rested baseline, including the multi-source interference test (MSIT) and n-back tasks, which measure executive functioning and working memory, respectively. Later that same week, each participant completed a 28-hour period of total SD, during which they were given ad libitum access to 10,500 kcal of food to consume throughout the overnight SD session. fMRI brain responses were used to predict subsequent food consumption, appetite, and hunger ratings during each third of the session using SPM8 ( $p < .001$ ).

**Results:** Functional activation within the ventral striatum at rested baseline, particularly the nucleus accumbens, was positively correlated with total kcals consumed during the period of sleep deprivation, but only for the final third of the overnight session (i.e., 6 a.m. to noon). This was observed for the MSIT ( $R^2 = .45$ ) as well as the n-back task ( $R^2 = .57$ ).

**Conclusions:** Prior research suggests that SD is associated with down-regulation of dopamine D2 receptors in the ventral striatum. Our findings suggest that individual differences in the responsiveness of the ventral striatum at baseline may confer some resistance to this down-regulation during SD, leading to a greater propensity for such individuals to overeat when sleep is lacking.

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#### **W.D. KILLGORE & L.D. NICKERSON. Predicting Resistance to Sleep Deprivation using Multimodal Neuroimaging.**

**Objective:** Some people are more resistant to the adverse cognitive effects of sleep deprivation (SD) than others, but the specific brain systems underlying this capacity remain relatively unexplored. Here, we used multimodal brain imaging with a novel data fusion technique to predict Resistance to SD.

**Participants and Methods:** A sample of forty-six healthy adults (23 male, 23 female; age: 20 to 43 years) underwent several neuroimaging scans at 3T, including task-based functional magnetic resonance imaging (fMRI), structural MRI, and diffusion tensor imaging (DTI). Later that same week, participants returned for a 28-hour SD session, with hourly performance monitoring (psychomotor vigilance test; PVT) across the SD session as a metric of Resistance. Data fusion of gray matter and white matter structural imaging and functional neuroimaging modalities was conducted using linked independent components analysis (LICA), and then regressed against Resistance scores.

**Results:** The LICA revealed a component that was significantly predictive ( $r = .48$ ,  $p = .003$ ) of Resistance to sleep deprivation. This component comprised four primary brain features: 1) greater fractional anisotropy (44%) and 2) reduced mean diffusivity (31%) throughout the brain, 3) increased functional activation within a fronto-parietal attention network during task fMRI, and 4) increased gray matter volume within left frontal and parietal regions and brainstem (3%).

**Conclusions:** Using multimodal neuroimaging and data fusion, the present findings suggest a core set of brain networks associated with the unique capacity to resist SD. These findings suggest that the ability to resist SD is associated with greater integrity of white matter axonal tracts and increased neural efficiency within a left lateralized fronto-parietal attention network. Future work may build upon this foundation to identify methods for enhancing the functioning of this system to sustain resistance capacity.

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### **Imaging (Structural)**

#### **J. SNEIDER, J.E. JENSEN, M.M. SILVERI & W.D. KILLGORE. Prefrontal GABA Correlates with the Ability to Sustain Vigilance During Sleep Deprivation.**

**Objective:** The ability to sustain vigilance in the face of prolonged sleep deprivation appears to be stable and trait-like, but the neurobiological underpinnings of this capacity remain unknown. One possible mechanism for this capacity may be the inhibitory neurotransmitter gamma-aminobutyric acid (GABA), which has been implicated in sleep regulation. Here we used magnetic resonance spectroscopy (MRS) to examine brain GABA within the medial prefrontal cortex (MPFC) as a potential predictor of resistance to sleep deprivation.

**Participants and Methods:** Twenty healthy adult men and 20 women underwent MRS at 3T. Proton metabolite data were acquired using MEGAPRESS from the MPFC, dorsolateral prefrontal cortex (DLPFC), and occipital lobe (OCC). MRS and cognitive functioning data were acquired prior to a 30-hour sleep deprivation challenge. Resistance to sleep deprivation was determined using a 10-minute Psychomotor Vigilance Test (PVT), acquired hourly during the deprivation challenge. PVT data were analyzed as speed [ $(1/RT) * 1000$ ], normalized as a percentage of baseline from the first three administrations.

**Results:** A significant decline in PVT performance was observed during sleep deprivation, with similar decrements observed across sexes: men performed at 86.5% and women at 84.9% of baseline (pre-deprivation) levels. While no sex differences were observed in OCC GABA, women had higher frontal lobe GABA, in both MPFC and DLPFC, relative to men. However, in men, higher MPFC GABA significantly predicted greater resistance to sleep deprivation on the PVT ( $p < .05$ ).

**Conclusions:** Findings suggest frontal lobe GABA, specifically in MPFC, contributes to the ability to resist sleep deprivation in men. Assessment of neurochemistry may therefore be useful in predicting and discriminating vulnerable individuals from those who are more resilient to sleep deprivation. Further exploration of sex differences is warranted. Correspondence: *William D. Killgore, Ph.D., Psychiatry, University of Arizona, Brain Imaging Center, McLean Hospital, 115 Mill Street, Belmont, MA 02478. E-mail: killgore@mclean.harvard.edu*

**J.F. BEATTIE, L. VER HOEF, R.C. MARTIN, H. DESHPANDE & S. LEE. Anterior Hippocampal Dentation Predicts Episodic Memory Performance in Healthy Adults.**

**Objective:** Previous literature demonstrates the role of the hippocampus in episodic memory; however, structure-function relationships of the hippocampus (e.g., volume and memory) have yielded mixed results (Petten, 2004). Previous analyses examined the relationship between left and right hippocampal dentation, a novel structural feature on the inferior surface, and episodic memory. Previous research suggests that beyond hemispheric specialization, the hippocampus may be regionally-specialized, such that the anterior (body) and posterior (tail) regions of the hippocampus support different types of memory (Kim, 2015). The current study examines this hypothesis.

**Participants and Methods:** Twenty-two healthy adults received episodic memory testing (CVLT-II; Rey Complex Figure Test), and an ultra high-resolution 3T structural MRI. Hippocampal dentation was rated independently by two neuroimaging experts. Inter- and intra-rater reliability were excellent for this novel rating system (ICC > 0.90).

**Results:** Analyses revealed a positive association between anterior hippocampal dentation and CVLT-II Acquisition score ( $p = .05$ ), CVLT-II Long-Delay Free Recall score ( $p = .02$ ), and Rey Recognition score ( $p = .007$ ). No significant difference was found between anterior dentation and Rey Delay score ( $p = .38$ ). No significant differences were found between any of the main memory outcome measures and posterior hippocampal dentation ( $p = 0.16$  to  $0.97$ ). When comparing correlation coefficients between anterior and posterior for each memory measure, no significant differences were found (i.e., anterior and posterior correlation coefficients not significantly different) in this small sample.

**Conclusions:** Anterior hippocampal dentation was positively associated with episodic memory performance in a healthy adult sample indicating possible regional specialization of hippocampal dentation, a novel morphological feature. Future studies will investigate this relationship in neurological populations, particularly those affecting memory and the hippocampus.

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**J.L. BUCHHOLZ, E.A. OLSON, R. FUKUNAGA, C.A. WEBB, W.D. KILLCORE, S.L. RAUCH & I.M. ROSSO. Expressive Suppression is Associated with Greater Lateral Orbitofrontal Cortex Volume in Adults with Major Depressive Disorder.**

**Objective:** Impaired emotion regulation (ER) is a central feature of major depressive disorder (MDD). Two common ER strategies are cognitive reappraisal (modifying thoughts about an emotion-eliciting event) and expressive suppression (inhibiting behavioral expression of emotion). In functional neuroimaging studies, activation of the lateral and medial orbitofrontal cortex (OFC) is associated with use of reappraisal and suppression, respectively. It is less clear whether anatomical variation in OFC subregions relates to ER strategies. This study examined whether self-reported use of reappraisal and suppression were associated with lateral OFC (lOFC) and medial OFC (mOFC) volume in adults with MDD and healthy controls (HC).

**Participants and Methods:** Our analysis included 52 right-handed adults with MDD (age  $M = 29.02$ ,  $SD = 7.62$ , 20 male), and 42 HC participants (age  $M = 28.24$ ,  $SD = 7.24$ , 19 male). Subjects were interviewed using the SCID for DSM-IV, completed the Emotion Regulation

Questionnaire (ERQ), and underwent 3T MRI. Multivariate analysis of variance examined reappraisal and suppression subscores of the ERQ relative to lOFC and mOFC volumes in both groups, controlling for intracranial volume, age and sex.

**Results:** Reappraisal was not significantly associated with OFC volumes in MDD or HC subjects. In MDD subjects, the multivariate effect of suppression was significant (Wilk's  $\Lambda = .861$ ,  $p < .05$ ), reflecting a significant association of suppression with lOFC volume ( $F(1,48) = 7.05$ ,  $p < .05$ ) but not mOFC volume ( $F(1,48) = 3.32$ ,  $p = .08$ ). In HC, suppression was not significantly associated with OFC volumes.

**Conclusions:** Greater use of expressive suppression to regulate emotion was associated with significantly larger lOFC volume in adults with MDD, suggesting that structural alterations in the lOFC may contribute to dispositional differences in ER. Further research is needed to characterize anatomical variations in OFC neural circuitry in dysfunctional ER in MDD, and assess whether these variations normalize with treatment. Correspondence: *Jennifer L. Buchholz, McLean Hospital, 115 Mill St., Belmont, MA 02478. E-mail: jlbuchholz@mclean.harvard.edu*

**L.M. CAGLE, L. SALMINEN, L. BAKER, D.H. LAIDLAW, R. CABEEN, T. CONTURO & R. PAUL. Elevated Depression Scores Predict Long-term Decline in White Matter Integrity Among Older Adults.**

**Objective:** Previous studies have demonstrated a relationship between depression and disruptions in white matter (WM) integrity. Quantitative tractography of WM fiber bundle lengths (FBLs) using diffusion tensor imaging is a measure of WM integrity that may be more sensitive to changes related to the expression of non-clinical symptoms of depression. To date, no studies have examined the association between symptoms of depression and longitudinal changes in WM integrity as measured by FBL. The present study examined the influence of subclinical depressive symptoms at baseline on whole brain and tract specific FBL change across a 36-month period, independent of age.

**Participants and Methods:** Nineteen healthy older adults without current axis I or II psychiatric diagnoses underwent neuroimaging and emotional assessment. Symptoms of depression were assessed with the Depression Anxiety Stress Scales. WM fiber models were created using deterministic streamline tractography, and FBLs were computed for both the whole brain and bundles selected using atlas-derived labels.

**Results:** Results revealed a significant relationship between higher reported depressive symptoms at baseline and reduction in mean whole brain FBLs over 36-months ( $r = -.709$ ,  $p = .007$ ). Tract-based analyses revealed significant correlations between higher baseline depression scores and more severe reduction in FBLs in the superior thalamic radiation, anterior thalamic radiation, fornix, cerebrosplinal tract, uncinate fasciculus, and hippocampal segment of the cingulum bundle.

**Conclusions:** These findings suggest an important relationship between subclinical symptoms of depression and increased vulnerability for reduced WM integrity over time. Further studies are needed to elucidate the mediating factor between disruptions in these networks and depression in older adults.

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**M. CHEN, M. IZZETOGLU, H. BLUMEN & R. HOLTZER. Spatial Co-registration of Functional Near-Infrared Spectroscopy to Magnetic Resonance Imaging in Older Adults.**

**Objective:** Traditional neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), are limited by requiring participants to remain motionless in a supine position while scanning. Such limitation makes it more difficult to study the functional neural substrates of critical abilities such as gait that are sensitive to aging and age-related diseases. Functional Near-Infrared Spectroscopy (fNIRS) is an emerging optical neuroimaging modality that allows movements during data acquisition. Like fMRI,

fNIRS measures the hemodynamic response, or changes in blood flow in brain tissues. However, fNIRS provides limited spatial information. A standard method to co-register fNIRS channels to structural images such as MRI is currently unavailable. fNIRS-MRI co-registration studies are scarce and, to our knowledge, have not been done in the elderly.

**Participants and Methods:** In the current study, fNIRS and structural MRI were acquired from 30 non-demented older adults. We applied existing techniques to co-register 16 fNIRS channels designed to assess hemodynamic changes in the prefrontal cortex to structural MRI. Vitamin E capsules were used to mark the locations of fNIRS detectors and light sources on the scalp. These markers became visible on the structural MRI scans for further analysis. We used the balloon-inflation algorithm to project fNIRS channel locations on the scalp to underlying cortical surface. Those individual cortical projection points were then normalized and averaged.

**Results:** Sixteen mean cortical projection points were found and presented in both MNI (Montreal Neurological Institute) and Talairach coordinate systems. These points resided in the prefrontal cortex and were visually depicted on a 3D brain model.

**Conclusions:** Our methods and results provide a detailed pipeline for fNIRS-MRI co-registration in older adults as well as useful spatial information for standalone fNIRS quantitative data in future studies.

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**Z.P. CHRISTENSEN, N.J. GOODRICH-HUNSAKER, E.D. BIGLER, M. DENNIS, C. GERHARDT, K. RUBIN, T. STANCIN, H.G. TAYLOR, K. VANNATTA & K.O. YEATES. Temporal Lobe Pathology and Increased Somatic Complaints in Pediatric TBI.**

**Objective:** Individuals who have sustained a traumatic brain injury (TBI), including children, often complain of physical symptoms. The current study examined children who were part of the Social Outcomes of Brain Injury in Kids (SOBIK) investigation wherein parents rated the degree of somatic symptoms in their children with TBI based on the Behavior Assessment System for Children (BASC-2). This study explores initial findings utilizing MRI voxel-based morphometry (VBM) technique to examine neuropathological correlates of parental reports of psychosocial adjustment, specifically somatic symptom endorsement in children.

**Participants and Methods:** Seventy-two children with TBI and 50 OI children (8-13 years of age) underwent magnetic resonance imaging (MRI) at 1.5 Tesla. Injury severity based on the Glasgow Coma Scale (GCS) was used to further subdivide TBI into mild, moderate, and severe injury groups. Advanced Normalization Tools (ANTs) were used to warp T1-weighted images and statistical analyses were performed using the Statistical Parametric Mapping (SPM8) toolbox in Matlab. A full factorial analysis was used to evaluate BASC-2 scores in conjunction with neuroanatomy in OI, mild, moderate, and severe TBI groups. A cluster threshold of 150 voxels was used to control for multiple tests of comparison and identify regions of interests.

**Results:** Whole-brain VBM revealed that higher somatization scores were associated with smaller volumes in the right temporal lobe. These findings only remained significant in the severe injury group ( $T = 5.25$ ; MNI peak, 34, -47, -8; cluster size, 1,539 mm<sup>3</sup>;  $PFWE < 0.05$ ). Somatization scores did not significantly correlate to any other injury group.

**Conclusions:** Reports of somatic symptoms in pediatric TBI were associated with alterations in the right anterior temporal lobe. Specifically, decreased brain volumes in the ventral and polar regions were associated with higher reports of somatization.

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**Z.P. CHRISTENSEN, N.J. GOODRICH-HUNSAKER, E.D. BIGLER, M. DENNIS, C. GERHARDT, K. RUBIN, T. STANCIN, H.G. TAYLOR, K. VANNATTA & K.O. YEATES. Neuroimaging Correlates of Aggression in Pediatric Traumatic Brain Injury.**

**Objective:** The Social Outcome of Brain Injury in Kids (SOBIK) is a multi-center pediatric TBI outcome study involving children, all of whom completed MRI, neuropsychological and social outcome measures, and were compared to those with just orthopedic injuries (OI). Social outcome was based on multiple measures, including parent ratings from the Behavior Assessment System for Children (BASC-2). The aim of this investigation was to explore initial findings between voxel-based morphometry (VBM) image analysis and social outcomes in pediatric TBI, specifically parental reports of aggression.

**Participants and Methods:** Seventy-two children with TBI and 50 OI children (8-13 years of age) underwent magnetic resonance imaging (MRI) at 1.5 Tesla. Injury severity based on the Glasgow Coma Scale (GCS) was used to further subdivide TBI into mild, moderate, and severe injury groups. Advanced Normalization Tools (ANTs) were used to warp T1-weighted images and statistical analyses were performed using the Statistical Parametric Mapping (SPM8) toolbox in Matlab. A full factorial analysis was used to evaluate BASC-2 scores in conjunction with neuroanatomy in OI, mild, moderate, and severe TBI groups. A cluster threshold of 150 voxels was used to control for multiple tests of comparison and identify regions of interests.

**Results:** Significant structural alterations that survived correction for family-wise error (FEW) were associated with BASC-2 Aggression scores in the left ( $T = 6.34$ ; MNI peak, -14, -5, -11; cluster size, 2,094 mm<sup>3</sup>;  $PFWE < 0.05$ ) and right medial temporal lobes in the mild TBI group ( $T = 6.29$ ; MNI peak, 13, -5, -12; cluster size, 3,155 mm<sup>3</sup>;  $PFWE < 0.05$ ). Due to sample size limits in the moderate and severe groups no findings in those groups survived FEW correction.

**Conclusions:** Increased bilateral atrophy of the medial temporal lobe was found to be associated with increased parental reporting of aggressive behaviors based on BASC-2 ratings.

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**S.J. CROWLEY, H. HUANG, S. AMINI, Q. ZHAO, J.J. TANNER, N. SCHWAB, L. HIZEL, M. DING, B. BRUMBACK & C. PRICE. Brain Voxel Based Morphometry in Idiopathic PD: The Influence of Total Intracranial Volume.**

**Objective:** Voxel-based morphometry (VBM) is a popular method for comparing structural brain differences in MRI analyses. For Parkinson's disease (PD), VBM has yielded mixed results. One cause for this discrepancy could be larger total intracranial volume (TICV) in PD, which has been reported, but not accounted for in all VBM studies. We explored TICV's influence in VBM through two experiments:

Experiment 1: compared PD patients and controls before and after controlling for TICV.

Experiment 2: compared controls split into large and small TICV before and after controlling for TICV.

**Participants and Methods:** Experiment 1 consisted of 40 PD participants and 40 controls. Experiment 2 consisted of 88 controls median split by TICV. All participants completed an MRI on a 3T scanner. TICV was calculated as gray+white+CSF from Freesurfer. VBM was performed on T1 images using an optimized VBM protocol (Good et al., 2001). Volume differences were assessed using a voxel-wise GLM analysis. An area was considered significant if cluster size  $> 10$  and  $p < .05$  corrected for familywise error.

**Results:** Experiment 1: PD had larger TICV than controls ( $1746 \pm 170$ cc and  $1647 \pm 126$ cc,  $p = .004$ ). Before controlling for TICV, the PD group showed reduced GM volumes primarily in bilateral temporal lobes, bilateral occipital lobes, bilateral calcarine sulcus, left parahippocampus, and bilateral cerebellum. After controlling for TICV, the PD group showed reduced volume in a smaller cluster in the left temporal lobe.

Experiment 2: The large TICV group showed reduced volume in parts of bilateral hippocampi, bilateral temporal lobes, left parietal lobe and

bilateral cerebellum. None of these differences survived after controlling for TICV.

**Conclusions:** Experiment 1 showed widespread volumetric decreases in PD that mostly disappeared after controlling for TICV. Experiment 2 demonstrated that TICV influences VBM results independently from other factors. Controlling for TICV in VBM studies is recommended. NIH R01 NR014181 (CP) and R01 NS082386 (CP)

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**S.J. CROWLEY, D. RAMON, S. AMINI, N. SCHWAB, L. HIZEL, J.J. TANNER & C. PRICE. Testing the Reliability and Validity of Three Total Intracranial Volume Measurement Methods.**

**Objective:** Total intracranial volume (TICV) is an important control variable, but its calculation is challenging. Manual TICV is the gold standard but is labor intensive, and automatic methods vary in reliability. To find a rapid and valid TICV approach, we assessed two Freesurfer TICV metrics (eTIV and Brainmask) relative to manual TICV. We evaluated validity by examining how the TICV metrics alter entorhinal cortex (ERC) volume/memory correlations. We hypothesized that eTIV would be inferior to the other metrics.

**Participants and Methods:** 40 Parkinson's disease (PD) and 40 controls completed an MRI and WMS-III Logical Memory Subtest (LM). TICV metrics were:

Manual TICV: raters traced the inner surface of the skull on every T1 slice

Freesurfer Brainmask: volume of gray, white, and CSF voxels

Freesurfer eTIV: calculated using the transformation matrix from T1 into Talairach space

Reliability: Two-way interclass correlations and dice similarity index for volume comparisons

Validity: Correlations between left ERC volume and LM retention (LMret) and discrimination (LMdis) were examined with and without correction for each TICV method

**Results:** Reliability: Brainmask volumes were larger than manual volumes (1696cc±158cc, 1665±166cc,  $p < .001$ ) and eTIV smaller (1564±256cc;  $p < .001$ ). Both correlated with manual TICV (Brainmask  $r = .94$ ,  $ICC = .92$ ,  $p < .001$ ; eTIV  $r = 0.82$ ,  $ICC = 0.68$ ,  $p < 0.001$ ).

Validity: Before controlling for TICV, ERC correlated with LMret ( $\beta = .254$ ,  $p = .023$ ) and LMdis ( $\beta = .232$ ,  $p = .038$ ). Brainmask and manual retained correlations for LMret ( $\beta = .322$  and  $\beta = .308$ ; respectively) and LMdis ( $\beta = .250$  and  $\beta = .244$  respectively). Associations were significant but weaker with eTIV (LMret:  $\beta = .277$  and LMdis:  $\beta = .231$ ).

**Conclusions:** Both Freesurfer metrics showed acceptable reliability and validity, yet the strength of expected ERC-memory associations were lower when controlling with eTIV. Given these findings, we recommend Brainmask over eTIV for brain-behavioral based research. Partially funded by NIH R01 NR014181 (CP) and R01 NS082386 (CP)

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**A. FRIDMAN, D. PISNER, P. SINGH & W.D. KILGORE. Gray Matter Volume in Left Medial Prefrontal Cortex Is Related to Life Satisfaction in Individuals with Mild Traumatic Brain Injury.**

**Objective:** The prefrontal cortex (PFC) is involved in linking emotion and motivation with situational appraisal to influence goal directed behavior. Considerable evidence supports the functional asymmetry of the PFC for emotional processes, where the left hemisphere is biased toward positive and approach emotions, and the right hemisphere is biased toward negative and withdrawal emotions. We hypothesized that gray matter (GM) volume in the PFC of individuals who have incurred mild traumatic brain injury (mTBI) would correlate with life satisfaction in accordance with prior models of affective asymmetry.

**Participants and Methods:** Twenty-six right-handed mTBI participants (11 males, mean age = 23.4) underwent high resolution T1 structural neuroimaging and completed the Satisfaction with Life Scale (SWLS). After covarying for age, gender, time since injury and intra-cranial volume, a voxel-based morphometric (VBM) multiple regression analysis was conducted within Statistical Parametric Mapping (SPM8) to explore the association between gray matter volume in the PFC and SWLS scores.

**Results:** Utilizing a small volume correction for the frontal lobe region-of-interest (ROI), greater GM volume in the left hemisphere of the superior frontal gyrus was positively correlated with SWLS scores (7 voxels,  $p < 0.05$ , FWE corrected). No association was found in the right PFC.

**Conclusions:** Consistent with the theory of lateralized affective processing, we find that greater volume of the left medial prefrontal cortex was associated with greater satisfaction with life among individuals with recent brain injuries. Future work should compare these findings to that of healthy controls and whether larger left PFC volume might be predictive of subsequent recovery. Considering the detrimental effects on mood that individuals often experience following mTBI, brain imaging techniques like VBM can be used to aid risk assessment for subsequent mood changes.

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**T. HUFF, Trevor Huff, Tracy Abildskov, Elisabeth Wilde & Erin Bigler et al. MRI Tissue-based intensity standardization for multi-site neuropsychological outcome studies: Problems and Potential Solutions.**

**Objective:** In this era of the human connectome, automated image analysis techniques, and large scale multi-site neuroimaging databases examining neuropsychological outcome, there is a particular need to address how to combine neuroimaging studies that use different volumetric sequences or MRI studies performed on different platforms.

**Participants and Methods:** Two different approaches were examined. Individual subjects were scanned on up to 4 different platforms at different intervals or the same individual scanned on the same scanner. The FreeSurfer (FS) outputs were compared between the standardized and nonstandardized human phantom images. Then, statistical analyses and standardization were performed on a large database of T1 images from a multi-site TBI project that involved three different MR scanners with two different platforms. Both the nonstandardized and standardized groups were analyzed and then compared.

**Results:** After standardization, the FS data remained variable for the human phantom outputs. However, statistical analyses show subtle differences between standardized and nonstandardized images from the multi-site dataset morphological maps yielding different behavioral findings. In some instances, the standardized images show an increase in cluster strength in the TBI group after family wise error correction. Similarly, presumably false positive findings from control comparisons were removed by standardization.

**Conclusions:** The human phantom data suggests that standardization does little to correct the underlying problems with multi-site imaging. This suggests that differences exist that are related to the multisite nature of the data acquisition. Recommendations on the best way for neuropsychological outcome studies to deal with these issues will be offered. Correspondence: *Trevor Huff, Neuroscience, Brigham Young University, 669 E S00 N #S30S, Provo, UT 84606. E-mail: Trevor.Huff@byu.edu*

**J.W. KIRTON, T. SEIDER, A. O'SHEA, D. LAMB, A. WOODS, R.A. COHEN & V.M. DOTSON. Regional White Matter Lesion Volume and Depressive Symptom Dimensions.**

**Objective:** Depression is a disorder that includes distinct symptom dimensions, including mood, somatic, and cognitive symptoms. Emerging research shows depressive symptom dimensions are related to distinct

underlying brain changes, suggesting that possible differences in etiological mechanisms may explain the heterogeneity of symptoms in depression. Little work on symptom dimensions of depression focuses on white matter lesions (WMLs). The current study was conducted to fill a gap in literature examining symptom dimensions and regional WMLs. **Participants and Methods:** Participants included 42 healthy volunteers (mean age=71.38) from the Active Brain study, an ongoing study at the University of Florida. Participants completed the Beck Depression Inventory, Second Edition and received a 3-Tesla magnetic resonance imaging scan, including T1 3D anatomical and T2-weighted fluid attenuated inversion recovery scans. WML volumes were quantified using Freesurfer, AFNI, and FMRIB Software Library. Regions of interest including frontal, temporal, parietal, and occipital lobes, and limbic and subcortical areas were defined using the Wake Forest Atlas from SPM 8. **Results:** We found that higher total depressive symptoms predicted increased temporal and frontal WMLs, particularly at older ages. We also found a depressive symptom by sex effect such that male sex and higher symptoms predicted increased temporal and limbic WMLs. Higher somatic symptoms predicted increased temporal and frontal WMLs, and this effect was greater at older ages. Elevated affective symptoms predicted increased temporal and limbic WMLs in men, but not women. Cognitive symptoms did not predict regional WMLs.

**Conclusions:** These findings are consistent with the literature showing that somatic and affective symptom dimensions are most strongly associated with depression-related brain changes. Findings suggest an important role of addressing the mechanisms associated with WML development in treating depression in older adults.

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**Z. MAHMOOD, D. SCHONFELD, T. KUHN, A. BURGGREN, A. MORALES, T. WILLIAMSON & A.D. THAMES. The Interactive Effects of HIV and Marijuana Use on Cognition and White Matter Integrity.**

**Objective:** Research on healthy individuals has demonstrated adverse effects of recent marijuana (MJ) use on cognition and brain structure connectivity. However, few studies have investigated this relationship in HIV+ populations, who often report use of MJ for symptom management. The current study examined the independent and interactive effects of HIV and MJ use on white matter (WM) integrity and neurocognition.

**Participants and Methods:** HIV+(n=19) and HIV-(n=17) individuals who reported current MJ use (n=18) or no use (n=18) underwent Diffusion Tensor Imaging and neuropsychological assessment. For MJ users, we examined frequency, usage amount and time since last use using the Marijuana Smoking History and the Drug Use History questionnaires. We extracted fractional anisotropy (FA) and mean diffusivity (MD) values from regions of interest.

**Results:** After controlling for age, nicotine and alcohol use HIV+ individuals demonstrated greater MD than controls in the cingulate gyrus, corticospinal tract and anterior thalamic radiation ( $p < .05$ ). MJ users had greater MD in the uncinate fasciculus than non-users, ( $p = .05$ ). Control MJ users showed greater MD of the hippocampus,  $F(5,30) = 5.43$ ,  $p = .03$ , and FA of the temporal superior longitudinal fasciculus,  $F(5,30) = 4.289$ ,  $p = .04$ , than control non-users. There were no significant differences between HIV+ MJ users and HIV+ non-users. There was a significant effect of MJ on learning and memory ( $p < .05$ ), with users performing worse than non-users. For MJ users, we found significant associations between amount of MJ consumed and memory functioning ( $r = -.34$ ) and MD of the cingulate gyrus ( $r = -.57$ ).

**Conclusions:** Consistent with previous studies, the adverse effects of MJ use on neurological integrity were found in healthy controls. Brain regions that were compromised as a function of MJ use are consistent with the learning and memory deficits. Failure to detect MJ-associated abnormalities among HIV+ individuals may be due to existing neurological compromise, rendering the effects of MJ undetectable.

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**A.E. MCGREAL, R. FUKUNAGA, E.A. OLSON & I.M. ROSSO. Relationship Between Resilience and Hippocampus Volume in Adults With and Without Posttraumatic Stress Disorder.**

**Objective:** Trait resilience, the ability to rebound from adversity, may relate to individual differences in neurobiological systems that modulate the stress response. The hippocampus is of particular interest as a neural correlate of resilience, given animal research showing that adaptive coping stimulates hippocampal growth. In humans, the link between trait resilience and hippocampal volume has received less study. It is also unclear to what extent relationships between hippocampal morphometry and resilience are preserved in individuals with stress-related psychopathology. This study examined whether trait resilience was associated with hippocampal volume in adults with posttraumatic stress disorder (PTSD) and healthy controls (HC).

**Participants and Methods:** Thirty-three adults with DSM-IV PTSD and 30 matched HCs completed the Connor Davidson Resilience Scale (CDRISC) and a structural MRI at 3T. Linear regressions were conducted separately for PTSD and HC groups, entering CDRISC scores as predictors of hippocampal volume, while controlling for intracranial volume, age and sex.

**Results:** PTSD and HC participants differed significantly in CDRISC scores ( $p < .01$ ), but not hippocampal volumes. CDRISC total score was significantly associated with total hippocampal volume in HCs [ $\beta = .42$ ,  $p = .02$ ], but not in PTSD participants. CDRISC score was significantly associated with both left [ $\beta = .41$ ,  $p = .02$ ] and right [ $\beta = .41$ ,  $p = .02$ ] hippocampal volumes in HCs. In a follow up analysis examining CDRISC subscales, acceptance was the only significant predictor for total [ $p = .03$ ], left [ $p = .03$ ], and right [ $p = .03$ ] hippocampal volume in HCs.

**Conclusions:** Trait resilience may be at least partly mediated by larger hippocampus volume in healthy adults and this relationship may be explained by the ability to accept and bounce back from change. Reduced trait resilience in PTSD may not be related to hippocampus structure, and may have partially distinct neural correlates than in healthy adults without stress-related disorders.

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**M.E. MCLAREN, S.M. SZYMKOWICZ, A. O'SHEA, A. WOODS, S.D. ANTON & V.M. DOTSON. Symptom Dimensions of Depression and Age Impact Subfield Hippocampal Volume.**

**Objective:** Depressive symptoms have been associated with volumetric differences in the hippocampus, particularly in the CA1, CA2-3, and subiculum subfields. We recently found an interaction between depressive symptoms and age such that higher depressive symptoms were associated with less age-related volumetric decline in the right subiculum and right CA1 regions. However, it is unclear whether any specific symptom dimensions of depression are responsible for this interaction between age and depressive symptoms. This study was conducted as a follow-up to address this question.

**Participants and Methods:** Forty-two community-dwelling older adults completed the Center for Epidemiologic Studies Depression Scale (CES-D) and underwent magnetic resonance imaging at 3T. Depressed mood, lack of well-being, and somatic subscale scores were calculated for each participant. Left and right volumes of CA1, CA2-3 and subiculum subfields were obtained via an automated FreeSurfer procedure. Multiple hierarchical regressions were conducted to assess the effects of age, CES-D subscale scores, and their interaction on hippocampal subfield volumes, with sex and estimated total intracranial volume as covariates.



**Results:** A significant interaction between somatic symptoms and age was found in the bilateral subiculum (right  $p=0.002$ , left  $p=0.012$ ) and right CA1 ( $p=0.003$ ), such that higher levels of somatic symptoms were associated with less age-related volume loss. A depressed mood by age interaction in the right subiculum ( $p=0.042$ ) showed a similar pattern.

**Conclusions:** Results suggest somatic symptoms of depression, and to a lesser extent depressed mood, may drive the interrelationship between age, depressive symptoms and hippocampal subfield volume. Findings highlight the importance of examining unique correlates of the heterogeneous symptoms that comprise depressive disorders. More research is needed to better understand the neurobiological underpinnings of depressive symptoms, and how this interacts with age-related brain changes.

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**C. MEWBORN, A.N. PUENTE, C.C. FARACO, L.M. RENZI, B.R. HAMMOND & L. MILLER. Microstructural White Matter Integrity Predicts Performance on Instrumental Activities of Daily Living (IADLs) in Older Adults.**

**Objective:** Previous research shows a positive relationship between brain structure and performance of activities of daily living (ADLs) in older adults. In particular, microstructural white matter (WM) changes are associated with decline in ADLs. We sought to replicate and extend findings on the relation of WM integrity and ADL performance.

**Participants and Methods:** 92 community-dwelling older adults (46 female) aged 64 to 86 years ( $M=73$ ,  $SD=6.13$ ) were recruited across two samples. Participants underwent diffusion tensor MRI. WM integrity was defined by fractional anisotropy (FA) and radial diffusivity (RD). Instrumental ADLs were assessed via the performance-based Direct Assessment of Functional Status – Revised (DAFS-R). Hierarchical regression analysis was conducted to predict DAFS-R from global FA and RD plus FA and RD in 4 regions of interest (uncinate fasciculus, fornix, genu of the corpus callosum, and hippocampal cingulum). Age, gender, education, and cognitive impairment were controlled.

**Results:** Global FA ( $R^2$  change = .05,  $p=.003$ ) and FA in the fornix ( $R^2$  change = .028,  $p=.028$ ), genu ( $R^2$  change = .078,  $p<.001$ ) and hippocampal cingulum ( $R^2$  change = .09,  $p<.001$ ) positively predicted DAFS-R. RD in the hippocampal cingulum ( $R^2$  change = .052,  $p=.004$ ) also positively predicted DAFS-R. Additional exploratory analyses showed a positive relationship between DAFS-R and FA in the cingulate, body and splenium of the corpus callosum, internal and external capsules, superior longitudinal fasciculus, and superior fronto-occipital fasciculus.

**Conclusions:** This study is one of the few to predict ADLs from WM integrity. To our knowledge it is the only study to use a performance-based IADL task. Results replicate previous findings and show diffuse WM involvement in older adults' IADL performance. Integrity of the hippocampal cingulum most strongly predicted IADLs. FA was more sensitive than RD to IADLs.

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**K. NG, Y. FUNG, M. NGO, S.J. VOGRIN, C. MEADE, S.J. COLLINS & S. BOWDEN. Automated versus Manual Measurement of Hippocampus and Entorhinal Cortex in a Memory Clinic Sample.**

**Objective:** Structural magnetic resonance imaging (MRI) is commonly used in assessing the integrity of the hippocampus and entorhinal cortex in suspected Alzheimer's Disease (AD). Compared to manual volumetry, automated segmentation protocols offered by FreeSurfer afford greater efficiency for quantitative measurement. Independent validation and clinical utility studies however, remain scarce for newer FreeSurfer

segmentation protocols, particularly when using routinely acquired diagnostic scans.

**Participants and Methods:** Manual and automated measurements of hippocampal and entorhinal volumes were performed on 30 routine diagnostic 1.5 T MRI scans of memory clinic patients referred for dementia evaluation. Automated measurements were generated with two hippocampal protocols and two entorhinal protocols in FreeSurfer (version 5.3.0). Comparison of automated measurements relative to manual volumetry for each region of interest was assessed for reliability with intra-class correlation coefficients and method agreement using Bland-Altman plots.

**Results:** High reliabilities and agreement were demonstrated by both FreeSurfer automated hippocampal protocols. The original hippocampal protocol (based on the Desikan atlas) overestimated whole hippocampal volumes by 9.6% while the new hippocampal subfields package underestimated volumes by 8.4% (excluding presubiculum and choroid plexus subregions). Compared to the hippocampal protocols, the entorhinal protocols showed poorer reliabilities and agreement; the recent ex-vivo validated entorhinal protocol over-estimated entorhinal volumes by 14% while the original entorhinal protocol (also based on the Desikan atlas) over-estimated entorhinal volumes by 103%.

**Conclusions:** These preliminary results support the likelihood that automated volumetry of the mesial temporal region using more recent FreeSurfer software versions can be performed on routinely acquired diagnostic MRI scans to assist in the evaluation of patients with suspected AD.

**E. OOT, N. GOLAN, Y. MASHHOON, J. MACKILLOP, M. OSCARBERMAN & M.M. SILVERI. Nucleus Accumbens Volume Predicts Delay Discounting in Emerging Adult Binge Drinkers.**

**Objective:** Impulsivity and abnormalities of the brain's reward system have been associated with varying levels of alcohol misuse. The current study examined delay discounting, a marker of impulsive decision making, in relation to the volume of the nucleus accumbens (NAcc), a key region in brain reward circuitry, and aimed to identify differences between binge drinkers and light drinkers.

**Participants and Methods:** Magnetic resonance imaging datasets were acquired at 3T in 18-24 year old binge alcohol drinkers (BD,  $n=18$ ; 9 male) and light alcohol drinkers (LD,  $n=19$ ; 9 male). Cortical reconstruction and volumetric segmentation were performed using FreeSurfer. Participants completed a battery of neuropsychological measures that included the Monetary Choice Questionnaire (MCQ), which assesses reward valuation and delay discounting.

**Results:** BD were significantly more likely than LD to discount delays (prefer smaller but more immediate rewards) on large-reward trials. In addition, smaller right NAcc volume was strongly predictive of a higher impulsive choice ratio for small, medium, and large rewards in the BD group, but not in the LD group.

**Conclusions:** Although BD and LD showed no significant differences in NAcc volumes in either hemisphere, right NAcc volume was significantly predictive of MCQ responses in BD. The finding that this relationship is specific to the BD group suggests that the behavioral outcomes of binge drinkers depend more heavily on reward system morphology than the outcomes of their LD counterparts (possibly due to impaired functioning of other brain regions involved in regulatory control). Characterization of reward system morphology and behavioral outcomes associated with binge alcohol consumption may help identify unique risk factors for the later manifestation of alcohol abuse and dependence in young individuals who are heavy frequent drinkers.

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**R.J. PIERS, A. NISHTALA, S. PREIS, E.J. BENJAMIN, S. SESHADRI, C. DECARLI, P.A. WOLF & R. AU. Association between Atrial Fibrillation and Volumetric MRI Brain Measures: Framingham Offspring Study.**

**Objective:** Atrial fibrillation (AF) is associated with a significant degree of morbidity and mortality. The increased risk of stroke and cognitive impairment associated with AF has been well studied. Although it is known that AF is detrimental to brain function, there is a paucity of research investigating the relationship between AF and brain morphology. We aim to investigate the association between AF and brain volume measures on magnetic resonance imaging (MRI) in the Framingham Heart Study (FHS) Offspring cohort.

**Participants and Methods:** The study sample included 2144 stroke/dementia-free participants (mean age=61.8±9.3 years; 54% women) who attended the 7th examination cycle (1999-2005) of the FHS Offspring cohort and underwent contemporaneous MRI. Linear regression was used to examine the association between prevalent AF and brain volume measures (total cerebral brain volume, frontal brain volume, temporal brain volume, temporal horn volume, hippocampal volume, and white matter hyperintensity volume). Models were adjusted first for age and sex and then for vascular risk factors and APOE4.

**Results:** A total of 73 (3.4%) participants had prevalent AF at the time of the MRI. In age/sex-adjusted models, AF was inversely associated with total cerebral brain volume (Beta±standard error [SE])= -1.18±0.33,  $p<0.001$ ), frontal brain volume (Beta±SE= -1.12±0.35,  $p=0.001$ ), and temporal brain volume (Beta±SE= -0.31±0.10,  $p=0.002$ ). After further adjustment for vascular risk factors and APOE4, AF remained associated with only frontal brain volume (Beta±SE= -0.82±0.38,  $p=0.03$ ).

**Conclusions:** Prevalent AF was associated with smaller frontal brain volume after accounting for vascular risk factor burden. Further exploration of the association between AF and brain morphology is warranted. Correspondence: *Ryan J. Piers, Neurology, Framingham Heart Study, 19 Harvard Avenue, Brookline, MA 02446. E-mail: rpiers@bu.edu*

**K.E. ROBINSON, E. SEMMEL, M.M. PEARSON, C.J. CANNISTRACI, A.W. ANDERSON, J.F. KUTTESCH & B.E. COMPAS. Diffusion Tensor Imaging Following Pediatric Brain Tumor: Associations with Neuropsychological and Psychosocial Functioning.**

**Objective:** Children are at risk for neurocognitive and psychosocial difficulties following pediatric brain tumor (PBT). These deficits may be due to disruptions in the anatomical integrity of brain systems that support neurocognitive function and/or emotion regulation, as a result of the tumor itself or its required treatment.

**Participants and Methods:** We assessed brain structure, specifically white matter integrity, and neurocognitive and psychosocial functioning of 8-16 year-old survivors of PBT ( $n=16$ ; 7 girls; mean time since treatment=4.94 years) and 8-16 year-old healthy children ( $n=16$ ; 10 girls). Children underwent diffusion tensor imaging, and completed neuropsychological assessment (WISC-IV, D-KEFS). Parent and self-report of children's executive (BRIEF) and psychosocial functioning (CBC, YSR) were obtained.

**Results:** Relative to healthy children, survivors of PBT had significantly lower overall fractional anisotropy (FA), indicating reduced white matter integrity ( $t=-2.56$ ,  $p=.016$ ). Survivors performed more poorly on most objective measures of neurocognitive function, and were rated by parents as having reduced social and total competency, withdrawal, social problems, and symptoms of internalizing, externalizing, and total problems. By self-report, survivors reported lower total competency. Lower FA was associated with poorer performance on most speed-based neurocognitive measures, poorer parent-reported executive function (BRIEF), and reduced overall competency and greater symptoms of anxiety/depression, and total problems (CBC).

**Conclusions:** Although neurocognitive and psychosocial deficits have been consistently documented following PBT, their neuroanatomical correlates have received less attention. Better understanding of how brain integrity contributes to deficits may improve early identification of children at elevated risk. White matter tractography and linkage with

the brain's functional activation are important next steps to understand the variability in outcome following PBT.

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**L. SALMINEN, D. LAIDLAW, R. CABEEN, T. CONTURO, E. AKBUDAK, C. PENG, S. CORREIA, J. HEAPS, L. BAKER, L.M. CAGLE & R. PAUL. Tract-Specific Changes in White Matter Fiber Bundle Lengths with Age.**

**Objective:** Cross-sectional studies utilizing quantitative tractography based on diffusion tensor imaging (qDTI) have shown that white matter fiber bundle lengths (FBLs) are shorter among older adults compared to younger adults. At present no study has examined the longitudinal impact of age on FBLs among healthy older adults, or the extent to which changes in FBL are associated with changes in more common DTI metrics.

**Participants and Methods:** The present study examined age-related changes in FBL in specific fiber tracts and whole-brain white matter among 48 older adults across a 36-month period. To account for anatomical differences in fiber organization, FBL was measured separately as both the average length and total length of fibers within a given tract. DTI scalar metrics were used as comparison methods for evaluating white matter changes with age.

**Results:** Results revealed a significant decrease in average FBL in the cingulate gyrus segment of the left cingulum (CGC), and a significant decrease in total FBL in the right anterior thalamic radiation (ATR) over time. The right ATR also demonstrated increased mean diffusivity and decreased fractional anisotropy across time points. Whole-brain analyses revealed a significant longitudinal reduction in total FBL, but no significant changes were observed in average FBL or DTI scalar metrics.

**Conclusions:** Results suggest that FBL is sensitive to aging effects in older adults and that total FBL may be preferentially sensitive to microstructural changes in whole-brain white matter compared to other DTI metrics. Changes observed for average FBL versus total FBL in the CGC and ATR are likely due to anatomical differences in fiber organization (e.g., packing density, length coherence), suggesting that both FBL indices provide unique information based on fiber tract organization. Further studies are needed to evaluate the functional significance of these findings.

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**D. SHAKED, W.F. ROSENBERGER, H. SHAO, C. DAVATZIKOS, L.I. KATZEL, R. GULLAPPELLI, S.L. SELIGER, G. ERUS, T. KOUO, M.K. EVANS, A.B. ZONDERMAN & S.R. WALDSTEIN. Differential Relations of Socioeconomic Status to Prefrontal Cortex Volumes among African American and White Adults.**

**Objective:** Disparities associated with lower socioeconomic status (SES) and African American (AA) race have been noted for subclinical brain pathology. Education is an SES indicator that has been related to smaller volumes in select regions of the prefrontal cortex (PFC). AAs may be more vulnerable to this association, in part, due to an aggregation of environmental and interpersonal stressors. Accordingly, here we examined potential interactive relations of education and self-identified race to regional PFC gray matter (GM) volumes.

**Participants and Methods:** Participants were 153 neurologically intact, community-dwelling AAs and Whites (mean age = 47 years; 41% male, 64% White, mean education = 12.8 years) from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) SCAN study. Participants underwent 3.0-T cranial magnetic resonance imaging. Volumetric T1-weighted MP-RAGE images were used to derive regions of interest (ROIs) using a multi-atlas label fusion method. Examined here were medial, lateral, inferior, and opercular regions of the

PFC. Multiple regression analyses examined interactions of education and race and their first-order associations, adjusting for sex and age, with each right (R) and left (L) ROI.

**Results:** Significant education×race interactions were noted for R frontal medial ( $r^2=0.03$ ;  $p<0.05$ ), L frontal medial ( $r^2=0.04$ ;  $p<0.05$ ), R frontal lateral ( $r^2=0.07$ ;  $p<0.01$ ) and L frontal lateral ( $r^2=0.07$ ;  $p<0.01$ ) regions, such that Whites with higher levels of education had greater volumes than all other groups.

**Conclusions:** Whereas Whites with higher educational attainment had greater lateral and medial PFC GM volumes, AAs did not. Findings may have prognostic significance for the disproportionate rates of dementia and cognitive decline seen in AAs and lower SES groups, and may be partially explained by the unique stressors encountered by these individuals.

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**P. SINGH, D. PISNER, A. FRIDMAN, S. ROBERTS & W.D. KILLGORE. Volumetric Differences in Gray Matter in Healthy Versus Overweight/Obese Individuals Post Mild Traumatic Brain Injury: A Voxel Based Morphometric Study.**

**Objective:** Mild traumatic brain injury (mTBI) typically involves diffuse injury to axonal pathways, but may also affect core gray matter structures. Due to its location deep within the brain, the striatum is often vulnerable to damage during mTBI. Striatal damage could have important implications for behavior, as this region plays a critical role in cognition, reward processing, and motivation, including food consumption. In the present study, we compared the whole brain gray matter volume of healthy normal weight individuals versus overweight/obese individuals with recent history of mTBI.

**Participants and Methods:** Participants included twenty four right handed mTBI individuals, 12 healthy ( $BMI \leq 25$ ) and 12 overweight ( $BMI > 25$ ). Voxel-based morphometry (VBM8) was used to analyze T1 high resolution magnetic resonance imaging (MRI) structural scans. Segmented gray matter images were analyzed to determine regions in which healthy and overweight groups were different

**Results:** After controlling for age, gender, intra-cranial volume, and time since injury, gray matter volume was significantly greater ( $p<0.005$ ) in the healthy group compared to the overweight group in a number of brain regions, including the bilateral caudate nucleus (head) regions, nucleus accumbens, bilateral parahippocampal gyrus, left inferior temporal gyrus, and left medial frontal gyrus

**Conclusions:** Significant differences in gray matter volumes were found between healthy and overweight individuals, particularly within regions involved in reward, executive functioning, memory, and emotion. Interestingly, the direction of findings for the ventral striatum is opposite of that often reported for non-brain injured individuals, raising the possibility that mTBI might alter these associations. Future research will need to examine the role of mTBI in weight gain and motivational deficits relative to non-injured individuals.

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**K. SMITH, T.Z. KING, B. CROSSON, R. MORRIS & C. CONWAY. Corpus Callosum Volume and Reading Skill in Adult Survivors of Childhood Brain Tumors.**

**Objective:** Adult survivors of childhood posterior fossa tumors can experience reading difficulties related to white matter integrity. Previously, reading was shown to be related to cortical white matter tracts, however information transfer across the corpus callosum (CC) may also play a role in reading. The current study examined how white matter volume in 5 divisions of the CC was related to degree of neurological risk and reading skill. Reading was hypothesized to correlate with the

most anterior and posterior CC divisions, which connect frontal and posterior reading systems, respectively.

**Participants and Methods:** Twenty survivors and 24 healthy adults participated. The CC was manually traced on 3 mid-sagittal slices of a T1-weighted MPRAGE scan. The CC was divided into a 5 division scheme based on prior tractography research of cortical connections. CC1 was most anterior (i.e., the genu) and CC5 was most posterior (i.e., the splenium). Total intracranial volume was used as a covariate. WJ-III Letter-Word Identification was utilized to measure reading, the finger tapping test to measure motor skill, and the Neurological Predictor Scale to measure neurological risk.

**Results:** Survivors had significantly lower volume in all CC divisions except CC3 (CC3 was a trend;  $p=.06$ ). Volumes of CC2-5 were negatively correlated with level of neurological risk (CC1 was a trend;  $p=.07$ ). Shunt placement and treatment with radiation/chemotherapy were both correlated with volumes in the body of the CC (CC2-4). Word reading was significantly related to volume of CC divisions 2-5. Volumes of CC2-4 were also related to motor skill.

**Conclusions:** Corpus callosum volume was almost globally reduced in survivors of posterior fossa tumors and volume varied with the level of neurological risk. Treatment with radiation/chemotherapy and shunt placement had the most impact on volume. Reading did not show the expected relationship with CC1; however CC5 was significantly related to reading but not motor skill and thus appears to be specific to reading.

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**E. STEIN, N. GOLAN, Y. MASHHOON, J. MECKLOSKEY, J.E. COHEN-GILBERT, J. SNEIDER & M.M. SILVERI. Insula Cortical Thickness Relates to Impulse Control in Adolescents and Emerging Adults.**

**Objective:** The brain undergoes dynamic and requisite changes during adolescence that are associated with improved cognitive efficiency. Developmental reductions in grey matter thickness reflect, in part, pruning of excess neurons and maturation of synapses, which contribute to improved cognitive and behavioral development. While prefrontal maturational changes are prevalent, less is known about the role of the insula, although it has been implicated in emotional regulation, decision making, prospective thinking, and self-rated impulsivity. The current study examined impulse control and insula cortical thickness in healthy adolescents (ADOL) and emerging adults (EA).

**Participants and Methods:** 31 ADOL and 18 EA underwent high-resolution MRI at 3T, and cortical surface reconstruction and thickness estimation were performed using Freesurfer. Inhibitory control measures included Barratt Impulsiveness Scale (BIS), Go-NoGo and Stroop Color-Word Task.

**Results:** Cortical thickness in superior circular sulcus of the insula was significantly greater in ADOL relative to EA; thickness on the left predicted better Go NoGo and Stroop performance and thickness on the right predicted better performance on Go NoGo and lower BIS scores (less total and motor impulsivity).

**Conclusions:** Results from this study replicate previous evidence of an age-related association between cortical thickness in a combined anterior insula region and BIS scores, collectively suggesting that cortical thickness reductions in insula, likely via normative neuronal pruning, are associated with better impulse control. The current findings also suggest that a specific region of ‘anterior insula’, the superior segment of the circular sulcus, dissociates domains of impulsivity, with hemisphere laterality uniquely predicting neuropsychological indices of cognitive control from self-reported motor impulsiveness.

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**S.M. SZYMKOWICZ, M.E. MCLAREN, L. DE WIT, A. O'SHEA, A. WOODS, S.D. ANTON & V.M. DOTSON. Structural Abnormalities in Cortical Thickness, Surface Area, and Volume of the Precuneus in Older Adults with Depressive Symptoms.**

**Objective:** The precuneus has been implicated in many structural and functional studies of depression due to its involvement in self-referential processing and visual imagery. We recently reported that older adults with higher depressive symptoms had greater cortical thickness in the left precuneus. However, it is unclear whether abnormalities in surface area or volume of this region are also evident. The current study addressed these questions.

**Participants and Methods:** Forty-three community-dwelling adults (mean age = 68.79 ± 7.00 years) completed the Center for Epidemiologic Studies Depression Scale and underwent structural magnetic resonance imaging scanning at 3T. Measures of cortical thickness, surface area, and volume were extracted from the right and left precuneus. Age-related differences in these measurements, as well as their association with total depressive symptoms, were assessed. Exploratory analyses investigating depressive symptom dimensions (depressed mood, lack of well-being, somatic) for any significant relationships were also conducted.

**Results:** Main effects of age were seen for left precuneus surface area ( $p = .015$ ) and volume ( $p = .011$ ), such that higher age was associated with less surface area and volume. An age by depressive symptoms interaction was found for cortical thickness in the left precuneus ( $p = .037$ ), such that higher depressive symptoms were associated with less age-related cortical thinning. Follow-up analyses found a significant age by somatic symptoms interaction ( $p < .001$ ), suggesting that somatic symptoms, rather than depressed mood or lack of well-being, drove this effect.

**Conclusions:** We found that cortical thickness, rather than surface area or volume, of the precuneus is associated with elevated depressive symptoms in older adults, and that this association may be driven by somatic symptoms. Further research is needed to better understand possible mechanisms through which subthreshold depressive symptoms are associated with the precuneus during aging.

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**V.J. WILLIAMS, J. JURANEK, K. STUEBING, P.T. CIRINO & J.M. FLETCHER. Increased Gyriification and Thinner Cortex in Children with Poor Single Word Decoding Skills.**

**Objective:** Prior studies of adults with dyslexia have demonstrated atypical patterns of neural structure and function implicating a left-hemisphere reading network. However, studies of pediatric dyslexia are sparse, vary widely in reading classification and neuroimaging methods, and thus yield inconsistent associations between reading ability and cortical metrics across studies. This study investigated differences in cortical thickness and local gyriification index between children with poor versus typical single word reading skills.

**Participants and Methods:** The study included 76 children/adolescents (8-16 years). Poor decoders ( $n=31$ ) were identified by deficient single word reading ability (WJ-III letter word ID standard score < 90), while a sample of children with typical decoding skills ( $n=45$ ) served as a comparison group. Using FreeSurfer, whole-brain analyses compared cortical thickness and local gyriification metrics between the two reading groups, controlling for age. All results were thresholded at  $p < 0.01$  and corrected for multiple comparisons using a cluster-wise simulation method.

**Results:** Following vertex-wise general linear model analyses per hemisphere, children with poor decoding skills demonstrated thinner and more gyriified cortex within the left inferior temporal region and left temporal-parietal-occipital junction compared to typical decoders. Additional areas of reduced cortical thickness were observed in the left anterior cingulate and post central cortices, as well as the right hemisphere precuneus, superior temporal and superior frontal cortices.

**Conclusions:** The convergence of thinner and more gyriified left inferior temporal cortex in poor decoders may reflect its early temporal role in processing word forms and highlights the importance of the ventral stream for successful decoding. Meanwhile, the temporal-parietal-occipital junction defines a critical area of association cortex forming part of the posterior neural network that underlies reading function in the brain. Correspondence: Victoria J. Williams, University of Houston, 3350 La Jolla Village Drive, 116B, San Diego, CA 92161. E-mail: tori55@gmail.com

**J. STELMOKAS, S. TOWLER, H. DODGE, I. DINOV & B.M. HAMPSTEAD. A Direct Comparison of Medial Temporal Lobe Volumes and Memory Using NeuroQuant® and FreeSurfer in Healthy Controls and Mild Cognitive Impairment.**

**Objective:** Although MRI-derived volumetric data are well established in research, these methods have generally not been translated into clinical practice. NeuroQuant® is a fully automated program that may bridge this translational gap. However, few studies have evaluated its relationship with established methods like FreeSurfer (considered the "gold-standard" in the current study). This study examined 1) the correspondence between NeuroQuant- and FreeSurfer-based medial temporal lobe volumes in a mixed sample of healthy adults and mild cognitive impairment (MCI) and 2) the relationship between these volumes and memory test performance.

**Participants and Methods:** A mixed sample of 77 participants (26 healthy young controls; healthy older controls (HOC); 31 MCI) underwent magnetic resonance imaging and memory testing (via the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Delayed Memory Index (DMI)). We obtained the volume of the inferior lateral ventricles (ILV), hippocampus (HP), and amygdala (AMG) using both NeuroQuant and FreeSurfer. Using Pearson correlations, these values were directly compared with each other and then with RBANS-DMI performance.

**Results:** All NeuroQuant and FreeSurfer volumes were significantly correlated in the total sample ( $r > 0.615$ ) as well as when we considered only the older participants (HOC&MCI,  $r > 0.761$ ), and only the MCI patients ( $r > 0.830$ ). All NeuroQuant and FreeSurfer volumes were significantly correlated with DMI in the total sample; however, only the AMG and HP remained significant in the older participants. There were no significant relationships between volume and RBANS-DMI in the MCI group alone (likely due to sample size).

**Conclusions:** Findings suggest that NeuroQuant 1) provides a reasonable measure of medial temporal lobe integrity, especially in older adults and 2) may finally make basic volumetric analysis feasible within the general clinical community – a critical step to clinical translation of research findings.

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**Medical/Neurological Disorders/Other (Adult)**

**A. VITALE, J. STELMOKAS, R.E. ANDERSON, R.J. SPENCER, P.H. PANGILINAN & L.A. BIELIAUSKAS. The Relationship Between Emotional Distress, Somatic Preoccupation, and Neurobehavioral Symptoms in Veterans with Mild Traumatic Brain Injury.**

**Objective:** Originally developed as a measure of heightened somatic/autonomic perception for back pain patients (Main, 1983), the Modified Somatic Perception Questionnaire (MSPQ) has been shown to detect exaggerated pain symptoms. Given the significant contribution of emotional distress to post-concussive symptoms (PCS), this study explored the MSPQ as an indicator of emotional distress and PCS.

**Participants and Methods:** 104 Veterans underwent evaluation for mild TBI and completed the MSPQ, neurobehavioral symptom inventory (NSI) and measures of emotional distress (Hospital Anxiety and Depression Scale (HADS); PTSD checklist (PCL); Insomnia Severity Index (ISI); Brief Pain Inventory (BPI)). Given high intercorrelations among these measures, a composite emotional distress variable (ED) was calculated based on z-scores from the HADS, PCL, and ISI. TBI injury variables were also explored (years since injury, longest period of disorientation/ loss of consciousness).

**Results:** Correlations between NSI total and measures of emotional distress ranged from  $r = .506-.744$ ; TBI injury variables were minimally correlated with NSI ( $r = .105-.151$ ). Results from hierarchical regression revealed that ED accounted for 64.4% of the variance in predicting NSI total and 32.9% of NSI somatic; MSPQ explained an additional 2.9% in NSI total and 11.4% of NSI somatic. The interaction between MSPQ and emotional distress was not significant.

**Conclusions:** Emotional distress accounts for the largest variance in PCS. Scores on the MSPQ do not seem to be related to the relationship between emotional distress and PCS, but do provide a small contribution to explaining variance in NSI total and NSI somatic. Results suggest that the MSPQ provides an additional measure of emotional distress to that obtained from other self-report measures, but its utility as a measure of over-reporting of PCS symptoms is limited.

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#### **O. BEZDICEK, L. MAYEROVA, S. ZAKHAROV & E. RUZICKA. Long-term Cognitive Sequelae of Methanol Poisoning.**

**Objective:** Methanol poisoning leads to lesions in the basal ganglia (BG), subcortical white matter and to demyelination and atrophy of the optic nerve. However, information regarding the evolution of cognitive deficits in a large methanol sample is lacking. The main objective of our study was to identify cognitive deficits due to methanol poisoning in long-term perspective.

**Participants and Methods:** A total of 50 patients with confirmed methanol poisoning were included in this longitudinal cross-sectional study. We compared their cognitive performance in two points in time (2013, mean age:  $47.34 \pm 13.51$ , education:  $11.96 \pm 1.98$  and 2015, mean age:  $49.08 \pm 13.52$ ). We administered a comprehensive neuropsychological battery, which included following domains: global cognitive functioning, attention, memory, executive functions and psychomotor and motor speed measures. The data were not normally distributed and we used Wilcoxon signed rank test.

**Results:** The cognitive performance between of methanol sample between 2013 and 2015 was significantly worse in following test measures: MMSE (Md (2013) = 28, Md (2015) = 27,  $p = .019$ ); Stroop Dots (Md (2013) = 12, Md (2015) = 13,  $p = .014$ ). However, the performance was also significantly better in Grooved Pegboard Test right hand (Md (2013) = 83, Md (2015) = 76,  $p = .036$ ) and BDI-II (Md (2013) = 10.5, Md (2015) = 5,  $p = .047$ ).

**Conclusions:** Long-term cognitive impairment after methanol poisoning in two years perspective seems to include an evolution of worsening in global cognitive functioning and attention (MMSE, Stroop-D) despite significantly lower level of depressive symptoms in BDI-II. However, the evolution includes also a better cognitive functioning in some of motor speed measures (GPT).

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#### **A.D. BONO, M.M. HALFACRE, E.M. MURRAY, K. ALTERESCU, J.T. TWAITE, K. SCORPIO, R. STAFFORD, J.L. SPIELMAN, L.O. RAMIG & J.C. BOROD. Evaluation of Facial Emotional Expression: Parkinson's Disease and Gender Effects.**

**Objective:** Facial expressivity impairment is a common symptom of Parkinson's disease (PD) that negatively impacts social interaction and relationships with family, peers, and healthcare providers (e.g., Brozgold et al., 1998). We examined multiple aspects of facial emotional expression to better understand facial expressivity deficits in individuals with PD. In addition, we examined gender differences in facial emotional expression.

**Participants and Methods:** Participants included 62 individuals with idiopathic PD (77% male) and 18 demographically matched Healthy Controls (61% male). To examine facial expression, participants were videotaped while producing emotional (happy, sad, & angry) and neutral monologues using elicitation procedures from the New York Emotion Battery (Borod, Welkowitz, & Opler, 1992). Monologues were divided into 15-second segments, which were randomized and evaluated by 24 naïve raters on Likert scales (from minimal to maximal) for 4 different aspects of facial expression, including emotional frequency (EF), emotional variability (EV), emotional intensity (EI), and non-emotional facial mobility (FM).

**Results:** Three-way mixed-model Analyses of Covariance (Group [2] X Gender [2] X Monologue Type [4]), with the Beck Depression Inventory-II score as the covariate, were conducted for each of the 4 facial variables. We found a significant difference between PDs and HCs for all 4 variables (i.e., EF, EV, EI, & FM), with PDs rated as significantly lower than HCs. In addition, women were significantly more expressive than men for all of the facial variables (i.e., EF, EV, EI, & FM).

**Conclusions:** Overall, our findings confirm and extend the literature documenting facial expressivity and mobility impairments in PD as well as gender differences in facial emotional expression. A better understanding of specific aspects of the facial expressivity impairment in PD can help to inform rehabilitation treatment as well as assist healthcare professionals interacting with and treating this population.

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#### **B.L. BRETT, C. GAMMAGE, K. SILLAY & B.C. BAUGHMAN. Neuropsychological Phenotypes in Essential Tremor and Parkinson's Disease Patients.**

**Objective:** The complete relationship between Parkinson's disease (PD) and Essential Tremor (ET) is unclear, highlighted by overlapping clinical features (Jimenez-Jimenez et al., 2011). Neurocognitively, both often demonstrate similar patterns of impairment (Cudaback et al., 2015). Previous studies attempting to simultaneously assess cognitive functioning in ET and PD patients were restricted by small samples and limited cognitive batteries employed (Lee et al., 2015; Ozen Barut et al., 2015). In the present study, differences in PD and ET were investigated using a more robust battery of tests within the same data set, allowing for a more direct comparison of these overlapping clinical populations.

**Participants and Methods:** Retrospective review was conducted of 43 participants, with 25 PD (13 male; 12 female) and 18 ET (10 male and 8 female) patients referred for routine neuropsychological assessment as part of standard pre-operative, deep brain stimulation, protocols. ET and PD served as the independent grouping variable in MANCOVA analysis. Age served as a covariate, with cognitive test variables as dependent variables.

**Results:** Group performance varied on measures of premorbid intellectual estimation ( $F = 6.21 (1,2), p = .02$ ) and word-list discrimination ( $F = 5.81, p = .021$ ). Broadly, the PD demonstrated the greatest impairments in learning and delayed memory; whereas ET patients displayed the greatest deficits on retrieval and semantic fluency.

**Conclusions:** Present findings support previous data suggesting similar cognitive deficits in PD and ET patients, emphasizing the role of frontosubcortical circuitry in both groups. However, our findings suggest

unique differences between the two populations, which may reflect unique pathological characteristics influencing varied presentations of cognitive impairment across groups. Implications for treatment and surgical selection will be discussed.

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**B.L. BRETT, C. GAMMAGE, K. SILLAY & B.C. BAUGHMAN. Neuropsychological Predictors of Levodopa Equivalent Dose in Parkinson's Patients Undergoing Deep Brain Stimulation.**

**Objective:** Conventional treatment of Parkinson's disorder (PD) often involves pharmacotherapy with levodopa (L-dopa) and typical benefits are offset by significant side effects and eventual reduced efficacy (Zittel et al., 2011). L-dopa equivalent dose (LED) provides a metric of medication burden and indirect proxy of disease severity (Tomlinson et al., 2010). Studies of surgical interventions for Parkinson's disease, including deep brain stimulation (DBS), have utilized LED as a post-operative outcome (Matzke et al., 2015). Relatively little, however, has been done to explore the relationship between neuropsychological data and LED. We attempt to extend this literature in a sample referred for DBS.

**Participants and Methods:** A comprehensive neuropsychological battery was administered to a sample of 12 subjects (5 males; 7 females). LED's were calculated using the guidelines of Tomlinson et al. (2010). LED change was determined through paired T-tests. Stepwise regression explored predictive value of neuropsychological data on post-operative LED.

**Results:** Significant change in post-operative LED scores were observed  $t(11) = 2.227, p = .05$ . Pre-operative LED accounted for significant variance in the initial model,  $b = .702, t(11), p = .01$ . Inclusion of the summary cognitive scores contributed significantly to the model,  $F(1, 11), p = .01, R^2 = .681, R^2_{Adjusted} = .610$ .

**Conclusions:** In many cases, unless a frank dementia syndrome is ascertained, patients may still undergo DBS regardless of their level of impairment. Our data suggests a unique relationship between neuropsychological performance and surgical outcome measures (i.e., levodopa equivalent dose). As such, the role of neuropsychological data in DBS decision making may be useful, along with other demographic and medical data, in identifying optimal candidates for DBS.

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**K.J. CARAHER, J.N. COPELAND & A.I. TRÖSTER. Neuropsychological, Mood, and Quality of Life Impact of Weight Status in Parkinson's Disease.**

**Objective:** Little is known about the relationship between body mass index (BMI), cognition, and quality of life (QoL) in Parkinson's disease (PD) despite a growing literature documenting obesity's detrimental impact on cognition, mood and QoL.

**Participants and Methods:** 72 patients were classified into NIH BMI categories (underweight N=2, normal N=20, overweight N=29, obese N=19, morbidly obese N=2). It was hypothesized that obese and overweight participants would have poorer QoL, executive function, impulse control, and more depressive symptoms than those of normal weight or underweight.

**Results:** The number of WCST categories ( $p=0.05$ ) attained was greater in the morbidly obese than the underweight or normal weight groups. BMI ( $r=.31, p<.01$ ) and BMI classification ( $r=.34, p<.01$ ) were associated with the number of categories. Subgroups of underweight and normal weight participants experienced a longer disease duration than those in the obese and morbidly obese group ( $p=.07$ ). BMI was inversely related to disease duration ( $r=-.24, p=.04$ ). Disease duration was related to WCST perseverative errors ( $r=.34, p<.01$ ) and inversely related to number of categories ( $r=-.40, p<.01$ ). PDQ-39 Bodily Discomfort (higher score indicates greater dissatisfaction) was related to BMI

classification ( $r=.24, p=.04$ ). BMI was not associated with impulsivity or depression.

**Conclusions:** The finding of an inverse association between PD duration and BMI is not unexpected. Weight loss is common in PD and may reflect diminished energy intake and/or higher energy expenditure. In this case, the better executive functioning in those with higher BMI is probably secondary to shorter disease duration and less extensive fronto-striatal degeneration. However, in such a scenario one might then expect greater bodily discomfort in those with longer disease duration and lower BMI instead of the obtained finding of poorer QoL in obesity. A limitation of this study was sample size and homogeneity.

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**N.E. CARLOZZI, S. GOODNIGHT, J. MINER, A. KRATZ, N. DOWNING, J. PAULSEN, J. LAI, E.A. HAHN, P. DAYALU, J. PERLMUTTER, M. NANCE, M. MCCORMACK, K. QUAID, C. ROSS, S. PERLMAN, R. GERSHON & D. CELLA. Self-reported cognition in Huntington disease.**

**Objective:** The insidious and progressive nature of Huntington disease (HD) often impedes assessment of cognition. New Neuro-QoL (www.neuroqol.org) self-report measures of cognitive health-related quality of life (HRQoL) offer additional information about HRQoL, but have not yet been compared to objective measures of cognitive functioning.

**Participants and Methods:** 536 individuals with HD completed two self-report measures of cognition (i.e., Neuro-QoL General Concerns and Executive Functioning) and three objective measures of cognition (Symbol Digit Modalities Test, Verbal Fluency, and Stroop Interference). Bivariate correlations (controlling for age and education) were examined among self-report and objective cognitive performance. ANOVAs were conducted to determine if self-report measures could differentiate: 1) between those with high vs low performance on objective measures (determined by median split); and 2) among individuals with prodromal, early-, and late-stage HD (determined by Total Functional Capacity scores from UHDRS).

**Results:** Self-report measures demonstrated low to moderate correlations with all objective measures of cognition ( $r$  range: 0.15 to 0.38). In general, individuals with more self-reported cognitive concerns had poorer performance on objective measures ( $p < 0.001$ , except for Neuro-QoL General Concerns and Verbal Fluency,  $p > 0.05$ ). In addition, individuals with prodromal HD indicated fewer self-reported concerns than those with either early- or late-HD, and individuals with early-HD reported fewer cognitive concerns than those with late-HD for self-report measures (all  $p < 0.001$ ).

**Conclusions:** In HD, self-reported cognition provides different information from objective cognitive performance measures. Given the importance and discriminant validity of self-reported cognition, both self-report and objective measures should be used to assess cognition in HD.

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**M.L. CHAN, A. HARLEY, S. GADE, R. KETELLE, B. MILLER & J.H. KRAMER. Predictors of Functional Ability in Corticobasal Degeneration and Progressive Supranuclear Palsy.**

**Objective:** Corticobasal degeneration (CBD) and progressive supranuclear palsy (PSP) are atypical parkinsonian disorders related to 4-R tau that are characterized by prominent motor difficulties (gait abnormalities, postural instability, rigidity, and alien limb). Cognitive deficits and neuropsychiatric symptoms are also typically present. Currently, the degree to which these different symptom types contribute to functional impairment is poorly understood. Our goal was to assess the independent contributions of cognitive, movement, and neuropsychiatric symptoms on functional independence.

**Participants and Methods:** We studied 33 CBD and 36 PSP patients who completed a comprehensive neurological assessment that included

the unified Parkinson's disease rating scale (UPDRS-motor). Memory and executive function factor scores were derived from a standard neuropsychological exam. An informant completed the Functional Activities Questionnaire (FAQ) and the Neuropsychiatric Inventory Questionnaire (NPI).

**Results:** Partial correlations controlling for age and MMSE showed that the FAQ correlated with memory and executive scores, UPDRS-motor, and several NPI domains (delusions, agitation/aggression, apathy, disinhibition, irritability, aberrant motor behavior, appetite/eating changes). These variables were entered in a linear regression that explained 46.2% of the variance in FAQ. Follow-up regressions controlling for all other predictors showed that irritability had the most unique variance (20.9%), followed by UPDRS-motor (7.3%), memory (7.3%), and executive functions (4.1%).

**Conclusions:** Motor, cognitive and neuropsychiatric symptoms all contribute to functional deficits in PSP and CBD, with the best predictors being irritability, parkinsonism, memory, and executive functions. These findings highlight the importance on non-motor symptoms in two syndromes historically considered to be primary movement disorders, and support the need for cognitive and neuropsychiatric assessment in PSP and CBD patients.

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**N. CHAYTOR, T. RIDDLESWORTH, S. BZDICK, P. ODEGARD, S. GRAY, J. LOCK, S. DUBOSE & R. BECK. The Relationship Between Neuropsychological Performance, Diabetes Numeracy, and Instrumental Activities of Daily Living in Older Adults with Type 1 Diabetes.**

**Objective:** While data are accumulating on the association between neuropsychological performance and real world endpoints, less is known about the association with medical self-management skills. Type 1 diabetes (T1D) self-management is often complex, and mismanagement can result in hypoglycemia and hyperglycemia and associated morbidity and mortality. Older adults with T1D may be at higher risk given normal aging and disease related cognitive decline.

**Participants and Methods:** The T1D Exchange conducted a case-control study evaluating factors associated with severe hypoglycemia in older adults with longstanding T1D. Neuropsychological (Symbol Digit Modalities Test; SDMT, Trail Making Test; TMT, Hopkins Verbal Learning Test-Revised; HVL-T-R, and the Grooved Pegboard Test; GPT) and functional (Diabetes Numeracy Test; DNT, and Functional Activities Questionnaire; FAQ) measures were administered to 201 older adults (age 60-86 years) with T1D duration of 20-73 years from 18 diabetes centers across the US.

**Results:** After adjusting for confounding variables, diabetes numeracy was related to memory (Hopkins Verbal Learning Test – Revised) and complex speeded attention (SDMT), with the overall model accounting for 27% of the variance; while the FAQ was associated with simple processing speed (TMT A), executive functioning (TMT B), complex speeded attention (SDMT) and dominant hand dexterity (GPT), with the overall model accounting for 29% of the variance. The severity of overall cognitive deficit (as assessed by global deficit scores) was uniquely associated with both diabetes numeracy and FAQ, when controlling for age, education, frailty and depression.

**Conclusions:** This study demonstrates that cognitive impairment in older adults with T1D has functional implications for both diabetes specific everyday skills and more general instrumental activities of daily living. Further research is needed to determine specific interventions to maximize diabetes self-management in older adults with declining cognition.

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**M. DEMIAN, R. SHAPIRO & W.L. THORNTON. Health Literacy Predicts Medication Adherence in Kidney Transplant Recipients Beyond the Effect of Common Indicators of General Literacy.**

**Objective:** Poorer health literacy (HL) has been linked to worse disease management in various medical populations. We have previously shown that lower HL is a risk factor for worse medication adherence in kidney transplant (TX) recipients. The current objective was to clarify the role of HL in predicting medication adherence in kidney TX recipients after controlling for the effects of other common indicators of general literacy (i.e., educational level, verbal intelligence, and knowledge).

**Participants and Methods:** 96 stable adult kidney TX recipients participated. HL was assessed by the Health Literacy Questionnaire (HLQ). Verbal IQ was assessed by the KBIT-II. Knowledge of medication management was measured by the Everyday Cognition Battery. Self-reported medication adherence was measured by the TX Effects Questionnaire- Adherence subscale. Correlational and hierarchical linear regression analyses were used to clarify the associations between HL and adherence.

**Results:** Male gender ( $r=-.34$ ,  $p<.01$ ), younger age ( $r=-.22$ ,  $p<.05$ ) and lower HL were associated with poorer adherence ( $r=-.35$ ,  $p<.01$ ). Decreased knowledge of medication management ( $r=.21$ ,  $p<.05$ ) and lower levels of verbal IQ ( $r=.23$ ,  $p<.05$ ) were associated with lower HL levels. Notably, lower HL levels significantly predicted poorer adherence after controlling for the effects of age, gender, educational level, verbal IQ, and knowledge of medication management ( $\Delta R^2=.09$ ,  $p<.01$ ). Additional analyses revealed that lower levels on the following 6 HL factors were significantly associated with poorer adherence: social support ( $r=-.38$ ), reading and understanding information ( $r=-.34$ ), having sufficient information ( $r=-.34$ ), navigating the healthcare system ( $r=-.31$ ), active engagement with healthcare providers ( $r=-.28$ ), and healthcare provider support ( $r=-.27$ ).

**Conclusions:** HL is a unique predictor of poorer medication adherence and is not redundant with other common indicators of general literacy. Interventions to improve adherence can target the 6 specific factors of the HLQ.

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**D.A. DENNEY, N. PATEL, L.S. HYNAN, M. CULLUM, R. RUCHINSKAS & L.H. LACRITZ. Cognitive and Behavioral Predictors of Fall Risk in Parkinson Disease.**

**Objective:** To determine which variables are most predictive of fall history to identify a comprehensive model of fall risk in Parkinson disease (PD).

**Participants and Methods:** 64 patients (Mage=66.6[9.7]; Meduc=15.4[2.2]) with PD were administered a neuropsychological battery and divided into high ( $\geq 2$  falls;  $n=32$ ) and low (0-1 fall;  $n=32$ ) fall risk based on number of falls over the prior 6 months. Separate stepwise logistic regression analyses were conducted to identify predictors of high/low fall risk from four domains: cognitive (Block Design, Digit Span, Trail Making Test B, Rey-Osterrieth Copy, and California Verbal Learning Test-2 [CVLT-II]), impulsiveness (Barratt Impulsiveness Scale-11 [BIS-11] and Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale), disease characteristics (postural instability, disease duration, and age), and balance confidence (Activities-specific Balance Confidence Scale). Significant predictors from each regression were included in a fifth "combined" model. Model comparisons were conducted using net reclassification improvement to determine if the combined model significantly improved fall risk prediction.

**Results:** Each stepwise logistic regression yielded significant results ( $p<.20$ ). The combined model was significant for postural instability (OR=8.66), verbal learning (CVLT-II; OR=0.95), and behavioral impulsiveness (BIS-11; OR=1.10). The combined model had the highest rate of correct high fall risk classification (83%) and was significantly

better than the disease characteristics ( $p=.04$ ) and cognitive ( $p=.03$ ) models but not the impulsiveness model ( $p=.12$ ).

**Conclusions:** Postural instability was the best predictor of fall risk; though incorporating cognitive and impulsiveness measures improved prediction of falls. Screening for impulsiveness and verbal learning deficits in addition to postural instability as part of routine clinical care may help better identify patients at higher risk of falls.

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**C.B. DUNN, F.C. GOLDSTEIN, I. HAJJAR, A.I. LEVEY & W. WHARTON. Associations Between Cognitive Functioning and the JNC-8 Guidelines for Hypertension in Older Adults.**

**Objective:** Guidelines for hypertension treatment by the Eighth Joint National Committee (JNC-8) in 2014 recommend a target blood pressure (BP) of <150/<90 mmHg in persons > 60 years old, in contrast to the 2003 JNC-7 recommendations of BP <140/<90 mmHg for this age group. The current study evaluated the impact of these different BP target cutoffs on cognitive functioning and the conversion from normal cognition to mild cognitive impairment (MCI).

**Participants and Methods:** This was a longitudinal observational study of individuals > 60 years old who were participants in the NIA Alzheimer's Disease Centers. All had normal cognition at baseline and received 4 annual assessments of BP, cognition, and functional status. Four hundred and fifty two participants were taking BP medications and had readings of <140/<90 at all visits (within the target range according to both sets of guidelines; reference group). Two other groups consisted of participants with either systolic BP of 140-149 mmHg (elevated according to JNC-7 guidelines but not according to JNC-8;  $N=112$ ) or >150 mmHg (elevated according to both sets of guidelines;  $N=280$ ) on 3 or 4 visits.

**Results:** Compared to the reference and the 140-149 mmHg groups, those with BP >150 mmHg exhibited lower cognitive performance in year 4 on the Mini-Mental State Exam and had a higher risk of conversion to a diagnosis of MCI. However, attention/working memory and set shifting were poorer in the 140-149 mmHg group compared to the reference group.

**Conclusions:** Findings of lower cognitive performance in some domains for the 140-149 mmHg group indicate the need for further research evaluating the implications of the JNC-8 hypertension cutoffs on cognitive functioning.

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**T.J. FARRER, D. ATTIX & T. MONK. Post-Operative Delirium Fails to Predict Cognitive Functioning Longitudinally.**

**Objective:** This study aimed to identify whether post-operative delirium predicts cognitive decline 12-18 months post-surgery in a cohort of older adults.

**Participants and Methods:** One hundred fifty-three elders (mean age=73.9, mean education=14.1) undergoing elective orthopedic surgery completed cognitive testing at baseline (T1) and at short-term (T2; 3-6 mo.) and long-term (T3; 12-18 mo.) follow-ups. Executive and Memory Composite scores were calculated across time points and change from T1 to T3 was the primary outcome of interest. Potential predictors of memory and executive function decline from T1-T3 were age, education, and post-operative delirium.

**Results:** Delirium and non-delirium groups did not differ in age, education, or sex. Those with postoperative delirium had significantly worse composite memory scores ( $M=-.25$ ,  $SD=.75$ ) at T3 compared to those without delirium ( $M=.24$ ,  $SD=.85$ );  $t(124)=2.16$ ,  $p=.032$ . The difference in the executive composite at T3 reached marginal significance;  $t(117)=1.94$ ,  $p=.054$ . Regression analysis revealed that change in memory from T1 to T3 was not related to age ( $\beta=-.01$ ,  $t(120)=-.113$ ,

$p=.26$ ), education ( $\beta=.016$ ,  $t(120)=1.0$ ,  $p=.32$ ), or post-operative delirium ( $\beta=-.089$ ,  $t(120)=-.56$ ,  $p=.57$ ). Change in the executive function composite from T1 to T3 was also not related to age ( $\beta=-.011$ ,  $t(107)=-.16$ ,  $p=.10$ ), education ( $\beta=.013$ ,  $t(107)=1.01$ ,  $p=.31$ ), or post-operative delirium ( $\beta=-.004$ ,  $t(107)=-.03$ ,  $p=.97$ ).

**Conclusions:** In this study, delirium does not appear to predict change in cognition longitudinally, despite differences in cognition between those who developed delirium and those who did not at follow-up. Understanding the bidirectional relationship between delirium and long-term cognition will require additional research on possible moderating factors such as cortical volume, white matter integrity, and severity and duration of delirium.

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**A. HARLEY, S. DUTT, D. LUONG, M.L. CHAN, S. GADE, A. BOXER, B. MILLER & J.H. KRAMER. Rate of Cognitive Decline in PSP vs. CBD.**

**Objective:** Progressive supranuclear palsy (PSP) and corticobasal degeneration (CBD) are 4R tau neurodegenerative diseases characterized by parkinsonian symptoms and cognitive deficits. PSP and CBD share similar cognitive characteristics, but little is known about the differences in their rate of cognitive decline over time. The current study addresses said differences longitudinally over 3 visits.

**Participants and Methods:** Clinically diagnosed PSP ( $n=24$ ) and CBD ( $n=19$ ) patients completed several neuropsychological measures at 3 visits, with an average duration of 2.1 years between visit 1 and 3. B values derived from linear regressions represented rate of cognitive decline. Independent sample t-tests assessed differences at baseline and in rate of decline.

**Results:** Cognitive scores between the two groups were similar at baseline with the exception of PSP subjects scoring higher on MMSE (24.8 vs. 27.5;  $p<.05$ ) and confrontation naming (11.5 vs. 14.4;  $p<.001$ ). CBD patients showed a faster rate of decline on several executive tasks, including lexical fluency ( $p<.05$ ), semantic fluency ( $t=-3.17$ ,  $p=0.003$ ) and digits backward ( $t=-3.23$ ,  $p=0.003$ ) than the PSP group. MMSE also dropped more rapidly ( $p<.01$ ), while there were no differences in verbal delayed memory, confrontation naming, semantic fluency, visual construction, or set-switching.

**Conclusions:** CBD was associated with a faster rate of decline in executive functioning and MMSE relative to PSP over a 2-year period. These findings highlight that despite several similarities in pathology and clinical presentation, important longitudinal differences in cognition may distinguish between PSP and CBD and improve differential diagnosis. Atrophy of the frontal lobes is also more characteristic for CBD than PSP, which could explain differences in rate of executive decline (Lee et al., 2011; Boxer et al., 2006).

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**J. HIGHSMITH, D. GONZALEZ, J.R. SOBLE, J. MARCEAUX & K. MCCOY. Cardiovascular Risk Models Predict Processing Speed Performance: Initial Evidence from a Veteran Sample.**

**Objective:** Cardiovascular disease (CVD) risk models assist providers in identifying at-risk patients as well as needed treatments. Meta-analyses indicate several CVD risk models show an inverse association with performance on tests of attention, executive functioning, and memory; although often slowed in CVD, processing speed was not evaluated. The purpose of this study was to assess the relationship between the QRISK2 model and processing speed in a veteran sample.

**Participants and Methods:** Participants included a mixed-clinical sample of 184 veterans without history of physical disease or injury likely to impact processing speed referred for neuropsychological evaluation. QRISK2 composite risk scores (10-year and relative risk)



were calculated for each veteran ( $M_{age}=58.1$ ,  $SD=14.3$ ;  $M_{education}=13.4$ ,  $SD=3.1$ ; 87% men). Bivariate correlations evaluated the relationship between risk scores, depression, obstructive sleep apnea (OSA), and processing speed (PSI) from the WAIS-IV. Hierarchical multiple regression evaluated risk values as predictors of PSI while controlling for education, OSA, and depression separately for young, middle, and older adults.

**Results:** Mean 10-year risk of CVD/stroke was 17.6% ( $SD=14.7\%$ ), with a relative risk of 1.98 ( $SD=1.32$ ) compared to healthy controls. In middle age, OSA, depression, and low education were related to higher relative risk of CVD/stroke. Bivariate correlations revealed a trend of decreasing education and increasing QRISK2 association with PSI as age increased. Regression revealed QRISK2 values were significant ( $p=.015$ ) and accounted for 7% of the variance in PSI for those over age 65.

**Conclusions:** CVD risk models were a significant predictor of processing speed in a clinical sample of veterans, although education accounted for the most PSI variance in early and middle adulthood. These findings extend previous research on CVD risk models and relationships with neuropsychological functioning to include cognitive efficiency.

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**J. JONES, I. SCHMALFUSS, J.J. TANNER, S. AALAEI-ANDABILI, M. WATERS, T. BEAVER & C. PRICE. Regional Leukoaraiosis, Lacunes, and Cognition in Atrial Fibrillation: A Pilot Investigation.**

**Objective:** There is limited understanding of regional leukoaraiosis (LA) versus burden of lacunar infarctions and peripheral strokes on cognition in adults with atrial fibrillation (AFib). We assessed regional load of LA as well as lacune and peripheral stroke volume in adults with AFib relative to non-AFib peers. We additionally examined if regional LA versus lacune and stroke volume contributed differently to cognition in these two groups.

**Participants and Methods:** 17 AFib patients and 17 controls completed memory, processing speed, and verbal fluency tests as well as structural MR imaging for LA, lacunae and stroke volume. Trained raters measured LA in three regions (infracortical, deep and periventricular) in order to assess LA that may differentially impact short versus long U-fibers, as well as lacunae (0.3-1.5mm in diameter) and stroke (>1.5mm in diameter) volume. Analyses examined group differences in neuroanatomical and cognitive variables, and hypothesized relationships between regions of LA and areas of cognition. We controlled for total intracranial and total white matter volume.

**Results:** Individuals with AFib had significantly more LA, particularly in the infracortical white matter region, relative to their peers. Lacunes and strokes were present in 9/17 (53%) and 11/17 (65%) of patients with atrial fibrillation, respectively. There was no evidence of lacunar infarction or strokes in control participants. Cognitively, individuals with AFib performed worse on measures of memory and fluency ( $p<.01$ ). Memory recognition negatively correlated with total LA ( $p=.024$ ) infracortical LA volume ( $p=.017$ ), and lacune volume ( $p<.001$ ). Lacune volume also related to inhibition ( $p=.036$ ). Stroke volume was not related to any cognitive domain.

**Conclusions:** AFib patients have significantly more LA, lacune and peripheral stroke volume relative to non-disease peers. Infracortical LA burden and the lacune volume were significantly associated with reduced memory performance with no relation seen between memory and larger strokes.

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**J. JONES, J.J. TANNER, M.S. OKUN, C. PRICE & D. BOWERS. Cognition and Parkinson's Disease: the Influence of Health Comorbidities and Leukoaraiosis.**

**Objective:** Mounting evidence has pointed to the detrimental effects of cardiovascular risk factors on cognition. One prevailing view is that

hypertension affects cognition via ischemic changes that disrupt frontal-subcortical connections. We examined if Parkinson's disease (PD) patients are at increased vulnerability for vascular-related cognitive impairment relative to controls. The underlying assumption behind this hypothesis relates to 'brain reserve'. The cognitive profile of individuals with PD is a frontal-subcortical dysexecutive profile. As such, PD patients may be vulnerable to vascular-related cognitive impairment (which also affects frontal-subcortical systems).

**Participants and Methods:** The sample included 67 PD patients and 61 elderly controls (total  $N = 127$ ). Participants completed neuropsychological measures of executive functioning, processing speed, verbal delayed recall/memory, language and auditory attention. Cardiovascular risk was assessed with the Framingham Cardiovascular Risk index. Participants underwent brain imaging (T1 and T2 FLAIR). Total and regional leukoaraiosis (periventricular, deep subcortical and infracortical) was measured by a trained rater.

**Results:** Overall sample characteristics: 70% male, age 67.7 years, disease duration (Parkinson patients only) 9.7 years, Unified Parkinson's Disease Rating Scale (Parkinson patients only) 20.4. Hierarchical regressions revealed that cardiovascular risk was related to worse executive functioning ( $p=.013$ ), processing speed ( $p=.035$ ) and delayed verbal recall ( $p<.001$ ) in Parkinson patients and Controls. Cardiovascular risk was related to language performance among Parkinson patients only. Leukoaraiosis was related to both cardiovascular risk and cognition among controls, but not Parkinson patients.

**Conclusions:** Overall results suggest that PD patients generally are not more vulnerable to vascular-related cognitive impairment. Rather, the influence of cardiovascular risk factors on cognition is similar among PD patients and controls.

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**S. KANG, N. ROSENBACH, P. WATSON, B. BASCETTA & J.L. STORBECK. Attentional Engagement Underlies Rey Complex Figure Test Performance in Systemic Lupus Erythematosus.**

**Objective:** Systemic Lupus Erythematosus (SLE) is associated with deficits in attention, executive functioning, visuospatial functions, and memory. Individuals with SLE have shown marked impairment on the Rey Complex Figure Test (RCFT), but mechanisms underlying poor performance have not yet been elucidated. The goal of this study was to explain performance on the RCFT through associated performances on other measures of cognition and qualitative analysis of individual components of RCFT performance.

**Participants and Methods:** Eighteen individuals with SLE (17 F, 1 M; age =  $42 \pm 10.77$  years) completed the RCFT, Trailmaking Test (TMT), and Judgment Line Orientation (JLO). The RCFT performances were scored and normed using the standard method and the Boston Qualitative Scoring System (BQSS). TMT, JLO, and BQSS scores were used as predictor variables in a regression model.

**Results:** RCFT copy trial performance positively correlated with TMT A and BQSS scores on configural presence, cluster accuracy, neatness, and perseveration. These variables together predicted RCFT copy performance ( $R = .94$ ,  $r^2 = .89$ ,  $p < .01$ ), but only neatness ( $p < .01$ ), perseveration ( $p = .03$ ), and TMT-A ( $p = .05$ ) emerged as independent predictors. Positive correlations with the delay trial included TMT-A, TMT-B, configural placement, cluster placement, and detail presence and placement. The regression model was significant ( $R = .87$ ,  $r^2 = .80$ ,  $p < .01$ ) with independent predictions from TMT-A and cluster placement performances.

**Conclusions:** Performance on the RCFT copy and delay trials is associated with measures of attention and processing speed in people with SLE. These findings suggest that simple attentional focus and efficiency underlie cognitive deficits in people with SLE. Future research is needed in order to understand the contribution of higher order attentional mechanisms, such as engagement and initiation, in cognitive functioning within the SLE population.

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**E. KOZORA, A. ULUG, D. ERKAN, A. VO, C.M. FILLEY, G. RAMON, A. BURLESON, R. ZIMMERMAN & M. LOCKSHIN. Functional MRI Abnormalities in Systemic Lupus Erythematosus and Antiphospholipid Antibody Positive Patients.**

**Objective:** Standardized cognitive tests and functional magnetic resonance imaging (fMRI) studies of SLE patients demonstrate deficits in working memory and executive function. These neurobehavioral abnormalities are not well studied in antiphospholipid syndrome (APS), which may occur independently of or together with SLE. This study compares an fMRI paradigm involving motor, working memory and executive function in SLE patients without antiphospholipid antibody (SLE), aPL-positive non-SLE patients (aPL+), and controls.

**Participants and Methods:** Brain magnetic resonance imaging (MRI), functional MRI (fMRI) and standardized cognitive assessment were obtained on 20 SLE (mean age 36.5, SD=11.7), 20 aPL-positive (mean age 37.6, SD=8.6) and 10 healthy female subjects (mean age =40.4, SD=11.8) with no history of neuropsychiatric activity.

**Results:** Analysis of fMRI data showed no differences in performance across groups on bilateral motor tasks. Significant group differences using ANOVA were found on two executive tasks (word generation and word rhyming) and in a working memory task (N-back). Patients positive for aPL demonstrated higher activation in bilateral frontal, temporal and parietal cortices compared to controls during tasks of working memory and executive function. SLE patients also demonstrated bilateral frontal and temporal activation during working memory and executive function tasks.

**Conclusions:** Compared to controls, both aPL positive and SLE patients had elevated cortical activation, primarily in the frontal lobes, during tasks of working memory and executive function. These findings are consistent with cortical over-activation as a compensatory mechanism for early white matter neuropathology in these disorders.

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**E. KOZORA, M. NITTA, K. BROWN & N. HAMZEH. Symptom Presentation and Cognitive Dysfunction in Patients with Sarcoidosis.**

**Objective:** Sarcoidosis is a systemic disorder of unknown etiology causing the formation of granulomas that can appear in any organ but typically in the lungs, lymph nodes, eyes and skin. Neurological presentations occur in 10%, but few studies have evaluated cognitive deficits in this population.

**Participants and Methods:** Twenty-eight patients with a primary diagnosis of sarcoidosis completed cognitive testing as part of their clinical care between 2000 and 2015. The subjects were 75% female, 93% Caucasian, had a mean age of 53.3 (SD=9.2) years, a mean education of 15.2 (SD=2.6) and a mean duration of disease of 7.0 years (SD=9.0).

**Results:** Analysis revealed a range of symptoms/disorders including pulmonary (60%), cardiac (33%), sleep apnea (50%), hearing loss (48%) and visual problems (41%). Minor neurological events occurred in 85% of the sample (67% headaches, 41% numbness and pain, 35% balance problems). Clinical interpretation of cognitive data indicated that 21% were in the normal range, 50% were mildly impaired, 11% were mildly to moderately impaired and 18% were moderately impaired. Patients had one or more tests impaired in learning in memory (82%), attention (71%), motor function (67%), problem solving (64%), expressive language (57%), visuconstruction (21%), and receptive language (18%). Over 35% of the group had symptoms of depression on the BDI-II. No associations using correlational analysis were noted between level of cognitive impairment, duration of disease, prednisone use or depression.

**Conclusions:** Our findings indicated that 79% of the patients with sarcoidosis referred for cognitive evaluation were impaired. Case by case presentations indicate there is a wide variety of organ involvement and neuropsychiatric presentations across individuals with sarcoidosis. Larger sample sizes across multiple sites may be necessary to better identify factors that contribute to cognitive dysfunction in this population.

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**S. LEVY, A. BOETTCHER, K. DAVIDSON, C. CATANIA, D.J. LIBON & C. PRICE. No Titanic Effect on Digit Symbol in Idiopathic Non-Dementia Parkinson's Disease.**

**Objective:** Subcortical illnesses such as Parkinson's disease (PD) are associated with decreasing output over time on tasks requiring processing speed and mental flexibility. This negative slope as a function of time to completion/and or test epoch has been termed the 'titanic effect'. We examined differences in WAIS-III Digit Symbol Coding quartile performances for non-demented individuals with and without idiopathic PD. We hypothesized that individuals with PD would show reduced output and greater slowing over time relative to controls after correcting for Digit Symbol copy performance.

**Participants and Methods:** Forty non-dementia individuals with PD (mean age= 67.8±5.44; mean education= 16.28±3.03) and 40 non-PD peers (mean age= 68.18±4.64; mean education= 16.75±2.35) completed the WAIS-III Digit Symbol Coding and Copy subtests. Total correct responses were counted by 30-second quartiles (30", 60", 90", 120"). Repeated Measures ANOVA assessed changes in quartile mean scores over time.

**Results:** Although there was a significant effect of group (p=0.02) showing decreased output overall for PD relative to non-PD, there was no significant interaction of group by quartile. Both the PD group (t=3.22, p<.01) and the control group (t=2.78, p<.01) declined in output from 30 seconds to 60 seconds. Output generated by PD participants did not continue to decline in subsequent test epochs.

**Conclusions:** While our PD participants had reduced output relative to controls, there was no significant decrement over time or evidence of increased bradyphrenia by quartile. For PD without dementia, there may be a certain threshold of cognitive impairment that must be met before significant decrements over time can be seen. Future studies should examine bradyphrenia across the span of task in PD individuals with mild cognitive impairment or dementia. R01 NS082386 (CP)

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**S. LEVY, J.J. TANNER, D. BOWERS & C. PRICE. One-Year Reliable Change of Cognition and Mood in Idiopathic Non-Dementia Parkinson's Disease.**

**Objective:** The progression of Parkinson's disease (PD) cognitive and mood changes over time remains poorly understood. We examined cognitive and mood changes in idiopathic non-dementia PD participants from baseline to 1 year. Based on frontal-striatal circuitry disruption evidenced in PD, we hypothesized that PD participants would have primary decrements in processing speed, attention, and working memory and increased mood symptoms relative to controls.

**Participants and Methods:** Forty PD and 40 control participants completed a comprehensive baseline and one year neuropsychological protocol. For PD participants, mean disease duration was 8.75 (SD = 5.37) and mean UPDRS-III scores was 17.95 (SD = 8.80). Repeated Measures ANOVA and reliable change methods assessed group differences and individual changes over time in cognition and mood.

**Results:** *Cognition:* There was a significant effect of group (p < .001) such that PD showed worse cognitive performance overall relative to non-PD. There was a significant group by time interaction (p < 0.01)

such that PD exhibited decrements in processing speed and non-PD showed improvements in attention, memory, and motor function. After one year, reliable change analyses revealed that 16.2% of PD participants declined in working memory and 10.8% in attention. *Mood*: There was a significant effect of group ( $p < .001$ ) such that PD participants showed greater depressive, apathetic, and anxious symptoms relative to controls. There was no significant interaction of group by time. At one year, 16.7% of PD participants experienced an increase in depressive symptoms, 5.5% in apathy, and 18.9% in state anxiety.

**Conclusions:** Cognition in PD progressed from processing speed to additional impairments in working memory and sustained/selective attention. Depressive and anxiety symptoms also significantly increased within the year. These changes support concepts of increased frontal-striatal deficits over time and the need to intervene on processing speed early in the disease process. R01 NS082386 (CP)

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**S.W. LIEBEL, S.J. BRYANT, U.S. CLARK & L.H. SWEET. Cognitive Processing Speed Mediates the Relationship between Age and Executive Functions in Cardiovascular Disease.**

**Objective:** Cardiovascular disease (CVD) is associated with cognitive impairments, including slowed cognitive processing speed (CPS) and impaired executive functions (EF). An extensive research literature suggests that CPS is a fundamental component of many of the brain's other functions; yet, relatively little research has explored the effects of CPS on EF in CVD. The present study examined the potential mediating role of CPS on the age-EF relationship in CVD.

**Participants and Methods:** Thirty-seven patients with CVD and 58 healthy older adult controls completed a neuropsychological and MRI assessment. A composite score for CPS and EF was formed with unit-weighted Z-scores of constituent tests to provide stable measures of ability in these domains. Pearson correlation coefficients established the significant relationship between the independent variable (age) and dependent variable (EF). Partial correlations controlling CPS examined possible attenuation of the age-EF relationship. Mediation analyses were conducted via PROCESS for SPSS. Statistical significance was set at  $p < .05$ , two tailed, for all tests.

**Results:** In the patient group, the relationship between age and EF ( $r = -.47$ ,  $p = .003$ ) was significantly attenuated by controlling CPS ( $r = -.06$ ,  $p = .74$ ). Mediation analysis revealed that there was a significant indirect effect of age on EF ability through CPS ( $b = -.039$ , BCa CI  $[-.079, -.017]$ ); this represents a moderate effect ( $\kappa^2 = .366$ , BCa CI  $[.135, .607]$ ). In the control group, the age-EF relationship ( $r = -.57$ ,  $p < .001$ ) was attenuated by controlling CPS as well ( $r = -.331$ ,  $p = .012$ ). Similar mediation results were found through CPS ( $b = -.024$ , BCa CI  $[-.047, -.008]$ ) and represent a moderate effect ( $\kappa^2 = .284$ , BCa CI  $[.120, .444]$ ).

**Conclusions:** CPS partially mediates the relationship between age and EF in both CVD and healthy control groups. These findings support the role of CPS as a fundamental component of EF.

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**L. NGUYEN, E. PIROGOVSKY TURK, J. FILOTEO, I. LITVAN, D. SONG, S.L. LESSIG & D.M. SCHIEHSER. Clinical Correlates of Sleep Disturbance in Non-demented Parkinson's Disease Patients.**

**Objective:** Sleep disturbance is common in individuals with Parkinson's disease (PD), yet the relationship among sleep quality and neuropsychiatric, cognitive, motor, and disease symptoms is not well delineated. Such knowledge may help elucidate the nature of sleep disturbance in PD and provide potential targets for sleep assessments and/or interventions.

**Participants and Methods:** Non-demented PD participants ( $n = 116$ ) completed the 15-item Parkinson's Disease Sleep Scale (PDSS), a measure of self-reported PD-specific sleep disturbances. Participants were

administered measures of global cognition ( Mattis Dementia Rating Scale), motor symptom severity (Unified Parkinson's Disease Rating Scale Part III), and neuropsychiatric symptoms (Neuropsychiatric Inventory). Postural Instability Gait Disturbance (PIGD) and Tremor Dominant (TD) motor subtype scores were also calculated.

**Results:** Increased sleep disturbances were significantly correlated with overall motor symptom severity ( $r = -.20$ ,  $p < .05$ ), but not with global cognition or psychiatric symptoms. Further analyses of motor symptoms revealed that greater levels of sleep disturbance significantly related to greater levels of PIGD symptoms ( $r = -.32$ ,  $p < .01$ ), but not TD motor scores. Poorer sleep quality also correlated with higher levodopa equivalent dose (LED,  $r = -.23$ ,  $p < .05$ ), but not with disease duration. After controlling for LED in a hierarchical regression analysis, greater postural instability/gait disturbance continued to significantly predict sleep disturbance.

**Conclusions:** Results suggest that postural instability/gait disturbance is a unique predictor of sleep disturbance in non-demented PD. The relationship between PIGD and sleep disturbance may be related to dysfunction in non-dopaminergic (e.g., cholinergic) systems; however, further research is needed to better understand the nature of this relationship. Moreover, findings provide potential treatment targets (i.e., motor symptoms) for future treatment studies of sleep disturbances in PD.

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**A. O'MARA & S. WYLIE. The Effects of Subthalamic Nucleus (STN) Deep Brain Stimulation (DBS) Across Phonemic, Semantic and Action Fluency Measures in Parkinson's Disease.**

**Objective:** Subthalamic nucleus (STN) deep brain stimulation (DBS) improves motor symptoms in Parkinson's disease (PD), but can reduce phonemic and semantic verbal fluency performance. Reduction in the spontaneous retrieval of action-related words (action fluency) is an early feature of PD, but the effects of STN DBS on action fluency are unknown. Here we compared the effects of STN DBS across phonemic, semantic and action fluency measures.

**Participants and Methods:** PD patients ( $N=19$ ) without dementia completed phonemic, semantic, and action fluency measures before and 6 months following DBS surgery in their best treated state. Raw performances were converted to age and education adjusted scaled scores and submitted to repeated measures ANOVA to test within-subject effects of task (phonemic, semantic, action) and timepoint (pre DBS, post DBS).

**Results:** Consistent with prior studies, PD patients showed a selective reduction in action fluency, but intact phonemic and semantic fluency scores pre-DBS. Post-DBS surgery, all three fluency measures showed a significant decline, but semantic fluency showed a significantly greater decline compared to phonemic and action fluency measures.

**Conclusions:** We confirmed a selective reduction in action fluency among PD patients, but show that STN DBS exerts a global reduction in spontaneous word production, irrespective of the lexical content. We consider putative mechanisms underlying these effects and discuss why semantic fluency measures may be particularly vulnerable to STN DBS effects.

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**S. PAQUETTE, P. FOURNIER, S. DUPONT, F. SZABO, P. GALAN & S. SAMSON. A Compromised Neural Noise-Cancellation Mechanism at the Center of Tinnitus Perception.**

**Objective:** Tinnitus incidence is rising due to an aging population and an increase in day-to-day noise exposure. Tinnitus has typically been viewed as having an exclusively auditory origin, mainly because it is an auditory percept and is often triggered by specific auditory conditions, such as noise trauma causing hearing loss. This said, experts estimate

that only a third of those with hearing loss will go on to develop tinnitus. Although many theories on its neurological underpinning exist, no studies have identified why tinnitus only occurs in specific individuals. According to Rauschecker and collaborators (2010), dysfunctional limbic noise cancelling mechanisms could be responsible for tinnitus perception after hearing loss. To test this hypothesis, we investigated the prevalence of tinnitus in a population of patients with a dysfunction of the amygdala in a case control study.

**Participants and Methods:** One hundred and sixty-six patients who had undergone unilateral medial temporal lobe resection (including the amygdala) for the relief of medically intractable epilepsy were contacted to take part in this epidemiologic study on tinnitus. Specifically, data were collected regarding the subjects' general health and audition. Data obtained from these patients was compared with data from paired healthy (n=332) and epileptic (n=332) controls taken from the French epidemiologic database Nutrinet-Santé (Herberg et al., 2010).

**Results:** As predicted, we found that 23.5% of epileptic patients who underwent median temporal lobe resection including the amygdala reported experiencing tinnitus. This prevalence is significantly different from the paired non-epileptic (3.7 times higher) and epileptic (2.5 times higher) controls, although it increases with age in all groups.

**Conclusions:** The present findings support the idea that a compromised neural noise-cancellation mechanism could be responsible for tinnitus perception, and provides convincing evidence for the crucial role of the amygdala in this phenomenon.

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**J. RECKOW, L.J. HINES, T.A. HALDIS, R. SETH, S.L. MITCHELL, C.M. DYKE, M. WIISANEN, P. SKARLOKEN, N. SPITZER, F. FERRARO, T. PETROS & D. SPAETH. Cognitive Changes Following Transcatheter Aortic Valve Implantation.**

**Objective:** Severe aortic stenosis may lead to angina, syncope, and heart failure (Otto, 2006). Transcatheter aortic valve implantation (TAVI) was developed as an alternative to surgical valve replacement in patients denied surgical candidacy due to mortality risk (Kappetein et al., 2013). Despite increased risk of ischemia following TAVI (Rodes-Cabau et al., 2011; Kahlert et al., 2010), cognitive function appears stable with potential improvements (Ghanem et al. 2013, Alassar et al., 2015). The present study examines the relationship between TAVI and cognition.

**Participants and Methods:** Forty TAVI patients (79.04±7.79 yr) completed neuropsychological evaluations at baseline and at one-month post-TAVI. Twenty-two participants completed brain MRIs at baseline and one month. Assessments included the Mini-Mental State Examination (MMSE), the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Stroop Color-Word Test, Trailmaking Test, and letter fluency. Measures of quality of life (KCCQ), mood (GDS), and ADL's (PSMS, FAQ) were included.

**Results:** Participants evidence mild global cognitive decline at baseline relative to normative sample (RBANS Total Index M = 85.26±14.69). Significant improvement at one month was observed in RBANS Language Index (p = 0.014), RBANS Fluency (p = 0.023), RBANS Figure Recall (p = 0.027), GDS (p = 0.018), and KCCQ (p < 0.001). There was a significant decline on RBANS List Recall (p = 0.001). Six patients (27%) evidence ischemia at one month. Participants with ischemia did not differ from those without at one month (RBANS Total Score, p = 0.45).

**Conclusions:** Despite increased ischemia, patients who undergo TAVI evidence improvement in quality of life, mood, and specific domains of cognition, with overall cognitive functioning remaining stable. Improvement in cardiac symptoms, mood, and quality of life may be associated with ability to engage in assessment and improvements in cognitive performance. Increased perfusion, despite ischemia, may also improve cognitive performance.

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**O.L. REY & L. MURRAY. Cognitive Performance of Hypertensive Adults.**

**Objective:** The goal of this project was to examine the association between hypertension (HT) and performance on tasks of processing speed, attention, memory, language, visuoconstruction, and executive function. Although the last 30 years have brought a rise in the amount of research evaluating the cognitive effects of HT, the results of these studies have been inconclusive. These inconsistent observations likely reflect methodological differences across studies regarding the selection of subjects and measurements. The recent increase in the incidence and prevalence of HT, and its known effects on brain anatomy and physiology, highlight the current relevance of this issue.

**Participants and Methods:** A group of 82 healthy adults were evaluated with a battery of 12 cognitive tasks. Half of the subjects had a diagnosis of HT and half did not. No significant differences between the groups were observed in terms of age or educational level. BP readings were obtained multiple times during testing sessions, following existing guidelines issued by the American Heart Association. The average BP was considered an independent variable for secondary analysis.

**Results:** ANOVA showed that the normotensive group obtained significantly higher scores than the HT group on processing speed, divided attention, attentional switching, visual memory, visuoconstruction, and most executive function tasks. This difference disappeared in most of the tasks when the groups were reorganized using onsite BP measurements as the independent variable. A logistic regression analysis yielded a model that included attention, fluency, and verbal memory tasks as the best predictors of subjects having or not having HT.

**Conclusions:** The current findings indicate that HT is associated with cognitive decline in otherwise healthy adults. As such, it should be considered an important variable both when selecting control groups for research studies on cognition and when accounting for influencing factors on the rehabilitation of subjects affected by brain damage.

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**L.E. SABBAH & I. PIRYATINSKY. Hashimoto's Encephalopathy Case Report.**

**Objective:** Hashimoto's encephalopathy (HE) is a rare neurological disorder characterized by positive antithyroid antibodies, altered mental status, and clinical response to glucocorticoid therapy (Chong, Rowland, & Utiger, 2003). HE is often difficult to diagnose because it can present with variable neurological manifestations and relapsing and remitting disease courses (Nelson, Jassam, & Taylor, 2014).

**Participants and Methods:** We present a 76-year-old Russian speaking right-handed woman with recurrent UTIs, hypertension, hyperlipidemia, type II diabetes, and a diagnosis of HE made in May of 2012. MRIs from her disease course and treatment will be presented. The patient was diagnosed with relapsing-remitting course and treatment-refractory HE, which was resistant to treatment and eventually successfully controlled with plasmapheresis, corticosteroids, and azathioprine in January 2014. MRI showing significant fluctuations with significantly impaired leukoencephalopathy, prompted a case study publication of her neurologic and imaging findings (Nelson, Jassam, & Taylor, 2014).

**Results:** Her cognitive functioning was of significant concern, however, due to language and cultural limitations, neuropsychological evaluation was not conducted until she was referred to our clinic in February of 2015. The interview and assessment was conducted in the patient's native language, and included assessment of attention, processing speed, learning, executive functioning, language, fine motor dexterity, visuo-spatial functioning, and memory. Psychiatric history was unremarkable. Significant cognitive impairment was noted as well as decline in instrumental ADLs.

**Conclusions:** Profile was inconsistent with typical dementia process, such as AD, FTD, PD, and this as well as neuropsychological findings will be discussed in detail in the result section. This case report is an interesting and rare presentation of a patient who has received treatment for HE and was later diagnosed with major neurocognitive disorder in February 2015.

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**R. SALAZAR & A. CRONIN-GOLOMB. Self-Perceived Stigma in Parkinson's Disease: Relation to Motor Symptoms, Age, Gender, and Mood.**

**Objective:** Parkinson's disease (PD) may persist in a person for decades with retained insight into the disease burden, and many with the disease perceive that they are stigmatized. Little is known about how PD-related demographic and disease characteristics relate to perceived stigma. We predicted that certain aspects of PD that make it difficult to conform to social norms would relate to self-perceived stigma, including visibility of motor symptoms (e.g., tremor, rather than trunk rigidity), female gender (societal emphasis on physical appearance in women), and younger age (societal expectations of physical vigor in younger persons). We expected that stigma would be associated with depressed or anxious mood.

**Participants and Methods:** We assessed 99 non-demented individuals with PD (44 F, 55 M) on motor function (Unified Parkinson's Disease Rating Scale, UPDRS), subjective quality of life (Parkinson's Disease Questionnaire, PDQ-39), and mood (Beck Depression Inventory-II; Beck Anxiety Inventory). The mean of the four stigma-related items of the PDQ-39 was correlated with scores for the other aspects of PD.

**Results:** For the entire group, perceived stigma correlated with younger age ( $r = -.26$ ,  $p = .005$ ), depression ( $r = .22$ ,  $p = .018$ ) and anxiety ( $r = .43$ ,  $p = .000$ ) but not with UPDRS motor items. For men, stigma correlated with depression ( $r = .34$ ,  $p = .007$ ) and anxiety ( $r = .48$ ,  $p = .000$ ). For women, stigma correlated with anxiety ( $r = .37$ ,  $p = .007$ ) and younger age ( $r = -.38$ ,  $p = .006$ ). The relation between age and stigma was strongest for women with tremor-dominant motor symptoms ( $n = 17$ ;  $r = -.44$ ,  $p = .039$ ).

**Conclusions:** Self-perceived stigma in PD was related to mood, and for women, it further related to younger age and tremor-dominant symptoms. The association of stigma perception with affective symptoms, age and gender may be an important focus for interventions, especially for younger women with physically obvious motor symptoms such as tremor.

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**H.L. SCHNEIDER, N. SUN-SUSLOW, S.A. ANDERSON, L. SEGALÀ, A.B. MILLARD, M.A. ROSSETTI, C. LUCA, J. JAGID, H.P. MOORE, C. SINGER & B.E. LEVIN. Does REM Behavior Sleep Disorder Alter Deep Brain Stimulation Outcome in Parkinson's Disease?**

**Objective:** Among patients with Parkinson's disease (PD), the presence of REM Behavior Sleep Disorder (RBD) is associated with a non-tremor predominant subtype and gait freezing, and increased rate of dementia (Bonnet et al., 2012). Deep brain stimulation (DBS) has been found to be an effective treatment for disabling motor symptoms in PD (Parsons et al., 2006). However, more research is needed to understand and identify patient characteristics that predict improvement or decline following DBS surgery. Therefore, this pilot study sought to examine whether RBD is an important factor linked to outcome following DBS surgery.

**Participants and Methods:** Participants were recruited from a larger study in the Department of Neurology examining cognitive functioning prior to and following DBS surgery. A total of 38 participants with PD, 32 without RBD and 6 with RBD, were compared on a battery of neuropsychological measures prior to and after DBS surgery. The two groups did not differ on age, gender, or disease duration. Overall, the

sample was 84% male (Mage= 63.3 years, Meducation= 12.6 years, and Mdisese duration= 12.5 years).

**Results:** Data were checked for normality, and measures of skewness and kurtosis showed normal distribution on all variables used. A one-way analysis of variance (ANOVA) revealed that the non-RBD and RBD groups did not differ on MMSE, verbal fluency, confrontation naming, verbal learning, and visual spatial judgment and integration. Patients with RBD did marginally worse only on digit span following DBS compared to their non-RBD peers,  $F(1,34) = 6.628$ ,  $p = .015$ . In general, all PD patients improved post-surgery.

**Conclusions:** This pilot study suggests that PD patients with and without RBD do not differ in cognitive outcomes following DBS. In fact, both groups perform similarly. Thus, while RBD may be an important marker for PD motor signs and disease progression, it does not appear to play as significant a role for cognitive outcomes following DBS.

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**B.M. SCOTT, J.A. LAFO, L. ALMEIDO, M.S. OKUN & D. BOWERS. Differential effects of apathy, depression, and anxiety on cognitive function in Parkinson's disease, essential tremor, and dystonia.**

**Objective:** The purpose of the present study was to (1) compare the prevalence and severity of anxiety, apathy, and depressive symptoms across three movement disorder patient groups; and (2) examine the differential effects of mood on cognition. We hypothesized that due to the link between dopamine and apathy, apathy would be greater in PD patients and associated with executive function. Anxiety would be more strongly linked to Essential tremor and related to memory.

**Participants and Methods:** Participants included 614 patients with idiopathic Parkinson's disease (PD=462), Essential tremor (ET=105) and dystonia (DYS=47) evaluated at the University of Florida Center for Movement Disorders and Neurorestoration. None had undergone deep brain stimulation. All participants completed neuropsychological evaluation and self-report mood measures: BDI, STAI and Apathy Scale. Two cognitive composite scores were computed using mean z-scores: 1) Memory: HVLT, WMS-LM delayed recall; and 2) Executive Function: TMT-B, Stroop Color-Word, COWA.

**Results:** Participants ranged from 30-90 years of age, were well-educated ( $M = 14.5$ ), with mean DRS-2 total scores of 133.8. The 3 groups did not differ in the severity and prevalence of mood symptoms, after controlling for age, education, and disease duration. However, a trend toward higher rates of apathy were found in PD and ET versus DYS patients. Regression analyses indicated that for PD patients, both apathy and state anxiety significantly predicted Executive Function ( $p < 0.001$ ), with state anxiety also predicting Memory ( $p < 0.001$ ). Mood symptoms did not predict cognitive composites in ET or DYS groups.

**Conclusions:** In contrast to our hypotheses, only the prevalence of apathy differed across movement disorder groups. Even so, apathy and anxiety each played an important role in the cognitive presentation of PD patients but not the other movement groups. Findings will be discussed in terms of current views on mechanisms of cognitive disturbance in movement disorder subgroups.

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**M. SHAH, J. LILIE & C. BREWER. Impact of sleep loss on attention in student with high or low Internet use.**

**Objective:** To examine impact of sleep loss on cognitive functioning particularly attention. The study also examined the role of Internet use on habitual sleep and its impact on cognitive functioning. The study also examine the association between sleep chronotype and cognitive functioning. Association between Internet use and cognitive functioning was also examined. Gender difference related to sleep time, Internet use, and cognitive performance was explored.

**Participants and Methods:** The participants for the current study were recruited from APA accredited school with students enrolled in graduate psychology program. The participants in the study were asked to maintain a sleep log for two weeks followed by on-site testing. Measures used in the study were BDI-II, BAI, Epworth Sleepiness Scale, Fatigue Severity Scale, Internet Addiction Test, Morningness-Eveningness Questionnaire, Stroop Color and Word Test, and the Test of Everyday Attention. **Results:** Significant group differences were found between individuals receiving less than 6 hours of nocturnal sleep per night and those receiving 6 to 8 hours and more than 8 hours of sleep related to daytime sleepiness, cognitive flexibility, sustained attention, selective attention, attentional switching, and auditory/verbal working memory and attention. No group difference among sleep group were found related to Internet use. Internet use was strongly associated with number of electronic devices owned, as well as inversely related to Anxiety. Gender difference were found related to Internet use and number of electronic devices, but not for nocturnal sleep time.

**Conclusions:** Customary sleep average less than 6 hours per night can impact cognitive functioning particularly attention and also leads to excessive daytime sleepiness. Additionally, individuals who own more electronic devices are prone to use Internet for extended period of time. Adequate sleep is necessary for optimal cognitive functioning. Environmental and social factors such as Internet can lead to decline sleep time. Correspondence: *Mihir Shah, Psy.D., Neuropsychology, NRS-Lifespan, 2004 Princess Ct, Woodbridge, NJ 07095. E-mail: mshahpsydcand@gmail.com*

**K.E. SLYNE, K.J. MANNING, G. CHAN, B.L. HENNIG & R. KAPLAN. The Association Between Cognition and Depression on Disease Severity in Huntington's disease.**

**Objective:** Depression is common in Huntington's disease (HD). The ubiquitous nature of depression in HD may explain why it poorly discriminates among different levels of disease progression. However, the interaction between depression and cognitive symptoms in HD may prove sensitive to monitoring clinical deterioration. We tested this hypothesis in a sample of HD patients with various levels of HD severity. **Participants and Methods:** Forty-seven adults with HD aged 19-63 (M=42.68, SD=12.82) completed the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; age-adjusted total score was used in the present study) and underwent motor and depression ratings on the Unified Huntington's Disease Rating Scale (UHDRS) annually over two years. Outcome variables included motor progression (M=21.27, SD=19.11) and total functional capacity score (M=10.18, SD=3.42). Two mixed linear models investigating effects of time, cognition, depression, and time x depression x cognition (as well as lower order) interactions were computed. Analyses controlled for age, gender, and CAG repeats.

**Results:** The interaction between depression, cognition, and time on motor functioning was not significant ( $p = .09$ ) although there was a main effect of cognition such that worse cognitive performance was associated with worse motor functioning irrespective of time ( $p = .04$ ). Likewise, the interaction between depression, cognition, and time on everyday functioning was not significant ( $p = .07$ ) although there was a main effect of depression such that greater depression was associated with worse daily functioning over time ( $p = .03$ ).

**Conclusions:** These preliminary results indicate that depression and cognition may be associated with different aspects of disease progression. Larger samples may elucidate interactions between depression and cognition on disease progression. Participant recruitment is ongoing.

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**N. SUN-SUSLOW, H.L. SCHNEIDER, S.A. ANDERSON, L. SEGALÀ, M. ROSSETTI, A.B. MILLARD, C. LUCA, J. JAGID, H.P. MOORE, C. SINGER & B.E. LEVIN. Components of Metabolic Syndrome in Predicting Deep Brain Stimulation (DBS) Outcome in Idiopathic Parkinson's Disease Patients.**

**Objective:** It is well established that hypertension (HTN) and body mass index (BMI), components of metabolic syndrome (MetS), are associated with increased risk for Alzheimer's disease. However, less known about how these factors impact non motor symptoms in Parkinson's disease (PD). The current study examined whether diagnosis of HTN and/or BMI prior to Deep Brain Stimulation (DBS) surgery influences post-surgical cognitive and/or emotional outcomes.

**Participants and Methods:** 36 patients diagnosed with idiopathic Parkinson's disease (Mean age=63.53, SD=7.96) underwent pre- and post- DBS neuropsychological evaluations. Patients underwent a neurological exam and were medically evaluated for HTN diagnosis (n=16 HTN, n=20 non-HTN) and BMI immediately prior to surgery and compared on verbal fluency (FAS, Animals), confrontational naming (BNT), verbal memory (CVLT-II), and psychological outcomes (BDI-II, BAI). Groups did not differ by sex, pre-surgical age, ethnicity, education, or PD disease duration. Results were analyzed using linear regression and analysis of covariance.

**Results:** Neither BMI nor HTN alone predicted change in cognitive or psychological outcome. However, together they significantly predicted change in semantic fluency (Animals;  $F(1,23)$ ,  $p=0.03$ ), where for every kg/m<sup>2</sup> unit increase in BMI, there was a 0.43 raw score decrease ( $p=0.02$ ). HTN diagnosis was associated with increased word production by 4.12 words ( $p=0.03$ ), which may be explained by confounding variables (i.e. HTN disease duration, medications, and/or effectiveness of treatment).

**Conclusions:** HTN and BMI differentially influence neuropsychological outcome post DBS surgery. These results suggest that BMI may heighten vulnerability of verbal fluency performance following STN-DBS in PD. Although PD has been associated with low cardiometabolic risk, these data suggest that the individual components of MetS may collectively interact in different ways.

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**S. VOGEL, M. PARSONS, J. TUROWSKI, N. KEARNS, A. GIFFI & M. BUDEV. Neuropsychological Function in Lung Transplant Survivors.**

**Objective:** Cognitive impairment in lung transplant candidates and recipients is an important factor in decisions about candidacy and patient outcomes. Prior studies of patients with pulmonary disease have had limited sample sizes or neuropsychological batteries. The objective of this study was to thoroughly characterize cognitive dysfunction in a large sample of lung transplant recipients.

**Participants and Methods:** 150 patients (Mean age = 59, SD=11) who had lung transplant  $\geq 1$  year prior to evaluation completed a battery of neuropsychological tests in 5 domains: language (LANG), processing speed (PS), working/Immediate memory (WM), delayed memory (MEM), and executive functioning (EF).

**Results:** Domain scores were created by averaging standard scores of tests with similar cognitive demands. Analyses revealed that 68% of patients scored at least 1.5 SD's below the mean in at least one cognitive domain and 16% scored at least 1.5 SD's below the mean in 2 or more domains. 36% scored below 2 SD's in at least one cognitive domain and 6% scored below 2SD's in more than one domain. The largest percentage of patients scoring 1.5 SD's or more below normative expectations was in the PS domain (22%), followed by MEM (18%), EF (12%), WM (11%), and LANG (5%).

**Conclusions:** The current study demonstrates a significant rate of cognitive symptomatology for individuals with a history of pulmonary disease and lung transplant. The cognitive domains affected implicate medial temporal structures as well as frontal/subcortical systems. These

data provide more detail about the frequency and nature of cognitive deficits in this population than has been previously available. Future directions include confirmatory factor analysis to examine domain integrity, correlational analyses among cognitive scores and disease factors (hypoxia, comorbidities, etc.), and sensitivity/specificity analyses of cognitive screening tools. Longitudinal studies to distinguish deficits experienced prior to and after transplant are also being planned.

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**H. WADSWORTH, K. DHIMA, D.S. BROWN, L.H. LACRITZ, R. RUCHINSKAS, J. WHITE & M. CULLUM. Cognition and Balance in Normal Pressure Hydrocephalus Pre- and Post-Lumbar Drain.**

**Objective:** To examine cognition and balance in individuals with suspected normal pressure hydrocephalus (NPH) pre- and post-lumbar drain (LD).

**Participants and Methods:** 53 individuals with suspected NPH underwent neuropsychological (NP) and physical therapy (PT) assessments before and after LD. NP tests included MMSE, Trail Making Test A & B, Animal fluency, Hopkins Verbal Learning Test-Revised, and Digit Span forward and backward. The Berg Balance Scale (BBS) was used to assess balance. 27 subjects later received a diagnosis of NPH and underwent a ventriculoperitoneal shunt placement (SH+) for treatment and 26 did not undergo shunting (SH-).

**Results:** Frequency analysis showed the majority of patients in the SH+ group performed similarly or slightly better on NP tests following LD, although no mean differences reached statistical significance. Paired t-tests demonstrated a significant pre/post LD improvement on the BBS [ $t(26)=-6.138, p<.01$ ] [ $Mpre=37.67(9.85); Mpost=42.22(9.90)$ ] in the SH+ group, but not in the SH- group. Frequency analysis revealed that post-LD, the SH- group generally tended to perform slightly worse on the BBS and cognitive measures when compared to the SH+ group; however, no mean differences between groups reached statistical significance. There were no significant correlations between the BBS and cognitive measures in either group.

**Conclusions:** Cognition and balance appear to be orthogonal in NPH, suggesting that they are influenced by different underlying processes. Cognition scores were generally stable and balance scores improved in those with confirmed NPH. Furthermore, a trend toward worse balance and cognition was found in those who were not selected for shunting. These findings highlight the utility of combining NP and PT assessments in the evaluation and management of NPH.

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**A. WARD, K.E. HOLM, F.S. WAMBOLDT, E. KOZORA, D.J. MOSER, B.J. MAKE, J.D. CRAPO, K. MESCHEDE, H.D. WEINBERGER, K.L. MOREAU, R.P. BOWLER & K.F. HOTH. Perceived Cognitive Difficulties and Objective Neuropsychological Performance in Former Smokers with and without Chronic Obstructive Pulmonary Disease.**

**Objective:** Smoking is the primary risk factor for chronic obstructive pulmonary disease (COPD). Patients with COPD have cognitive deficits in executive functioning, processing speed, and memory. This study explored whether perceived cognitive difficulties are associated with objective cognitive performance in former smokers. We hypothesized that perceived cognitive difficulties would be associated with executive and memory performance beyond depression and COPD status.

**Participants and Methods:** 95 former smokers recruited from the COPD Gene study completed questionnaires (perceived cognitive difficulties: Cognitive Difficulties Scale [CDS]; and mood: Hospital Anxiety and Depression Scale [HADS]), neuropsychological assessment (memory recall, executive functioning, visual-spatial processing, and language), and pulmonary function testing (airflow limitation). Bivariate

Pearson correlations were conducted between the CDS and each cognitive domain. For significant correlations, simultaneous multiple linear regression was used to determine if perceived cognitive difficulties were associated with objective performance. The following covariates were included: age, sex, pack-years, premorbid functioning (WRAT-IV Reading), HADS total, and COPD status (yes/no).

**Results:** Bivariate correlations were significant for the CDS and executive functioning ( $r=-.24, p<.05$ ) and language ( $r=-.24, p<.05$ ). Higher perceived cognitive difficulties were associated with worse executive functioning ( $\beta=-.072, SE=.034, p<.05$ ), with significant covariates of sex ( $p<.05$ ), WRAT-IV Reading ( $p<.05$ ), and COPD status ( $p<.05$ ). Perceived cognitive difficulties were not associated with language ( $p>.05$ ).

**Conclusions:** Perceived cognitive difficulties were associated with objective performance on executive functioning tasks in former smokers beyond the effect of COPD status and depression. Clinicians should be aware that cognitive complaints may be indicative of executive dysfunction in COPD and former smokers.

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**V.J. WASSERMAN, A. JAYWANT, M. KEMPPAINEN & A. CRONIN-GOLOMB. Parkinson's Disease Affects the Perception of Motion-Defined Gestures.**

**Objective:** Parkinson's disease (PD) is associated with altered social cognition and visual perception. Little is known, however, about how the disease affects perception of socially complex biological motion, specifically motion-defined communicative and non-communicative gestures. We predicted that individuals with PD would perform more poorly than normal control (NC) participants in discriminating between communicative and non-communicative gestures, and in describing communicative gestures. We related gesture perception to the participants' level of motor disability and gender, because action perception depends in part on the integrity of the motor system, and there are gender differences in social cognition in PD.

**Participants and Methods:** We assessed 23 individuals with PD (10 men) and 24 NC adults (10 men) who were matched for age and education level. Participants viewed point-light human figures that conveyed communicative and non-communicative gestures. Participants were asked to describe each gesture and decide if the gesture was "communicative" or "non-communicative." Motor disability was quantified using the Unified Parkinson's Disease Rating Scale. Social functioning was assessed with the Social Adaptation Self-Evaluation Scale.

**Results:** Statistical analyses were conducted using ANOVA and Spearman rank-order correlations. PD as a group were less accurate than NC in describing only non-communicative gestures ( $p < .01$ , Cohen's  $d = .82$ ). Men with PD were impaired in describing and discriminating between communicative as well as non-communicative gestures ( $p's < .09$ , Cohen's  $d's > .75$ ). There was no correlation between gesture perception and social functioning or motor disability in PD.

**Conclusions:** The present study demonstrated PD-related impairments in perceiving and inferring the meaning of biological motion gestures. Men with PD may have particular difficulty in understanding the communicative gestures of others in interpersonal exchanges. This research was supported by NINDS grants F31NS078919 and R01NS067128.

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**M. WOJTOWICZ, K. GOOD, C. STOREY, D. LEWIS, R. MCKELVEY, H. ROBERTSON & J. FISK. Olfaction and Cognition in First-Degree Relatives of Individuals with Parkinson's Disease.**

**Objective:** Patients with Parkinson's disease (PD), even in its early stages, are known to demonstrate olfactory deficits. There is also evidence suggesting that asymptomatic relatives of individuals with PD who demonstrate hyposmia, are at increased risk for developing PD

in the future. The purpose of this study was to compare measures of olfaction as well as measures of information processing speed and performance variability in asymptomatic first-degree relatives of persons with PD and matched controls.

**Participants and Methods:** Asymptomatic first-degree relatives of individuals with PD [FDR group;  $n=20$ ,  $M(SD)$  Age= $53.30$  ( $7.13$ )] and matched healthy controls [ $n=18$ ;  $M(SD)$  Age= $52.67$  ( $9.42$ )] completed the University of Pennsylvania Smell Identification Tests (UPSIT) and the Computerized Test of Information Processing (CTIP). The CTIP includes three reaction time subtests that progressively increase in complexity and cognitive processing demands (i.e., a simple reaction time, SRT; choice reaction time, CRT; semantic search reaction time, SSRT). **Results:** Mean UPSIT scores did not differ between groups ( $p>.05$ ). Seven individuals (35%) in the FDR group scored below established cutoff scores on the UPSIT compared with 3 individuals (16.7%) in the control group ( $p>.05$ ). Mean reaction times (RT) on the CTIP increased with test complexity (all  $ps<.001$ ) in both groups but there were no significant differences in mean RT between groups ( $p>.05$ ). However, the FDR group demonstrated greater performance variability on the SRT task compared to healthy controls ( $p=0.02$ ; Cohen's  $d=.79$ ).

**Conclusions:** There were no significant differences in olfactory performance between the first-degree relatives of individuals with PD and controls. However, first-degree relatives demonstrated greater performance variability in reaction time.

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**M. WOJTOWICZ, K. GOOD, C. STOREY, D. LEWIS, R. MCKELVEY, H. ROBERTSON & J. FISK. Olfaction, Information Processing Speed, and Performance Variability in Early Parkinson's Disease.**

**Objective:** Cognitive impairment and impaired olfaction are common in Parkinson's disease (PD) over time. However, sensitive measures of cognitive changes in early stages of PD remain limited. The purpose of this study was to examine olfaction, information processing speed, and performance variability in early stage PD.

**Participants and Methods:** Individuals with early PD ( $n=16$ ; modified Hoehn & Yahr stage 1-2.5) and healthy controls ( $n=18$ ) were compared. All PD patients were tested while taking their usual medications. Each participant completed the University of Pennsylvania Smell Identification Tests (UPSIT) and the Computerized Test of Information Processing (CTIP). The CTIP includes three reaction time subtests that progressively increase in complexity and cognitive processing demands (i.e., a simple reaction time, SRT; choice reaction time, CRT; semantic search reaction time, SSRT).

**Results:** Participants with PD had poorer olfactory identification scores on the UPSIT compared to healthy controls ( $p<.001$ ); 87.5% of the PD patients scored below established cutoff scores for the UPSIT. Mean reaction time (RT) and intra-individual variability (IIV) on the CTIP were analyzed using repeated measures ANCOVAs that included age as a covariate; age was non-significant ( $ps>.05$ ). Mean RTs increased with test complexity on the CTIP ( $ps<.05$ ) in both groups. PD patients were both slower and more variable on all subtests of the CTIP ( $ps<.01$ ). In order to examine information processing speed independent of motor speed, we examined performance on CRT and SSRT, while controlling for SRT performance. Using this method, mean RTs for the PD patients remained significantly slower on the SSRT task ( $p=.004$ ) but not the CRT task ( $p>.05$ ).

**Conclusions:** Early-stage PD patients demonstrated poor performance on a smell identification test. These individuals also demonstrated slower response speed and more variable performance on computerized tests of information processing speed.

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**K.A. WYMAN-CHICK, P.K. MARTIN, R.W. SCHROEDER, K.L. DINH & A.M. RACH. Verbal fluency in parkinsonism with and without dopaminergic deficiency on [123I]-FP-CIT SPECT imaging.**

**Objective:** There are no studies examining cognition in individuals with parkinsonism who demonstrate normal dopamine uptake on [123I]-FP-CIT SPECT imaging [i.e., Scans Without Evidence of Dopaminergic Deficiency (SWEDD)]. Verbal fluency deficits are often present in parkinsonism; therefore the purpose of this study is to determine if participants with SWEDD have similar verbal fluency performance to those individuals who demonstrate dopaminergic deficiency on imaging.

**Participants and Methods:** Data for the present study were obtained from Parkinson's Progression Marker Initiative. Participants diagnosed with idiopathic Parkinson's disease were included in the study if they completed tests of verbal fluency at baseline and 24-months and SPECT imaging. Forty-two participants had SWEDD, while 255 participants had evidence of dopamine deficiency. ANCOVAs were used to compare category and letter verbal fluency performance between the two groups at baseline and 24-months, controlling for education and motor symptom severity.

**Results:** At baseline, group differences in both letter and category verbal fluency were not significant at  $p<.05$ . At 24-months, letter fluency performance was significantly worse in the SWEDD group compared to the dopamine deficient group  $F(1, 293) = 9.72$ ,  $p=.002$ ,  $\eta^2 = .032$ ; as was category fluency,  $F(1, 293) = 5.67$ ,  $p=.019$ ,  $\eta^2 = .019$ , after controlling for education and motor symptom severity. Education was significantly related to letter fluency,  $F(1, 293) = 33.69$ ,  $p<.001$ ,  $\eta^2 = .103$ , but not category fluency. Motor symptoms were significantly related to letter fluency,  $F(1, 293) = 6.50$ ,  $p=.011$ ,  $\eta^2 = .022$  and category fluency,  $F(1, 293) = 5.76$ ,  $p=.017$ ,  $\eta^2 = .019$ .

**Conclusions:** Among individuals with parkinsonian symptoms, individuals with SWEDD have significantly worse verbal fluency after 24-months than those with dopaminergic deficiency on SPECT imaging. The results suggest deficits in verbal fluency, in some individuals with parkinsonism, seem to be related to changes outside of the dopaminergic system.

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**K.A. WYMAN-CHICK, K.L. NETSON, P.K. MARTIN & R.W. SCHROEDER. Equivalency of verbal fluency categories among older adults with Parkinson's disease.**

**Objective:** Deficits in category fluency are common among patients with Parkinson's disease. While different categories have been used to measure verbal fluency across studies, research comparing the equivalency of categories has examined raw scores rather than standardized scores, limiting clinical utility and interpretation. The purpose of the current study is to examine equivalency of performance across three different semantic categories when standard scores are utilized.

**Participants and Methods:** Data from the Parkinson's Progressive Marker Initiative (PPMI) were used in this study. This study examined 249 participants with Parkinson's disease over the age of 60 ( $M = 67.63 \pm 5.25$ ). Average education was 15.71 ( $\pm 3.37$ ) years. Mean symptom duration was 21.78 ( $\pm 22.01$ ) months. The sample was 68.7% male and 95.2% Caucasian. Three verbal fluency categories were administered: animals, vegetables, and fruits. Raw scores were converted to z-scores using normative age-based data. Repeated-measures ANOVA was conducted to compare means of verbal fluency performance across categories.

**Results:** Mauchly's test indicated the condition of sphericity had been met,  $\chi^2(2) = 0.991$ ,  $p=.32$ . There was a significant effect of verbal fluency category on cognitive performance,  $F(1.78, 442.03) = 383.85$ ,  $p<.001$ ,  $\omega^2 = .064$ . Pairwise comparisons using a Bonferroni correction revealed significant findings: Participants performed better on animal fluency ( $M = -0.05 \pm 0.93$ ) than vegetable fluency ( $M = -0.54 \pm 1.12$ )



and fruit fluency ( $M = -0.45 \pm 1.15$ ); however vegetable fluency and fruit fluency performances did not differ significantly.

**Conclusions:** Verbal fluency categories are not equivalent in older individuals with Parkinson's disease, even when using age-corrected standardized scores. Clinicians should be aware of these differences when selecting and interpreting category fluency tests in this population. Further research is needed to determine which category is most accurate in detecting impairments in semantic fluency.

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## Dementia (Non-AD)

**K. KRISHNAN, M.M. MACHULDA, J.L. WHITWELL, A.M. BUTTS, J.R. DUFFY, E.A. STRAND, M.L. SENJEM, A.J. SPYCHALLA, C.R. JACK JR., V. LOWE & K.A. JOSEPHS. Clinical Profiles of Logopenic Primary Progressive Aphasia based on FDG-PET.**

**Objective:** The logopenic variant of primary progressive aphasia (lvPPA) appears to be heterogeneous based on differing clinical presentations, and on varying patterns of hypometabolism observed on fluorodeoxyglucose 18-F positron emission tomography (FDG-PET). This study investigated differences between left temporal predominate and left parietal predominate variants of lvPPA, classified based on predominant pattern of hypometabolism on FDG-PET.

**Participants and Methods:** Fifty-four patients were diagnosed with lvPPA and underwent neurological and neuropsychological evaluations, apolipoprotein genotyping, and FDG-PET. All were amyloid-positive with Pittsburgh Compound B (PiB) PET. Patterns of FDG-PET hypometabolism were qualitatively assessed by five investigators who reliably classified all 54 patients into left temporal predominate and left parietal predominate groups. Demographic, neuroimaging, genetic, neurological and neuropsychological profiles were compared across both groups.

**Results:** Thirty-nine patients were classified as temporal predominate and 15 as parietal predominate. There were no significant differences between groups on demographic measures, language tests, apolipoprotein E genotype, or global PiB deposition. Individuals with the parietal predominate pattern demonstrated significantly greater behavioral dyscontrol, lower recall and recognition on memory measures, and more impaired cognitive flexibility (false discovery rate = 0.05).

**Conclusions:** We have demonstrated that lvPPA is not a homogeneous syndrome. A subset of patients with lvPPA, characterized by predominant parietal hypometabolism, show greater cognitive dysfunction and more behavioral features than the more typical temporal predominant lvPPA.

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## Psychopathology/Neuropsychiatry (Including Schizophrenia)

**R.S. SCHEIBEL, N.J. PASTOREK, M. TROYANSKAYA, J. KENNEDY, J.L. STEINBERG, M. NEWSOME, X. LIN & H.S. LEVIN. A Preliminary Investigation of Stress Symptoms and Cognitive Control-Related Brain Function Following OEF/OIF Deployment.**

**Objective:** Cognitive functional magnetic resonance imaging (fMRI) paradigms have found altered activation in subjects with posttraumatic stress symptoms (PTSS). These changes have included decreased activation within association cortex, especially frontal areas involved in executive functions, as well as increases within others involved in emotion, autonomic regulation, and basic sensory and motor functions.

However, the previous studies had used a global PTSS score. The present investigation used individual cluster scores to examine relationships with avoidance-numbing (AN), hyperarousal (H), and re-experiencing (RE) symptoms.

**Participants and Methods:** A cognitive control fMRI paradigm (i.e., Arrows Task) was used to examine 15 subjects who had been deployed to Afghanistan or Iraq, seven of whom had scores above 38 on the Posttraumatic Stress Disorder Checklist (PCL-C). Image correlation analyses were completed for each of the three PCL-C cluster scores.

**Results:** Within the full sample the analyses for all three PCL-C cluster scores revealed negative correlations consistent with suppressed activation throughout large portions of the brain. When high PCL-C subjects were examined separately both positive and negative correlations were significant. More extensive suppression was observed within temporal lobe structures for RE, while AN and H had suppressed right dorsolateral prefrontal cortex activation that was not found with RE. Higher scores on all three PCL-C clusters were associated with enhanced activation within right anterior insula, but only RE also had increases within the left insula.

**Conclusions:** While engaging cognitive control the elevations on all three PCL-C cluster scores were associated with neural dysfunction. Despite high overlap for suppressed activation, there were also unique areas for each PCL-C symptom cluster. Areas with enhanced activation were more constrained and the only one that was common to all PTSS was the right anterior insula, a structure involved in interoception and autonomic regulation.

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## INS Early Career Award Presentation: Non-Pharmacologic Treatment of Memory Deficits in Mild Cognitive Impairment

**Presenter: Benjamin M. Hampstead**

**2:30–3:30 p.m.**

**B.M. HAMPSTEAD. Non-Pharmacologic Treatment of Memory Deficits in Mild Cognitive Impairment.**

Memory deficits characterize Alzheimer's disease and its clinical precursor amnesic mild cognitive impairment (aMCI). While a growing body of research furthers our understanding of the detection, characterization, and neuroanatomy of these memory deficits, the clinical translation of these findings has lagged. So, providers continue to be faced with the critical question of "What can I do about it?" Treatment is typically limited to a handful of medications that are, at best, marginally successful. This limitation has fostered a growing interest in non-pharmacologic treatment methods for minimizing learning and memory deficits, approaches that include cognitive training and cognitive rehabilitation. These techniques hold promise but remain poorly (or mis-)understood. In this session, I will first discuss several key methodological issues that plague cognitive training (CT) and cognitive rehabilitation (CR) in aMCI. I will then use a hierarchical model to evaluate whether common techniques used in CT and CR (e.g., spaced retrieval, mnemonic strategies) are beneficial for teaching specific content versus enhancing a general cognitive process. Finally, I will discuss the use of non-invasive electrical brain stimulation as another promising treatment approach that may enhance cognition directly or indirectly via interactions with cognitive intervention. Examples from ecologically-relevant memory paradigms that we have developed will be included throughout and functional magnetic resonance imaging (fMRI) evidence of technique-dependent change will be used to discuss possible mechanisms of action. Patient-specific predictors, such as neuropsychological performances and brain volumes, will be integrated since these factors are

vital for selecting techniques that are most beneficial at the individual patient level.

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## Paper Session 8. Executive Functions/Frontal 1

**Moderator: Katherine L. Possin**

**2:30–3:30 p.m.**

### **B.M. BETTCHER, D. MUNGAS, N. PATEL, J. ELOFSON, S. DUTT, M. WYNN, C. WATSON, M. STEPHENS, C. WALSH & J.H. KRAMER. Neuroanatomical Substrates of Executive Functions: Beyond Prefrontal Structures.**

**Objective:** Executive functions are often considered lynchpin “frontal lobe tasks”, despite evidence that a network of anterior and posterior structures supports them. We assessed whether prefrontal grey matter volumes independently predict executive function performance when statistically differentiated from global atrophy and individual non-frontal lobar volume contributions.

**Participants and Methods:** All community-dwelling participants (n=202) were administered comprehensive executive function measures and a subset (n=183) obtained neuroimaging. We developed a latent variable model to decompose lobar grey matter volumes into a global factor and specific lobar volumes that were independent of global grey matter. We then added mean fractional anisotropy (FA) for frontoparietal white matter regions to the models.

**Results:** Results suggested that the 2-factor model (cognitive control, updating/working memory) plus a speed factor best explained our data. Global grey matter was related to the executive function and speed variables in all four lobar models, but none of the effects testing incremental contributions of lobe-specific volumes were significant. In contrast, when assessing the effect of white matter FA, cingulum FA made independent contributions to updating/working memory ( $\beta=.25$ ) and corpus callosum FA was independently related to cognitive control ( $\beta=.24$ ) and speed ( $\beta=.31$ ).

**Conclusions:** Study findings indicate that while prefrontal grey matter volumes are associated with measures of executive functions in older adults, they do not independently predict executive functions when statistically isolated from global atrophy and individual non-frontal lobar volume contributions. In contrast, better microstructure of frontoparietal white matter continued to predict executive functions after accounting for global grey matter atrophy. These findings contribute to a literature suggesting that prefrontal contributions to executive functions cannot be viewed in isolation from more distributed grey and white matter effects.

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### **K.D. BROWN, K. AGBAYANI, J. ZHANG, G. BRITZ & M.F. DULAY. Study of the executive function network after focal stroke to frontal lobe, cerebellum, thalamus or pons.**

**Objective:** Executive impairments are primarily associated with frontal lobe damage, but functional imaging and lesion studies have also identified subcortical regions critical to normal executive function. Previous studies propose the presence of feedforward fronto-ponto-cerebellar and feedback cerebello-thalamo-frontal loops within the executive network. It remains unclear if focal damage to any location along this network results in similar rates of executive impairment. We compared the frequency of executive impairments after focal unilateral stroke to the frontal lobe, cerebellum, thalamus and pons.

**Participants and Methods:** Eighty-four patients (ages 32-90; 67% male; mean education=14.9 years; mean age=59.7 years) who sustained a unilateral stroke were tested an average of 4 months after injury. Patients who sustained unilateral frontal lobe (N=23), cerebellar (N=25), thalamic (N=19), and pons (N=17) strokes received measures of phonemic fluency, mental flexibility, organization, practical problem solving and abstract reasoning. Exclusion criteria included multifocal or bilateral stroke based on MRI of the brain and a MMSE score below 25.

**Results:** There were no between-groups differences in demographic variables. Frontal lobe, cerebellar and thalamic strokes had similar rates of impairment on mental flexibility tasks (58% frontal, 52% cerebellar, and 47% thalamic; Fisher’s exact test  $p>0.05$ ). Thalamic and frontal lobe strokes had significantly higher rates of impairment on phonemic fluency compared to cerebellar and pons strokes (67% frontal, 65% thalamic, 45% cerebellar, and 44% pons; p values  $<0.05$ ).

**Conclusions:** About half of patients who sustained a stroke in the fronto-ponto-thalamo-cerebellar loop exhibited executive difficulties. Damage to the network appears to result in a type of disconnection dysexecutive syndrome.

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### **A.K. MILLER & M.R. BASSO. Neuropsychological and Behavioral Correlates of Impulsivity among Substance Abusing Women.**

**Objective:** Individuals who abuse drugs and alcohol are apt to behave impulsively (Nielsen et al., 2012) and prone to manifest neuropsychological impairment, especially executive function deficits (Kalechstein & Newton, 2007). Diminished executive function and impulsive tendencies may diminish an individual’s ability to act purposefully and persist in goal-directed behaviors. Completing treatment for substance misuse requires sustained effort and self-control, which may be diminished by impulsivity or poor executive function. The present study examined the impact of impulsivity and executive function on treatment outcomes among women enrolled in a court-ordered substance abuse treatment program.

**Participants and Methods:** 53 women (age: M=32.55; education: M=10.64) were administered the UPPS-P, a self-report measure of impulsivity (Cyders et al., 2007), and a battery of neuropsychological tests, including the Iowa Gambling Task (IGT) and Color-Word Interference and Verbal Fluency subtests from the D-KEFS at the start of treatment. Six-months later, treatment outcomes were assessed (i.e., continued status in treatment, therapist ratings of treatment engagement, and self-reported distress).

**Results:** Multiple regression evaluated the relative importance of the UPPS-P and measures of executive function in predicting treatment outcomes. The IGT, D-KEFS Color-Word Interference and Verbal Fluency subtests, and UPPS-P achieved significance ( $p’s<0.05$ ) and the semi-partial correlations ranged from 0.18 to 0.61.

**Conclusions:** Measures of executive function and a self-report measure of impulsivity predicted treatment response for substance abusing women. Worse executive function and higher impulsivity predicted worse treatment outcomes. The results have meaningful implications for future treatment planning. For example, patients with compromised executive function or elevated impulsivity might benefit from a treatment approach that emphasizes concrete, specific, and practical advice and problem-solving assistance (Bates et al., 2002).

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### **J. DONELAN, T. HARRISON GOLDMAN, R. MCLEAN & V. D’SA. Early lead exposure in children. Is there a neuropsychological effect?**

**Objective:** Despite a significant decrease in blood level concentrations in children, childhood lead exposure continues to be one of the most critical and preventable environmental problems among childhood diseases.

In 2012, CDC guidelines for childhood lead poisoning were decreased from 10 µg/dl to the 5 µg/dL level. This study investigated the effect of childhood lead exposure on attention and executive functioning (EF). **Participants and Methods:** Neuropsychological data from 205 children (age 5-17 yrs : M=10.27, SD=3.04) seen in a neurodevelopmental clinic were linked to state health department records of blood lead testing. Children were categorized based on their highest level of lead (high (HLL)=≥5 µg/dL, n=72; low (LLL)=≤4 µg/dL, n=133); lead level was also assessed continuously.

**Results:** Groups were comparable in age and Full Scale IQ, although the LLL group was more likely to be diagnosed with ADHD. On attention measures (CPT-II), the HLL group made more commission errors  $t(49.029) = 2.235$ ,  $p = .03$  and a weak but significant correlation was found between lead level and commission errors ( $r = .231$ ,  $p = .031$ ). Parent ratings of EF difficulties (BRIEF) indicated the LLL group showed greater metacognitive difficulties  $t(95) = 2.150$ ,  $p = .034$ ; there was a trend in this direction for the Global Executive Composite  $t(95) = 1.929$ ,  $p = .057$ . No differences were found when examined continuously.

**Conclusions:** The results suggest that high levels of lead exposure have an impact on individual measures of attention as assessed via laboratory measures. In contrast, parents may not be as aware of the impact of lead on EF in everyday life. Further research using longitudinal designs and non-clinical controls is needed

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## Paper Session 9. Mild Cognitive Impairment (MCI)

Moderator: Jill Razani

2:30–3:30 p.m.

**K.J. BANGEN, A.L. CLARK, M.L. WERHANE, E.C. EDMONDS, D.A. NATION, N.D. EVANGELISTA, M.W. BONDI & L. DELANO-WOOD. Cortical Amyloid Burden in Empirically-Derived Mild Cognitive Impairment Subtypes.**

**Objective:** We examined positron emission tomography (PET) imaging levels of cortical beta-amyloid, a hallmark protein in Alzheimer's disease (AD), across empirically-derived mild cognitive impairment (MCI) subgroups and cognitively normal older adults.

**Participants and Methods:** 584 ADNI participants (445 MCI, 139 normal controls [NC]) underwent florbetapir PET amyloid imaging and neuropsychological testing. Of those with ADNI-diagnosed MCI, a previous cluster analysis (Bondi et al., 2014) classified 51% of the current sample as Amnesic MCI, 8% as Dysexecutive/Mixed MCI, and 41% as belonging to a Cluster-Derived Normal (i.e., cognitively normal) group.

**Results:** The Dysexecutive/Mixed and Amnesic MCI groups showed significantly greater amyloid deposition relative to the Cluster-Derived Normal and NC groups who did not differ from each other. Approximately 78% of the Dysexecutive/Mixed MCI, 62% of the Amnesic MCI, 41% of the Cluster-Derived Normal, and 34% of the NC group exceeded the threshold for amyloid positivity. We found a group by apolipoprotein E (APOE) genotype interaction whereby, relative to APOE ε4 non-carriers, ε4 carriers within the Amnesic MCI, Cluster-Derived Normal, and NC groups showed greater amyloid deposition. Within the Dysexecutive/Mixed MCI group, who showed greater cognitive impairment and may have been farther along in the disease course, amyloid deposition did not differ between APOE ε4 carriers and non-carriers.

**Conclusions:** Empirically-derived MCI subtypes show considerable heterogeneity in florbetapir PET amyloid levels. The group x APOE interaction raises the possibility that, among APOE ε4 carriers, amyloid may play a larger role early in the disease course compared to those without an ε4 allele. Our findings further support that conventional criteria for MCI are susceptible to false positive diagnostic errors, and

underscore the notion that amyloid deposition may be nonspecific given its common occurrence across heterogeneous cognitively impaired and normally aging groups.

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**C. PETTIGREW, A. SOLDAN, Y. ZHU, M. WANG, T. BROWN, M. MILLER & M. ALBERT. Cortical Thickness and Cognitive Reserve in Relation to Clinical Symptom Onset in Preclinical AD.**

**Objective:** We examined whether cortical thickness in 'AD vulnerable regions' was related to time to clinical symptom onset during preclinical Alzheimer's disease (AD), and whether cognitive reserve (CR) modified this relationship.

**Participants and Methods:** These analyses included 240 participants from the BIOCARD cohort who were cognitively normal and primarily middle-aged at baseline (M age = 56 years). Participants have been followed for up to 19 years with annual clinical and cognitive assessments; of the 240, 52 have developed MCI or AD dementia.

The average cortical thickness of 'AD vulnerable regions' was measured from baseline MRI scans, including: 4 temporal, 3 parietal, and 2 frontal regions (obtained from FreeSurfer). CR was indexed with a composite score combining education and baseline scores on the National Adult Reading Test and vocabulary. Cox regression models (co-varying age and gender) were used to determine whether thickness in AD vulnerable regions was associated with time to onset of clinical symptoms, and whether CR modified this association.

**Results:** The mean time from baseline to clinical symptom onset was 7 years. Lower cortical thickness was associated with an increased risk of progression from normal cognition to clinical symptom onset within 7 years ( $p = .03$ ), but not with progression more than 7 years from baseline ( $p = .95$ ). Additionally, higher CR was associated with a reduced risk of progression ( $p < .001$ ). There was no interaction between CR and cortical thickness in relation to risk of progression to symptom onset within 7 years ( $p = .41$ ).

**Conclusions:** Cortical thinning in AD vulnerable regions is detectable in cognitively normal individuals several years prior to the onset of clinical symptoms that are a harbinger of a diagnosis of MCI. These results suggest that measures of cortical thickness and CR in preclinical AD are independently associated with time to clinical symptom onset within seven years.

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**D.J. LIBON, K. GIFFORD, T. HOHMAN, E.M. LANE, K. PECHMAN, M. PRIDMORE, L. ACOSTA, L. LOGAN, K.M. WISNIEWSKI, M. WIGGINS, C. SEABOLT, R. MARTIN-WILLET, C. DUNIFON, M. BABICZ, M. THURSBY & A.L. JEFFERSON. Dissociating Constructs Underlying Working Memory in Mild Cognitive Impairment: A Competitive Queuing Analysis.**

**Objective:** Competitive queuing (CQ) models of working memory (WM) posit two hierarchical mechanisms: (1) excitatory parallel planning responsible for item activation; and (2) inhibitory competitive choice/response suppression responsible for simultaneous item recall followed by item suppression. The current research sought to dissociate these mechanisms in participants with mild cognitive impairment (MCI).

**Participants and Methods:** Participants were drawn from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging, including single domain amnesic MCI (aMCI; n=58), multi-domain MCI (mMCI; n=46) and normal controls (NC; n=124). WM was assessed with a seven trial 5-span backward digit span test. ANY ORDER recall (recall regardless of correct serial position) defined CQ parallel processing; SERIAL ORDER recall (recall in exact serial position) defined CQ competitive choice/response

suppression. Serial order position effects, hippocampal volume, and white matter hyperintensity (WMH) burden were also quantified.

**Results:** Adjusting for age and MOCA scores, groups differed for ANY ORDER ( $p < 0.001$ ) and SERIAL ORDER recall ( $p < 0.04$ ). Within-group analyses found the expected recency effect (better recall for serial order position 5 vs. serial order position 4;  $p < 0.001$ ) for aMCI and NC groups. However, progressively worse decline across all 5 serial order positions was noted among mMCI participants ( $p < 0.01$ ). Regression analyses found better SERIAL RECALL was associated with larger hippocampal volume ( $\beta = 0.231$ ;  $p < 0.02$ ).

**Conclusions:** In mMCI reduced ANY ORDER/ SERIAL ORDER and recency effects suggests WM impairment involving both CQ mechanisms. In aMCI WM deficits may be limited to impaired CQ inhibitory competitive choice/ response suppression. Regression analyses suggest better SERIAL ORDER and competitive choice/ response suppression is associated with greater hippocampal volume.

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**B.M. BETTCHER, M. WYNN, L. JASTRZAB, S. WILKINS, J.H. KRAMER & G. COPPOLA. Pro- and Anti-Inflammatory SNPs Predict Memory Performance in Mild Cognitive Impairment.**

**Objective:** Accumulating evidence suggests that inflammatory processes play a role in Alzheimer's Disease (AD). Despite this established association, little is known about how inflammation-related genes relate to memory function in the earliest stages of pathogenesis. We hypothesized that pro- and anti-inflammatory single nucleotide polymorphisms (SNPs) would independently predict memory function in Mild Cognitive Impairment.

**Participants and Methods:** DNA specimens for 55 amnesic MCI's and 24 normal controls were genotyped for pro-inflammatory IL-6 (rs1800795) and anti-inflammatory IL-10 (rs1800896) promoter SNPs. Blood levels of IL-6 and IL-10 were also assayed. All participants completed measures of list learning (CVLT-II short form; 10' delay) and visual memory (Benson Figure; 15' delay), and a subset completed a novel measure of pattern separation (Stark MST; Percent Correct).

**Results:** MCI participants showed greater likelihood of homozygosity for the A allele of IL-10 SNP rs1800896, and showed lower levels of peripheral IL-10 levels than healthy controls. Controlling for demographics and diagnosis, the C/C genotype of the IL-6 SNP was associated with better verbal memory recall (accounting for overall learning;  $t = 2.62$ ,  $p = .01$ ) and pattern separation ( $t = 2.40$ ,  $p = .02$ ) than the G/G genotype. The A/A genotype of the IL-10 SNP was associated with worse verbal memory recall ( $t = -2.56$ ,  $p = .01$ ) and delayed visual recall ( $t = -2.76$ ,  $p = .008$ ) relative to the G/G genotype. When SNPs were entered into the model simultaneously, both contributed significantly to verbal memory outcomes, and were more strongly related to delayed recall than peripheral cytokine levels of IL-6 and IL-10.

**Conclusions:** Results suggest a potential role for pro-(IL-6) and anti-inflammatory (IL-10) SNPs in modulating episodic memory performance in MCI. These findings add to a growing body of literature on inflammatory processes in neurodegenerative disease, and highlight the need for further assessment of immunogenetic underpinnings of AD.

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## Paper Session 10. Cancer

**Moderator: Kevin R. Krull**

**2:30–3:30 p.m.**

**Y. CHEUNG, W.E. REDDICK, T.M. BRINKMAN, J.O. GLASS, L. ROBISON, C. PUI, M.M. HUDSON & K.R. KRULL. White Matter Integrity, Neurocognitive and Neurobehavioral Outcomes in Long-term Survivors of Childhood Acute Lymphoblastic Leukemia (ALL).**

**Objective:** To examine the association between white matter integrity, as reflected through diffusion tensor imaging (DTI), and neurocognitive/ neurobehavioral outcomes in long-term survivors of ALL treated with chemotherapy only.

**Participants and Methods:** Of 302 eligible ALL survivors treated on a chemotherapy protocol that omitted cranial irradiation, 213 (70.5%) (mean[SD] age = 14.6[4.7] years; time since diagnosis = 7.7[1.8] years) completed comprehensive neurocognitive testing. Parents completed the Behavior Rating Inventory of Executive Function. DTI was collected in 174 of these survivors to assess white matter integrity. Fractional anisotropy (FA), radial diffusivity (RD) and axial diffusivity (AX) were extracted from voxels in frontal and parietal regions of interest, as well as within the frontostriatal tract. Generalized linear models were used to examine associations between DTI and neurocognitive/neurobehavioral scores, adjusting for current age.

**Results:** Compared to population norms, survivors demonstrated lower performance on measures of executive function, processing speed, attention and memory, and had more parent-reported neurobehavioral problems (all  $p$ 's  $< 0.01$ ). Worse cognitive flexibility, fluency and visual-motor processing speed were associated with higher RD in bilateral frontal (all  $p$ 's  $< 0.05$ ) and parietal ( $p$ 's  $< 0.05$ ) regions. Inattentiveness was associated with lower FA in frontal regions ( $p$ 's  $< 0.05$ ) and higher FA in the frontostriatal tract (left:  $p = 0.007$ ; right:  $p = 0.04$ ). Neurobehavioral problems were associated with lower FA in the frontostriatal tract (working memory  $p = 0.008$ ; planning  $p = 0.015$ ) but not parietal or other frontal regions. Memory and visual-spatial skills were not associated with DTI measures.

**Conclusions:** White matter integrity in frontal and parietal regions is key to certain neurocognitive domains in long-term ALL survivors. Neurobehavioral problems are particularly associated with reduced integrity in the frontostriatal tract.

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**H.M. CONKLIN, J.M. ASHFORD, L. HUANG, H. ZHANG, D.J. INDELICATO, F.A. BOOP, P. KLIMO & T.E. MERCHANT. Cognitive Performance Before and After Proton Therapy in Children Recently Treated for Craniopharyngioma.**

**Objective:** Craniopharyngioma is a benign tumor that often behaves aggressively given location near critical brain structures and tendency to cause neurologic and endocrine deficits. Consensus is lacking regarding best treatment approach with some favoring radical surgery and others preferring limited surgery and radiation therapy. Proton therapy (PT) may offer better cognitive outcomes than conventional radiation therapy, given greater sparing of healthy brain tissue. In this study we investigated cognitive performance before and after PT.

**Participants and Methods:** Patients treated for craniopharyngioma [ $N = 78$ ; 9.7  $\pm$  4.7 years at baseline; 48.7% Male; 1.4  $\pm$  1.0 pre-PT surgeries] participated in comprehensive cognitive assessments prior to PT (baseline) and one year post PT ( $n = 45$ ), in an ongoing trial.

**Results:** At baseline, patients performed significantly worse than normative expectations ( $t$ -tests,  $p$ 's  $< .05$ ) on measures of memory (e.g., CVLT-C Total Trials), executive function (e.g., WISCIV Digit Span Backward) and fine motor dexterity (Grooved Pegboard), with parents reporting greater executive dysfunction (e.g., BRIEF Working Memory

Index), psychosocial distress (e.g., BASC-2 Internalizing) and lower adaptive functioning (e.g., ABASII Practical). Linear mixed models revealed more surgeries, more extensive surgery and presence of diabetes insipidus were predictive of worse baseline performance ( $p < .05$ ). Models also revealed significant declines in attention (WISCIV Digit Span Forward; BASC-2 Attention Problems) over time with male gender, more extensive pre-operative hypothalamic involvement, more extensive surgery and CSF diversion predictive of decline ( $p < .05$ ).

**Conclusions:** Prior to adjuvant therapy children with craniopharyngioma experience cognitive difficulties, which are influenced by surgical method and endocrine status. Following PT there are declines in attention related to patient, disease and treatment related factors. These findings may guide treatment planning and indicate targets for monitoring and intervention.

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**S. VUOTTO, T.M. BRINKMAN, C. LI, A. LOWN, J. MARCHAK, D. SRIVASTAVA, P. NATHAN, L. ROBISON, G. ARMSTRONG & K.R. KRULL. The Impact of Alcohol Consumption on Neurocognitive Dysfunction in Adult Survivors of Childhood Cancer.**

**Objective:** To examine associations between drinking patterns and neurocognitive impairment in adult survivors of childhood cancer.

**Participants and Methods:** Participants included 3,806 adult survivors of childhood cancer (mean[SD] age at evaluation = 34.7[6.0] years, time since diagnosis = 24.8[4.4] years) enrolled in the Childhood Cancer Survivor Study (CCSS). Impairment was defined as scores falling >90th percentile of sibling data on the CCSS Neurocognitive Questionnaire (NCQ), which includes scales for task completion, emotional regulation, organization, and memory. Exposures included age at drinking initiation (<18 vs. >18 years of age) and a pattern of heavy drinking (defined as heavy/risky drinking at study baseline and at 13 year follow-up). Risk ratios (RR) and corresponding 95% confidence intervals (CI) were calculated using log-binomial regression, with adjustment for current age, age at diagnosis, sex, and race.

**Results:** In multivariable models stratified by cranial irradiation (CRT) exposure, younger age at drinking initiation was associated with greater risk of memory impairment (CRT: RR=1.3, 95% CI: 1.0-1.7; non-CRT: RR=1.4, 95% CI: 1.1-1.8). Among survivors who did not receive CRT, younger age at drinking initiation (RR=1.4, 95% CI: 1.1-1.7) and heavy drinking (RR=1.5, 95% CI: 1.0-2.2) were associated with increased risk of emotional dysregulation. In the non-CRT group, heavy drinking also was associated with greater risk of impaired organization (RR=1.2, 95% CI: 0.8-1.9) and memory (RR=1.3, 95% CI: 0.8-2.0).

**Conclusions:** Our results suggest that younger age at drinking initiation is associated with increased risk of impaired memory beyond exposure to CRT in childhood. A pattern of heavy drinking over time is associated with impaired emotional regulation, organization and memory among survivors who were not treated with CRT. Early intervention to modify drinking behaviors may reduce risk of neurocognitive impairment among survivors.

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**A.R. STUDAWAY, T.M. BRINKMAN, R.P. OJHA, N. ZHANG, J. BUTLER, D. SRIVASTAVA, L. ROBISON, M.M. HUDSON & K.R. KRULL. Neurocognitive and Quality of Life Outcomes of Chronic Hepatitis C Infection among Adult Survivors of Childhood Cancer: A Report from the St. Jude Lifetime Cohort.**

**Objective:** To examine the association between chronic hepatitis C virus (HCV) infection and neurocognitive function and health-related quality of life (HRQOL) among adult survivors of childhood cancer.

**Participants and Methods:** Neurocognitive testing was conducted in 837 survivors of pediatric cancer (mean[SD] age = 35[7.4] years; time since diagnosis = 29[6.2] years) who received blood products prior to universal HCV screening. No significant differences were observed between confirmed HCV seropositive (n=80) and seronegative survivors (n=757) in sex, race, time since diagnosis, or neurotoxic treatment exposures. Survivors also completed a standardized measure of HRQOL. Multivariable Poisson regression models were used to compare outcomes between seropositive and seronegative survivors. Prevalence ratios (PR) and 95% confidence intervals (CI) were calculated.

**Results:** Seropositive survivors performed worse on measures of focused attention ( $P=0.001$ ), long-term verbal memory ( $P=0.01$ ), visual motor processing speed ( $P=0.006$ ), cognitive flexibility ( $P=0.001$ ) and verbal fluency ( $P=0.01$ ), compared to seronegative survivors. In multivariable models adjusted for sex, age at diagnosis, and cancer treatment exposures, seropositive survivors were at increased risk of impaired attention (RR=1.2; 95% CI: 0.9-1.6), memory (RR=1.3; 95% CI: 0.9-1.7), processing speed (PR=1.3; 95% CI: 1.0-1.6), and executive function (PR=1.3; 95% CI: 1.1-1.6). Seropositive survivors reported worse general (PR=1.6; 95% CI: 1.2-2.1), physical (PR=1.5; 95% CI: 1.1-2.3), and mental HRQOL (PR=1.5; 95% CI: 1.1-2.1).

**Conclusions:** Survivors of childhood cancer with history of HCV infection are at risk for neurocognitive impairment and reduced HRQOL, beyond the known risks associated with neurotoxic therapies. This HCV seropositive population may benefit from targeted assessment of neurocognitive functioning and HRQOL, and subsequent intervention. An assessment of liver status may also help guide treatment.

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## Plenary F. The Development of Executive Functions: Principles and Strategies for Aiding that and Differences by Genotype and Gender

Presenter: Adele Diamond

3:45–4:45 p.m.

**A. DIAMOND. The Development of Executive Functions: Principles and Strategies for Aiding that and Differences by Genotype and Gender.**

Among the most important abilities children can develop are the “executive functions” (EFs). EFs consist of 3 core skills: inhibitory control (e.g., resisting one's first impulse and giving a wiser, more considered response; staying focused and persevering), working memory (e.g., mentally working with and relating facts and ideas), and cognitive flexibility (e.g., thinking outside the box; looking at familiar problems in new ways; flexibly adjusting to changed demands or priorities). These are critical for reasoning, creative problem-solving, self-control, and success in all life's aspects. They are often more predictive than IQ or SES.

Executive functions depend on prefrontal cortex (PFC) and interrelated brain regions. Unusual properties of PFC make it vulnerable to environmental and genetic variations that have little effect anywhere else in the brain. This has implications for how best to treat different types of ADHD, why the brightest people sometimes have the most fragile personalities especially when stressed, and why the Yerkes-Dodson curve (that cognitive performance is better when one is a bit aroused rather than calm) does not seem to apply to females.

EFs can be improved even in the very young by exercising and challenging them, much as physical exercise hones our bodies. I will walk through some ways to aid EF development. A few widely-held beliefs will be de-bunked: Aerobic exercise (by itself) does not improve EFs (or memory). Transfer is not wide; people only improve on what they practice. I will also present the data that have led me to predict that the

activities that most successfully improve EFs will be found to be those that not only directly train and challenge diverse EF skills but also indirectly support EFs by addressing emotional, social, and physical needs. Learning Objectives

Become better able to describe what executive functions are.

Become better able to use information about the special properties of the dopamine system in prefrontal cortex in working with patients.

Become better able to explain principles and strategies for improving executive functions.

Become better able to discuss what the research says about fostering executive function development in children.

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### **Plenary G. Developing Neuropsychology in Developing Countries: An African Perspective**

**5:00–6:00 p.m.**

#### **A. WATTS. Developing Neuropsychology in Developing Countries: An African Perspective.**

More than 80% of the world's population live in the less developed countries (World Bank, 2014), where neurological, mental health,

developmental and substance use (NMDS) disorders are highly prevalent. This cluster of disorders represents a growing public health problem especially in these under resourced and less developed countries where the treatment gap and contribution to the burden of disease is disproportionately large. This underscores the need for neuropsychological research, education, training and services in these regions of the world. However, the relevance of neuropsychology, with its Western roots, in these countries is not immediately apparent to policy makers who frequently do not understand the complex impacts of NMDS disorders on population health and economic growth. Instead their focus is on preventing or containing the poverty and food insecurity which are prioritized as primary threats to development.

This presentation will address critical priorities and challenges related to establishing and growing neuropsychology within this context. In doing so an African perspective will be used to illustrate evolving issues, including relevance and elitism, the use of assessment and therapeutic techniques within the context of multicultural diversity, and human rights and policy imperatives.

Learning Objectives

As a result of participating in this course, the learner will be able:

To describe the specific public health problems that point to the need for neuropsychological research, education and training services in developing countries.

To explain the challenges related to applying neuropsychological principles developed in the West to contexts of multicultural diversity.

## **SATURDAY MORNING, FEBRUARY 6, 2016**

### **CE 11. War and the Brain: Neuropsychological Alterations among Returning Veterans**

**Presenter: Jennifer Vasterling**

**7:20–8:50 a.m.**

#### **J. VASTERLING. War and the Brain: Neuropsychological Alterations among Returning Veterans.**

Complaints of neurocognitive impairment have emerged after almost every major war-zone deployment in recent history. While contextualizing recent war-zone participation within this historical context, this course will focus on neurocognitive alterations among veterans of the wars in Iraq and Afghanistan. Often referred to as the “signature wounds” of contemporary military conflicts, the course will cover two primary risk factors for neurocognitive alterations in returning veterans: traumatic brain injury (TBI) and psychological stress. The course will review the literature on neuropsychological consequences of deployment TBI, especially focusing on mild TBI, the neuropsychological consequences of stress-related mental disorders, especially focusing on posttraumatic stress disorder (PTSD), and potential interactions between deployment TBI and PTSD.

Learning Objectives

As a result of participating in this course, the learner will:

Recognize relevant war-related neuropsychological risk factors, and Have greater facility in applying existing empirical findings addressing deployment-related TBI and PTSD to clinical practice.

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### **CE 12. Introduction to Ethics in the Mind- And Neuro-Sciences (Neuroethics)**

**Presenter: Eric Racine**

**7:20–8:50 a.m.**

#### **E. RACINE. Introduction to Ethics in the Mind- And Neuro-Sciences (Neuroethics).**

With advances in the behavioural and brain sciences, a new field of ethics, “neuroethics”, has emerged as an interdisciplinary response to important ethical dilemmas associated with research, health care delivery, and health policy. The field also attempts to capture insights from neuroscience to inform how we view ethics. This workshop will introduce to the history and development of neuroethics. Then, three examples of clinical practices and related research areas where the speaker has been active will be summarized and discussed with participants: (1) the use of deep brain stimulation in Parkinson's disease and in neuropsychiatric conditions; (2) the use of fMRI in disorders of consciousness; and (3) the ethical challenges associated with the use of cognitive enhancers. The final part of the workshop will focus on how psychologists can further contribute to the development of neuroethics.

Learning Objectives

Explain the emergence of the field of neuroethics

Recognize some current areas of ethical controversy

Engage in reflection on the contribution of psychologists to neuroethics

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## Poster Session 8. Cognitive Intervention/ Rehabilitation, Dementia, and Drugs

9:00–10:30 a.m.

### Cognitive Intervention/Rehabilitation

#### L.J. ALTMANN & J.P. WILSON. **Effects of Depth of Semantic Processing on Action Initiation.**

**Objective:** Theories of embodied cognition assert that processing action words impacts speed of initiation and movement of the referenced body part, which may benefit rehabilitation. We hypothesized that the degree of semantic activation in different word processing tasks would differentially impact reaching initiation.

**Participants and Methods:** Adults (N=34) aged 18-30 completed a reaching task in baseline and 3 experimental conditions, which required depressing a large button in front of them until a two-inch green dot appeared on a touch-screen monitor, then touching the dot. Immediately after depressing the button, participants performed one of four tasks, presented in blocks: nothing (baseline), or word reading, anagram solving, or category generation, all of which required producing a word aloud. Inter-stimulus intervals (ISI) between offset of voice response and the green dot varied (250 or 500ms). Stimuli included arm-action and non-action words. The dependent variable was the time from appearance of the green dot until button release (RT).

**Results:** Responses following word reading were fastest but insensitive to stimulus type. RTs following anagram solving of action words slowed relative to non-action words and baseline. RTs following word generation slowed regardless of stimulus type. After generating action words, RTs were significantly slower than after generating non-action words. Longer ISIs induced slower RTs following anagrams and category generation.

**Conclusions:** Unexpectedly, reading action words failed to facilitate reaching relative to non-action words. These results suggest two conclusions: 1) the greater effort expended on the priming task, the greater difficulty disengaging from that task to begin a second task, and 2) producing words semantically related to the planned action appears to exacerbate the difficulty with disengagement. Thus, using self-generated semantic cues to movement may hinder rather than help movement initiation.

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#### D. CHAPMAN, J.I. ALVA, H.J. THOMPSON & E. TRITTSCHUH. **Memory Skills Class Impact on Healthcare Utilization in Older Veterans with PTSD.**

**Objective:** Older Veterans with PTSD are at higher risk for dementia, but early detection can be confounded by the fact that PTSD is often associated with cognitive symptoms. Those at risk for decline may benefit from group psychoeducation that targets healthy brain aging. The “Memory Skills for Older Adults with PTSD” protocol is an outpatient psychoeducational class series developed at the VAPugetSound. This study utilized chart review to measure patterns of healthcare utilization in past participants.

**Participants and Methods:** Veterans: age>50, diagnosis of PTSD, subjective complaints and/or mild objective cognitive decline. Participants engaged in 8 - 1hr sessions utilizing a skills manual developed for this population. Retrospective chart review was performed to examine group participation and utilization of health and support services.

**Results:** The Vietnam era Veterans (n=25) ranged in age from 57-75 years. Service connection was in place for 72%, with PTSD connection from 30-100%. 80% of subjects completed 4+ sessions. Cognitive screenings had been done for 52% prior to the classes. Pre-existing conditions/risk factors for dementia included HTN, DM, CAD, and depression. Chart review reveals that they were actively engaged in

mental health services (96%) or under psychiatric care (84%) at time of enrollment and continued these services after class completion. Of the support and specialty services queried, mental health, psychiatry, neurology, physical therapy, and occupational therapy showed the greatest number of new services utilized, ranging 8-16%.

**Conclusions:** Memory Skills group participation varies and is associated with pre/post group utilization of health and support services, particularly mental health specialties, but also proactive specialty services. Future goals are to chart review additional group participants which may reveal new associations between group characteristics, service utilization, and cognitive outcome.

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#### C. ANDERSON-HANLEY, N. BARCELOS, M. MALONEY, M. MICHEL, K. STRIEGNITZ & T. SAULNIER. **Neuropsychological Effects of Interactive Physical & Cognitive Exercise System (iPACES) for Older Adults: Pilot Comparison of In-Home Neuro-Exergame Versus Neuro-Game.**

**Objective:** Physical exercise has been found to be a powerful force in brain health, with cognitive benefits seen in healthy as well as impaired older adults, and can be seen with only a single bout (Angavaren et al., 2008; Colcombe & Kramer, 2003; Hess et al., 2014). However, only about 16% of older adults exercise at recommended levels (CDC, 2013). “Neuro-exergaming” combines physical exercise with interactive virtual reality features that may motivate exercise and yield added cognitive benefit (Anderson-Hanley et al., 2012). Research is examining the salient features of such interventions, so that more powerful tools, perhaps tailored to specific cognitive problems, can be designed. This study evaluated the neuropsychological benefits of a workout with a theoretically-derived neuro-exergame compared with playing a sedentary neuro-game.

**Participants and Methods:** Ten older adults (mean age = 61 yrs.) were enrolled; eight completed two single bout sessions. First, participants played a tablet-based neuro-game Memory Lane© (learn errand locations, travel 3D path, then retrace path). Two weeks later, they completed an aerobic single bout playing Memory Lane© via an interactive Physical and Cognitive Exercise System (iPACES© 2013-2015 patent pending), where an under-table elliptical controlled the neuro-exergame. Tests of executive function (Color Trails, Stroop & Digit Span) were administered before and after each single bout.

**Results:** Pilot testing revealed it is feasible for older adults to use the iPACES at home. Neuro-exergaming yielded significantly greater improvement in Stroop than the game only (p=.019).

**Conclusions:** Pilot findings suggest added benefit of interactive physical and cognitive exercise, beyond neuro-gaming alone. Further research would be useful to confirm findings and explore factors that may be salient in the design of neuro-exergames.

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#### E. BARLOW-KRELINA, M. SADEGHI, C.A. GIBBONS, K. SHAIKH, W. FUNG, W. MESCHINO & C. TILL. **Efficacy of Working Memory Training for Individuals with Early-Stage Huntington’s Disease: A Pilot Study.**

**Objective:** Cognitive dysfunction is considered to be the most debilitating component of Huntington’s Disease (HD), with prominent deficits in working memory (WM). Difficulties can be observed early, with 40% of patients showing mild cognitive impairment prior to meeting diagnostic criteria for the disorder. There are currently no established treatments for these symptoms.

We aimed to assess whether completion of a WM training program led to improvements on standardized WM tasks that (1) resemble those

practiced (i.e. criterion measures), and (2) that involve WM but differ from the trained task (i.e. near-transfer measures), in patients with HD.

**Participants and Methods:** Six patients with early stage HD and cognitive dysfunction underwent a 25-day computerized adaptive WM training program (Cogmed). A coach made weekly phone contact to provide motivational and training support.

A cognitive battery was administered prior to and following the WM program. Criterion measures included the Weschler Memory Scale (WMS-III) tests of Digit Span and Spatial Span. Near-transfer measures included the WMS-IV test of Symbol Span and the Woodcock Johnson-III test of Auditory WM.

**Results:** Four patients completed the program within the six-week recommended timeframe ( $M=36.5\pm 4.0$  days). Each of these patients had improved performance on the trained tasks (mean improvement score= $15.5\pm 14.7$ ). A Wilcoxon signed rank test demonstrated near-significant improvement in spatial span and auditory WM (both  $p$  values =0.066), with the intervention accounting for 42% of the variance in these scores. No improvements were observed in the other measures.

**Conclusions:** These pilot data provide support for the efficacy of the Cogmed program in early-stage HD patients. Improvements were observed in a visuospatial WM task that resembled those practiced, and a near-transfer effect was observed in an auditory WM task. A full-scale intervention project is needed to understand the reliability of changes in criterion and near-transfer measures.

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**O. BARTHELEMY, M. GROSSO, J. DEGUTIS & A. CRONIN-GOLOMB. The Effects of Sustained Attention Training on Cognitive and Functional Outcomes in Parkinson's Disease: A Pilot Study.**

**Objective:** Non-motor deficits such as in visuospatial function, attention, and working memory are prevalent in Parkinson's disease (PD) and can significantly affect daily functioning. Cognitive training programs have shown mixed success in PD, with benefits being largely restricted to tasks very similar to training. In the current pilot study, to promote greater generalization we trained persons with PD to improve at sustained attention, a process that underlies and modulates several other cognitive processes such as learning and executive function.

**Participants and Methods:** Eight non-demented individuals with mild-to-moderate idiopathic PD (6 men; mean age 63.6 years) were assessed before and after 4 weeks of at-home tonic and phasic attention training (TAPAT) (5 days/week, 36 mins/day, 12 hours total). Neuropsychological assessments included visuospatial processing (visual dependence), short-term memory (digit span and spatial span), long-term memory/learning (RAVLT), and executive function (verbal fluency, Stroop, Trails). Functional outcomes included walking tasks and the index of disease severity, the Unified Parkinson's Disease Rating Scale (UPDRS).

**Results:** All participants significantly improved on the training task. Comparing pre- to post-training revealed significantly decreased visual dependence, improved delayed recall on the RAVLT, increased spatial span, and improvement on the UPDRS. There were no improvements on executive functioning tasks or the walking tasks.

**Conclusions:** The results of this pilot study suggest that in PD, training sustained attention can generalize to improvements in working memory, long-term memory/learning, and visuospatial function as well as reducing disease severity. Future studies using a larger dose of training and a matched active control group would be useful to further test the effectiveness of this training program.

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**M.M. HALFACRE, A.D. BONO, K. ALTERESCU, E.M. MURRAY, J.T. TWAITE, K. SCORPIO, K. SAVAGE, G. SALIM, J.L. SPIELMAN, L.O. RAMIG & J.C. BOROD. The Effect of the Lee Silverman Voice Treatment (LSVT) on Facial Mobility, Social Engagement, and Emotional Experience in Parkinson's Disease (PD).**

**Objective:** PD is associated with emotional processing deficits, which affect communication and social interactions. However, few treatments address the social impact of these deficits. This study examined the influence of LSVT (Ramig et al., 1995) on facial mobility (FM), social engagement (SE), and emotional experience (EE) on individuals with PD compared to Healthy Controls (HCs).

**Participants and Methods:** Participants were 39 individuals with PD (69% male) and 14 demographically-matched HCs (62% male). PD participants were randomly assigned to 3 groups: 12 received voice treatment (LSVT), 14 received speech articulation treatment (Spielman et al., 2012), and 13 received no treatment. Participants produced emotional (happy, sad, angry) and neutral monologues using procedures from the New York Emotion Battery (Borod, Welkowitz, & Obler, 1992), which were videotaped and evaluated by 18 trained raters (50% male) for FM (amount of muscle movement) and SE (how much the rater wanted to interact with the poser/participant). After each emotion monologue, participants indicated the overall intensity of their emotional experience during the monologue (EE-O), the intensity of their emotional feelings right after the monologue (EE-I), and the accuracy with which they produced the monologue (EE-A).

**Results:** A Group (4) x Gender (2) x Time (2) x Monologue Type (3 or 4) ANOVA was performed for each variable. The LSVT group significantly ( $p<.05$ ) improved on FM, EE-O, and EE-I from pre- to post-treatment; the 3 other groups did not. For EE-A, male PDs improved ( $p<.10$ ) after LSVT for the Anger monologue. Gender differences were also found; women, relative to men, displayed higher ( $p<.05$ ) FM and EE-I overall and a trend toward higher SE for the Anger monologue at Time 1.

**Conclusions:** Findings suggest that LSVT may be a useful treatment to increase facial movement and the ability to experience feelings in individuals with PD. Clinically, enhanced emotional experience may be useful in improving mood disorders that often co-occur with PD.

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**T.K. CHOUDHURY, K. CRIST, C.G. HARRIS, T.K. SATTERWHITE, B. TREECE & M.K. YORK. Comparative Patient Satisfaction and Efficacy of a Parkinson's Disease Enrichment Program (PEP).**

**Objective:** To evaluate the patient satisfaction and efficacy of a Parkinson's Disease Enrichment Program (PEP) for improving cognitive and psychiatric symptoms and quality of life in Parkinson's disease (PD)

**Participants and Methods:** Twenty independently functioning non-demented PD patients participated in a five-week PEP, which is a broad-spectrum social enrichment group. Each four-hour weekly session included content which addressed education, exercise, recreation and socialization/support. PD participants received a pre-assessment, including cognitive tests and questionnaires for depression, anxiety and quality of life (QOL). After the completion of the program, participants completed post-assessment batteries to measure changes in neurocognitive and psychiatric status, as well as patient satisfaction regarding the program.

**Results:** The mean age of participants was 68.9 years, with a mean education level of 16.6 years and a mean time since diagnosis of 6.3 years. Following the PEP program, significant improvements were observed for semantic category switching and accuracy, as well as delayed recall of a word list. No significant cognitive declines were noted. After 5 weeks, participants reported a significant reduction in symptoms of depression and in distress caused by their PD symptoms. 100% of participants reported overall high satisfaction with the program.

**Conclusions:** Positive participant feedback and short-term cognitive and mood improvements suggest that further expansion of this program



for treatment of NMS may be beneficial in improving cognitive and psychiatric status in PD patients. Follow-up data will be collected after 6 months to measure for longer-term improvements in cognition and emotional status. Additional PEPs will continue to be evaluated to augment sample size and strengthen internal validity. Future studies will compare the efficacy of PEPs to a best medical therapy group and a cognitive rehabilitation intervention for PD.

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**E.L. CLARK, R.G. DEASON, R.T. DALEY, M.J. TAT, C.B. NAGLE, A. BUDSON & M.K. O'CONNOR. Using a Mindfulness Approach to Reduce the Imagination Inflation Effect in Older Adults.**

**Objective:** The imagination inflation effect is a type of memory distortion resulting in an increased tendency to falsely remember that a previously imagined action has been performed. Previous research has shown that the imagination inflation effect can have substantial implications for daily functioning. An intervention based on mindfulness principles was hypothesized to decrease the imagination inflation effect in healthy older adults.

**Participants and Methods:** Healthy older adults ( $n=12$ ; mean age=78) participated. In the first session, participants were read an action statement such as "turn off the stove" and engaged in one of three activities: listened to the statement being read, performed the action, or imagined performing the action. During session two (immediately following session one), participants imagined action statements from the first session, as well as completely new action statements. In session three (24 hours later), participants were asked to determine whether action statements were or were not performed during the first session. Intervention participants ( $n=6$ ) were instructed before the first and third sessions to attend to various aspects of their sensory experience.

**Results:** Following intervention, participants had better recognition (hits minus false alarms) of performed actions after three imaginings (Control  $M = 0.63$ ,  $SD = 0.13$ ; Intervention  $M = 0.90$ ,  $SD = 0.02$ ;  $t(5) = -2.12$ ,  $p < 0.05$ ).

**Conclusions:** Older adults were helped by an intervention based on mindfulness principles intended to decrease the imagination inflation effect. These data and methods can be used to tailor cognitive rehabilitation strategies and to improve memory for actual events.

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**R.T. DALEY, E.L. CLARK, R. BERMAN, E. KWON & M.K. O'CONNOR. Age Well through Interaction and Scientific Education (AgeWISE): A Cognitive Intervention for Older Veterans.**

**Objective:** Concerns regarding dementia have increased with the number of aging adults. Yet, the public's knowledge of dementia remains limited and older adults often misinterpret normal aging as pathologic. This pilot study sought to explore the impact of AgeWISE (Age Well through Interaction and Scientific Education), a 12-week psychoeducational and skills training intervention. We hypothesized AgeWISE would: 1) enhance knowledge of memory and aging; 2) increase perceived self-efficacy related to memory; and 3) help to maintain cognition in cognitively healthy older Veterans (VT).

**Participants and Methods:** In this randomized controlled trial VTs, aged 64-87, completed a medical history and global cognitive function screen (Mini-Mental State Exam) to determine eligibility. Eligible VTs completed baseline neuropsychological testing (NPT) and questionnaires and were randomized to intervention ( $IV = 10$ ) or control ( $OC = 10$ ) groups. IVs participated in AgeWISE and OCs were instructed to continue "life as usual." All VTs completed NPT and questionnaires again at 12 weeks.

**Results:** Results revealed higher scores on the Knowledge of Memory Aging Questionnaire post-intervention for IVs ( $M = 21.4$ ,  $SD = 3.27$ ) compared to OCs ( $M = 18.80$ ,  $SD = 2.20$ ), [ $F(1,18) = 5.20$ ,  $p = 0.04$ ].

This improvement was significant [ $F(1,18) = 4.35$ ,  $p = 0.05$ ]. IVs ( $M = 44.1$ ,  $SD = 9.39$ ) also scored higher on the Multifactorial Memory Questionnaire Ability subscale, a measure of perceived memory ability, compared to OCs ( $M = 32.40$ ,  $SD = 12.20$ ), [ $F(1,18) = 10.10$ ,  $p = 0.005$ ]. This improvement was significant, [ $F(1,18) = 5.77$ ,  $p = 0.03$ ]. NPT did not significantly improve for either group post-intervention, although numerically IVs showed improvement on some measures.

**Conclusions:** AgeWISE improved perception of memory ability and is a means of providing education about brain health and improving psychological, and possibly, cognitive health.

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**S. JONES, J. GREEN, E. SKENE & G. ESKEs. Does Working Memory Training Work? A Pilot Study in Parkinson's Disease.**

**Objective:** Cognitive impairment is common in Parkinson's Disease (PD), including deficits in attention and working memory (WM). No specific treatment is routinely offered to PD patients to improve cognition. We examined if WM training could benefit attention and WM, and generalize to daily function in individuals with PD compared to healthy controls.

**Participants and Methods:** Fifteen participants with idiopathic PD (Hoehn & Yahr Stage 1, 2) on stable medications, and 15 healthy older adults participated (matched on age, education, premorbid IQ). All participants were randomly assigned to either WM training (adaptive dual n-back) or control training (non-adaptive computer activity) for 5 times per week (30 minutes/day) for 5 weeks. All participants completed a standardized neuropsychological battery and a computerized battery of attention tasks at baseline (simple and choice reaction time (RT), go-no-go, flanker, Sternberg item and location WM, visual search). Outcome tests included the computerized attention tasks, Dysexecutive Questionnaire, Cognitive Failures Questionnaire (CFQ) and Raven's Progressive Matrices.

**Results:** At baseline, PD participants showed lower performance than the control group on tests of attention, memory and executive function (Trail Making test, Hopkins Verbal Learning Test, phonemic fluency) as well as problems with initiation, interference, and WM on the computerized tasks. After WM training, the PD group showed significant improvement on computerized tasks of initiation (simple and choice RT, simple discrimination search task), and verbal WM compared to the control group. WM training also resulted in better performance on a test of executive control (flanker task) and self-reports of everyday action slips (CFQ) in both PD and control groups.

**Conclusions:** These pilot results suggest that WM training has both specific and generalizable effects that are not confined to persons with PD. Further investigation of these effects is ongoing.

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**H. FRANZ, C.B. FORTIER, A. KENNA, C. HURSH, A.G. ETCHIN, W.P. MILBERG & R. MCGLINCHEY. Preliminary Effectiveness of the STEP-Home Workshop in Facilitating Post-Deployment Reintegration among OEF/OIF/OND Veterans.**

**Objective:** Veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) face many challenges as they re-enter civilian life, given their unparalleled rates of comorbid physical and psychological conditions. Difficulties with civilian reintegration are present regardless of exact clinical diagnosis. The current study evaluates the preliminary effectiveness of a newly developed reintegration workshop, STEP-Home, designed to aid all OEF/OIF/OND Veterans in their transition from military to civilian life.

**Participants and Methods:** The 12-session workshop is adapted from the evidence-based rehabilitation program, "STEP," which has

demonstrated efficacy in ameliorating cognitive and emotional deficits following mTBI in civilians (Short-Term Executive Plus, STEP; Cantor et al., 2014). STEP-Home targets the unique needs of post-deployment Veterans by focusing content of the civilian STEP program on commonly faced reintegration issues. Six groups (n=47) of OEF/OIF/OND Veterans participated in the study. Evaluation of preliminary effectiveness was assessed via self-report scales administered pre and post-workshop including: Quality of Life Scale (QOLS), World Health Organization Disability (WHODAS-2), Military to Civilian (M2C), Connected to VA Services, Impulsive Aggression Scale (IAS), and attention scale (ARCES).

**Results:** Preliminary data show modest improvements in QOLS (pre=56.7;SD=13.5;post=58.2;SD=17.5), WHODAS-2 (pre=51.7;SD=22.4;post=48.1;SD=20.0), M2C (pre=32.2;SD=13.0;post=26.9;SD=12.6), IAS (pre=38.5;SD=28.0;post=34.1;SD=27.6), and ARCES (pre=40.7;SD=9.2;post=38.0;SD=8.3). Veterans reported significant increases in feeling connected to the VA ( $p<.01$ ;pre=27.2;SD=5.6;post=33.9;SD=3.1). A group member reported, "This is keeping me busy, it's the highlight of my week. I like coming here."

**Conclusions:** STEP-Home demonstrates potential to improve reintegration into civilian life for an often difficult to engage cohort of Veterans.

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#### **S. GUIMOND & M. LEPAGE. Increase in Prefrontal Activity Following a Brief Memory Training in Schizophrenia Patients.**

**Objective:** Episodic memory (EM) is one of the most affected cognitive domains in schizophrenia and strongly relates to community functioning and outcome. Self-initiation of semantic encoding strategies (SISES) is impaired in this population and may partially explain their EM difficulties. We recently developed and tested a brief cognitive training that significantly improved the SISES in a group of people with schizophrenia. The aim of the current study was to determine whether this training could improve neural activity in brain areas known to be involved in SISES, notably the prefrontal cortex.

**Participants and Methods:** Thirty individuals with enduring schizophrenia performed the Semantic Encoding Memory Task (SEMT) at baseline while brain activity was assessed with an fMRI scan. The SEMT is devised to isolate the SISES in one specific condition. A significant deficit within this condition was observed in 12 patients, which were consequently included in our training group. The training consisted of two 60-minute sessions including a short meta-memory presentation, semantic encoding strategy memory exercises, and a bridging period. After completion of training, patients memorized new items in the SEMT task once again, while undergoing fMRI. To observe brain activity differences pre-post training, we performed a paired t-test between the contrasts that isolate the SISES.

**Results:** Memory training led to a significant increase in brain activity in the left prefrontal cortex in the condition where patients needed to self-initiate semantic encoding strategies ( $p < 0.001$ ). Patients also significantly improved their EM performance in this condition ( $p < 0.005$ ).

**Conclusions:** In the current study, EM improvements were associated with increased brain activity in regions responsible for SISES in healthy controls. These results suggest that a brief intervention targeting this deficient memory process can positively impact performance and brain activity.

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#### **M.D. HO, P.I. MARTIN, M.K. YEE, B. KOO, E. BAKER, M.R. HAMBLIN & M.A. NAESER. Increased Functional Connectivity in Default Mode Network Associated with Application of Transcranial, Light-Emitting Diodes to Treat Chronic Aphasia: Case Series.**

**Objective:** This study examined effects of scalp application of red and near-infrared (NIR) light-emitting diodes (LEDs) on naming in chronic aphasia patients and on resting-state functional-connectivity (rs-fcMRI). Red and NIR wavelengths of light improve mitochondrial function in hypoxic/compromised cells by increasing adenosine tri-phosphate (ATP) and improving cell function; there is focal increase in rCBF.

**Participants and Methods:** Four right-handed persons with aphasia participated at 2-13Y post- left hemisphere (LH) stroke (4M, 46-69Y). Each was tested 3x at Entry/Baseline. Change of +2SD from Baseline on a primary outcome measure - picture naming (Boston Naming Test, Philadelphia Naming Test) or verbal fluency (FAS, Animals) was considered significant for a case (95% Confidence Interval,  $p=.05$ ). LED therapy is non-invasive, painless, non-thermal (<500mW). The 2-inch diameter, LED cluster heads are FDA-cleared as non-significant risk (MedX Health). A total of 18 LED treatments were applied (MWF, 6 Wks). The rs-fcMRI scans (3T Philips, Achieva) obtained pre-/post-LED series were analyzed with REST toolkit (Song et al., 2011).

**Results:** Two cases had Mod./Poor Response (MR/PR), +2SD on 2/6 naming tests and -2SD on 1; or no change. They received LEDs on LH and 1 node on Default Mode Network (DMN), midline, bilateral mesial prefrontal cortex (mPFC); 13J/cm<sup>2</sup>/LED. Two cases had Good Response (GR), +2SD on 2-4/6 naming tests and -2SD on 0. They received LEDs on LH and 2 nodes on DMN (mPFC, precuneus); 26J/cm<sup>2</sup>/LED. Correlations were converted to z-scores. Paired t-tests on these data showed MR/PR cases had no significant changes on rs-fcMRI post-LED. GR cases had significant increases post-LED within DMN,  $p<.0005$ ; Salience,  $p<.0005$ ; Central Executive,  $p<.05$ , networks.

**Conclusions:** Results suggest transcranial LED may be useful to treat aphasia and other CNS disorders.

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#### **A.W. HUNT, M. PANICCIA, N. REED, D.R. DAWSON & M. KEIGHTLEY. A Top-Down Approach to Management of Youth with Prolonged Recovery Following Concussion.**

**Objective:** The purpose of this study was to determine the feasibility of a top-down self-management intervention featuring metacognitive strategy training on return to activity for youth with persistently elevated post-concussion symptoms. Specific objectives were to determine effects on: 1) activity performance; 2) symptom reduction; and 3) mood of both youth and their parents.

**Participants and Methods:** A pre-post single case design was used with two youth athletes with persistent post-concussion symptoms and their mothers. Both youth also reported problems with participation in usual activities (e.g. school, sport). Measures of activity performance (COPM, PAQ), symptoms (PCSI), and mood (Beck) (both youth and parent) were collected. The intervention (CO-OP Approach) entailed 10, 30-minute, in-home sessions that focused on teaching participants to use a metacognitive problem solving strategy (Goal-Plan-Do-Check) to work toward self-identified activity based goals. Qualitative interviews were conducted post-intervention to understand participants' experiences and perceptions about key features of the intervention.

**Results:** Clinically significant, positive changes were found on participants' performance of all activity-based goals. Improvements were seen on measures of physical activity participation, symptoms, mood and anxiety (youth and parent). Qualitatively, youth participants indicated that the intervention 'taught' them 'how to get back to doing things'. Parents reported it helped their child 'regain confidence'.

**Conclusions:** A top-down approach to rehabilitation for youth with prolonged elevation in symptoms following concussion is feasible and

may contribute positively to activity resumption, symptom resolution and mood. More rigorous study is warranted.

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**A. JAYWANT, T.D. ELLIS, S. ROY, C. LIN, S. NEARGARDER & A. CRONIN-GOLOMB. From Seeing to Moving: A Translational Intervention to Enhance Walking in Parkinson's Disease.**

**Objective:** Parkinson's disease (PD) causes impairments in walking that persist despite pharmacological treatment. Perceptual training using the repeated observation of human motion and actions (i.e., biological motion) has been used successfully to improve upper limb function and freezing of gait in PD, but it is unknown if it can also improve spatio-temporal aspects of walking. We examined the efficacy and feasibility of a home-based perceptual training (gait observation) intervention for enhancing walking in PD.

**Participants and Methods:** Non-demented individuals with PD experiencing walking difficulty were randomized to Gait Observation (N=13; intervention condition; viewing videos of healthy and parkinsonian gait) or Landscape Observation (N=10; control condition; viewing videos of moving water) and engaged in perceptual training daily for eight days. Walking was assessed using accelerometers in the laboratory (baseline and post-training assessments) and continuously at home during the training period. Self-report questionnaires of mobility and quality of life, including the 39-item Parkinson's Disease Questionnaire, were administered.

**Results:** ANOVA and linear mixed-effects models were conducted to determine change in walking. At post-training assessment, only the Gait Observation group reported significantly improved mobility ( $p < .05$ , Cohen's  $d = .25$ ). No improvements were seen in objective (accelerometer-derived) walking data, including daily activity, walking speed, stride length, stride frequency, leg swing time, or gait asymmetry. Participants found the at-home computer task and accelerometer feasible to use.

**Conclusions:** Gait observation holds promise as a means of enhancing walking in PD. Training with a more challenging and adaptive task, and the use of explicit perceptual learning and practice of observed actions, may be required to effect significant objective improvements. This research was supported by the National Institute of Neurological Disorders and Stroke (grants F31 NS078919 and R01 NS067128)

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**W.D. KILLGORE & M. WEBER. Blue Wavelength Light Therapy Reduces Daytime Sleepiness following Mild Traumatic Brain Injury.**

**Objective:** Some of the most common symptoms of mild traumatic brain injury (mTBI) include excessive daytime sleepiness and fatigue, with approximately 50% of affected individuals reporting such problems. Some evidence suggests that morning blue wavelength light therapy may provide an effective treatment for fatigue problems in mTBI patients. Here we tested a six-week program of blue wavelength light therapy for its effectiveness at reducing daytime sleepiness in individuals with mTBI.

**Participants and Methods:** Thirty individuals (15 female; aged 18-45 years) with a history of mTBI during the preceding 18 months completed the Epworth Sleepiness Scale (ESS) and several other questionnaires at baseline and again after 6 consecutive weeks of treatment. Participants were randomly assigned to use either a blue-wavelength (active;  $n=15$ ) or amber-wavelength (placebo;  $n=15$ ) light device at home for 6 weeks (30-minutes each morning).

**Results:** Repeated measures ANOVA, controlling for the number of days of light used, baseline sleep disturbance, and total sleep obtained on the baseline night, showed a significant reduction in ESS scores for the blue light group but not the amber light group ( $p=.04$ ). Furthermore, 86% of those receiving blue light showed a decline in sleepiness scores whereas only 40% of those receiving amber light showed a decline ( $p=.008$ ).

**Conclusions:** Six weeks of daily morning treatment with blue wavelength light therapy was associated with a significant improvement in daytime sleepiness compared to placebo among individuals with mTBI. Because morning exposure to blue light has been shown to suppress melatonin and phase advance the circadian rhythm, it is likely that the observed effects are due to improvement in sleep and daytime alertness due to entrainment of the circadian system. Blue wavelength light therapy may be an effective means for reducing sleepiness in patients with mTBI.

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**W.D. KILLGORE, M. WEBER & D. PENETAR. Blue Wavelength Light Therapy Improves Balance following Mild Traumatic Brain Injury.**

**Objective:** Mild traumatic brain injury (mTBI) is associated with a number of cognitive and psychomotor symptoms, including persistent difficulties with balance and stance stability. Additionally, mTBI has been associated with sleep problems and fatigue in up to 50% of patients. Blue wavelength light therapy has previously been shown to improve fatigue in mTBI patients. We hypothesized that improvement of sleep via circadian re-entrainment with blue light exposure therapy would enhance brain repair and therefore be associated with improvement in balance problems following mTBI.

**Participants and Methods:** Twenty-eight individuals (15 female; aged 18-48 years) with a history of mTBI during the preceding 18 months underwent balance and stance-stability (BSS) testing while standing erect on a platform with feet together, eyes open, with arms extended, palms up. In a double-blind design, participants were randomly assigned to use either a blue-wavelength (active;  $n=14$ ) or amber-wavelength (placebo;  $n=14$ ) light device. Participants then underwent 6 weeks of at-home light exposure therapy (30-minutes daily, prior to 11:00am). Following treatment, participants again returned to the lab to undergo the BSS test.

**Results:** Compared to baseline, the active blue light group decreased body sway movement by 9.89% while the amber placebo light placebo group increased by 23.98%,  $F(1,25) = 4.31$ ,  $p = .048$ . Furthermore, the change in stance stability was found to be significantly correlated with the change in subjective sleepiness from baseline to post-treatment, but only for the active light group ( $r = .58$ ,  $p = .03$ ), but not for the placebo light condition ( $r = -.31$ ,  $p = .31$ ).

**Conclusions:** Six weeks of daily morning exposure to BLUE light was associated with an improvement in stance stability compared to a matched placebo and this improvement corresponded directly to the reduction in daytime sleepiness. Blue light therapy may be an effective treatment for balance problems following mTBI.

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**S.A. LANGENECKER, N. DAVIDSON & C. IRMITER. Degree of engagement in cognitive remediation predicts improvement in family support and cognitive skills in adults with Autism Spectrum Disorder.**

**Objective:** One area of increasing interest in cognitive enhancement and remediation is in autistic spectrum disorder (ASD). The present study is an open label, single intervention using Posit Science for computer remediation for this population..

**Participants and Methods:** Thirty-five individuals were recruited, with a primary diagnosis of autism ( $n = 17$ ), Asperger ( $n = 12$ ), and Pervasive Developmental Disorder, NOS ( $n = 6$ ) for an open labeled, single trial study, over the course of eight weeks. Inclusion criteria were also Ritvo Autism and Asperger Diagnostic Scale-Revised (RAADS-R score greater than 14, and WRAT Reading standard score greater than 68. Six Posit modules (attention, memory, brain speed, people skills, navigation, and intelligence) were available to participants. Far transfer

measurements included the Vineland Adaptive Behavior Scale (parent/caregiver report), and the Scales of Independent Behavior-Revised. Other aspects of functioning were captured with the Multidimensional Scale of Perceived Social Support and Cognitive Self-Report.

**Results:** Individuals completed on average, 257 levels of training across all six areas. Degree of engagement (number of levels completed, in total), was predictive of improvement in attention, brain speed, people skills, and navigation. There was an interaction between the number of levels completed and improvement in the RAADS ( $p = .01$ ), predicted primarily by number of levels completed in brain speed ( $B = -.18$ ,  $p = .30$ ) and navigation ( $B = -.65$ ,  $p = .001$ ). Number of levels completed predicted a significant increase in perceived family support ( $p = .02$ ) and improvement in cognitive skills ( $p = .02$ ).

**Conclusions:** Cognitive remediation may be an effective way to strengthen skills in computer tasks. Far transfer to functioning in activities, by self and other's report, were not present; whereas level of engagement (levels completed) did predict improvement in self-report cognitive functioning and family support.

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#### **S.L. MARTINDALE, S.B. MORISSETTE & S.L. DOLAN. Sleep Quality as a Mediator Between Combat Experiences and Neuropsychological Outcomes in Iraq/Afghanistan Veterans.**

**Objective:** Veterans returning from combat frequently report sleep difficulties and poor sleep quality, the root cause of which may range from sleep apnea or pain to anxiety or nightmares. Sleep problems are often associated with cognitive difficulties that can manifest behaviorally, causing difficulties with daily life. By evaluating sleep as a modifiable mediator for combat veterans with cognitive difficulties, we can determine if sleep may be a viable primary target in treatment to attempt to improve specific presenting cognitive issues.

**Participants and Methods:** Participants were 129 male veterans, ages 22-55, deployed to the wars in Iraq and Afghanistan after 2001. Participants completed the DRR1-2 Combat Experiences Scale, Pittsburgh Sleep Quality Index, and a neuropsychological assessment battery including the CVLT-II, WAIS-IV Digit Span Forward and Backward, Wisconsin Card Sorting Task – 64, D-KEFS Color Word Interference, Tower Test, Trails, and Verbal Fluency.

**Results:** Analyses indicated that combat experiences influenced cognitive flexibility, measured with the D-KEFS Color-Word Interference inhibition/switching condition, through its effects on sleep quality. Combat experiences was negatively associated with sleep quality,  $a: \beta = -.06$ ,  $p < .01$ , which was, in turn, negatively associated with cognitive flexibility,  $b: \beta = .17$ ,  $p < .01$ . Additionally, an indirect relationship was seen between combat experiences and processing speed, measured with the D-KEFS Color-Word Interference combined naming and reading composite score, such that greater sleep problems were associated with slowed processing speed,  $b: \beta = .15$ ,  $p = .01$ .

**Conclusions:** Cognitive flexibility and processing speed were sensitive to poor sleep quality in veterans with greater combat experiences. Veterans presenting with slowed processing speed and cognitive inflexibility may benefit from sleep evaluations to determine if addressing sleep issues in early treatment is appropriate.

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#### **M.D. MCCURDY, L.F. QUAST, E. TURNER, S. PULASKI, C. BLACK, I. PALTIN, L.P. BARAKAT & M.C. HOCKING. Feasibility and Acceptability of a Computerized Cognitive Training Program in Survivors of Pediatric Brain Tumor.**

**Objective:** Pediatric brain tumor survivors (PBTS) are at risk for long-term attention and working memory deficits following tumor-directed treatments. These difficulties are increasingly being addressed with

home-based cognitive training programs such as CogmedRM, though research establishing the feasibility of these interventions is limited. The present study used qualitative methods to evaluate the feasibility and acceptability of CogmedRM in PBTS and their caregivers.

**Participants and Methods:** Potentially eligible participants ( $N=108$ ), greater than two years from the conclusion of tumor-directed treatments, were identified through a tumor registry at a large mid-Atlantic Children's Hospital. Fifty-four were unable to be contacted and 19 declined participation; 15 had no identified working memory deficits, resulting in a final sample of 20 PBTS, ages 7-15 years ( $M=10.8$ ,  $SD=2.6$ ). PBTS were scheduled to complete 25 1-hour CogmedRM sessions over 35-42 days, accompanied by weekly coaching calls.

**Results:** Ten participants (50%) completed all 25 sessions over 31-79 days ( $M=49.0$ ,  $SD=14.4$ ). Of the 10 non-completers, 3 failed to start training after enrollment. Non-completers attempted 0-19 sessions ( $M=7.2$ ,  $SD=7.6$ ) over 43.1 days ( $SD=29.6$ ) before withdrawing. Completers ( $M=94.3$ ,  $SD=16.3$ ) and non-completers ( $M=90.4$ ,  $SD=15.6$ ) did not differ in terms of baseline IQ. Parents of completers were more likely to be married (90% v. 60%) and employed (80% v. 40%). Despite reporting PBTS boredom (70%) and frustration (100%) during training, parents of completers were satisfied with the intervention (100%) and indicated that overall PBTS enjoyed sessions (80%). Parents of non-completers cited time commitment and survivor noncompliance as reasons for withdrawing.

**Conclusions:** CogmedRM may be a feasible and acceptable intervention for PBTS with access to greater family resources. It is important to screen families in need of additional supports prior to beginning in-home sessions in order to identify and address potential barriers to adherence.

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#### **C.P. MCFARLAND, M. HALUZOVA, B. STEWART & M. PRIMOSCH. Improving Inhibition: The Effectiveness of Implementation Intentions and Visual Imagery may be Limited by Cue Specificity.**

**Objective:** Self-regulation of one's behavior is an integral part of managing common everyday tasks. An important form of self-regulation is the inhibition of goal-irrelevant responses. Recent studies demonstrated that inhibition can be facilitated by implementation intentions (if-then statements) in children with ADHD (Gawrilow & Gollwitzer, 2008; Gawrilow, Gollwitzer, & Oettingen, 2011). In an unpublished study of undergraduate students (McFarland, Grilli, & Glisky, 2014), we found that implementation intentions did not improve inhibition; however, visual imagery did. The aim of the present study was to examine the effectiveness of implementation intentions and visual imagery when a less specific cue for response inhibition was used.

**Participants and Methods:** Forty-two undergraduates were randomly assigned to one of three instructional groups (standard, implementation intention, imagery) after which they completed a lexical decision task. Participants were told to withhold a response any time they encountered a word belonging to the category 'animal'.

**Results:** One-way ANOVAs revealed no group differences in inhibition,  $F(2,39) = .80$ ,  $p = .46$ , lexical decision accuracy,  $F(2,39) = .64$ ,  $p = .53$  or reaction time,  $F(2,39) = 1.09$ ,  $p = .35$ . Participants who received implementation intentions or imagery instructions were no more likely to successfully inhibit inappropriate responses than participants who received standard instructions.

**Conclusions:** These results suggest that the effectiveness of implementation intentions and visual imagery in facilitating inhibition may be limited to very specific cues. Although neither strategy was effective in the current study, methodological factors may have played a role. Future research will examine the generalizability of these strategies using other paradigms. The current findings raise important questions about the clinical utility, and potential limitations, of these strategies.

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**T. NOVAKOVIC-AGOPIAN, G. ABRAMS, J. BURCIAGA, G. CARLIN, A. CHEN, M.R. MADORE, F. LOYA & K. LAU. Executive Function Training in Veterans with PTSD and mTBI.**

**Objective:** Difficulties in executive control functions, including selection, maintenance, and execution of goal-relevant information and activities are common sequelae of both TBI and PTSD. Goal-Oriented Attentional Self-Regulation (GOALS) training was designed to target these deficits with attention regulation training applied to participant-defined goals. In previous studies both Veteran and civilian participants with chronic TBI significantly improved post GOALS, but not control training, on measures of attention/executive function, functional task performance, and self-report measures of emotional regulation (Novakovic-Agopian et al 2011, Novakovic-Agopian et al 2015), and on goal-directed control over neural processing on fMRI (Chen, et al 2011). The objective of this ongoing study is to assess effectiveness of GOALS training in Veterans with comorbid PTSD and mTBI.

**Participants and Methods:** Twelve Veterans (ages 29-68) with diagnosis of PTSD, history of chronic mTBI and mild-moderate executive dysfunction were randomized to start with either 5 week GOALS or control Brain-Health (EDU) training. Participants that started with EDU switched to GOALS during second 5 weeks. Assessments at baseline, weeks 5, 10 and 6 months included neuropsychological, functional task performance and self-report measures

**Results:** Post GOALS training, but not post EDU, participants significantly improved on neuropsychological measures of attention/executive function, complex functional task performance and measures of emotional regulation. Participants reported incorporating trained strategies into their daily life..

**Conclusions:** GOALS training may be promising in Veterans with concurrent PTSD and chronic mTBI. Improving cognitive control functioning may also improve functioning in other domains such as functional complex task performance and emotional regulation. The challenges and importance of: a) assessing change in functioning at different levels, and b) using participant-defined goals applied to relevant training, will be discussed.

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**T.W. OLIVIER, F. PASTRANA, J. HUSSEY & D.G. NEMETH. Effectiveness of a Comprehensive Cognitive Rehabilitation Protocol with a Neurologically-Compromised Adolescent.**

**Objective:** Cognitive rehabilitation is an important intervention for remediation of higher-level skills, both following acute neurological injury and as a long-term maintenance intervention. This case study highlights the effects of a comprehensive cognitive rehabilitation protocol with a 16 year-old female with a history of cerebral palsy, epilepsy, autism, learning disorder, and ADHD.

**Participants and Methods:** Cognitive rehabilitation interventions were primarily targeted at improving executive functioning (e.g., working memory). Social skills training and medication management services were later included at the request of the parents. Data from a comprehensive neuropsychological evaluation were used as a baseline for development of a treatment protocol. The CNS Vital Signs (CNS-VS), a valid, reliable screening of neurocognitive functioning, was used throughout the course of treatment to track progress. The patient's ongoing treatment plan has consisted of approximately 70 cognitive rehabilitation and social skills training visits over a period of 13 months, and medication management services, provided by a clinical, medical, and neuropsychologist.

**Results:** The CNS-VS was administered after five months of treatment, which included approximately 20 sessions, and again nearly five months

later, after additional cognitive rehabilitation and introduction of social skills training. Improvements were observed in verbal and visual memory, processing speed, executive functions, complex attention, and cognitive flexibility. Moreover, the family reported qualitative, functional improvements in behavior and adaptive functioning.

**Conclusions:** This case study describes the effectiveness of a comprehensive treatment protocol that included cognitive rehabilitation, social skills training, and medication management in a neurologically-compromised adolescent. Qualitative and quantitative improvements were observed and reported in several cognitive domains, including executive functioning, memory, attention, and adaptive skills.

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**A. R.-MERCIER, T. WYKES, C. REEDER, K. GUAY, D. NADEAU & C. CELLARD. A study of Feasibility and Acceptability using a Computerized Cognitive Remediation program with youth suffering from Psychiatric disorders with Maltreatment.**

**Objective:** Cognitive remediation is a behavioral treatment to facilitate improvement in cognitive and social functioning among different psychiatric populations. No study has evaluated the feasibility and acceptability of cognitive remediation with teenagers with psychiatric disorders in a context of youth protection intervention. The aims of this study were to assess the feasibility of CIRCuiTS teenagers' version, a cognitive remediation program, for at-risk youth and to investigate the acceptability of the program by teenagers and their social interveners

**Participants and Methods:** Qualitative questionnaires which assess the attractiveness, ease of understanding and use and culturally acceptability of specific aspects of the program were completed by clients and therapists. Therapeutic alliance was also evaluated. Nine teenagers with a psychiatric disorder who suffered from maltreatment during childhood or adolescence and their social interveners participated to the evaluation of the therapy. The main issues arising from this feasibility study were also collected (sessions missed, length of sessions, dropout).

**Results:** Qualitative analysis of rating of CIRCuiTS showed a positive evaluation of the attractiveness, ease of understanding and use and culturally by clinical and therapist participants. The relationship between therapist and client was positive which promoted trust and mutual aid. Despite the good evaluation of the program, many teenagers have abandoned the therapy for different reasons.

**Conclusions:** The comments and feedback facing the implementation of the therapy suggested that several considerations must be taken into account to promote the adherence of teenagers to CIRCuiTS.

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**S. RASKIN, M. SMITH, G. MILLS & E. AIKEN. Use of Goal Management Training to Improve Prospective Memory Performance in Individuals with Brain Injury.**

**Objective:** Prospective memory (PM) is common after brain injury and can impair daily functioning. One potential treatment approach is a metacognitive strategy used successfully to improve executive functioning, Goal Management Training (GMT).

**Participants and Methods:** There were a total of 10 individuals with traumatic brain injury (TBI). Mean age was 44. 25 (s.d.=5.34); 6 were male and 4 female. The study was administered as a randomized controlled trial with a active treatment group (AT) (GMT) of 5 and an attention control group (AC) of 5 that received information on brain injury in a computerized education module. The groups were matched for sex, age and education. The AC group was offered treatment at the end. GMT was modeled after Levine et al. (2011). Each participant was asked to identify a goal in their daily life. Sessions took place twice per week for six weeks for one hour. The primary measure of efficacy was Memory for Intentions Screening Test (MIST). A battery of attention,

memory and executive function measures and generalization measures were used.

**Results:** There was significant improvement on MIST total and reduction of MIST errors for AT but not AC overall. Individuals that demonstrated the greatest improvement were those with the highest attention and retrospective memory scores on standardized tests. On the neuropsychological measures there was a significant improvement on tests of executive functioning but not other measures of cognitive functioning only after AT. There was a significant improvement on measures of generalization overall following the AT but not the AC.

**Conclusions:** GMT has been demonstrated to be an effective executive function intervention for individuals with TBI. This study has demonstrated that it can lead to measurable improvement in PM performance. In particular, GMT seems to be helpful for those participants who show relatively intact attention and retrospective memory performance but impaired PM and executive functions.

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**E. THIBAudeau, A. R.-MERCIER, T. WYKES, C. REEDER, C. EAST-RICHARD, D. NADEAU & C. CELLARD. Improving Verbal Memory in Teenagers with Psychiatric Disorder and a History of Maltreatment: A Multiple Case Study.**

**Objective:** Maltreatment is a risk factor for cognitive and functional deficits during adolescence. The combination of maltreatment and psychiatric disorder is associated with important cognitive deficits. However, cognitive remediation therapy (CRT) has never been used to reduce these deficits. This multiple case study aims to compare the effect of a top-down CRT on verbal memory in two teenagers presenting different neuropsychological profiles.

**Participants and Methods:** Case A and B both had psychiatric disorder with a history of maltreatment and they showed cognitive deficits at baseline. Case B also had a language disorder. A neuropsychological battery was administered followed by a computerised CRT programme (CIRCuiTS) comprising 40 sessions. Cases A and B were reassessed post-CRT and three months post-CRT. Reliable Change Indices were calculated from baseline to post-CRT and from baseline to three months post-CRT. The cognitive strategies used for verbal task were also analyzed, including semantic, serial and subjective (elaboration of one's own significant categories of information) strategies.

**Results:** After CRT, they both showed significant improvement in verbal learning (A: RCI=2.2; B: RCI=3.7) and working memory (A: RCI=3.5; B: RCI=4.4), as well as a significant improvement in verbal episodic memory (RCI=3.3) for case B. This verbal improvement was accompanied by the increased use of semantic and subjective strategies for case A, and subjective strategies for case B. Three months after CRT, they both showed significant improvement in verbal learning (A: RCI=2.2; B: RCI=2.2), with significant improvement in verbal episodic memory (RCI=1.6) for case A and working memory (RCI=3.6) for case B. Case A used semantic strategies and case B used subjective strategies.

**Conclusions:** These preliminary results suggest that CRT improves verbal memory in teenagers with psychiatric disorder and a history of maltreatment. The benefits are explained by different strategies pattern. Correspondence: Elisabeth Thibaudeau, Ph.D student, School of psychology, Laval university, 4678 rue promenade des soeurs, Quebec, QC G1Y2W1, Canada. E-mail: elisabeth.thibaudeau.2@ulaval.ca

**K.R. THOMAS, O. PUIG-NAVARRO & E.W. TWAMLEY. Age as a Moderator of Change Following Compensatory Cognitive Training in Severe Mental Illness.**

**Objective:** We aimed to determine whether age moderated cognitive, symptom, and functional changes following a 12-week Compensatory Cognitive Training (CCT) intervention for participants with severe mental illness (SMI). CCT focused on the cognitive domains of attention, learning, prospective memory, and executive functioning, which are often impaired in people with SMI.

**Participants and Methods:** Seventy-seven unemployed outpatients with SMI (46 with severe mood disorders and 31 with schizophrenia/schizoaffective disorder; mean age=44.43 years) received CCT for 12 weeks in the context of a supported employment program. Participants were administered cognitive, symptom severity, and functional measures at baseline and 3-, 6-, and 12-month follow-ups, as well as at 18- and 24-months for symptom/functional measures.

**Results:** Mixed effects models, controlling for diagnosis, showed significant visit x age interactions such that younger participants improved more over time on category fluency [ $\beta=-.280$ ,  $t(42.10)=-2.76$ ,  $p=.008$ ] and financial capacity [UCSD Performance-Based Skills Assessment;  $\beta=-.194$ ,  $t(54.02)=-2.21$ ,  $p=.031$ ]. Older participants showed greater reduction in positive symptom severity [Positive and Negative Syndrome Scale;  $\beta=-.109$ ,  $t(78.35)=-2.34$ ,  $p=.022$ ] and reported greater functional improvement on the Independent Living Skills Survey [ $\beta=.118$ ,  $t(109.77)=2.05$ ,  $p=.043$ ].

**Conclusions:** Age moderated the effects of CCT over time on several measures of cognition, symptom severity, and functioning. In general, the findings were mixed such that both older and younger participants differentially improved on cognitive and functional outcomes over time following CCT. Younger participants improved on objective measures of verbal processing speed and financial capacity, whereas older participants demonstrated less severe positive symptoms and reported better subjective daily functioning.

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**L. OHLHAUSER, J. UPSHAW, D. LEITNER, A.F. PARKER, A.M. SCHUSTER, M. LIBBEN & H. MILLER. Beyond Simple Narrative: Biological, Neuropsychological, and Social Support Factors Involved in Atypical Recovery from Stroke in a Single Case Study.**

**Objective:** In-depth analyses of unique clinical cases, such as patient HM, have made invaluable contributions to the field of psychology and have played a vital role in directing future research. This case study aimed to go beyond simple narrative by utilizing qualitative and quantitative methods to identify biological, neuropsychological (NP), and social support factors involved in extraordinary recovery outcomes following stroke.

**Participants and Methods:** This case study followed a 57-year-old female, JD, for 3 years post-stroke. Methods included repeated functional ability assessments with various raters using the Mayo Portland Adaptability Inventory-4 (MPAI-4), comprehensive NP testing, and clinical interviews.

**Results:** JD suffered a severe subarachnoid haemorrhage and remained in a vegetative state 6-weeks post-stroke. 6 months post-stroke, JD followed basic 1-step commands, but suffered significant expressive aphasia, preventing participation in even the most basic NP assessment. Initially seen as an undesirable candidate, JD was accepted into a transitional rehabilitation centre at her spouse's urgency. She remained there for 2 years, before being discharged home to the care of her spouse. 3 years post-stroke, JD exhibited striking improvement in NP performance. Despite significant lingering cognitive deficits, JD showed dramatic functional improvement. She could ambulate on her own, prepare simple meals, participate in household decisions, and be left on her own for short periods. MPAI-4 Ability T-scores (M=50, SD=10) ranged from severely impaired immediately post-stroke (T=77), to mild-moderately impaired 3 years post-stroke (T=54). With support and advocacy from her spouse, JD obtained a level of independence that starkly contrasts her cognitive deficits.

**Conclusions:** This methodologically strong case study highlights the importance of both ongoing rehabilitation and social support in stroke recovery. Social support should be considered as a moderator of stroke recovery in future research and treatment planning.

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### **E.M. WEKKING & I. TSCHOCHNER. Improving the Sequelae of Cognitive Deficits in Patients with Severe Mental Illness: an Individual Approach.**

**Objective:** Recently, it is suggested in the literature (Paquin et al., 2014) that in overcoming cognitive deficits in patients with schizophrenia, attention should be paid to tailoring the treatment more to the specific patients needs. This improves generalization to real life situations, which is illustrated by present case.

**Participants and Methods:** Patient, a 48 year old man with schizophrenia was referred by his casemanager for treatment of his cognitive deficits. Before treatment he underwent an extensive neuropsychological assessment, deficits in executive functioning and memory were objectified.

The 24 session protocol for the treatment of the executive dysfunctions (Spikman et al. 2010) which leaves room for individual, personalized, targets was executed. His goal for treatment was cleaning up his apartment –which was a terrible mess- without the help of others and, secondly, taking up his hobby as a photographer.

The training was performed by the cognitive trainings assistant (IT) and the clinical neuropsychologist (EW).

**Results:** Patient needed 40 sessions to complete the protocol. It was difficult for him to complete his homework assignments. Because of his executive problems he had difficulties to stick to the task during treatment, and was easily distracted. Finally, he managed to develop a strategy for cleaning his house and he completed a photo project which he put on an internet site. At six months follow up he still kept to his cleaning schedule.

**Conclusions:** In this individualized approach of a successful cognitive training, a standardized protocol was combined with a functional, personal treatment goal. At six months follow up, the patient was still able to use the learned strategies.

### **L.A. WIEGAND, R. PERNA, C.K. BLOCK & J. CAROSELLI. Factors Associated with Positive Rehabilitation Outcome from Cerebrovascular Insult as Measured by Change in Functional Ability Using Mayo-Portland Adaptability Inventory Change Scores.**

**Objective:** Research has produced mixed findings in regards to variables associated with positive rehabilitation outcomes from cardiovascular insults. The current study aims to better understand the demographic, socioeconomic, and differing injury sub-types that influence rehabilitative recovery.

**Participants and Methods:** This study involved 164 participants who were involved in a multidisciplinary brain injury rehabilitation program. Most individuals were three months post stroke. All individuals in the study successfully completed the Mayo-Portland Adaptability Inventory (MPAI-4), as comprehensive measure of functional ability, at both intake and discharge. In a linear regression model, MPAI change scores (admission minus discharge) were used as the dependent variable. Demographic factors (Age, Gender, and Race), Socioeconomic/Situational factors (Living Situation, Education, Substance Abuse History, Marital Status, and Pre-injury productivity), as well as Injury subtype information (Vascular Event Etiology and Vascular stroke type) were used as independent variables.

**Results:** Our analysis indicated gender ( $t=-2.094$ ;  $p=.038$ ), substance abuse history ( $t=2.722$ ;  $p=.007$ ), pre-injury productivity ( $t=-1.990$ ;  $p=.048$ ), and vascular event etiology ( $t=-2.438$ ;  $p=.016$ ) were predictive of rehabilitative response. Factors not indicative of rehabilitative change included Age, Race, Living Situation, Education, Marital Status, and Vascular Stroke Type.

**Conclusions:** An overarching goal of this study was to help clarify factorial differences in post-acute stroke functional outcomes. Given

the complexity of compounding pre-morbid factors that can influence rehabilitation outcome, this study may help clarify those in need of more integrative and intensive rehabilitation to achieve similar gains.

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### **Dementia (Alzheimer's Disease)**

#### **S.L. AGHJAYAN, E.C. MORMINO, P. VANNINI, G. MARSHALL, D.M. RENTZ, J. JACKSON, R.A. SPERLING, K.A. JOHNSON & R.E. AMARIGLIO. Subjective Memory Concerns and Amyloid Burden in Clinically Normal Individuals: the Impact of Age, Education, and Sex.**

**Objective:** Converging evidence suggests that subjective cognitive concerns (SCC) has been associated with biomarker evidence of amyloid-beta ( $A\beta$ ) burden and neurodegeneration in individuals without clinical impairment, and may serve as an early indicator of those at risk for Alzheimer's disease dementia (AD). Here, we sought to investigate whether age, education, and/or sex impacts the relationship between SCC and  $A\beta$  burden using PiB-PET imaging in clinically normal older individuals (CN).

**Participants and Methods:** We studied 279 CN (59% females) enrolled in the Harvard Aging Brain Study, ages 63-90 (mean  $73.6\pm6$ ) with 6-20 years of education (mean  $15.8\pm3.1$ ). SCC was assessed as a composite score of the Memory Functioning Questionnaire, Everyday Cognition Scale, and the adapted Structured Telephone Interview for Dementia Assessment. Age was measured continuously. High and low education was categorized as  $>16$  and  $\leq 16$  years, respectively.  $A\beta$  burden was measured across an aggregate of cortical regions vulnerable to  $A\beta$  deposition. A series of linear regression models assessed the potential modifying role of demographic variables with respect to  $A\beta$  burden and SCC.

**Results:** Age did not modify the relationship between SCC and  $A\beta$  burden ( $p=0.247$ ). While individuals with lower education had greater overall SCC ( $p=0.022$ ), the relationship between  $A\beta$  burden and SCC was stronger in the high education group compared to the low education group ( $p=0.05$ ). Although sex did not modify the relationship between  $A\beta$  burden and SCC in a single model, in separate models women ( $p<.001$ ) demonstrated a significant association between SCC and  $A\beta$  burden in contrast to men ( $p=.372$ ).

**Conclusions:** These findings suggest what those with SCC who are highly educated and/or female, may be more perceptive of the memory changes that place them at risk for AD progression. As the field moves toward early detection of AD, SCC in highly educated women may provide additional evidence of those who should be clinically followed and referred to AD prevention trials.

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#### **A. BONNER-JACKSON & L. BORATO. Variables Affecting Caregiver Burden in a Memory Clinic Population.**

**Objective:** Dementia is a growing public health concern. Caregiver burden is a well-described phenomenon and refers to negative medical, social, cognitive, and emotional outcomes of providing care for individuals with cognitive impairment or dementia (e.g., Alzheimer's disease). Our goal was to examine factors that may contribute to caregiver burden in a heterogeneous memory clinic sample.

**Participants and Methods:** Participants included 50 caregivers of individuals who were seen for a comprehensive neuropsychological evaluation in a memory clinic setting. Mean patient age was 68.6 years. The patient sample was heterogeneous and included individuals diagnosed with Mild Cognitive Impairment ( $N=28$ ) and dementia ( $N=17$ ). The majority of caregivers (76%) were spouses. Caregivers completed

a self-report measure of caregiver burden (Zarit Burden Inventory), as well as measures of patient neuropsychiatric symptoms (NPI-Q) and an activities of daily living questionnaire (ADLQ). Composite Memory (MEM) and Executive Functioning (EXEC) variables were created based on data from the neuropsychology exam. Regression analyses were conducted and included MEM, EXEC, NPI-Q ratings (severity and distress), ADLQ, MOCA, and patient age as predictors of caregiver burden. **Results:** Only functional impairment and subjective caregiver distress on the NPI-Q were significantly related to subjective caregiver burden, while burden was not significantly related to either MEM or EXEC. Additionally, a significant negative correlation was identified between EXEC and total functional impairment.

**Conclusions:** Findings are consistent with previous work linking caregiver burden with patient neuropsychiatric symptoms and functional impairment. Additionally, we propose that progressive declines in cognitive function (particularly executive functioning) may result in worsening functional impairment, which in turn increases caregiver burden. Correspondence: *Aaron Bonner-Jackson, Ph.D., Center for Brain Health, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195. E-mail: aaronbonnerjackson@gmail.com*

**G.M. CASTILLO, J. ALOSTAZ, A.T. FLOWERS, K. KAUZOR, P. LU, E. WOO, J. RINGMAN, L. APOSTOLOVA & J. RAZANI. Tower Test Performance between MCI and AD Individuals.**

**Objective:** Previous research has demonstrated that the Delis-Kaplan Executive Function System (D-KEFS) Tower Test as a good measure of various executive functioning skills (Swanson, 2005). Mild Cognitive Impairment (MCI) typically precedes the onset of dementia, particularly Alzheimer's disease (AD). The purpose of this study was to assess the differences between MCI, AD, and normal controls on the D-KEFS Tower Test.

**Participants and Methods:** There is 169 participants composed of 3 groups: 57 AD, 46 MCI, and 66 normal controls participated. Participants previously diagnosed with Probable AD and the Peterson et al. (2001) research criteria for MCI were recruited from medical centers in the greater Los Angeles area. For the D-KEFS Tower Test participants were presented with a diagram displaying different size discs placed in specific formation on pegs. Participants are then required to replicate the design while not violating specific rules (e.g., can only move one disc at a time, cannot place a larger disc on a smaller one).

**Results:** A series of ANOVAS were conducted which revealed significant differences between groups on the tower total achievement score  $F(2,144)=21.552, p=.001$ . Specifically normal controls outperformed MCI and AD, and MCI outperformed AD. However, there were no significant differences found between groups on the tower test rule violation ratio  $F(2,145)=1.137, p=.324$  and tower test total accuracy ratio  $F(2,145)=1.098, p=.336$ .

**Conclusions:** Overall, it appears that MCI shows impairment, albeit milder, on the overall ability to perform this task of executive functioning. It appears that even at very mild stages of cognitive impairment individuals have difficulty with the organization, planning, and execution of commands required by this task.

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**T.P. COTHRAN, D.V. MERKITCH, V.T. DINH, G.T. STEBBINS, T.B. PARRISH, R.C. SHAH, N.T. AGGARWAL, L. BARNES, D. BENNETT, D.A. EVANS & M.A. TRIVEDI. A Preliminary Analysis of Differences in Neuroimaging Biomarkers between Middle-Aged African-American and White/Non-Hispanic Individuals with a Parental History of Alzheimer's Disease.**

**Objective:** African Americans are at greater risk for Alzheimer's disease (AD) relative to White/Non-Hispanics. Unfortunately, neuroimaging studies of cognitively-normal individuals at risk for AD have included individuals who are almost exclusively White/Non-Hispanic and therefore

little is known about the process and mechanism of changes in brain structure/function in African Americans at risk for AD. We examined differences in biomarkers of brain structure/function between African Americans and White/Non-Hispanics with a parental history of AD.

**Participants and Methods:** Seventy-eight middle-aged children of persons with AD underwent genetic testing, neuropsychological evaluation, and neuroimaging. An exploratory convenience sample was created comprised of 15 African American (14 female) and 56 White/Non-Hispanic (38 female) participants. Voxel-based morphometry (VBM), arterial spin labeling (ASL), and diffusion tensor imaging (DTI) analyses were conducted using SPM8 (Statistical Parametric Mapping).

**Results:** Relative to White/Non-Hispanics, African Americans in this sample showed greater gray matter volume in the bilateral occipital and parietal lobes, bilateral posterior cingulate, and left inferior and anterior temporal lobe (voxel familywise error rate [FWE]  $p=.05$ , cluster size  $[k]=20$ ); reduced blood flow in the bilateral parahippocampal gyrus and hippocampus, bilateral thalamus, and left posterior cingulate (cluster FWE  $p=.002, k=3500$ ); as well as differences in white matter integrity in the left posterior cingulate and the splenium of the corpus callosum (voxel FWE  $p=.05, k=20$ ).

**Conclusions:** AD may present differently among African Americans; however, little is known about the etiology of brain changes and their interactions with genetic and other risk factors (e.g., cardiovascular and psychosocial). These results warrant further investigation and underscore the importance of including African Americans and other minorities in neuroimaging studies of individuals at risk for AD.

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**B.L. DEFEIS, C. ZHU, K. ORNSTEIN, Y. GU, Y. STERN & S. COSENTINO. Healthcare Outcomes of Dementia Diagnosis Disclosure: Patients Uninformed of Dementia Diagnoses Are More Likely to Be Hospitalized.**

**Objective:** Disclosure of dementia diagnosis to patients remains controversial in part due to family concerns about patient quality of life. The extent to which such disclosures are associated with patient outcomes such as healthcare utilization is unknown. The current study examines the association of dementia diagnosis disclosure in relation to Medicare based outcomes.

**Participants and Methods:** Data were collected from 238 patients diagnosed with Probable AD or Dementia with Lewy Bodies from the multi-center Predictors of Disease Course in Alzheimer's Disease study. Caretakers were asked (yes/no) if patients had been informed of their diagnosis. Data on healthcare use were obtained from patients' Medicare claims and were matched to interview data according to the year of the clinical evaluation. Medicare use and demographics were compared between informed and uninformed patients using chi square analyses and analyses of variance covarying for age, gender, education, medical comorbidities, and dementia severity.

**Results:** Out of 238 patients, 67.6% were informed of their diagnoses, and 32.4% were uninformed. Uninformed patients were more likely to be female, widowed, have fewer years of education, and to have children as their caretakers who did not live with them. There were no significant differences between groups in dementia severity or medical comorbidities. Adjusting for these variables, uninformed patients (29.9%) were hospitalized more frequently than informed patients (15.5%;  $p=.003$ ).

**Conclusions:** Patients who are uninformed of their dementia diagnoses are more likely to be hospitalized. Disclosure of dementia diagnosis was associated with characteristics of both the patient and the caretaker. Consideration of healthcare outcomes may be factored into the discourse between clinicians and caretakers of whether to disclose diagnoses to patients with dementia.



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**J. BERG, J. DURANT, S.J. BANKS & J.B. MILLER. Comparing the Test of Practical Judgment with the Neuropsychological Assessment Battery Judgment subtest in a Dementia Population.**

**Objective:** Poor judgment is often associated with cognitive decline and is an important consideration when assessing older adults suspected of dementia. The Test of Practical Judgment (TOP-J; Rabin et al., 2007) and Judgment subtest from the Neuropsychological Assessment Battery (NAB-JDG; Stern & White, 2003) are both interview-based questionnaires designed to measure judgment. Observations in practice suggest a consistent discrepancy in a dementia population, such that NAB-JDG performance is often considerably better than TOP-J performance. This study sought to explore this phenomenon in greater detail.

**Participants and Methods:** Records from 48 consecutive referrals (Age:  $M = 73.0$ ,  $SD = 10.0$ ; Education:  $M = 14.0$ ,  $SD = 2.7$ ; 54% female) seen for neuropsychological evaluation as part of routine care in an outpatient neurodegenerative disorders clinic were reviewed. Measures of interest included the TOP-J and NAB-JDG. Discrepancy scores were calculated between z-scores and a partial correlation was conducted controlling for age. A paired-samples t-test was calculated to compare performance on TOP-J and NAB-JDG.

**Results:** The two judgment measures were significantly correlated ( $r = 0.37$ ,  $p < 0.05$ ). Discrepancies between z-scores ranged from  $-4.9$  to  $1.0$  ( $M = 1.4$ ,  $SD = 1.2$ ) with 56% of participants obtaining discrepancy scores greater than 1 standard deviation. Z-scores between the TOP-J ( $M = -1.45$ ,  $SD = 1.31$ ) and NAB-JDG ( $M = -.06$ ,  $SD = 1.11$ ) were significantly different;  $t(47) = -7.89$ ,  $p < .001$ .

**Conclusions:** In a dementia population, individuals perform significantly better on the NAB-JDG than the TOP-J, and generally within normative expectation. Even though both tests are designed to measure judgment ability, this discrepancy suggests that they may be measuring different constructs. Relying solely on the NAB-JDG subtest in a dementia population may lead to under identification of individuals with difficulties.

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**M. ENNOK, K. ANNI, K. BURK & Ü. LINNAMÄGI. Performance of WAIS-III Digit-Symbol subtest and Incidental Learning procedures in patients with Alzheimer's disease.**

**Objective:** Digit-Symbol (DS) subtest is one of the most sensitive subtests of neurological disorders in Wechsler scales. WAIS-III includes optional procedures but these have not received much attention. This study examines the performance of DS subtest and its optional procedures in patients with Alzheimer's disease.

**Participants and Methods:** The sample is 20 patients with AD (mean age: 75.1 yrs; mean MMSE: 21.9) and 20 healthy controls (mean age: 74.8 yrs; mean MMSE: 29.1). Participants were administered the Estonian version of WAIS-III DS Coding, Copy and Incidental Learning procedures. In addition to standard scoring we noted number of qualitative observations (repetitions, perseverations, intrusions, distortions, confabulations, overwriting, missing answers). To evaluate changes in speed, the proportional scatter score was found (scatter between 30-sec intervals divided with raw score).

**Results:** AD patients performed significantly worse in Coding ( $U = 69.500$ ;  $p < .001$ ; mean scores AD  $M = 6.4$  ( $SD = 2.7$ ), controls  $M = 9.3$  ( $SD = 1.9$ )) and in Copy ( $U = 85.500$ ;  $p = 0.001$ , mean scores AD  $M = 53.9$  ( $SD = 22.3$ ), controls  $M = 80.55$  ( $SD = 27.2$ )). The speed in both tasks did not differ significantly between the groups. Errors made in Coding and Copy were rare, but they were observed in both groups. Control group gave significantly more correct answers in Pairing ( $U = 40.500$ ;  $p < .001$ ,

AD  $M = 2.2$  ( $SD = 3.5$ ), controls  $M = 8.7$  ( $SD = 3.5$ )) and also in Free Recall ( $U = 36.000$ ;  $p < .001$ , AD  $M = 3$  ( $SD = 2.2$ ), controls  $M = 6.6$  ( $SD = 1.7$ )). The AD patients had more missing answers. Other error types observed were distortions, intrusions and confabulations but these were seen in both groups.

**Conclusions:** AD patients show deficit in speed of processing in both Coding and Copy task. They have also poorer incidental learning mostly because of not remembering the target symbols. Other patient groups may show a different profile of qualitative observations of DS Coding and optional procedures, that can lead to better understanding of cognitive deficits in various neurological conditions.

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**G. BARON, K.N. MORGAN & R.R. FALLOWS. The Relationship Between Subjective Instrumental Activities of Daily Living (IADL) Complaints and Objective Measures of Functioning.**

**Objective:** This study examined differences in subjective functional complaints (SFC) between two patient populations, major neurocognitive disorder (MND) and no-MND and their collateral informants, in addition to how SFC correlated with objective measures of functional status. Hypothesis: Stronger correlations would be observed between objective measures and collateral reports of SFC compared to patient report.

**Participants and Methods:** This study utilized archival data collected from an outpatient neuropsychology clinic. Participants completed the Texas Functional Living Scales (TFLS; total T-score) or the Pillbox Test (pass/fail) and underwent a clinical interview (total number of concerns). Eighty-one participants were included in the study of which 59 had no-MND (70.8(7.1) yrs old; 14.2(3.3) yrs education; 20 collaterals) and 22 had MND (75.8(6.9) yrs old; 13.1(3.4) yrs education; 7 collaterals). Pearson correlations (TFLS and SFC) and Spearman-Rho (Pillbox and SFC) were used to examine strength of correlation while paired t-tests were used to determine differences between reports of SFC.

**Results:** Patient and collateral total SFC were significantly different across both patient pairs: (no-MND patient (0.8(0.9)), collateral (1.2(1.2));  $t(19) = -2.37$ ,  $p = .03$ ) (MND patient (1.9(1.7)) collateral (2.4(1.7));  $t(14) = -2.27$ ,  $p = .04$ ). Correlations between TFLS and SFC in MND patients ( $r = -.42$ ,  $p = .06$ ) and collaterals ( $r = -.48$ ,  $p = .09$ ) approached significance while the no MND group did not. No group SFC was significantly correlated with the pillbox test.

**Conclusions:** Significant differences between collateral and patient report of SFC were observed regardless of diagnosis. There was a trend toward significant correlation between the TFLS and patient/collateral report in the MND group; however, no correlation reached significance for functional measures and SFC. Findings suggest objective functional measures may be providing information about functional status that may be different and meaningful from patient/collateral report.

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**J. FERRER-ARACÓN & V. PATIÑO TORREALVA. Semantic processing of concrete and abstract words in Alzheimer's disease and primary progressive aphasia.**

**Objective:** Analyze differences of semantic processing between patients with Alzheimer's disease and primary progressive aphasia, through development of two new tasks that evaluate semantic of concrete and abstract words

**Participants and Methods:** Four patients with AD, three patients with PPA and seven healthy volunteers who composed control group. Were used two new tasks to evaluate semantic processing of concrete and abstract words: Semantic similarity task and Semantic verification task

**Results:** Semantic similarity task: There was no difference at percentage of correct responses among patients with AD and control group in

concrete ( $U = 6.0, p = .108$ ) and abstract stimuli ( $U = 10.0, p = .335$ ). Patients with PPA was significantly lower than control group to concrete ( $U = .500, p = .018$ ) and abstract stimuli ( $U = .500, p = .010$ ). Semantic verification task: Percentage of correct answers in patients with AD was lower than control group in abstract stimuli ( $U = 3.5, p = .040$ ), but there was no differences in concrete stimuli ( $U = 6.0, p = .185$ ). Patients with PPA was below than control group ( $OR = 0.0, p = .015$ ) in both types of stimuli (concrete:  $U = 0.5, p = .010$ ; abstract:  $U = 0.0, p = .012$ ).

**Conclusions:** Performance of patients with PPA shows more severe deficit of concrete and abstract knowledge (Hoffman & Lambon Ralph, 2011; Hoffman et al, 2013; Jefferies et al, 2009). This effect could be explained by using tasks that involve a high load semantics that involves not only the recognition of the meaning of words, but also the development of a semantic judgment, reducing as far as possible the effect of processing information. Patients with AD show higher performance than patients with PPA, but are slightly affected in tasks that involving a judgment on the semantic relationship, especially abstract concepts. This effect could be explained because concrete words have a wider contextual support and activate associative richer information than abstract concepts (Schwanenflügel, 1991).

**C.M. FIGUEROA, E.K. FESTA, B.R. OTT & W.C. HEINDEL. Sensitivity of Component Attentional Measures to Subtle Cognitive Changes and Real-World Driving Performance in Early Alzheimer's Disease: A Longitudinal Examination.**

**Objective:** Distinct components of attention are differentially sensitive to early cognitive changes in Alzheimer's disease (AD) and to real-world driving performance. This study examined the ability of neurocognitive tests of attention to: a) detect subtle cognitive changes in high functioning drivers with AD and b) predict current and evolving driving risk in this population.

**Participants and Methods:** Older drivers diagnosed with very mild ( $n=43$ ) or mild ( $n=21$ ) AD completed a standardized on-road test at baseline and 6 months. Tests of spatial orienting, alerting, inhibitory control, visual search, and visuomotor tracking were administered under single- and dual-task conditions at both time points, along with a standard neuropsychological battery.

**Results:** Repeated-measures ANOVAs with Time (0, 6 months) and Test Condition (single, dual) as factors revealed differential cognitive changes across the two groups: For very mild AD, accuracy under dual-task conditions for visuomotor tracking and visual search declined over 6 months; for mild AD, alerting under dual task conditions and inhibitory control under both single- and dual-task conditions declined over 6 months. Regression analyses also revealed that single-task alerting and orienting predicted current driving performance, while single-task inhibitory control performance predicted 6-month decline in driving.

**Conclusions:** In high-functioning drivers with AD, tests of attention were able to detect cognitive decline over 6 months and to predict current and evolving driving risk. Consistent with the presence of divided attention deficits early in AD, attentional measures under dual-task conditions were particularly sensitive to decline, with specific attentional components differing with disease severity. In contrast, single-task conditions that more effectively assess distinct attentional processes were more sensitive to driving performance. Component attentional measures may be useful for early detection and assessment of subtle cognitive decline, as well as driving risk.

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**J.S. GOLDBERG, A.J. JACOBSON, M. MCDONNELL, J. SHAPIRA, E. JIMENEZ, P. LU, L.D. MEDINA, R.J. MELROSE, G.J. LEE, D.L. SULTZER & M.F. MENDEZ. Neuroanatomical Correlates of Apathy on The Frontal Systems Behavior Scale in Frontotemporal Dementia And Early-Onset Alzheimer's Disease.**

**Objective:** To examine neuroanatomical correlates of symptoms of apathy in behavioral variant frontotemporal dementia (FTD) and early-onset Alzheimer's disease (EAD).

**Participants and Methods:** 15 FTD ( $M_{age}=59.5;SD=11.4$ ) and 20 EAD ( $M_{age}=59.1;SD=5.3$ ) patients underwent MRI, and their caregivers completed the FrSBe to quantify frontal-executive symptoms. Subscales were developed from the FrSBe apathy subscale (AP) to assess cognitive (AP-C), behavioral (AP-B), and emotional (AP-E) symptoms of apathy. Surface-based reconstruction was applied to each MRI scan to extract gray matter thickness measures(TM). TMs within bilateral superior frontal regions were extracted for each subject to provide a numeric summary of regional thickness. Partial correlations were used to investigate the relationship between apathy and frontal thickness in FTD and EAD patients. Voxel-wise analyses between apathy and white matter integrity (fractional anisotropy, FA) were conducted using tract based spatial statistics (TBSS) in FSL.

**Results:** FTD subjects ( $M=53.5,SD=8.9$ ) demonstrated significantly higher AP scores than EAD subjects ( $M=32.6,SD=8.5$ ) ( $p<.001$ ), as well as higher scores on AP-B, AP-C and AP-E subscales ( $ps<.001$ ). Controlling for age, FTD patients' right superior frontal thickness (RSFT) negatively correlated with total AP scores ( $r=-.54, p<.05$ ) and AP-C scores ( $r=-.56, p<.05$ ). AP-B or AP-E did not significantly correlate with RSFT ( $ps>.05$ ). Conversely, EAD patients' RSFT negatively correlated with only AP-B ( $r=-.47, p<.05$ ). No other AP scores were significantly associated with RSFT ( $ps>.05$ ). Across both groups, more apathy was associated with lower FA in primarily frontal white matter tracts ( $p<.05$  corrected). The pattern of findings was the same across all subscales.

**Conclusions:** In FTD and EAD, apathy was associated with the right superior frontal cortex and frontal white matter tracts. Greater characterization of the neuroanatomical basis of psychiatric symptoms could aid in tailored intervention strategies.

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**I. HANULIK, A. HE, F. DE LEON, B. ROBERG, L. APOSTOLOVA, J. RINGMAN, M.J. WRIGHT & E. WOO. Longitudinal Assessment of Two Types of Prospective Memory in Healthy Aging and Mild Cognitive Impairment.**

**Objective:** Prospective memory (PM) involves planning and executing an intended action in the future. PM is often measured by asking participants to perform a simple action when signaled by a cue, but in daily life, PM can depend upon specific contingencies (e.g., remembering to take one medication after a meal and another medication on an empty stomach). The current study examines longitudinal changes in two types of PM in healthy older adults and persons with mild cognitive impairment (MCI).

**Participants and Methods:** Healthy older adults ( $n = 49$ ) and participants with MCI ( $n = 36$ ) were administered the PM tasks at baseline and at one year follow up. Participants were instructed to request a "pill" following the completion of 8 cognitive tasks in order to examine simple PM. To examine contingency-based PM, participants were further instructed to remember to request one "pill" if the task just completed required memorization and two "pills" if it did not.

**Results:** ANOVAs were conducted to evaluate the impact of diagnosis and time separately for simple PM and contingency-based PM. For simple PM, there were no significant effects of diagnosis, time, or their interaction. For contingency-based PM, the healthy older controls outperformed MCI across both the baseline and follow up assessments.

**Conclusions:** We found that when participants were asked to execute a simple intention in the future, there were no differences in performance

for healthy older adults and persons with MCI. However, when the intention was dependent upon a contingency, those with MCI performed more poorly than healthy older controls. This finding demonstrates that individuals with MCI have difficulties with more complex forms of prospective memory.

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**E.R. HARTMAN, S. CORREIA, R. CABEEN, D. LAIDLAW, P.F. MALLOY, S.P. SALLOWAY & S. DEONI. Effects of Cerebrovascular Risk on White Matter Network Characteristics in Mild Cognitive Impairment and Alzheimer's Dementia.**

**Objective:** This study's objective was to determine the effect of cerebrovascular (CV) risk on diffusion tensor imaging (DTI) based white matter (WM) networks in mild cognitive impairment (MCI) and Alzheimer's dementia (AD) using graph theoretical analysis. AD and subcortical ischemic vascular disease (SIVD) are often comorbid. SIVD is related to CV risks. Some have proposed that SIVD causes or exacerbates AD or that they share an upstream mechanism. We examined whether the relationship between CV risk and AD reflects parallel versus interacting processes. We hypothesized the latter; that CV risk would interactively impact both frontosubcortical WM networks typically affected by SIVD and temporo-limbic-parietal (TLP) WM networks affected by AD.

**Participants and Methods:** Participants were MCI=16, mild AD=11, moderate-severe AD=6. CV risk was the sum of risk factors. Structural network models were created using whole-brain dMRI tractography and T1 MRI gray matter segmentation with Freesurfer. Quantitative analysis included global and local measures weighted by fractional anisotropy. Local frontosubcortical and TLP connections were selected using a priori gray matter areas. AD severity was estimated by total gray matter volume.

**Results:** In regression analyses, CV risk showed no effect on global graph theory metrics. In frontosubcortical networks, higher CV risk associated with more network segregation and higher local connectivity. In TLP networks, CV risk associated with less segregation and lower local connectivity. Interaction analysis showed a more widespread and inconsistent effect of CV risk in more severe AD.

**Conclusions:** CV risk increased segregation and local connectivity of frontosubcortical WM networks typically affected in SIVD and had the opposite effect in TLP WM networks primarily affected in AD. These findings suggest a regionally specific interactive impact of CV risk on network connectivity in AD.

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**C. HAYS, Z.Z. ZLATAR, A. BISCHOFF-GRETHER, L.M. CAMPBELL, M.J. MELOY, D. GALASKO & C.E. WIERENGA. Relationship Between Cerebral Blood Flow and Cerebrospinal Fluid Levels of Amyloid Beta and Tau in Normal Cognitive Aging.**

**Objective:** Alterations in cerebral blood flow (CBF) are associated with Alzheimer's disease (AD) risk and may reflect early disease pathology. What is still unclear is how changes in CBF relate to cerebrospinal fluid (CSF) biomarkers of AD.

**Participants and Methods:** Twenty-five cognitively normal older adults (mean age=70.8, SD=3.5) underwent arterial spin labeling (ASL) MRI to measure whole brain resting CBF and a lumbar puncture to assess CSF levels of amyloid beta ( $A\beta_{42}$ ), phosphorylated tau (pTau), and total tau (tTau). Linear mixed effect models preliminarily investigated the voxel-wise relationship between CBF and each biomarker separately, controlling for age.

**Results:** Significant positive associations between CBF and  $A\beta_{42}$  levels were found in brain regions implicated in AD-related degeneration, including the bilateral medial temporal lobe (MTL) (hippocampus and parahippocampal gyrus) (corrected  $p < .05$ ). Positive associations between CBF and CSF levels of pTau and tTau were found in widespread

frontal brain regions, including the medial frontal gyrus and the anterior cingulate ( $p < .05$ ).

**Conclusions:** Results suggest that increased brain perfusion in the MTL is selectively associated with less amyloid (higher CSF  $A\beta_{42}$  levels). Contrarily, higher CBF was related to higher tau pathology, possibly reflective of cortical neurovascular dysregulation. This is the first study to investigate the voxel-wise relationship between ASL-measured CBF and CSF derived biomarkers of AD, and results suggest that CBF is differentially sensitive to levels of  $A\beta_{42}$  and tau. Future studies should investigate the association between CBF, CSF-measured AD biomarkers, and cognitive performance in cognitively normal and preclinical samples to elucidate the combined predictive value of CBF and AD biomarkers in detecting early cognitive decline.

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**K. HAZLETT ELVERMAN, C.M. FIGUEROA, R.J. MCKINDLES, B.D. SCHMIT & K.A. NIELSON. Preclinical Markers of Risk for Alzheimer's Disease in a Task of Inhibitory Control.**

**Objective:** Significant advances have been made in understanding Alzheimer's disease (AD), but our ability to accurately predict who will develop AD remains limited. Executive functioning has been neglected as a preclinical marker of AD, despite the vital role of these abilities (e.g., planning, set shifting, inhibition) in everyday functioning. Indeed, inhibitory deficits have been found to predict impairment in activities of daily living, an important criterion in the diagnosis of AD. This study examined executive functioning differences in event related potentials (ERPs) based on age and genetic risk for AD (+/- apolipoprotein-E  $\epsilon 4$ ; APOE- $\epsilon 4$ ).

**Participants and Methods:** Participants included 42 young adults (73% female; Mage=20, Medu=14) and 49 healthy, cognitively intact older adults (71% female; Mage=80, Medu=15). Genetic testing was conducted for older adults, 24 of whom were APOE- $\epsilon 4$  carriers. Participants completed the Parametric Go/No-Go/Stop task while ERPs were collected.

**Results:** Significant ERP differences by genetic risk emerged such that APOE- $\epsilon 4+$  participants exhibited significantly more negative amplitudes than APOE- $\epsilon 4-$  participants at midline electrodes in response to Stop trials (Fz:  $p=.003$ , FCz:  $p=.006$ , Cz:  $p=.035$ ) and No-Go lures (Fz:  $p=.021$ , FCz:  $p=.009$ , Cz:  $p=.039$ ). These neural differences were seen in the absence of genetic risk differences in task performance. Expected age differences also emerged, with older adults exhibiting slower ERP latencies, particularly to Stop trials. These results were consistent with behavioral data showing significantly slower reaction times in older compared to young adults in Go, No-Go, and Stop conditions (all  $p < .001$ ).

**Conclusions:** This study revealed significant genetic differences in ERP's in healthy older adults, revealing a new early marker of AD risk, and indicated the importance of executive abilities, such as inhibition, in preclinical AD. Inexpensive and easily accessible ERPs may be more sensitive to preclinical risk than cognitive testing alone.

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**A. HE, I. HANULIK, F. DE LEON, B. ROBERG, J. RINGMAN, L. APOSTOLOVA, K. TINGUS & E. WOO. Longitudinal Assessment of Metacognition in Mild Cognitive Impairment and Dementia.**

**Objective:** Metacognition involves awareness and monitoring of one's own cognitive abilities. Poor metacognition is one hallmark of dementia. In this study, we evaluated longitudinal changes in metacognition.

**Participants and Methods:** Participants included 78 controls, 108 MCI, and 48 dementia participants. Participants were given brief descriptions of each of 6 cognitive tasks and the total scores possible. They made predictions about how they would score on each task, and then

following task performance, they made postdictions about their scores. Metacognition was the difference between participants' actual scores and self-ratings.

**Results:** ANCOVAs were conducted to determine the longitudinal impact of diagnosis, metacognition (pre- vs post-diction) and cognitive task on prediction accuracy. At baseline, there was a significant interaction among diagnosis, metacognition, and task; for verbal learning, the dementia group overestimated performance, the MCI and control groups underestimated performance, and all groups' postdictions were more accurate than predictions. For visuoconstruction, all groups underestimated performance, and postdictions were more accurate than predictions.

At follow-up, there were significant interactions between diagnosis and metacognition and for diagnosis by task type; again, the dementia group overestimated performance, the MCI and controls groups underestimated performance, and all groups' postdictions were more accurate than predictions. In addition, the MCI groups' prediction accuracy was the worst for all tasks, and the controls were more accurate than the dementia group only for nonverbal memory and verbal learning tasks.

**Conclusions:** In summary, metacognition is poor in MCI in regard to general underestimation of performance. At follow-up, the MCI groups' prediction accuracy was worse than the control and dementia groups for all tasks, while controls only had better prediction accuracy than the dementia group depending on task type.

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**E. HOIDA, D.A. KELLY, C. KANDAH, C. KAY, M. LANCASTER, S.M. RAO, J.L. WOODARD, K.A. NIELSON, J. SMITH, S. DURGERIAN, M.A. SUGARMAN & M. SEIDENBERG. Memory Age and Semantic Specificity of Famous Names in AD and Individuals at Genetic Risk for AD.**

**Objective:** There is considerable effort to identify measures sensitive to cognitive differences in pre-clinical Alzheimer's Disease (AD). One approach is the comparison of individuals at varying genetic risk. To date, the focus has been on episodic memory. However, AD also involves impairment in retrieval of more recently acquired concepts, particularly for more specific features. Here, we compared the performance of AD and two cognitively intact groups (CI) with different gene risk status on famous name discrimination for recent and remote names with probes at different levels of semantic specificity.

**Participants and Methods:** 49 participants (ages 69-87): 14 cognitively intact APOE ε4 carriers (CI+), 19 cognitively intact non-carriers (CI-), and 16 AD were administered a famous name discrimination task for 60 recent famous names (within 10 years), 60 remote famous names (40 years+), and 60 non-famous names. Probes of increasing semantic specificity followed: categorical (reason for fame), associative (related name), and attribute (specific accomplishment).

**Results:** The AD group correctly discriminated a greater proportion of remote names relative to recent names compared to the two CI gene risk groups. (all  $p$ 's < .01). This pattern became more pronounced as semantic specificity increased. The CI+ showed a similar pattern: significantly greater accuracy for remote relative to recent names compared to the CI- at both the categorical ( $p = .03$ ) and associative semantic levels ( $p = .01$ ).

**Conclusions:** The investigation of person-identity semantic knowledge, particularly for specific semantic features of recent versus remote famous names may be useful in pre-clinical identification of individuals at risk for AD. These findings also have implications for current models of long-term memory consolidation.

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**A.J. JACOBSON, J.S. GOLDBERG, J. SHAPIRA, E. JIMENEZ, P. LU, G.J. LEE & M.F. MENDEZ. Executive Dysfunction and Reduction in Cortical Thickness Distinguishes Behavioral Variant Frontotemporal Dementia From Early-Onset Alzheimer's Disease.**

**Objective:** Early-onset forms of dementia, such as behavioral variant frontotemporal dementia (bvFTD) and early-onset Alzheimer's disease (EOAD), are frequently misdiagnosed. The purpose of the study was to examine the diagnostic utility of a caregiver-based measure of executive function, the Executive Dysfunction (ED) subscale from the Frontal Systems Behavior Scale (FrSBe), and surface-based morphometric measures of cortical thickness.

**Participants and Methods:** Fifteen bvFTD ( $M_{age}=59.5, SD=11.4$ ) and 20 EOAD ( $M_{age}=59.1, SD=5.3$ ) patients underwent MRI and caregivers completed the FrSBe, yielding the ED score. Surface-based reconstruction was applied to each MRI scan. Thickness values within selected regions of interest were extracted to provide a numeric summary of regional thickness. Hierarchical logistic regression of ED score and cortical thickness was used to discriminate between bvFTD and EOAD.

**Results:** BvFTD patients ( $M=68.1, SD=14.2$ ) experienced more ED compared to EOAD patients ( $M=47.7, SD=13.3$ ) ( $p<.001$ ). Controlling for multiple comparisons, bvFTD patients showed gray matter (GM) loss in bilateral frontal regions, while EOAD patients presented with GM loss in left parietal regions. Compared to thickness alone (77.1% classified), the combination of ED and bilateral superior frontal thickness was significantly better at classifying (94.3%) bvFTD and EOAD patients [ $\chi^2(4)=31.4, p<.001$ ], explaining between 59.2% (Cox and Snell  $R^2$ ) and 79.5% (Nagelkerke  $R^2$ ) of the variance in diagnostic group.

**Conclusions:** Compared to EOAD, bvFTD patients show a greater loss of GM in frontal regions, specifically the right and left superior frontal cortex, as well as experience more severe symptoms of ED. The combination of caregiver ratings and cortical measures more effectively discriminated between these misdiagnosed dementias, aiding in the differential diagnosis of bvFTD and EOAD.

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**S.E. JOHN, A. GURNANI, C.A. BUSSELL, J. SAURMAN, J.W. GRIFFIN, K. GRAJZEL & B.E. GAVETT. Effectiveness and Unique Contribution of Neuropsychological Tests in the Differential Diagnosis of Dementia.**

**Objective:** Clinical diagnosis of dementia considers multiple factors. Among them, neuropsychological test performance (NP) and disease severity are weighed heavily. A latent dementia phenotype,  $\delta$ , quantifies dementia severity using cognitive and functional indicators. However,  $\delta$  has not been investigated nor compared to the neuropsychological data from which it originates on efficacy in differentiating dementia etiologies. This study compares the effectiveness and measures the relative contributions of  $\delta$  and NP in differential diagnosis within the National Alzheimer's Coordinating Center (NACC) database.

**Participants and Methods:** Individuals given one of four clinical diagnoses (Alzheimer's disease (AD), Dementia with Lewy Bodies (DLB), Frontotemporal Dementia (FTD), Vascular Dementia (VaD)) at initial NACC visit were analyzed. Dyad samples (e.g., AD v DLB) were matched on sex, race, ethnicity, education, age, APOE ε4 alleles, handedness, and propensity scores (derived from preceding variables). Six logistic regression models predicting diagnosis of each possible dyad were performed.

**Results:** Across all six comparisons, NP demonstrated superior area under the curve (AUC) values to  $\delta$  in classifying clinical diagnosis (AUC for AD v DLB: NP = .76,  $\delta = .59$ ; AD v FTD: NP = .76,  $\delta = .59$ ; AD v VaD: NP = .78,  $\delta = .64$ ; FTD v DLB: NP = .73,  $\delta = .52$ ; DLB v VaD: NP = .68,  $\delta = .51$ ; FTD v VaD: NP = .70,  $\delta = .52$ ). NP also represented a greater relative contribution ( $R^2$ ) to diagnosis than  $\delta$  ( $R^2$  of NP, .154 to .245;  $R^2$  of  $\delta$ , .002 to .012).

**Conclusions:** Although  $\delta$  comprises all of the NP tests used in these analyses, NP is better than  $\delta$  at classifying dementia subtypes and

uniquely explains approximately 15-25% of the variance in assignment of diagnostic category. The results support previous contentions that  $\delta$  is most suitable as a measure of dementia severity, not differential diagnosis.

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**E.M. LANE, J. NEAL, D. LIU, K. GIFFORD, T.J. HOHMAN, L. LOGAN, M. WIGGINS, K.M. WISNIEWSKI, K. NISWENER & A.L. JEFFERSON. Insulin Sensitivity, Neuropsychological Performance, and Cognitive Diagnosis: The Vanderbilt Memory & Aging Project.**

**Objective:** Insulin resistance is associated with cognitive impairment and risk for the development of Alzheimer's disease. This study examines whether insulin sensitivity relates to neuropsychological performance in older adults with normal cognition (NC) and mild cognitive impairment (MCI) and whether these associations interact with cognitive diagnosis or apolipoprotein e4 (APOE4) status.

**Participants and Methods:** Participants were drawn from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging. At enrollment, NC ( $n=137$ ,  $73\pm 7$  years, 41% female) and MCI ( $n=137$ ,  $73\pm 8$  years, 40% female) underwent fasting blood draw and comprehensive neuropsychological protocol. Insulin sensitivity was calculated using quantitative insulin sensitivity check index (QUICKI). Linear regressions, adjusted for age, sex, race, education, body mass index, systolic blood pressure, prevalent cardiovascular disease, cognitive diagnosis, and APOE4, cross-sectionally related QUICKI to neuropsychological performance. Secondary analyses tested heterogeneous effects of QUICKI with QUICKI x diagnosis and QUICKI x APOE4 interactions, and subgroup analyses.

**Results:** There were no main effects between QUICKI and neuropsychological performances ( $p$ -values $>0.13$ ). There were significant interactions for QUICKI x cognitive diagnosis on California Verbal Learning Test (CVLT) learning ( $\beta=-78.53$ ,  $p=0.006$ ) and CVLT delayed recall ( $\beta=-27.10$ ,  $p=0.008$ ). MCI participants with increased insulin sensitivity performed worse on CVLT learning ( $\beta=-51.28$ ,  $p=0.04$ ). NC that were APOE4 positive performed worse on Trail Making B ( $\beta=261.72$ ,  $p=0.03$ ).

**Conclusions:** The effects of insulin sensitivity on memory performance vary depending on cognitive diagnosis and APOE4 status. Future work will assess the interaction of insulin sensitivity, cognitive diagnosis, and APOE4 status on longitudinal cognitive changes.

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**J. LARA-RUIZ, D. BANUELOS, P. LU & J. RAZANI. Functional Outcome, Cognitive Decline and Symptoms of Depression in Participants with Alzheimer's.**

**Objective:** We conducted the current study to evaluate the relationship between functional outcome, cognitive decline and symptoms of depression in participants diagnosed with Alzheimer's disease (AD).

**Participants and Methods:** Participants with mild to moderate AD ( $N = 42$ ) were administered the Direct Assessment of Functional Status (DAFS) assessing skills related to daily living tasks, the Mini Mental State Exam (MMSE) assessing cognitive abilities, and the Beck Depression Inventory-II (BDI-II) assessing depression

**Results:** Findings from a linear regression indicate that both MMSE and DAFS were significant predictors of depression. While MMSE was negatively correlated with depression ( $p < .05$ ), DAFS was positively correlated with depression scores ( $p < .05$ ).

**Conclusions:** As expected, a decline in cognitive abilities was associated with more depression. However, functional ability was positively correlated with depression, which could be related to participants having more awareness when they are more functional and are able to report their depressive symptoms. In addition, other factors such as stress, caregiver assistance, and/or demographic variables (e.g., education, gender, and ethnicity) may play a role in the relationship between functional ability and depression. This should be examined in future research. Lastly, longitudinal data needs to be examined to determine if decline in cognition and functional ability as a result of AD contributes to more depressive symptoms in the future. Findings from this study may contribute to improving treatments and quality of life in AD participants. Correspondence: *JOSE LARA-RUIZ, B.A., PSYCHOLOGY, CALIFORNIA STATE UNIVERSITY, NORTHRIDGE, 11722 HARTSOOK ST, Valley Village, CA 91607. E-mail: JOSE.LARARUIZ.392@MY.CSUN.EDU*

**E.A. LIVANOS, A. RAMADAN, C. CHRISTODOULOU, E. ROSEMAN, T. PRESTON & B.K. LEBOWITZ. Stability of HART Estimated IQ in Clinically Referred Patients.**

**Objective:** Estimating baseline intellectual capacity is a critical component of the neuropsychological evaluation. The Hopkins Adult Reading Test (HART) is a single word reading test that produces an estimate of IQ in approximately five minutes. Further, IQ estimates based on similar measures are believed to be relatively resilient to the adverse cognitive influence of many neuropathological processes. Thus, measures like the HART are particularly useful in the evaluation of patients who are suspected of having a neurodegenerative condition. While reliability and validity data are available, limited research has explored the stability of the HART in clinically referred individuals. The current study explored the stability of the HART in a clinically referred sample of patients seen in a neurology department.

**Participants and Methods:** The study sample consisted of 84 patients (Mean age = 59.7 years; SD = 15.5) who were seen on two occasions. Follow-up assessment occurred after an average interval of 18 months.

**Results:** Similar to published reliability data, baseline and follow-up estimated IQ scores were highly correlated ( $r = .95$ ,  $p < .01$ ). Further, the modal difference between estimated IQ at baseline and at follow-up was zero, and 96% of the sample performed within 4 points of the estimated baseline IQ score. The overall sample means were almost identical (Baseline Estimated IQ = 106.6; Follow-up Estimated IQ = 106.5). Further, the correlation between baseline and follow-up testing was unchanged when the sample was split and younger ( $<61$  years of age) and older ( $> 60$  years of age) participants were analyzed separately.

**Conclusions:** Given the findings, the current study provides support for the stability of the HART in the estimation of IQ in clinical settings. Correspondence: *Brian K. Lebowitz, PhD, Neurology, Stony Brook University Medical Center, 14 Technology Drive, Suite 12B, Setauket, NY 11733. E-mail: Brian.Lebowitz@stonybrookmedicine.edu*

**C. LOBUE, M. CLEM, K. WILMOTH, H. WADSWORTH, H.C. ROSSETTI, F.L. WOON, J. HART, K. WOMACK & M. CULLUM. Earlier Age of Diagnosis in Alzheimer Disease by Sex: The Additive Effect of Traumatic Brain Injury History and Apolipoprotein e4.**

**Objective:** Traumatic brain injury (TBI) and apolipoprotein e4 (Apoe4) are risk factors for Alzheimer Disease (AD). Prior studies suggest these factors may interact and be moderated by sex. We utilized a large national cohort to examine whether an interaction between history of TBI and ApoE4 was associated with earlier age of AD diagnosis by sex.

**Participants and Methods:** Subjects with a clinical diagnosis of AD were obtained from the National Alzheimer's Coordinating Center Uniform Data Set, stratified by sex ( $n$  female=2656;  $n$  male=2115), and categorized based on self-reported lifetime TBI with loss of consciousness but no chronic deficit (TBI+ vs TBI-) and presence of ApoE4. The interaction of TBI history and ApoE4 on age of diagnosis was examined using ANCOVA, accounting for race, education, and family history of dementia.

**Results:** Age of diagnosis differed by TBI history and Apoe4 independently. TBI+ subjects were diagnosed with AD on average 2.4 and 1.9 years earlier ( $p \leq .01$ ) than TBI- subjects for females (M Age=73.9 vs 76.3) and males respectively (M Age=73.7 vs 75.6). Age of AD diagnosis was 2.4 and 1.8 years earlier ( $p \leq .01$ ), respectively, for female (M Age=75.2 vs 77.6) and male (M Age=74.7 vs 76.5) Apoe4 carriers relative to non-carriers. Relative to those with a history of TBI or Apoe4 alone and in the absence of both risk factors, females and males having both TBI history and Apoe4 had the earliest age of AD diagnosis (M DiffYears=females  $\geq 2.8$ ; males  $\geq 2.5$ ); however, this interaction was non-significant ( $p \geq .26$ ).

**Conclusions:** History of self-reported TBI and presence of Apoe4 were independently associated with earlier diagnosis of AD in both females and males. However, an interaction between these two risk factors was not observed regardless of sex. These findings suggest TBI and Apoe4 may be associated with an earlier expression of cognitive decline that is additive but not synergistic.

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#### D.A. NATION, J.K. HO & B. YEW. Older Adults Taking AT1-Receptor Blockers Exhibit Reduced Cerebral Amyloid Retention and Progression to Dementia.

**Objective:** Evidence suggests that angiotensin II AT1-receptor blockers (ARBs) may be protective against dementia, and studies in transgenic animals indicate that this may be due to improved amyloid- $\beta$  (A $\beta$ ) clearance. We investigated whether taking ARBs was associated with an attenuation of age-related increases in cerebral A $\beta$  retention, and reduced progression to dementia.

**Participants and Methods:** Eight hundred seventy-one stroke-free and dementia-free older adults from the Alzheimer's Disease Neuroimaging Initiative (ADNI) study underwent baseline lumbar puncture, and a subgroup ( $n=124$ ) underwent 12 and 24 month follow-up lumbar puncture. Participants were followed at variable intervals for clinical progression to dementia. Linear mixed models and ANCOVA compared ARBs users with those taking other antihypertensives (O-antiHTN) or no antihypertensives (No-antiHTN) on cerebral spinal fluid (CSF) A $\beta$  and phosphorylated tau (P-tau) levels. Cox regression and chi-square analyses compared groups on progression to dementia.

**Results:** ARBs users exhibited greater vascular risk and lower educational attainment than the No-antiHTN group. Longitudinal analyses indicated higher CSF A $\beta$  and lower P-tau in ARBs users versus other groups. Cross-sectional analyses revealed age-related decreases in CSF A $\beta$  in other groups but not ARBs users. ARBs users were less likely to progress to dementia and showed reduced rate of progression relative to the No-antiHTN group.

**Conclusions:** Patients taking ARBs showed an attenuation of age-related decreases in CSF A $\beta$ , a finding that is consistent with studies done in transgenic animals. These findings may partly explain why ARBs users show reduced progression to dementia despite their lower educational attainment and greater vascular risk burden.

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#### Y.T. QUIROZ, L. SAFAR, S. GALE, C. POSADA & J.C. SHERMAN. Depression with Spiritual Delusions as a Manifestation of Early-Onset Alzheimer's Disease: A Case Report.

**Objective:** Major depressive disorder (MDD) with psychotic features is a distinct type of depressive illness in which mood disturbance is accompanied by either delusions, hallucinations, or both. Psychotic features can also be seen in delirium and dementia. We describe a Latino woman with a long-standing history of depression who initially presented with spiritual delusions and was later diagnosed with early-onset Alzheimer's disease (EOAD). This case is remarkable for several reasons; While

psychotic features may be present years after dementia diagnosis, they are very uncommon in preclinical EOAD; Spiritual delusions can be overlooked when considering spirituality in Latino patients; A literature review revealed no previous reports of MDD with psychotic features preceding EOAD.

**Participants and Methods:** A 53-year-old right-handed Latino woman with medical history of migraines, sleep apnea and depression presented to the hospital with complaints of cognitive impairment. Patient's family described changes in memory, word-finding and behavior (acting on a belief that her dead parents were living with her). Her ability to independently execute activities of daily living had progressively declined. In the context of her depression, they noticed a significant worsening of her mood in the past year.

**Results:** Further evaluation revealed a paternal family history of EOAD. She was diagnosed with depression with psychotic features in light of her fixed delusion. Neuropsychological evaluation revealed impairment across all cognitive domains and severe depression. Her MMSE score was 22/30. She was diagnosed with probable dementia and referred to a behavioral neurology clinic where CSF biomarkers were highly consistent with AD.

**Conclusions:** This case illustrates the need to consider EOAD in the differential diagnosis of depression with psychotic features in individuals with family history of dementia. Early diagnosis of dementia can improve treatment and prognosis of dementia. Research on this topic is recommended.

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#### A. RADKE, D. LORING, J.J. LAH, J.M. PELLISSIER & F.C. GOLDSTEIN. Recognition Memory as a Cognitive Biomarker for Alzheimer's Disease.

**Objective:** Recognition memory is often evaluated in neuropsychological assessments to distinguish encoding from retrieval impairments, and it is relatively preserved in normal cognitive aging. Alzheimer's disease (AD) is considered to the prototype of a disorder characterized by encoding deficits. We investigated whether recognition memory performance is also useful in distinguishing AD from normal aging.

**Participants and Methods:** Participants were enrolled in the Alzheimer's Disease Neuroimaging Initiative (ADNI). Recognition scores (hits minus false alarms) on the Rey Auditory Verbal Learning Test were converted to standardized scores based on the performance of the normal controls.

**Results:** The sample included 225 individuals with normal cognition (mean age=76.1 years), and 193 individuals with AD (mean age=74.5). Seventy five percent of the AD patients were impaired in recognition memory compared to only 7% of the controls,  $p < .001$ . Using a cut score of  $z = -2.0$  SDs, the sensitivity of recognition memory performance to distinguish AD from normal cognition was 75%, while the specificity was 93%. Positive predictive value was 90% and negative predictive value was 81%. There was a significant correlation ( $p < .05$ ) for the AD patients between poorer performance on the recognition memory test and lower left temporal lobe volume.

**Conclusions:** Recognition memory performance appears to be a good cognitive biomarker for Alzheimer's disease.

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#### R. ROSTAMI, S. AMANO, A.N. FONTEH, B.E. STALEY SHUMAKER & M. HARRINGTON. The Association between Executive Function and Lipid Levels in the CSF of Individuals with Pre-symptomatic Alzheimer's Pathology.

**Objective:** Ceramide and sphingomyelin are lipid components of myelin sheaths and play an integral role in processing amyloid precursor protein and removal of  $\beta$ -amyloid and tau. We hypothesize that an

earlier change in executive function is associated with changes in these lipid levels in the CSF of individuals with pre-symptomatic Alzheimer's pathology.

**Participants and Methods:** The study included 36 cognitively healthy participants with normal levels of  $\beta$ -amyloid and tau (CH-NAT) in their CSF and 34 cognitively healthy participants with pathological levels of  $\beta$ -amyloid and tau (CH-PAT) in their CSF (pre-symptomatic Alzheimer's pathology group). The participants' neuropsychological battery included the Stroop Color-Word Interference Test and also had 20 mL of lumbar CSF collected close to the time of assessment.

**Results:** Results show a significant difference in levels of sphingomyelin ( $p = .04$ ) and in the ratio of levels of ceramide to sphingomyelin ( $p = .03$ ) between the two groups. The groups significantly moderated the relationship between lipid levels and executive function. The CH-PAT group's levels of ceramide ( $p < .05$ ) and the ratio of levels of ceramide to sphingomyelin ( $p < .01$ ) were positively associated with executive function and levels of sphingomyelin ( $p < .05$ ) were negatively associated with executive function. The association in the CH-PAT group was significantly larger in levels of ceramide ( $p < .05$ ) and the ratio of levels of ceramide to sphingomyelin ( $p < .05$ ) than it was with levels of sphingomyelin alone.

**Conclusions:** Significantly increased levels of sphingomyelin and the ratio of ceramide to sphingomyelin in the CSF of the CH-PAT group, when compared to the CH-NAT group, suggests a role of these lipids in amyloid processing. Positive association of ceramide and the ratio of ceramide to sphingomyelin in the CH-PAT group with executive function and negative association of sphingomyelin with executive function suggests that changes in membrane composition influence neuropsychological measures.

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**M.K. COLVIN, M. DALY, A. LAFFER, S. MANCUSO & J.C. SHERMAN. An investigation into cognitive and test factors that impact performance on the Free and Cued Recall Test among patients with MCI and Dementia.**

**Objective:** The Free and Cued (F & C) Recall task is highly sensitive in predicting dementia, particularly of the Alzheimer's type. While this test has great value in dementia diagnosis, given the task's multiple demands, including naming, appreciation of semantic categories, learning, as well as retrieval of the pictured objects, we asked whether performance is affected by naming and learning success within the task, the degree to which item prototypicality (i.e., goodness of example) impacts performance and how well performance correlates with performance on other semantic access and memory tasks.

**Participants and Methods:** We administered the F & C Recall test as part of a larger neuropsychological battery to 137 patients including 42 with MCI, amnesic type, 53 with MCI, non-amnesic type, 19 with possible and probable AD and 23 with other dementias. We recorded patients' naming and initial encoding success during the learning trial.

**Results:** Our findings replicate previous studies indicating a particular sensitivity of this task to amnesic forms of MCI and dementia. We found that training success, both naming and initial encoding, predicted free recall while initial encoding predicted free and cued performance. Regression analyses indicate that patients' performance on the free recall trial was predicted by performance on memory measures (LM I and LMII) while delayed verbal memory (LMII) and confrontation naming (BNT) predicted combined free and cued recall performance. Patients were significantly better at recalling high than low prototypicality items. Verbal fluency performance (phonemic, category) did not predict performance.

**Conclusions:** Our findings suggest that the sensitivity of the F & C Recall task is best understood when contributions of semantic memory as well as a decline in associative memory are considered. We discuss our findings in terms of their relevance in understanding the breakdown

in memory and semantic knowledge in MCI and dementia and the role that these factors play in this diagnostic test.

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**M.J. TAT, C.B. NAGLE, A. STARK-LAUDATE, E. GOSSELIN, M.R. ZEGEL, E.A. VASSEY, P. SOLOMON & A. BUDSON. Caregiver and clinician impressions of false memory in patients with Alzheimer's disease: A questionnaire study.**

**Objective:** Alzheimer's disease (AD) is characterized by the rapid rate of forgetting for new information. Patients also commonly exhibit false memories, and no studies have examined the impact of false memories in every day life. We examined the frequency with which caregivers and clinicians observed false memories in patients on several activities of daily living.

**Participants and Methods:** 115 caregivers and 178 clinicians were recruited. Caregivers were family members providing care for a patient with AD. Clinicians individuals that saw patients in their practice. Participants filled out a questionnaire asking how often patients forgot or falsely remembered to complete an everyday activity (How often does your loved one/patient misplace things?: How often does your loved one/patient know where something is but are mistaken?) There were 5 response options: Often, Sometimes, Rarely, Never, or Don't Know. We were interested in the frequency which participants observed forgetting versus false memory.

**Results:** Raw scores from each question type were entered into repeated measures ANOVAs. For caregivers and clinicians, the frequency of forgetting was higher than the frequency of false memory. Forgetting and false memories were more frequent as disease severity increased.

**Conclusions:** Caregivers may simply be more aware of the forgetting of information, and less aware of false memory. Clinicians also observe more forgetting, as memory assessments commonly examine forgetting rather than false memory. Although forgetting was more frequent overall, the frequency of false memory was not dramatically lower in comparison. These results suggest that caregivers and clinicians are more aware of the incidence of forgetting in patients, though false memories are just as prevalent. Including false memory measures in various assessments may add to the diagnostic utility in characterizing memory impairments in patients with AD.

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**D.F. TATE, S. TASS & E.D. BIGLER. Global Measures of Brain Volume and Neuropsychological Performance in the Cache County Memory and Aging Study.**

**Objective:** There have been significant efforts to identify biomarkers that could be used to diagnose, track treatment effects, and/or explain functional outcomes in patients with a dementia diagnosis. The purpose of this study was to examine the functional relationships between volumetric magnetic resonance imaging (MRI) measures and neuropsychological tests in the Cache County Memory and Aging Legacy dataset to elucidate the relationship between these variables.

**Participants and Methods:** Using canonical correlation analysis (CCA) methods, the relationship between linear combinations of "predictor" variables (31 brain volume measures) and linear combination of "response" variables (13 neuropsychological tests from the CERAD batter) was examined in 163 participants with a range of dementia diagnoses (20 healthy controls, 61 Alzheimer's disease, 46 vascular dementia, 30 mixed).

**Results:** Results demonstrated an overall significant model between the variables (Wilk's  $\lambda=0.0247$ ,  $p<0.001$ ). Only the first (out of 13 possible) canonical correlation results was significant (r-value=0.79) explaining 49% of the variance. The second CCA result was not significant, but explained a significant amount of the variance as well (31%). Visual inspection of the raw/standardized canonical function

coefficients indicated that global measures of brain integrity (gray/white matter volume, CSF, ventricle-to-brain ratio) are significantly related to measures of memory (immediate and delayed logical memory and Benton visual performance) and animal fluency. More specific measures of brain volume (i.e., hippocampal volume, temporal lobe gyral volumes) were not found to be related using the CCA methods.

**Conclusions:** These results emphasize the importance of global brain volume measures in predicting cognitive performance in dementia patients. The global aspects of these structural changes predictive of outcome imply failure in multi-system or whole brain networks that subserve cognition. The clinical application of these findings will be addressed.

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**C. VILA-CASTELAR, J.J. LY, K. VAN DYK, L. KAPLAN, J.T. BERGER, L.O. MACINA, J.L. STEWART & N.S. FOLDI. Detecting response to Cholinergic treatment in AD after 6 week double-blind placebo controlled trial: sensitivity of attentional measures on accuracy, fatigue and variability.**

**Objective:** Cholinesterase inhibitors are standard treatments of Alzheimer's disease (AD). The standard industry efficacy measure aggregates multiple cognitive areas, leading to poor sensitivity. As acetylcholine modulates attention, we hypothesized that treatment effects could be detected using demanding attention tasks within  $\approx 6$  weeks, while global or other domain-specific cognitive measures would not.

**Participants and Methods:** 23 participants newly diagnosed with AD were in a longitudinal randomized double-blind placebo-controlled trial. After baseline (T1), participants were randomized (Drug [donepezil 5mg] = 12; Placebo = 11), and retested after  $\approx 6$  weeks (T2). Global function, specific domains (memory, language, visuospatial, and executive function) and 3 load-varying attention tasks (Simple Detection, Covert Orienting, and Attentional Blink) were assessed. Measures included speed and variability using reaction time (RT) and Standard Deviation (SD), orienting using costs and benefits, fatigue using RT difference across multiple trial blocks, and accuracy of top-down identification under varied load. Treatment effects were measured with repeated measures analysis of variance (ANOVA) and Wilcoxon signed-rank tests.

**Results:** Variability: By T2, only the Drug group decreased variability at high load (T1-T2,  $z = -2.04$ ,  $p = .04$ ,  $d = .64$ ). Fatigue: At T2, the Placebo group slowed overall RT across blocks on detection (Block1-2,  $z = -2.22$ ,  $p = .03$ ,  $d = .53$ ) and orienting (Block1-5,  $z = -2.93$ ,  $p = .00$ ,  $d = .95$ ). Accuracy: the Placebo group worsened from 62% (T1) to 37% (T2),  $z = -2.20$ ,  $p = .03$ ,  $d = .98$ . No other measures showed treatment effects.

**Conclusions:** Supporting our hypothesis, our attention tasks detected cholinergic augmentation in AD after only  $\approx 6$  weeks: the Drug group improved variability while the Placebo group worsened accuracy and increased fatigue. Global and domain-specific measures failed to detect change. Attention, measured by accuracy, variability and fatigue, may be valuable to assess efficacy of cholinergic treatment.

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**C. VILA-CASTELAR, J.J. LY, L. KAPLAN, K. VAN DYK, J.T. BERGER, L.O. MACINA, J.L. STEWART & N.S. FOLDI. Attentional Blink predicts treatment response to cholinesterase inhibitors in patients with AD: accuracy on a high load top-down task.**

**Objective:** Developing sensitive tools to detect early response to cholinesterase inhibitors in patients with Alzheimer's disease (AD) remains challenging. The Alzheimer's Disease Assessment Scale-Cognition Subscale (ADAS-Cog) assesses efficacy at 6 months, which confounds treatment response with disease progression, as well as small effect sizes. As

acetylcholine modulates attention, we hypothesized that the Attentional Blink task would be more sensitive and predict treatment response once steady state is reached ( $\approx 6$  weeks).

**Participants and Methods:** 20 participants newly diagnosed with AD were in a longitudinal trial. After baseline (T1), participants took daily donepezil (5mg), and retested after  $\approx 6$  weeks (T2) and  $\approx 6$  months (T3). Responders (N=9) and non-responders (N=11) were classified by T3 ADAS-Cog scores. Measures: ADAS-Cog and Attentional Blink, a top-down task presenting two sequential alphanumeric characters at 5 increasing levels of temporal load (Stimulus Onset Asynchrony [SOA]: 655, 532, 399, 266, or 133 ms). A priori letter or number category cues prompted which item to report (DV: Accuracy at each SOA). Analyses comprised two binary logistic regressions: 1) predicting T3 responder classification using T2 ADAS-Cog and SOA accuracy as IVs; 2) using significant predictor variables in a new model to assess predictive power.

**Results:** At T2, two SOAs significantly predicted T3 response (399ms:  $\beta = -20.29$ ,  $SE = 10.47$ ,  $Exp(B) = .00$ ,  $p = .01$ ; and 266ms:  $\beta = -3.34$ ,  $SE = 3.30$ ,  $Exp(B) = .03$ ,  $p = .04$ ). A model including only significant SOAs predicted T3 treatment response (Sensitivity=78%, Specificity=82%,  $p = .01$ ). Increased accuracy resulted in higher odds to respond to treatment.

**Conclusions:** The ability to accurately report an alphanumeric target under high temporal load after 6-weeks cholinergic treatment significantly predicted industry accepted drug-response classification at 6-months. This supports that mechanisms of attention are highly sensitive to cholinergic augmentation, and may be potential identifiers of treatment response.

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## Dementia (Non-AD)

**M. BERTOUX, C. O'CALLAGHAN, L.C. DE SOUZA, M. SARAZIN, B. DUBOIS & M. HORNBERGER. Social cognition distinguishes amnesic behavioural variant frontotemporal dementia from Alzheimer's disease.**

**Objective:** Recent studies showed that the diagnostic distinction of behavioural variant frontotemporal dementia (bvFTD) and Alzheimer's disease (AD) should no longer rely on the evaluation of memory, as one out of two bvFTD patients could suffer from a severe episodic amnesia. During the last decade, social cognition testing has appeared as very useful to distinguish both diseases at early stages. The aim of this study was to investigate the ability of a short (<20min) Social cognition & Emotional Assessment, namely the mini-SEA, to distinguish bvFTD from AD, regardless of the presence of amnesia.

**Participants and Methods:** 103 participants, including 38 bvFTD, 35 AD and 30 controls were included. 48% of patients underwent a lumbar puncture therefore corroborating the initial diagnosis. All underwent a neuropsychological assessment, including an episodic memory evaluation controlling for executive processing and the mini-SEA, which include an evaluation of theory-of-mind (Faux-pas) and facial emotion recognition. bvFTD patients were divided on their memory performance into amnesic (n=19) and non-amnesic (n=19) subgroups.

**Results:** bvFTD had lower mini-SEA scores compared to controls and AD, which had subnormal performances. The mini-SEA was able to distinguish amnesic and non-amnesic bvFTD from AD with respectively 85.1% and 93.9% of accuracy. In contrast, as expected, memory was only able to classify 69.7% of patients.

**Conclusions:** Regardless the presence of amnesia, the mini-SEA, a short social cognition assessment, could accurately distinguish bvFTD from AD. These findings highlight the necessity to revise the existing neuropsychological diagnosis criterion of bvFTD in order to (1) include social cognition deficit as a diagnosis marker and (2) withdraw the relative preservation of episodic memory from the criterion.



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**A. CARR, P. PAHOLPAK, E. JIMENEZ & M.F. MENDEZ. Perceived Emotional Intelligence (EI) and Social Behavior Disturbance in Behavioral Variant Frontotemporal Dementia (bvFTD) and Early-Onset Alzheimer's Disease (eAD).**

**Objective:** EI is the ability to recognize emotions, to discriminate feeling states, and to use these to guide behavior (Salovey et al., 2004). Given focal social disturbances in these early-onset dementing illnesses, identifying differences in neurocognitive mechanisms linked with EI and social dysfunction may be helpful to distinguish bvFTD from eAD, and more broadly examine the role of EI in social behavior.

**Participants and Methods:** 11 bvFTD patients and 11 eAD patients completed the EI Scale (Schutte et al., 1998) and a neurocognitive battery. Caregivers completed the Emotional Blunting Scale (Mendez et al., 2006) and the Social Dysfunction Scale (Barsuglia et al., 2014). Participants underwent magnetic resonance scans.

**Results:** No significant differences amongst groups were observed in demographics. BvFTD patients reported higher levels of EI compared to eAD patients ( $p = .026$ ). BvFTD patients reported higher levels of emotional regulation ( $p = .030$ ), increased ability to appraise emotions in others ( $p = .011$ ), and social skills than eAD patients ( $p = .026$ ). Perceived ability to appraise emotions correlated with emotional blunting behaviors ( $p = .029$ ), thoughts ( $p = .022$ ) and social dysfunction ( $p = .002$ ). Perceived social skills and ability to utilize emotions correlated with increased thought blunting ( $p = .026-.030$ ). EI were inversely associated with ventromedial prefrontal cortex ( $r = -.46$ ,  $p = .016$ ) and anterior temporal lobe ( $r = -.40$ ,  $p = .020$ ). EI correlated with reduced performances in executive function tasks ( $r = -.42$ ,  $p = .013$ ).

**Conclusions:** BvFTD rated themselves as having higher levels of emotional intelligence than eAD patients. Given the higher levels of social dysfunction, this likely reflects perceived abilities but not the ability in real life situation. These findings can clarify the relationship of socio-emotional behavioral changes in these dementia syndromes relevant to an aging population.

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**A. FEDOR, S. GARCIA & J. GUNSTAD. Cognitive Function does not Moderate the Relationship Between Subjective and Objective Physical Activity in Older Adults.**

**Objective:** Cognitive impairment is common in the older adult population and strategies have been developed in an attempt to slow or reverse this. However, most of these approaches have had marginal, if any success. Recently, exercise has emerged as a possible way to improve cognitive functioning in an older adult population. Though the self-reported accuracy of the amount of exercise in which an older adult engages has been poor.

**Participants and Methods:** 60 older adults were recruited as part of a larger study. Each participant completed a packet of self-report questionnaires, including a measure of physical activity, neuropsychological measures of memory and other cognitive abilities, and were given an objective measure of physical fitness.

**Results:** Over 50% of participants reported performing vigorous intensity physical activity on a weekly basis, and over 40% indicated performing moderate intensity physical activity weekly. However, objective data revealed participants spent almost of their time immobile. Correlations between subjective and objective reports of physical activity were low. Cognitive function did not moderate the relationship between subjective and objective report of physical activity.

**Conclusions:** These findings suggest older adults have little insight into the amount, or intensity, of physical activity they are performing on a daily basis. Future work is needed to confirm these findings and

identify factors which might help older adults accurately estimate their level of daily physical activity.

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**M. KORSNES. The Mini-Mental State Exam (MMSE) and the Montreal Cognitive Assessment (MoCA) as a diagnostic screening tool in an old age psychiatry department.**

**Objective:** In old age psychiatry, it is desirable to quickly predict the underlying cause of low scores on cognitive screening tests. Excising screening tools are poor predictors of underlying cause. Can a combination of established screening tools (MMSE and MoCA) give better prediction in differentiating between causes of cognitive decline? The purpose of the study was to investigate if a combination of subtests within existing screening tools may facilitate better prediction of the cause of poor performance on cognitive screening tests.

**Participants and Methods:** 134 patients were tested with MMSE and MoCA at admission, and later grouped according to diagnosis at discharge. 122 patients fitted into main diagnostic groups, Alzheimer (14), Other Dementia (13), Schizophrenia (9), Delusional (7), manic (29), Bipolar (10), MDD (25), GAD (15). Group results on subtests of MMSE/MoCA were analysed with Anovas corrected for age, sex and education.

**Results:** The Alzheimer patients had severe problems with all the subtests; several patients could not complete the tests, particularly not the MoCA test. The "other dementia" group had severe problems with most subtests, particularly MMSE Orientation, MMSE Figure Drawing, MoCA Visuo-cognitive test, MoCA Clock drawing, MoCA Abstraction and Orientation. The Schizophrenia group had problems attending to the tests, and the results are generally not valid for this group. The other groups showed patterns of poorer and better performances than the average patients on several subtests of MMSE and MoCA.

**Conclusions:** The Mini-Mental State Exam (MMSE) and the Montreal Cognitive Assessment (MOCA) are two diagnostic tests that both are used for screening purposes when there is a suspicion of cognitive problems. Our preliminary results shows that a combination of MMSE and MoCa subtests give a better prediction towards a particular diagnosis than MMSE or MoCa separately.

**V. LATREILLE, J. CARRIER, R.B. POSTUMA & J. GAGNON. Neuropsychological Correlates of Dementia Development in Parkinson's Disease.**

**Objective:** Cognitive impairments are frequent in Parkinson's disease (PD). The cognitive profile observed in PD is often heterogeneous, although some studies have reported that more posterior cognitive deficits are associated with increased risk of dementia. This longitudinal study examined whether specific cognitive domains in non-demented PD patients at baseline were associated with increased risk of developing dementia at follow-up (mean: 4.5 years).

**Participants and Methods:** Sixty-eight PD patients and 44 healthy controls underwent a comprehensive neuropsychological assessment at baseline visit. For each cognitive domain (attention, executive, episodic memory, and visuospatial), Z-scores were combined into a composite score. Analyses of covariance, with either age or disease severity as covariant, were performed to compare the groups on cognitive data, and Receiver Operating Characteristics (ROC) curves were computed to measure the sensitivity and specificity of cognitive domains to predict dementia outcome in PD.

**Results:** At follow-up, 18 PD patients developed dementia (PDD) and 50 PD patients remained dementia-free (PDnD). PDD patients scored markedly lower on all cognitive measures at baseline compared to PDnD patients and controls. PDnD patients also had poorer scores on attentional and executive functions than controls. Using ROC curves, attention, executive, and visuospatial scores showed the highest sensitivity (0.83, 0.78, and 0.94, respectively) and specificity (0.89, 0.91, and 0.80, respectively) to identify PDD patients. Episodic memory scores

showed modest subject-wise classification (sensitivity 0.67; specificity 0.78).

**Conclusions:** This study shows that attention, executive, and visuospatial measures are sensible early markers of dementia development in PD. As reported in the literature, visuospatial abnormalities appeared more specifically associated with PDD, supporting the notion that posterior dysfunctions are related to a more rapid cognitive decline in PD.

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**C. PARANAWITHANA, C. SENARATHNA, S. KATHRIARACHCHI, A. FERNANDO & J. MENDIS. Validation of the Repeatable Battery for the Assessment of Neuropsychological Status for individuals diagnosed with Dementia.**

**Objective:** The study aimed at assessing the convergent, concurrent and clinical validity of the RBANS in patients diagnosed with dementia. **Participants and Methods:** The reliability of the instrument was determined by assessing internal consistency, test-re-test and inert-rater reliability. Preliminary clinical validity was performed among 40 dementia patients and 40 normal controls. Convergent validity was established using the standardized Sinhala Mini Mental State Examination (MMSE). Concurrent validity was established by assessing patient performance on the Sinhala version of the RBANS and their functional outcome (i.e., employment status). A discriminant function analysis was performed to assess the extent to which employment status is associated with the RBANS Sinhala version. Further, a discriminant function analysis was performed to categorize and distinguish patients from that of normal controls.

**Results:** The RBANS demonstrated good internal consistency reliability for both the patient and control groups and good test-retest & inter-rater reliability for the patients. Dementia patients performed significantly worse and showed more marked cognitive impairment than healthy controls on the Sinhala RBANS. A moderate correlation was evident between the Sinhala RBANS and the MMSE. It was possible to correctly classify employment status by equal to or more than 87% of the time by using the RBANS Total score, showing evidence for concurrent validity. The Sinhala RBANS was capable of classifying patients from that of controls 93% of the time or more using the RBANS Total score, and further, showed good patterns of inter-correlations within RBANS Indexes, supporting evidence for construct validity.

**Conclusions:** The Sinhala RBANS revealed coherence in identifying cognitive impairment in dementia patients.

**L.A. SCHAEFER & M.A. SLUKA. Vowel Versus Consonant Letter-Word Fluency: Differences Between Dementia Types?**

**Objective:** Behforuzi et al. (2013) have shown that initial vowel fluency in patients with Alzheimer's disease (AD) was significantly lower than consonant fluency, when compared to normals and MCI patients. However, there are no studies comparing this between patients of varying dementias. This study examines initial vowel versus consonant letter-word fluency between patients with subcortical and cortical dementias.

**Participants and Methods:** A retrospective analysis of outpatients referred for cognitive assessment of dementia (N=27; mean age=75 years, male=9; female=18) was conducted. All patients had been administered the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) and Letter Fluency (COWA), among other tests. Calculation of the Randolph Cortical/Subcortical Index (Randolph et al., 1998) was conducted to confirm cortical and subcortical dementia populations (subcortical=10; cortical=17). Analysis of variance was performed between groups for F, A, S, total COWA, F/A ratio, S/A ratio, and RBANS indices. Pearson correlations were performed between RBANS indices and individual letter fluency by group.

**Results:** There was no significance between cortical and subcortical groups on fluency for A ( $F(1,25)=1.143, p=.295$ ); A was lower for both

groups. However, F ( $F(1,25)=5.090, p=.033$ ) and S ( $F(1,25)=5.510, p=.027$ ) were significantly higher in the cortical group, consistent with prior literature (Herbert et al., 2014). There was a trend for the cortical group to produce more words across letter ( $F(1,25)=3.992, p=.057$ ). There was no significance found for the F/A or S/A ratios. RBANS Attention Index was significantly lower in the subcortical group ( $F(1,25)=7.368, p=.012$ ). Correlations were not significant.

**Conclusions:** Results of this study indicated that impairment in vowel fluency (i.e., representing more weakly connected, phonetic-lexical networks) is not specific for cortical (AD) dementia. Thus, assessment of vowel fluency in particular may prove to be an early indicator of dementia in general.

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**B.E. STALEY SHUMAKER, S. AMANO, P. SIDDARTH, R. ROSTAMI & M. HARRINGTON. Variation of Verbal Memory in Healthy Older Adults with Diastolic Blood Pressure and Cholesterol.**

**Objective:** In this study, the authors seek to understand how diastolic blood pressure (DBP) within normal blood pressure range (NBPR) and cholesterol affect verbal memory in healthy cognitively asymptomatic older adults. The goal is to gain more insight into the interplay between variability in blood flow and cognitive functioning by specifically addressing elevated DBP NBPR and cholesterol levels as potential risk factors of dementia, and how these affect verbal memory in healthy older adults.

**Participants and Methods:** Participants and medical procedures (uniform clinical assessment, ApoE4 classification) information were derived from archival data at Huntington Medical Research Institutes (HMRI). The sample size consisted of 70 participants, 36 participants were classified as cognitively healthy with normal CSF amyloid/Tau ratio (CH-NAT), and 34 participants were classified as cognitively healthy with pathological CSF amyloid/Tau ratio (CH-PAT). The verbal memory score was a composite Z-score consisting of the LM II total raw score, and the CVLT LDFR corrected raw score.

**Results:** After controlling for age, gender, education level, and ApoE4 genotype, the linear regression showed a negative correlation between participant's DBP and verbal memory such that raised DBP NBPR was associated with decreased verbal memory scores ( $F(5, 67) = 6.61, p = .001$ ). In the overall sample, cholesterol was found to have no significant association with verbal memory ( $F(5, 57) = 4.22, p = .77$ ). However, cholesterol and verbal memory reached near significance in the CH-PAT clinical group ( $F(2, 28) = 7.15, p = .01$ ).

**Conclusions:** As both diastolic and systolic blood pressure (SBP) play an important role in health and the prevention of dementia, these findings point towards elevated DBP and SBP NBPR as possible preclinical markers for dementia in healthy older adults. The results demonstrate how problems with blood pressure regulation may impair memory prior to symptoms of cognitive decline.

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**Drug/Toxin-Related Disorders (Including Alcoholism)**

**A. BAZINET, J. CONLEY, S. ANDERSON, M. ARBUCKLE, J.M. LOFTIS & M. HUCKANS. Neuropsychological Performance of Adults with Active Methamphetamine Dependence Compared to Adults in Early Remission and Never Users.**

**Objective:** Numerous studies have shown that, relative to never users, individuals with methamphetamine (MA) dependence have lower cognitive performance in the months following cessation of use, particularly

on tests of memory and executive function. Less is known about the cognitive performance of active MA users, though low doses of MA have been shown to improve attention and concentration (with users desiring these effects). Understanding the cognitive impact of active MA dependence may provide insight into factors that maintain MA addiction and interfere with intervention and recovery.

**Participants and Methods:** The Neuropsychological Assessment Battery (NAB) was used to assess attention, language, memory, spatial abilities, and executive function in individuals currently meeting DSM-IV criteria for MA dependence (MA-ACTs;  $n=19$ ; mean # of days since last use = .63), individuals in early recovery from MA dependence (MA-REMs;  $n=40$ ; mean # of days since last use = 120.5; last use >30 days & < 6 months) and never users (CTLs;  $n=26$ ). Participants in MA groups did not meet criteria for any other recent substance dependence.

**Results:** Analysis of variance was used to assess group differences in age and education corrected NAB standard scores within each domain. Omnibus tests revealed that groups differed on the domains of memory and executive function ( $p<.05$ ) but not attention, language, or spatial abilities. Post-hoc comparisons indicated that the MA-REMs had worse memory ability compared to CTLs ( $p<.01$ ), and worse executive function compared to MA-ACTs ( $p<.05$ ). MA-ACTs performed similarly to CTLs on all domains and subtests.

**Conclusions:** At least some cognitive problems appear and persist during remission from MA addiction but are not present during active MA use. Barriers to MA use cessation may, therefore, potentially include a desire to avoid the cognitive symptoms that may result from remission, or to self-medicate cognitive difficulties that may have existed prior to any MA use.

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**A. LE BERRE, E.M. MÜLLER-OEHRING, M. SERVENTI, A. PFEFFERBAUM & E.V. SULLIVAN. Differential Impairment in Prospective and Retrospective Metamemory Monitoring in Nonamnesic Alcoholism: Evidence toward Mnemonic Anosognosia.**

**Objective:** Metamemory refers to personal knowledge about one's own memory ability with implications for cognitive processes relevant to monitoring and controlling memory. Monitoring processes can be assessed with prospective measures such as Feeling-Of-Knowing (FOK) judgments predicting future recognition performance, or retrospective confidence judgments (RCJ) made on previous memory performance. Alcoholic patients with amnesic Korsakoff's Syndrome (KS) show poor FOK but intact RCJ. The neuropsychological continuum from mild to moderate deficits in nonamnesic alcoholics (ALC) to amnesic KS raises the possibility that ALC uncomplicated by clinically-detectable amnesia may suffer anosognosia for their mild memory deficits. Previously, overestimation of memory capacities was revealed with the FOK measure in French alcoholics, but retrospective monitoring was not examined.

**Participants and Methods:** Here 24 ALC and 26 age-matched controls from the U.S. completed a 3-stage, episodic memory paradigm with prospective and retrospective monitoring: 1) learning of 48 unrelated words pairs; 2) cued recall of the second word of a pair and prospective FOK judgment of future recognition performance; 3) word recognition task with RCJ. For the FOK task, participants viewed the first word of each previously-learned word-pair associated with 3 options for judging the second word: I know, I feel I know, I don't know. For RCJ, participants assessed their confidence that they did successfully recognize the correct word.

**Results:** ALC were less accurate than controls in recognition and in assessing their future recognition, which was marked by overestimation, but were as accurate as controls on confidence ratings of actual recognition performance.

**Conclusions:** This dissociation of impaired FOK with intact RCJ has been noted in other neurological disorders including Alzheimer's disease and suggests evidence for a mnemonic anosognosia in nonamnesic

alcoholism that may undermine clinical treatment efforts. Support: AA017168, AA017923, AA010723.

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**J.J. MAHONEY, A. KALECHSTEIN, S. BAJO, P. ADUEN, T. NEWTON & R. DE LA GARZA. The Impact of Comorbid Drug Use and Cocaine Use Patterns on Cognitive Functioning in Individuals with Cocaine Use Disorders.**

**Objective:** To determine whether comorbid drug use (nicotine, alcohol, and marijuana) impacts cognition in individuals diagnosed with a cocaine use disorder (CUD) and also whether cocaine use patterns impact cognitive functioning. It was hypothesized that those individuals who use other substances comorbidly, as well as those who report more years, recent, and daily cocaine use, will demonstrate greater cognitive dysfunction.

**Participants and Methods:** Recently abstinent cocaine users who concurrently use nicotine ( $n=17$ ), alcohol ( $n=15$ ), or marijuana ( $n=20$ ) were matched to individuals who only use cocaine. Comparisons were made on the following measures: Continuous Performance Task-II, N-Back working memory test, and Hopkins Verbal Learning Task-Revised. In a separate analysis, recently abstinent cocaine users ( $N=125$ ) were divided into tertiles based on cocaine use variables (years, recent – last 30 days, and daily cocaine use – grams per day) and the highest and lowest groups were compared using one-way ANOVA.

**Results:** Cocaine users who concurrently use nicotine, alcohol, or marijuana did not differ from cocaine users alone on any cognitive measures (all  $p$ 's > 0.05). In addition, cocaine users who used for more years ( $25.2\pm 0.6$  vs.  $10.1\pm 0.6$  years), had more recent cocaine use over the past month ( $26.3\pm 0.5$  vs.  $6.0\pm 0.6$  days), and reported more daily cocaine use ( $1.8\pm 0.0$  vs.  $0.7\pm 0.0$  grams) had comparable results to those users with use patterns of shorter duration, less frequency, and lower daily intake ( $p$ 's > 0.05).

**Conclusions:** Although it is assumed that use of nicotine, alcohol, and marijuana may further exacerbate cognitive deficits in individuals with CUD, the results of the current study did not support that assumption – at least in this cohort. In addition, while it seems reasonable to infer that more years of use, greater recent use, and larger amounts of cocaine used on a daily basis would be risk factors for impaired cognition, our findings also did not support this.

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**J.J. MAHONEY, A. KALECHSTEIN, R. SALAS, S. BAJO, P. ADUEN & R. DE LA GARZA. Cognitive Functioning in Cigarette-Deprived Smokers.**

**Objective:** To determine the effects of cigarette deprivation (~24 hours) on cognition and whether specific nicotine withdrawal symptoms correlate with performance on cognitive measures.

**Participants and Methods:** Cigarette smokers ( $n=36$ ) were administered a cognitive battery after smoking ad libitum (Day 1) and then following cigarette deprivation (Day 2, confirmed using carbon monoxide levels). The cognitive battery included the Continuous Performance Task-II (CPT-II), N-Back working memory test, and Hopkins Verbal Learning Task-Revised. Participants were also administered the Wisconsin Smoking Withdrawal Scale (WSWS) to assess nicotine withdrawal symptoms.

**Results:** Self-reported hours since last cigarette were significantly greater on Day 2 than Day 1 ( $26.9\pm 7.2$  vs.  $1.3\pm 0.8$ ;  $p < .0001$ ) and exhaled breath CO was significantly lower on Day 2 versus Day 1 ( $3.3\pm 1.8$  vs.  $16.0\pm 6.6$  ppm;  $p < .0001$ ). Following cigarette deprivation, participants displayed worsened delayed recall on the HVLt-R ( $p=0.007$ ). There were no significant differences on any other cognitive measures between conditions. The craving subscale of the WSWS was positively correlated with the number of commission errors on the CPT-II during

the smoking as usual ( $r=.481$ ,  $p=0.006$ ) and following cigarette deprivation ( $r=.411$ ,  $p=0.02$ ) conditions (i.e. higher craving scores were associated with lower levels of inhibitory control).

**Conclusions:** Overall, the difference in performance on the cognitive measures between the smoking as usual and cigarette deprivation conditions was minimal, contradictory to previous findings noting deprivation related deficits in attention, inhibitory control, reaction time, and working memory. One potential explanation may be that the cognitive withdrawal effects may resolve within the 24 hour timeframe. These findings question the impact nicotine withdrawal has on cognition and whether withdrawal effects earlier in the cigarette deprivation process contribute to neurocognitive decrements.

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**K. MULHAUSER, C. WHITE, R. VAN PATTEN, T. MARALDO, M.R. FARNEY & J. WEINSTOCK. Abstinence-based Changes in Neurological Functioning During Residential Treatment for Alcohol and Cocaine Use Disorders.**

**Objective:** Heavy use of alcohol and cocaine is associated with neuropsychological deficits in domains such as attention, memory, and executive functions (EFs). Although the literature is mixed, cognitive abilities tend to improve secondary to extended abstinence. The present study evaluated changes in neuropsychological status over a brief, 10-day period of sustained abstinence early in residential treatment for substance use disorders (SUD). We hypothesized that (a) neuropsychological deficits would be evident at baseline and (b) that participants would demonstrate differential improvement in EFs relative to other cognitive abilities.

**Participants and Methods:** Participants ( $N=18$ ) were evaluated after detoxification and upon admission to a hospital-based residential treatment program for SUD and reevaluated prior to discharge, approximately 10 days later. Neuropsychological domains of memory, visuospatial abilities, attention, language, and EFs were assessed. Our primary analysis included a paired *t*-test comparing results at T1 and T2 for each domain. Covariates, such as addiction severity and substance use frequency/intensity were also evaluated.

**Results:** At baseline, 83% of participants demonstrated Borderline or Impaired functioning (<9th percentile) in one or more domains of neuropsychological functioning, with the median participant impaired in three domains. Contrary to our second hypothesis, results demonstrated statistically significant functional improvements in the areas of immediate memory and language ability, but not in other domains evaluated.

**Conclusions:** These findings contribute to our understanding of early abstinence-based changes in neuropsychological functioning. Notably, domains of immediate memory and language abilities, but not EFs, showed early sensitivity to abstinence-based improvements. Other domains may require longer durations of abstinence to improve. These findings suggest important clinical implications for residential treatment effectiveness during the initial stages of recovery from SUD.

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**R. GONZALEZ, I. GONZALEZ, J.M. ROSS & J. DUPERROUZEL. Effects of Cannabis Use on Neurocognition among Persons Living with HIV: Preliminary Observations.**

**Objective:** Most US states with “medical marijuana” laws include HIV as a qualifying condition. Both HIV and cannabis use are independently associated with neurocognitive deficits; however, research on how cannabis use may affect neurocognition among persons living with HIV is lacking.

**Participants and Methods:** Adult participants in our study were stratified into one of four groups based on HIV-serostatus and cannabis (CB) use history: HIV+/CB+ ( $n = 28$ ); HIV+/CB- ( $n = 47$ ); HIV-/CB+ ( $n = 55$ ); HIV-/CB- ( $n = 67$ ). Exclusion criteria were history of significant

neurological, psychiatric, and developmental disorders; hepatitis C; and recent, significant use of any substance (with the exception of cannabis among the CB+ groups). CB+ participants were recent cannabis users with a history of regular use. Group status was an independent variable in all analyses; whereas average neurocognitive performance for each of the five domains (Processing speed, Learning, Memory, Motor, and Executive) and average overall performance were dependent variables in separate ANOVAs. Age, estimated IQ, and education were entered as covariates in all analyses due to significant between-group differences ( $p < .05$ ).

**Results:** Age and estimated IQ were significant predictors in most models. No significant between group-differences emerged for any neurocognitive domain ( $p$ -values  $> .16$ ). Exploratory analyses of individual test scores revealed statistically significant between-group differences only for the Iowa Gambling Task (IGT), with the HIV+/CB- group performing more poorly than the HIV-/CB- group ( $p = .04$ ).

**Conclusions:** We found little evidence for between group differences among a relatively healthy sample of individuals stratified on HIV-serostatus and cannabis use history. These preliminary findings must be interpreted cautiously due to small sample sizes, but suggest that cannabis-associated neurocognitive deficits among individuals with HIV may be modest. Supported by NIDA R01 DA031176 and R01 DA033156 (PI: RG)

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**J.M. ROSS, J. DUPERROUZEL, I. GONZALEZ & R. GONZALEZ. Decision-Making and Cannabis Use Interact to Predict Risky Sexual Behavior.**

**Objective:** Risky sexual behavior (RSB) and substance use are related and common among teens. However, little is known about how cannabis use (CU) may influence RSB. Among young adults, CU and decision-making (DM) performance predict RSB. This study is the first to examine how CU and DM influence RSB among teens.

**Participants and Methods:** Participants are 195, 14-17 year olds, screened to ensure that a majority are cannabis users. Exclusion criteria include significant neurological, psychiatric, or developmental disorders. DM was measured with three computerized tasks: two assessed DM under specified risk (Cups Task [CT] and Game of Dice Task [GDT]) and one assessed DM under ambiguous risk (Iowa Gambling Task [IGT]). RSB was assessed with the total score on the Risky Sexual Behavior Questionnaire (RSBQ). Amount of lifetime CU, DM performance, and their interaction were used to predict RSB using multiple linear regression.

**Results:** Specifically, when using the IGT, only amount of CU predicted RSB,  $\beta = .278$ ,  $p < .01$ . Significant interactions with CU were observed for GDT and CT ( $p = .03$  and  $p < .01$ , respectively). Simple slope analyses revealed that more CU predicted more RSB, when GDT performance was average,  $\beta = .31$ ,  $p < .01$ , and below average,  $\beta = .48$ ,  $p < .01$ . Similarly, more CU predicted more RSB, when CT performance was average,  $\beta = .27$ ,  $p < .01$  and below average,  $\beta = .50$ ,  $p < .01$ . No significant relationships between CU and RSB were observed when DM was above average.

**Conclusions:** Below average DM performance under conditions of specific risk contributed to a stronger relationship between CU and RSB. In contrast with young adults, there was no significant interaction when DM was assessed under conditions of ambiguous risk. The contrary findings between young adults and teens may be due to different stages of cognitive development; perhaps DM in ambiguous situations requires complex DM abilities and therefore is more difficult for all teens. Strengthening DM abilities in cannabis using teens may reduce RSB.

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**S.A. SASSOON, W. CHU, R. FAMA, D. PROUTY, S. TAPERT, S.A. BROWN, F.C. BAKER, D.B. CLARK, I.M. COLRAIN, M.D. DE BELLIS, B. NAGEL, K.M. POHL, A. PFEFFERBAUM & E.V. SULLIVAN. Visuospatial Construction and Memory in Adolescence: Relations with Age, Sex, Alcohol Drinking, and Organizational Strategy.**

**Objective:** During adolescence, cognitive processes of visuospatial construction, memory, planning, and organization are maturing. Because these functions are affected by alcohol dependence, we asked whether moderate alcohol use during adolescence interacts with sex and visuospatial organizational skills.

**Participants and Methods:** Participants were boys (337 NO/LOW drinkers; 64 exceeding drinking criteria, EDC) and girls (343 NO/LOW; 74 EDC), age 12–21 years, from the National Consortium on Alcohol & Neurodevelopment in Adolescence (NCANDA), a multi-site longitudinal study on the effects of alcohol exposure on brain development. All completed the Rey-Osterrieth Complex Figure Test, which measured visuospatial construction (figure copy) and episodic memory (immediate and delayed recall). Pen-switching every 30 sec tracked organizational strategy, scored as holistic or piecemeal.

**Results:** Simple effects of sex and alcohol use on copy and recall tasks were not significant. Copy and recall scores were higher in older than younger NO/LOW boys and girls. A significant interaction of sex and copy strategy in the NO/LOW drinkers indicated that girls using a holistic strategy were more accurate in figure copy than those using a piecemeal strategy; copy accuracy was not related to strategy in the boys. Unlike NO/LOW, EDC girls' and boys' copy and recall scores did not show an age effect. Girls but not boys in the EDC group benefited from holistic strategy in figure recall. EDC girls with piecemeal strategy had the poorest recall scores. Results endured on reanalysis using demographically-matched samples.

**Conclusions:** NO/LOW and EDC groups exhibited performance differences with respect to age, sex, and use of organizational strategy to augment construction and recall accuracy of visuospatial information. Whether these differences pre-dated onset of drinking or resulted from it remains to be determined. Support: AA021697, AA021695, AA021692, AA021696, AA021681, AA021690, AA021691

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**F.C. ROBERTSON, K. SULLIVAN, Z. HOLTMAN, E. MEINTJES, P.A. JANULEWICZ & L. LONDON. Herbicide Exposure and Brain Magnetic Resonance Imaging (MRI) in South African Farmers.**

**Objective:** To investigate the association between pesticide exposure and MRI brain volumes.

**Participants and Methods:** Twenty male farmers (mean age  $48 \pm 9$  years) from the Western Cape, South Africa with self-reported past exposure to organophosphate (OP) insecticides and herbicides (HBs) during the past 5 year period. Mean education was  $7 \pm 3$  years of schooling, equal to Grade 6 in South Africa. All farmers underwent high resolution structural T1-weighted multi-echo magnetization-prepared rapid gradient echo (MEMPRAGE) neuroimaging on a 3T Siemens Allegra MRI scanner. Images were processed semi-automatically using FreeSurfer software. Comparisons between farmers with and without self-reported OP and HB exposure were conducted using SPSS software.

**Results:** Of the 20 subjects, 7 reported OP exposure, 8 HB exposure, 1 both OP and HB exposure, 1 fungicide (sulphur) exposure only, and 3 no pesticide exposure. HBs included Gramoxone (Paraquat dichloride), Glyphosate (Potassium salt), Simazine (2-Chloro-4, 6 bis(ethylamino)-s-triazine), and Mamba (Glyphosate isopropylamine salt). The HB-exposed farmers were on average 10.4 years older ( $p=0.005$ ) and had 3.2 years less education ( $p=0.02$ ) than the HB-unexposed farmers. Brain volumes of total gray and white matter, subcortical gray matter, hippocampus, amygdala, caudate, putamen, pallidum, and nucleus accumbens were lower among HB-exposed farmers. ANCOVAs controlling for age and education showed that the volumes of left accumbens

( $p=0.03$ ) and total white matter ( $p=0.04$ ) were significantly lower in HB-exposed farmers. Analyses controlling for age, education and intracranial volume showed that total white matter volume was significantly smaller in the HB group ( $p=0.02$ ).

**Conclusions:** Self-reported herbicide exposure in the past 5 years appears to be associated with smaller white matter brain volumes in South African farmers in this pilot study. Larger confirmatory studies using biomarker-based exposure data will help further clarify these initial findings.

**A. TIMKO, D. AASE & N. PLISKIN. Psychiatric Symptom Clusters are Associated with Social Perception Task Performance among Individuals with Alcohol Use Disorder.**

**Objective:** Deficits in social perception among alcohol users appear to persist with abstinence and are associated with treatment outcomes (Charlet et al., 2014; Foisy et al., 2007). Deficits in complex emotion recognition and social perception have also been observed among individuals with cognitive symptoms of depression (Lee, et al., 2005) and anxiety disorders (Plana, et al., 2014), respectively. However, prior studies exploring if social perception performance is associated with psychiatric symptoms in alcohol users are limited, and have not explored specific psychiatric symptom clusters. The present study measured depressive and anxiety symptom clusters and social perception performance in alcohol users during early alcohol abstinence. We hypothesized that cognitive symptoms of depression and anxiety would be negatively associated with performance on social perception tasks.

**Participants and Methods:** Subjects were 30 patients (10 women, 20 men) participating in an inpatient treatment program for alcohol use disorder. Subjects were interviewed and administered a brief cognitive battery that included a Social Perception task. The sample was divided into two groups, those with intact ( $n=22$ ) and impaired ( $n=8$ ) performance on the Social Perception test.

**Results:** Both affective/somatic and cognitive subscales of the BDI, along with overall depression scores, were significantly elevated among individuals with impaired performance on the Social Perception task. Affective/somatic symptoms of anxiety were also higher among those with lower social perception scores, while cognitive symptoms of anxiety and overall anxiety score did not differ between the two groups.

**Conclusions:** Findings suggest that social perception deficits among alcohol users during early abstinence may be associated with both affective/somatic and cognitive symptoms of depression, as well as affective symptoms of anxiety.

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**E. TOMLINSON, D. PENNINGTON, T. WONG, J. DACK, J. BIELENBERG, L.C. HOYMAN, B. LASHER, E. SCHRODEK, S. YOHANNES, J. MCDONALD & S. BATKI. Smoking Effects on Cognitive Function in Veterans with Comorbid PTSD and Alcohol Use Disorder.**

**Objective:** Cognitive dysfunction is commonly observed in both Alcohol Use Disorder (AUD) and Posttraumatic Stress Disorder (PTSD) and is associated with worse treatment outcome. There is a high concordance of cigarette smoking in AUD and PTSD, however, few studies examine the role of smoking and cognition in veterans with these co-occurring disorders.

**Participants and Methods:** We assessed 53 veterans (2 female) with PTSD entering a RCT of topiramate treatment for AUD. Smoking (sAUD) and non-smoking (nsAUD) veterans were compared on domains of cognition including processing speed, working memory, auditory-verbal learning and recall, cognitive flexibility, cognitive inhibition, response inhibition, choice inhibition, risk-taking, and decision-making. Generalized linear models were used in all analyses. All primary cross-sectional models comparing sAUD to nsAUD at study entry included fixed predictors of group (smoker, non-smoker). Secondary

cross-sectional models investigating smoking severity in sAUD at study entry included fixed predictors of average cigarettes per week in last 90 days (CPW), average drinks per week in last 90 days (DPW), and the interaction term of CPW-by-DPW.

**Results:** Smoking AUD performed significantly worse than nsAUD on response inhibition [ $x^2(1) = 4.36, p < 0.05$ ]. However, sAUD performed better on tests of working memory [ $x^2(1) = 5.189, p < 0.05; x^2(1) = 4.04, p < 0.05$ ] compared to nsAUD. CPW-by-DPW trends were observed for working memory ( $p = 0.07$ ), auditory-verbal learning ( $p = 0.07$ ) and recall ( $p = 0.09$ ).

**Conclusions:** Findings suggest that cigarette-smoking veterans presenting for AUD treatment with comorbid PTSD exhibit less inhibition than non-smokers. Although smokers performed better in working memory than non-smokers, smoking and drinking may have a negative synergistic effect on working memory, auditory-verbal learning and recall. Interventions targeting these domains may be particularly beneficial for cigarette-smoking veterans with AUD and PTSD.

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**N.E. WRIGHT, D. SCERPELLA & K. LISDAHL. Young Adult Marijuana Use and Gender Effects on Frontolimbic Function: Depression, Anxiety, Impulsivity, and Executive Dysfunction.**

**Objective:** 14.4% of 12th graders report past month marijuana (MJ) use. Repeated CB1 binding due to THC results in downregulation of the endocannabinoid system in cortex and limbic regions. Here we examine the influence of young adult MJ use on anxiety, depression, impulsivity, and executive dysfunction. The influence of alcohol and gender were also assessed.

**Participants and Methods:** 84 subjects (42 MJ, 42 controls) aged 18-25 were balanced for gender (39 female). 63% were white. Exclusion criteria included: MRI contraindications, left handed, comorbid Axis-I disorders, major medical or neurologic disorders, prenatal issues, or prenatal alcohol/illicit drug exposure, or excessive other drug use in lifetime. Subjects completed the Frontal Systems Behavior Scale, BIS/BAS, State-Trait Anxiety Inventory (State), and BDI-II. Multiple regressions were run to predict anxiety, depressive symptoms, impulsivity, and executive dysfunction from MJ group status, past year alcohol use, gender, and MJ\*gender interactions, controlling for cotinine.

**Results:** MJ use predicted increased depressive symptoms ( $p = .04$ ). Decreased drive ( $p = .05$ ), fun-seeking ( $p = .02$ ), reward responsiveness ( $p = .006$ ) and BAS Total ( $p = .09$ ) were predicted by MJ use. Increased cotinine level predicted increased drive ( $p = .03$ ) and BAS Total ( $p = .008$ ) and marginally predicted increased fun seeking ( $p = .06$ ). Decreased BIS Total was predicted by gender ( $p = .04$ ) and marginally predicted by alcohol use ( $p = .09$ ). Disinhibition ( $p = .06$ ) and anxiety ( $p = .06$ ) were marginally predicted by MJ\*gender, with female users demonstrating increased disinhibition and anxiety. Apathy and Executive Dysfunction were not predicted by any measures.

**Conclusions:** Depression was greater in MJ group, while components of impulsivity were decreased. Cotinine level resulted in opposite impulsivity findings. Female MJ users had greater anxiety and disinhibition. In sum, we found that MJ use in young adults may result in damage to PFC and limbic regions. Future research is needed to confirm the neuronal correlates.

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## Electrophysiology/EEG/ERP

**G. MIGNAULT GOULET, B. RICH ZENDEL & I. PERETZ. Music Lessons in Teenagers with Congenital Amusia.**

**Objective:** Congenital amusia is characterized by difficulties processing music and pitch and can be diagnosed using the MBEA (Peretz et al, 2003). The impairment can be traced to an abnormal P3 brain response during pitch discrimination tasks and seems to arise from a disruption of the propagation of information from frontal regions to the auditory cortex (Peretz et al, 2005; Mignault et al, 2012). The goal of this study was to determine if 3 months of guitar lessons could improve pitch discrimination and normalize the associated P3 response in amusics.

**Participants and Methods:** 18 participants (11-16 years) were tested. 12 of them took part in weekly group guitar lessons for 3 months. They were categorized as either amusics (below cut-off on the scale task, N=4), poor pitch discriminators (above cut-off on the scale task, but with difficulties at the pitch discrimination task, N=4), or control (N=4). We also included 6 no-contact control participants. Participants were tested before and after guitar lessons; no-contact controls were tested at a 3 months interval. Participants performed the scale task in which they had to discriminate melodies. This was followed by a pitch discrimination task, where they heard sequences of 5 tones and had to identify if all tones were identical or if the final tone was shifted in pitch (by 25 or 200 cents), while EEG was monitored.

**Results:** There was an improvement on scale task for all participants ( $p < 0.005$ ). Some amusics and poor pitch discriminators improved their ability to detect pitch changes at post-test, but the improvement was not statistically significant as a group. Most critical, after guitar training there was an emergence of a P3 response to the 25 cents pitch change in amusics.

**Conclusions:** Pitch discrimination may be ameliorated by music lessons in people with pitch processing difficulties. The emergence of a P3 brain response to small pitch change in amusics after 3 months of music lessons may be indicative of neural plasticity that precedes improvement in task performance.

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## Memory Functions

**D.M. O' SHEA, V.M. DOTSON, R.A. FIEO, A. TSAPANOU, L.B. ZAHODNE & Y. STERN. Older adults with poor self-rated memory have less depressive symptoms and better delayed memory performance when perceived self-efficacy is high.**

**Objective:** To investigate whether self-efficacy moderates the association between self-rated memory and depressive symptoms in a large sample of older adults. The influence of self-efficacy on memory performance was also examined in a subsample of individuals who reported poor memory.

**Participants and Methods:** Non-demented participants ( $n = 3766$ ) were selected from the 2012 wave of the Health and Retirement Study. Depressive symptomatology was assessed with the 8-item Center for Epidemiologic Studies Depression Scale. A modified version of the Mid-life Developmental Inventory Questionnaire was used as the measure of self-efficacy. Participants were asked to rate their memory presently on a five-point scale from Excellent (1) to Poor (5). Immediate memory and delayed memory (after a five minute interval) were measured by the number of correct words recalled from a 10-item word list.

**Results:** Multiple regression analyses revealed that negative ratings of memory were significantly associated with greater levels of depressive symptoms, with this effect being greatest in those with low levels of self-efficacy. Additionally, self-efficacy had a positive association with delayed but not immediate memory performance in individuals who reported poor memory ( $N = 1196$ ) even after controlling for demographics and depression.

**Conclusions:** Self-efficacy moderates the relationship between subjective memory and depressive symptoms. Higher self-efficacy may buffer against the impact of subjective memory difficulty on one's mood and thereby mitigating the effect of depression on objective memory. Interventions should focus on increasing perceived self-efficacy in depressed individuals reporting poor memory function to potentially minimize memory impairment.

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## **Poster Symposium 2. Neuropsychological Assessment & Rehabilitation from Literates to Illiterates: An Indian Perspective**

**Organizer: Ashima Nehra**

**9:00–10:30 a.m.**

### **Cognitive Intervention/Rehabilitation**

#### **A. NEHRA, H. KAUR & S. CHOPRA. Neuropsychological Assessment & Rehabilitation from Literates to Illiterates: An Indian Perspective.**

**Symposium Description:** With a diverse Indian population having varied levels of education, culture and socio-economic status it becomes important to use standardized neuropsychological testing specific to the population so that we can make correct inferences about their cognitive status. 'One size fits all' policies are not possible in a diverse country like India. Clinical Neuropsychology is a super-specialization with a strong focus on evidence-based practice for various neurological conditions. People with no formal education represent a major proportion of the world's population. There is widespread recognition about the role of literacy and its affect in neuropsychological functioning of the individuals. The impact of literacy is reflected in various spheres of cognitive functioning. Therefore, the symposium will discuss & unravel (1) the role and importance of neuropsychological assessment in assessing the illiterate or low literate population suffering from various neurological conditions such as stroke, aphasia, dementia, TBI & other neurological conditions (2) The neuropsychological rehabilitation programs especially developed for the illiterate persons where restorative & compensatory techniques using an eclectic approach are used, depending upon patient's level of education. Importance of using evidence based assessment and rehabilitation techniques based on national & international literature will be highlighted focusing on case specific interventions in dealing with the illiterate or low literate population along with highly educated patients which would strengthen the need for more culture fair tests for assessing neuropsychological functioning and also culture fair rehabilitative techniques, thereby helping in planning better rehabilitative programs for improved quality of life of patient populations worldwide.

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#### **A. NEHRA, H. KAUR & S. CHOPRA. Neuropsychological Assessment in India: Impact of Education Revolution.**

**Introduction:** Although lifespan changes in cognitive performance and Flynn Effect (FE) have both been well documented, there has been little scientific focus to date on the net effect of these forces on cognition at the population level. Performance on non-verbal tests such as copying

figures, drawing maps or listening to tones can be significantly influenced by the individual's culture. Arguments against the use of some current neuropsychological non-verbal instruments, procedures, and norms in the assessment of diverse educational and cultural groups are discussed. The present objective is to see the evidence of FE in cognitive functioning in India. **Methodology:** Widely used test for memory is the Post Graduate Institute Memory Scale (PGI-MS) developed in 1976 to assess ten domains of memory which can also be used for illiterates. From a community setting, a normative sample of 305 consenting individuals without any previous medical history of psychiatric or neurological disorders constituted our cross-sectional study design. People with 0-5, 6-9 and more than 10 years of education matching the earlier age range i.e. from 20 to 69 years were evaluated. **Results:** In 0-5 years of education FE is seen in recent memory, temporal sequencing, delayed & immediate recall. In 6-9 years of education FE is seen in attention, remote & recent memory, delayed & immediate recall, new learning ability & visual retention. More than 10 years of education FE is seen in attention, delayed & immediate recall. Across different education levels such significant changes are seen in different age ranges. The cognitive abilities for people between 20-69 years, on the basis of previous norms are an underestimate of their present abilities. Present generation with 0-5 and 6-9 years of education perform better in their cognitive abilities as compared to those assessed in 1976. **Conclusion:** Education influences the cognitive functioning and therefore FE needs to be assessed not only in cognitive functioning but also in IQ for the developing nations like India. Neuropsychological tests with updated norms should be used for clinical & research purposes so that they do not lead to a misdiagnosis while assessing memory complaints.

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#### **A. NEHRA, H. KAUR & S. CHOPRA. Development & Effectiveness of a Home Based Neuropsychological Rehabilitation Program for Patients Suffering from Aphasia.**

**Introduction:** Aphasia is the most striking cognitive sequel of stroke and other neurological conditions. Neuropsychological rehabilitation (NR) ameliorates cognitive, emotional, psychosocial & behavioral deficits caused by an insult to the brain. Being a large country with large population, India presents endless varieties of physical features and cultural patterns. India not only possesses racial diversity but also linguistic diversity with more than 400 languages is spoken. Therefore, its rehabilitation also becomes challenging. An attempt is made to synthesize these different models into a comprehensive model of NR.

**Methodology:** 22 patients suffering from post stroke aphasia were recruited in an ongoing randomized controlled clinical trial with 11 in the Treatment As Usual (TAU) and 11 in the Treatment Group (TG) using block randomization. Pre-Post Neuropsychological assessment included Indian Aphasia Battery (IAB), Color Trail Test 1 (CTT1) & 2 (CTT2), Visual N Back, Stroke Specific Quality of Life (SSQOL) and Stroke Aphasia Depression Questionnaire (SADQ). An 8 week home based neuropsychological program was developed with tasks for language and cognitive remediation. As NR techniques from the West can't be blindly adapted for use in a diverse country like India. The designed tasks had no influence of age and education. Post assessment was done after 2 months from the baseline assessment. **Results:** Wilcoxon sign rank test revealed that the neuropsychological assessment of TG post NR shows a marked improvement in the scores of the IAB as compared to the TAU. The scores of CTT1, SSQOL and SADQ also showed improvement in the TG as compared to the TAU. **Conclusions:** A home based NR programme can help in ameliorating the language as well as cognitive deficits in patients suffering from aphasia & can come as aid in developing countries where it becomes difficult for patients for routine travel to the hospital due to financial constraints.

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**A. NEHRA, H. KAUR & S. CHOPRA. Cognitive Rehabilitation of Individuals after Traumatic Brain Injury Using an Eclectic Literacy and Culture Free Intervention Program.**

**Introduction:** It is estimated that there are nearly 1.5 to 2 million survivors of Traumatic Brain Injury (TBI) in India. TBI can lead to cognitive impairments and persistent Post Concussive Symptoms (PCS). The effectiveness of Neuropsychological Rehabilitation (NR) post TBI is well documented and established, but there is a paucity of literacy and cost effective cognitive retraining interventions for developing nations which can be used as home-based retraining interventions. **Methodology:** Thirty four consenting individuals between 18-45 years, educated from 0-17 years, within one month of Mild/Moderate TBI; with cognitive complaints and/or PCS, were randomized to the control or the intervention group. They were evaluated using standardized neuropsychological tools for episodic memory, recent memory, working memory, focussed attention, delayed recall, short term verbal memory, paired associate learning, new learning, visual memory, recognition, verbal fluency, perceptuo-motor functioning, anxiety, depression, PCS and Quality of Life (QOL). The 6-week, home-based NR included cognitive retraining for focussed and divided attention; short term and long term visual memory; visuo-spatial and planning ability; and relaxation techniques.

**Results:** Within group analysis showed improvement in all domains in both groups. There were significant improvements in the intervention group as compared to the control after 6 weeks, in episodic memory ( $p=0.030$ ); working memory ( $p=0.016$ ); short term verbal memory ( $p=0.007$ ); paired associate learning ( $p=0.050$ ); new learning, anxiety ( $p=0.007$ ); depression ( $p=0.032$ ); PCS ( $p=0.050$ ); and QOL (0.005). PCS still persisted in the control group on follow up ( $p=0.300$ ), which shows NR was also successful in ameliorating PCS. **Conclusions:** Frequently used cognitive interventions have been found to be non-reproducible in developing nations like India, as literacy rates can affect task performance. This intervention can be used with patients with low education levels or from lower socio-economic status who cannot afford daily visits to the Neuropsychologist or a tertiary care centre for Cognitive Remediation.

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**Invited Symposium 4. Cognitive Rehabilitation and Neuroimaging in Clinical Populations**

**Chair: John DeLuca**

**Discussant: Erin D. Bigler**

**9:00–10:30 a.m.**

**J. DELUCA, J. DELUCA, N.D. CHIARAVALLOTI, N. OJEDA, M. KESHAVAN & E.D. BIGLER. Cognitive Rehabilitation and Neuroimaging in Clinical Populations.**

**Symposium Description:** Evidence for cognitive rehabilitation has been accumulating for the past several decades across various clinical populations. More recently this evidence has started to include changes in the brain which have been shown to be associated with rehabilitation effectiveness. This symposium will summarize the behavioral and neuroimaging data associated with cognitive rehabilitation in four clinical populations: Traumatic Brain Injury, Schizophrenia, Multiple Sclerosis and Parkinson's disease. Presentations will be given by leading

researchers/clinicians from each respective field. Speakers will present current research findings, discuss the limitations of this work and discuss future research needs regarding behavioral and neuroimaging aspects of cognitive rehabilitation in each of their respective areas of expertise. The four presentations will be followed by a critical review of the field in general and a discussion on how such work impacts on clinical applicability currently and in the future.

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**J. DELUCA & N.D. CHIARAVALLOTI. Cognitive Rehabilitation in Multiple Sclerosis.**

It is now well established that up to 70% of persons with multiple sclerosis (MS) suffer from cognitive impairment (Chiaravalloti & DeLuca, 2008). Such impairments can have a significant impact on everyday functional activity in persons with MS. The objective of this presentation is to briefly outline recent research on the effectiveness of cognitive rehabilitation in persons with MS.

Three recent Cochrane reviews on cognitive rehabilitation (Rosti-Otjavi & Hamalainen, 2011, 2014; das Nair et al, 2012) have yielded mixed conclusions. Such reviews of cognitive rehabilitation research have concluded that there is a low level of evidence to support such rehabilitation at this time in persons with MS, primarily because of the low number of studies and several methodological problems in design. However, beyond the Cochrane approach, there is modest support that behavioral interventions can significantly improve targeted cognitive processes. This is especially true in the area of learning and memory, processing speed and executive functions. Recent studies have shown that cognitive rehabilitation not only improves neuropsychological functioning, but also results in increased functional brain activity on fMRI and functional connectivity in the brain, as well as improved everyday life activity and quality of life (e.g., Chiaravalloti et al, 2012, 2013; Amato et al., 2014; Bonavita et al, 2015; Mattioli et al, 2010). Overall, the latest research shows that cognitive rehabilitation can be effective and is ready for clinical application for persons with MS.

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**N.D. CHIARAVALLOTI. Cognitive Rehabilitation and Neuroimaging in Traumatic Brain Injury (TBI).**

The modified Story Memory Technique© (mSMT) is a behavioral intervention that teaches context and imagery to facilitate learning within 10-sessions over 5 weeks. Substantial efficacy data now exists in support of the application of the mSMT to the MS population. The currently presented series of studies was designed to examine the efficacy of the mSMT in persons with TBI.

In study 1, 69 participants with moderate-severe TBI, 35 in the treatment group and 34 in the placebo control group, were enrolled in a double-blind, placebo-controlled randomized clinical trial (RCT). A baseline neuropsychological assessment was administered, including questionnaires assessing everyday memory. Repeat assessments were conducted immediately and six months following treatment. The treatment group demonstrated significant improvement on a prose memory task relative to the placebo group post-treatment ( $\eta^2=.064$  medium effect). Similar results were noted on objective measures of everyday memory, specifically prospective memory (Cohen's  $w=.43$ , medium effect), and family report of disinhibition in daily life ( $\eta^2=.046$ , medium effect). The mSMT was thus concluded to be effective for improving learning and memory in persons with TBI.

A second study examined changes in cerebral activation on functional Magnetic Resonance Imaging (fMRI) following mSMT treatment in persons with TBI in a subsample of participants enrolled in the larger RCT. Eighteen individuals with TBI were randomly assigned to treatment ( $n=9$ ) or placebo ( $n=9$ ) groups. Baseline and follow-up fMRI was collected during a list-learning task. Significant differences in cerebral



activation from before to after treatment were noted in regions belonging to the default mode network (DMN) and executive control network in the treatment group only. Results are interpreted in light of these networks. Activation differences between the groups likely reflect increased use of strategies taught during treatment. This study demonstrates a significant change in cerebral activation resulting from the mSMT in a TBI sample. Findings are consistent with previous work in Multiple Sclerosis. Behavioral interventions can show significant changes in the brain, validating clinical utility.

**Classification of Evidence:** Based on widely accepted classification systems for treatment study design, this study provides Class I evidence that the modified Story Memory Technique<sup>®</sup> behavioral intervention improves both objective memory and everyday memory in persons with TBI over 5 weeks. Thus, this study extends the evidence for efficacy of the treatment protocol to a sample of persons with TBI.

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**N. OJEDA, M. DÍEZ-CIRARDA, N. IBARRETXE-BILBAO & J. PEÑA. Cognitive, Functional and Brain Changes in Parkinson's Disease After Cognitive Remediation.**

Parkinson's disease is a neurodegenerative disease comprising both motor symptoms and cognitive decline. Very few studies have examined the role of cognitive rehabilitation to reverse those deficits. We design a study to assess the efficacy of an integrative cognitive rehabilitation program (REHACOP) to improve cognition, clinical symptoms, and functional disability of patients with PD, as well as to examine possible cerebral changes related to them. Forty four PD patients underwent a neuropsychological assessment, and MRI-fMRI assessment at baseline and after 3-month treatment. T1-weighted structural and functional MRI (fMRI) images during a memory paradigm (learning and recognition) were acquired to assess grey matter volume and brain activation. PD patients were randomized into REHACOP group (n=22) and control group (n=22). During 3 months REHACOP group received cognitive rehabilitation program (REHACOP), while control group attained occupational therapy, (same period & frequency). After, REHACOP group showed statistically significant and clinically meaningful changes in processing speed, visual memory, theory of mind, functional disability, and tendency to improvement in verbal memory. In addition, REHACOP group showed increased brain activation during learning fMRI paradigm in left middle and inferior frontal areas and during recognition fMRI paradigm in left inferior frontal gyrus and postcentral gyrus. Moreover, compared to control group, REHACOP group at post-treatment showed increased brain activation during recognition fMRI paradigm in middle temporal and occipital areas in correlation with improvement in cognitive functions. Results suggest that an integrative cognitive rehabilitation program in PD can produce not only significant changes in cognition and functional disability, but also cerebral activation changes. **Correspondence:** Natalia Ojeda, PhD, Avenida de las Universidades 27, Bilbao 48007, Spain. E-mail: [nojeda@deusto.es](mailto:nojeda@deusto.es)

**M. KESHAVAN. Cognitive Rehabilitation and Neuroimaging in Schizophrenia.**

Deficits in social functioning are present early schizophrenia, may persist despite antipsychotic treatment, and tend to remain stable in severity or even worsen in subsequent phases of the illness. At the heart of the functional disability in this illness lies substantive cognitive impairment. Attention, executive function, verbal memory and social cognition may each contribute to functional outcome; in particular, social cognition measures have better predictive value for community functioning. Current pharmacotherapeutic approaches have limited impact on these deficits. Cognitive remediation approaches are being developed based on the principles of neuroplasticity; one of these is Cognitive Enhancement Therapy (CET). Recent data from our group has shown efficacy of this approach in early course schizophrenia and schizoaffective disorder.

These effects on social cognition have translated into significant improvements in functional outcome with regard to social adjustment, instrumental task performance, and work readiness. The beneficial effects appear to persist beyond the cessation of treatment. CET is accompanied by longitudinal changes in brain structure and function that may explain the therapeutic benefits. Several questions remain about the neurobiological mechanisms underlying CET effects, applicability of CET in community settings and predictive questions of who may be the best candidates of this intervention.

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**Symposium 12. Health Factors Related to Cognitive and Neural Plasticity**

**Chair: Elizabeth Leritz**

**Discussant: William P. Milberg**

**9:00–10:30 a.m.**

**E. LERITZ, S.M. HAYES, D.H. SALAT, A. HALEY, M. VOSS, E. LERITZ, S.M. HAYES & W.P. MILBERG. Health Factors Related to Cognitive and Neural Plasticity.**

**Symposium Description:** Elevated cerebrovascular risk factors (e.g., high blood pressure, high cholesterol, elevated glucose) contribute to a host of age-related neurodegenerative conditions including vascular dementia, Alzheimer's disease, and generalized vascular-related cognitive decline. The prevalence of diseases such as hypertension, hypercholesterolemia, obesity and diabetes has risen sharply in recent years, and even in preclinical stages these conditions are associated with alterations to neural integrity and cognition. Despite this fact, while we have learned a great deal about the effects of individual risk factors, there is less known about how conjoint risk affects neural integrity, and even less known about how lifestyle modifications to reduce risk can affect the brain and cognition. This symposium will discuss the current state of the science regarding how vascular risk factors impact brain structure and function in middle and older-aged individuals, using sophisticated neuroimaging and neuropsychological techniques. Elizabeth Leritz will present data regarding brain structural and cognitive differences in individuals with metabolic syndrome, a constellation of at least three co-occurring CV risk factors. David Salat will present data on how markers of reduced insulin resistance and kidney function affect white matter integrity, and will also discuss alternate ways of conceptualizing conjoint risk. Andrea Haley will present data on how markers of obesity in mid-life are associated with reduced neuronal viability, assessed using MR spectroscopy. Finally, Scott Hayes and Michelle Voss will present data on how fitness levels impact the relationship between risk and neural integrity, and will demonstrate the effectiveness of tools such as exercise to modify the effect on cognition. William Milberg will serve as a discussant emphasizing the importance of considering vascular risk in studies of aging and of designing studies focusing on intervention and outcome. **Correspondence:** Elizabeth Leritz, PhD, Harvard Medical School, VA Boston Healthcare System, 150 South Huntington Ave, GRECC 1S2 (JP), Boston, MA 02130. E-mail: [elizabeth\\_leritz@hms.harvard.edu](mailto:elizabeth_leritz@hms.harvard.edu)

**E. LERITZ, L. NORDSTROM, D.H. SALAT, R. MCGLINCHY & W.P. MILBERG. Neuroanatomical and Neuropsychological Correlates of Conjoint Cerebrovascular Disease Risk.**

**Introduction:** Cardiometabolic syndrome (CMS), a constellation of three or more co-occurring cerebrovascular disease (CVD) risk factors, is associated with vascular-related cognitive impairment and dementia, especially when diagnosed in midlife. Our lab has established that individual CVD risk factors, such as high blood pressure, high cholesterol, and dysregulated glucose, may have differential effects on neural tissue,

but it is rare for these conditions to exist in isolation. The purpose of this study was to examine how comorbid CVD risk, defined using NCEP (Adult Treatment Panel III) CMS criteria, affects neural integrity, indexed via cortical thickness, and cognition.

**Methods:** Sixty-four middle to older aged adults underwent a battery of neuropsychological testing that included both standardized and experimental measures covering all cognitive domains. Participants also underwent a structural brain MRI scan as well as a brief medical evaluation including blood pressure testing as well as a serum blood draw to extract physiological and metabolic information. Seventeen participants in the sample were diagnosed with CMS according to NCEP-III criteria. This group was compared to the non-CMS group on cognitive measures as well as cortical thickness across the entire cortical mantle.

**Results:** The non-CMS group demonstrated reduced cortical thickness in several brain regions, including middle temporal, parietal, occipital and lateral frontal. Consistent with these findings, this group also demonstrated significantly worse performance on tasks of learning, executive function, processing speed, and manual dexterity.

**Conclusions:** These results demonstrate that CMS is associated with significant alterations to brain structure and cognition. These effects appear to be more than just an additive effect of individual CVD risk factors, suggesting that the conjoint risk reflected by CMS may result in a unique neuroanatomical and neuropsychological profile.

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#### **D.H. SALAT. Differential Associations between Systemic Markers of Disease and White Matter Tissue Health in Middle Aged and Older Adults.**

Age-associated changes in cerebrovascular health impacts brain tissue integrity. Little is known, however, about how variation in markers of systemic health may influence the brain and this is particularly true in individuals with generally good health. We examined 139 individuals ranging in age from 40 to 86 years old who were physically healthy and cognitively intact. Eleven markers and five indicators were obtained from venous blood sampling (total-cholesterol, HDL, LDL, triglyceride, insulin, fasting glucose, hemoglobin A1C, creatinine, blood urea nitrogen, albumin, total protein, estimated glomerular filtration rate, creatinine clearance rate, insulin-resistance, mean glucose, and cholesterol/HDL ratio). Five underlying factors explained significant variance in the blood markers. The first factor (interpreted as insulin/HDL factor (IHF)) and third factor (interpreted as kidney function factor (KFF)) each showed strong associations with white matter tissue microstructure. These associations differed regionally with the IHF being more related to the integrity of the deep white matter and projection fiber systems whereas the KFF was more associated with the periventricular and watershed white matter regions. Differential segregated associations with white matter integrity for insulin and HDL levels and serum markers of kidney function may provide information about mechanisms of brain changes across the lifespan. Future work is needed to determine whether there is potential for therapeutic modulation of systemic health to enhance or prevent decline in brain structural integrity. These results emphasize the need for more focused understanding of the influence of systemic health and organ function on the brain.

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#### **A. HALEY, S. KAUR, A.C. BIRDSILL, E. PASHA & H. TANAKA. Mechanisms linking abdominal obesity to neuronal viability in midlife.**

Visceral adipose tissue (VAT) is associated with metabolic fluctuations and risk of dementia. VAT has also related to abnormal cortical thickness in midlife. Here, we explore two potential mechanisms linking abdominal obesity to decreased neuronal integrity: synaptic plasticity and neuronal regeneration as indicated by brain derived neurotrophic factor

(BDNF) and endothelial function as measured by asymmetric dimethylarginine (ADMA), an endogenous inhibitor of nitric oxide synthase. 73 volunteers (36 men; 50±6 yrs of age) completed dual energy X ray absorptiometry (DXA) scan to assess body composition, a blood draw to measure BDNF and ADMA levels, and a 1H MRS scan of occipitoparietal grey matter to measure N-acetyl-aspartate (NAA), a marker of neuronal viability. The contribution of VAT mass and volume to variance in NAA was estimated using linear regression models, adjusting for age, sex and markers of chronic inflammation. The roles of neuronal regeneration and endothelial function in driving the relationship between VAT and NAA were explored using mediation.

Greater VAT was associated with lower NAA levels (VAT mass beta=-0.28, p=0.035; VAT volume beta=-0.28, p=0.035), adjusting for age, sex, and C-reactive protein. Neither BDNF nor ADMA accounted for the detected relationships (95%CI BDNF -0.0003 to 0.0011; 95% CI ADMA -0.0049 to 0.0003).

Greater mass and volume of visceral adipose tissue were related to lower neuronal viability, a sign of brain vulnerability in otherwise healthy middle-aged adults. These relationships were independent of age, sex, and inflammation. Thus, abdominal obesity appears to negatively impact the brain early in life and these effects are not solely due to inflammation. However neither impaired neuronal regeneration nor endothelial dysfunction, as measured by BDNF and ADMA levels, fully accounted for this relationship. Thus, further research into the mechanisms by which visceral adiposity exerts deleterious effects on the brain is warranted.

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#### **S.M. HAYES. Cognitive and Neural Correlates of Physical Activity in Aging.**

Aging is associated with cognitive and neural decline, although there is substantial individual variability among older adults. Physical activity is one factor that may be positively associated with cognition and the brain. The majority of studies examining cognition and daily physical activity have used subjective assessments, such as self-report questionnaires that may be subject to omissions and biases. In the current studies, physical activity was objectively assessed using an accelerometer in young (age 18-31 years) and older (ages 55-82 years) adults. Standardized neuropsychological tests, as well as an experimental face-name relational memory task, were administered to assess executive function and episodic memory capacities. Diffusion tensor imaging (DTI) was used to assess white matter microstructure. Older adults performed more poorly on tasks of executive function and episodic memory. Physical activity was positively associated with a composite measure of visual episodic memory, as well as face-name memory accuracy in older adults. Physical activity was not associated with cognitive performance in younger adults. DTI revealed a similar pattern, as an age group by physical activity interaction was observed in multiple white matter regions. The interaction was driven by a greater positive association between physical activity and white matter integrity in older adults relative to younger adults. These results support the notion that physical activity contributes to cognitive and neural variability among older adults.

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#### **M. VOSS. Investigating the Relationships Between Physical Activity, Exercise, and Fitness with Functional Brain Health in Older Adults.**

Although greater physical activity and cardiorespiratory fitness are known to delay age-related cognitive decline and decrease risk of Alzheimer's Disease, there is a lack of understanding of how physical activity and fitness protect the aging brain. We have previously shown that 1 year of aerobic exercise training enhanced the functional integrity of brain networks that are susceptible to age-related cognitive decline and neurodegenerative diseases such as the Default Mode Network (DMN).

In this talk I will present results from two studies that further test the mechanisms associated with these protective effects of exercise on the aging brain. The first study tested the concept that there are acute effects of exercise in the same brain systems that are affected by chronic exercise training. In healthy older adults, we found that 30 minutes of moderate-intensity aerobic cycling selectively increased functional synchrony among brain regions associated with attention, executive control, and memory that typically display age-related reductions in their synchrony. In the second study, we examined the independent relationships between physical activity and fitness with functional brain health among healthy older adults. We found that cardiorespiratory fitness, but not physical activity, was related to greater functional connectivity of several cortical networks associated with age-related decline, and effects were again strongest in the DMN. Together, our findings support the proposal that cardiorespiratory fitness is an important factor in moderating the adverse effects of aging on cognitively and clinically relevant functional brain networks, and that investigating the acute effects of exercise that would increase fitness levels may accelerate discoveries of the mechanisms associated with physical exercise as a stimulus for enhanced brain health in aging adults.

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## Paper Session 11. Pediatric Neuropsychology

Moderator: **Mary Best**

9:00–10:30 a.m.

**C.A. DENTON, L. TAMM, C. SCHATSCHNEIDER, J.N. EPSTEIN, L. ARNOLD & H. TAYLOR. Effects of Attention-Deficit/Hyperactivity Disorder (ADHD) Treatment and Intensive Reading Instruction for Children with Comorbid ADHD and Significant Word Reading Difficulties (RD).**

**Objective:** This study compared ADHD treatment alone, RD treatment alone, and their combination for children with both ADHD and RD. Hypotheses were: (a) reading outcomes would be better with RD treatment than with ADHD treatment; (b) attention outcomes would be better with ADHD treatment than with RD treatment; and (c) combined treatment would result in better outcomes in both domains than either disorder-specific treatment.

**Participants and Methods:** Children ( $n=215$ ) in grades 2-5 met DSM-IV criteria for ADHD and had significant word reading or decoding deficits. Children were randomized to receive 16 weeks of (a) ADHD treatment (carefully-managed medication + parent training), (b) RD treatment (intensive phonologically-based reading instruction), or (c) Combined ADHD + RD treatment. Outcomes were measures of word reading and phonological decoding and parent and teacher attention ratings. Analyses utilized a mixed models covariate-adjusted gain score approach where post-test is regressed onto pretest and the other predictors in the model (e.g., treatment group).

**Results:** Attention outcomes were significantly better in the ADHD treatment and Combined treatment groups relative to RD treatment alone; the ADHD and Combined groups did not differ. Word reading and decoding outcomes were significantly better in both the RD treatment and Combined treatment groups relative to ADHD treatment alone; the RD and Combined groups did not differ.

**Conclusions:** Children with comorbid ADHD and RD benefit from specific treatment of each disorder. ADHD treatment is associated with significantly more improvement in inattentive symptoms than RD treatment, and intensive reading instruction is associated with significantly better word reading and decoding outcomes than ADHD treatment. Combining the treatments allows treating both disorders simultaneously but does not appear to have additive value for either disorder. This research was supported by grant 1R01 HD060617-01 from the National Institute of Child Health and Human Development.

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**J. SCOTT, D.H. WOLF, M.E. CALKINS, E.C. BACH, J.N. WEIDNER, T.M. MOORE, R.D. HOPSON, C.T. JACKSON, R. GUR & R.C. GUR. Cognitive Functioning in Adolescent and Young Adult Cannabis Users: Results from a Large Community-Based Sample.**

**Objective:** Cannabis use by adolescents and young adults has been associated with alterations in cognitive functioning, although findings have been somewhat inconsistent and primarily based on users seeking treatment and individuals responding to research advertisements. Moreover, few studies have examined cognition in less frequent cannabis users.

**Participants and Methods:** We examined associations between cannabis use and cognitive functioning using the Penn Computerized Neurocognitive Battery (CNB) in a community-based sample of 4,961 youths, ages 14-21, from the Philadelphia Neurodevelopmental Cohort. Participants were classified into cannabis Non-Users ( $n=3,765$ ), Occasional Users ( $n=960$ ), and Frequent Users ( $n=236$ ).

**Results:** There was a significant interaction between age and group on executive control measures, such that Frequent Users had reduced accuracy on a measure of abstraction/mental flexibility compared to Non-Users at younger but not older ages. Main effects of cannabis group were found on social cognition and complex cognition; specifically, Frequent and Occasional Users were more accurate than Non-Users in facial emotion processing and spatial abilities. Earlier onset of cannabis use was modestly associated with worse performance in executive control, episodic memory, language, and social cognition.

**Conclusions:** Overall, we found modest relationships between cannabis use and cognitive functioning, including small associations between reduced cognitive performance and earlier initiation of use. Although reduced mental flexibility in frequent cannabis users is concordant with prior studies, many previously reported deficits were not replicated in our large, community-based sample. Results also highlight previously unidentified cognitive strengths in cannabis users, which may indicate that individuals with stronger social and spatial skills are more vulnerable to cannabis use. Longitudinal studies with representative samples are needed to examine dose-response effects of cannabis on brain-behavior functioning.

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**R. GONZALEZ, J.M. ROSS & J. DUPERROUZEL. Decision-Making as a Risk for Development of Cannabis Dependence among Teens: Preliminary Observations.**

**Objective:** Studies report deficits in decision-making (DM) among cannabis users, especially among young, frequent users and those with a cannabis use disorder. Given the role of orbitofrontal circuit dysfunction in addiction neuropathophysiology and in poor DM, it is possible that such deficits may precede initiation and place teens at greater risk for transitioning to cannabis addiction. We examined DM performance among teens at risk for escalating cannabis use to determine if baseline performance predicted development of cannabis dependence at 6-month follow-up.

**Participants and Methods:** Participants were 176 adolescents, ages 14 to 17. Exclusionary criteria at screening included significant mental health, developmental, or neurological disorders, as well as significant other drug use. As part of a larger battery, three measures of DM were administered: the Iowa Gambling task (IGT), the Cups Task (CT), and the Game of Dice Task (GDT). The dependent variable for all analyses was a dichotomous variable reflecting whether a participant transitioned to DSM-IV cannabis dependence during their 6-month follow-up.

**Results:** Poorer expected value sensitivity on the CT gain trials and greater number of risky choices on the GT were associated with greater risk of conversion to cannabis dependence ( $p$ -values  $< .05$ ). In contrast, expected value sensitivity for CT loss trials and IGT performance were not associated with our outcome ( $p$ -values  $> .25$ ).

**Conclusions:** Among teens, aspects of DM performance were associated with conversion to cannabis dependence 6 months later. Taken together, these preliminary findings suggest that DM under conditions of specified risk (i.e., when clear probabilities of gains or losses are presented) may be an early indicator of propensity for compulsive and problematic cannabis use, especially under conditions of potential gain. Furthermore, among teens, DM under specified risk may be a more sensitive indicator of dysfunction than DM under ambiguity. Support: R01 DA031176 and R01 DA033156 to RG

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**V.J. HINTON, R.J. FEE, K. ENGELSTAD & D.C. DE VIVO. The Cognitive and Behavioral Phenotype Associated with Glut 1 Deficiency Syndrome.**

**Objective:** To characterize the neurobehavioral profile associated with Glut-1 Deficiency Syndrome (Glut1 DS). Glut1 DS is characterized by a mutation that affects the production of the Glut 1 protein that functions as a glucose transporter across the blood-brain barrier. Affected individuals present with infantile-onset epilepsy refractory to medications, developmental delays, movement disorders and deceleration of head growth. Current standard of care involves maintaining the children on a ketogenic diet. We have evaluated children presenting with the disorder and describe their cognitive and behavioral phenotype.

**Participants and Methods:** 43 children with Glut1 DS (4-12 years, 22 male) were given a battery of tests that included the Kaufman Assessment Battery for Children (KABC), Peabody Picture Vocabulary Test (PPVT) and Expressive Vocabulary Test (EVT) and Vineland Scales of Adaptive Behavior (VABS).

**Results:** Overall, mean IQ fell in the mild intellectual delay range (mean,  $sd = 72, 16$ ), and the data were normally distributed (Kolmogorov-Smirnov  $z = .68$ , ns). On the KABC, Sequential Processing was significantly higher than Simultaneous Processing (mean,  $sd$ : Sequential 81, 18; Simultaneous: 69, 16, paired  $t = 5.29$ ,  $p < .001$ ). On language measures, receptive vocabulary was significantly better than expressive vocabulary (mean,  $sd$  PPVT: 79, 18; EVT 64, 15, paired  $t = 3.98$ ,  $p < .001$ ). Adaptive behaviors were low, yet variable (VABS ABC mean,  $sd = 64, 23$ ). Socialization skills were significant strengths (mean,  $sd$ : Communication 71, 25; Daily Living 59, 25; Socialization 82, 22, paired  $t_s = 8.23, 3.60$ ,  $p_s < .001$ ).

**Conclusions:** Individuals with Glut 1 DS have a characteristic neurobehavioral profile that includes mild intellectual delays and lowered adaptive skills. Strengths are observed in sequential processing and receptive vocabulary skills, with notably good social abilities.

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**K.S. MANGIN, L.J. HORWOOD & L.J. WOODWARD. Trajectories of Cognitive Development in Very Preterm and Typically Developing Children.**

**Objective:** Cognitive delay is common amongst children born very preterm. However, very little is known about how these difficulties develop with age or the mechanisms that increase longer-term risk. This study used growth curve modeling to describe patterns of cognitive development from 4 to 12 years in very preterm and full term born children, and identify predictors of children's cognitive development over time. Predictors examined included; family social risk, sex, and

the severity of cerebral white matter abnormalities on MRI at term equivalent age.

**Participants and Methods:** Data were drawn from a prospective longitudinal cohort study of 110 very preterm ( $\leq 32$  weeks gestation) children born between December 1998–2000 and a comparison group of 113 full term born children. General cognitive functioning was assessed at repeated intervals (corrected ages 4, 6, 9, and 12 years) using short forms of the WPPSI-R and WISC-IV and cognitive trajectories were examined using linear mixed effects growth curve analysis. White matter abnormalities on term MRI and early family social risk provided measures of biological and environmental risk, respectively.

**Results:** At all ages, very preterm children obtained lower IQ scores than their full term born peers ( $p < .001$ ), with a minimum average decrement of 9 IQ points. Growth curve modelling showed that both groups had relatively stable cognitive trajectories across childhood, with no evidence of increasing or decreasing risk of delay with age. Results supported a cumulative risk model, with sex ( $p < .05$ ), family social risk ( $p < .05$ ) and neonatal white matter abnormalities on term MRI ( $p < .001$ ) significantly predicting cognitive performance.

**Conclusions:** Children born very preterm are at elevated risk of cognitive impairment. Study findings suggest that despite some intra-individual variability, cognitive functioning of typical and high risk very preterm children was stable and influenced by early neurological development and the child rearing environment.

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**L.C. COSTA, J. SIDERIS, M. GREEN & S.R. HOOPER. First Grade Predictors of Early Elementary School Writing Skills Through Fourth Grade.**

**Objective:** The aim of this longitudinal study was to identify early elementary (1st grade) predictors of later (4th grade) writing skills (i.e., text generation). We explored the contributions of 1st grade individual predictor measures (e.g., hand dexterity, rapid letter naming, working memory, word retrieval) and latent trait predictors (i.e., fine-motor, language, executive functions) to writing in 2nd, 3rd, and 4th grades.

**Participants and Methods:** Participants ( $n = 137$ ) began participation in 1st grade and were followed through 4th grade. The participants were assigned to one of two groups based on their writing performance in first grade: typically developing writers or struggling writers. Measures included tests of motor (dominant and non-dominant hand dexterity), language (phonological awareness, receptive vocabulary, rapid letter naming and orthographic processing), and executive functions (working memory, planning and inhibition of response). The primary writing outcome was the WIAT-II Written Expression Scale. To examine the predictive value of the measures, we conducted step-wise longitudinal logistic regressions to explore relationships among writing risk (i.e., bottom quartile) and the targeted predictors over time.

**Results:** Preliminary results indicated that the latent variables were predictive of being at-risk for difficulties in writing. Specifically, findings suggested that the latent trait of fine-motor was able to predict 58% of cases, language accounted for 64%, and executive functions 71%. Further data analyses will compare whether the latent traits accounted for more variance for at-risk status than single measures.

**Conclusions:** Results suggest that fine-motor skills, language, and executive functions contributed to writing. We will examine the relative predictive value of these latent traits versus specific measures at 1st grade across 2nd, 3rd, and 4th grades. The evidence from this study could be used to develop writing assessments and to target specific interventions to develop early writing skills.

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**E. TROYB, R. MCLEAN & B.A. JERSKEY. Examining the Relationship Between Restricted and Repetitive Behaviors and Executive Functioning in Children with Autism Spectrum Disorders.**

**Objective:** The executive dysfunction theory of Autism Spectrum Disorders (ASDs) proposes that restricted and repetitive behaviors (RRBs) result from deficits in planning, self-monitoring, inhibition of ongoing behaviors, and initiation of new behavior (Russell, 1997). Research examining the role EF plays on RRBs has been limited and has yielded mixed results (Leekham et al., 2011). The current study examined the relationship between RRBs and EF among children with ASD.

**Participants and Methods:** Participants were obtained from the Autism Consortium Clinical Genetics Database and included 64 children aged 6-18 years ( $M=9.8$ ,  $SD=3.4$ ; IQ:  $M=99.7$ ,  $SD=19.7$ ) and 50 children aged 2-5 years ( $M=4.1$  years,  $SD=1.0$ ; IQ:  $M=91.3$ ,  $SD=20.5$ ). RRBs were assessed with the Repetitive Behavior Scale, Revised and EF was examined with the Global Executive Composite (GEC) of the Behavior Rating Inventory of Executive Function (BRIEF) and the BRIEF, Preschool.

**Results:** Linear regression indicated that EF significantly predicted stereotyped behaviors (Age 2-5:  $F(1, 48)=9.8$ ; Age 6-18:  $F(1, 62)=12.2$ ; both  $p's < .01$ , both *Adjusted R*<sup>2</sup>=.15), ritualistic behaviors (Age 2-5:  $F(1, 48)=14.9$ , *Adjusted R*<sup>2</sup>=.22; Age 6-18:  $F(1, 62)=7.7$ , *Adjusted R*<sup>2</sup>=.10; both  $p's < .01$ ), and insistence on sameness (Age 2-5:  $F(1, 48)=13.9$ , *Adjusted R*<sup>2</sup>=.21; Age 6-18:  $F(1, 62)=9.3$ , *Adjusted R*<sup>2</sup>=.12; both  $p's < .01$ ). In addition to these factors, among children aged 2-5 years, EF also predicted self-injurious behaviors ( $F(1, 48)=10.3$ ,  $p < .01$ , *Adjusted R*<sup>2</sup>=.16) and compulsive behaviors ( $F(1, 48)=8.1$ ,  $p < .01$ , *Adjusted R*<sup>2</sup>=.13). EF did not predict restricted interests in either age group. The results did not change when controlling for IQ.

**Conclusions:** These results suggest that deficits in EF may result in some RRBs, as predicted by the executive dysfunction theory. But, contrary to the theory, EF did not predict circumscribed interests. Future studies should explore the possibility that early RRBs impact the development of EF.

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**Symposium 13. Risk Factors in the Development of Executive Functioning in Children**

**Chair: Rachel Weber**

**9:00–10:30 a.m.**

**R. WEBER, S. DUVAL, S.J. ERICKSON, P.C. MACLEAN, T. DUFFIELD, J.R. LOWE, R. WEBER, A. JOHNSON & T. LAFAVOR. Risk Factors in the Development of Executive Functioning in Children.**

**Symposium Description:** The term executive functioning (EF) refers to higher-order cognitive skills required in the processes of planning and organizing behavior and regulating feelings and thoughts (Diamond, 2013). They are thought to develop over time, increase in complexity, and underlie goal setting (Best, Miller, & Jones, 2009) and are of particular interest due to their widespread roles in supporting academic, social, and adaptive functioning (Garon, Bryson & Smith, 2008; Rothbart, Ahadi, Hershey, & Fisher, 2001). Numerous indicators of risk exist including poverty, preterm birth, and homelessness and high residential mobility (HHM) (Blair & Razza, 2007; Burnett, Scratch & Anderson, 2013; Obradovic, 2010). Independently these are concerning; however, they frequently co-occur, and the compounding effect may be even more impactful. Identification and understanding of indicators of risk is required in order to understand and promote EF development. This symposium consists of 3 studies that collectively span the developmental stages of preschool, childhood, and pre-adolescence;

each study examines the relative contributions of these risk indicators on childhood EF, both in their performance on EF tasks and in caregiver ratings of their daily EF. Paper 1, by Duvall, Erickson, MacLean, Duffield, and Lowe, examined risk factors that predict EF in preschoolers born preterm, with gestational age and maternal depression significantly contributing to EF task performance and EF ratings. Paper 2, by Weber and Johnson, examined risk and resilience factors that predict EF in linguistically diverse children, with caregiver education interacting with dual language exposure to predict EF task performance. Paper 3, by Lafavor, examined the contributions of HHM and cognitive ability in predicting EF, with HHM status predicting parent ratings of EF above and beyond IQ. These results will be discussed in regards to their commonalities and implications for research and clinical practice.

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**S. DUVAL, S.J. ERICKSON, P.C. MACLEAN, T. DUFFIELD & J.R. LOWE. Risk Factors for Executive Function in Preschoolers Born Preterm.**

**Objective:** Children born very preterm (<32 weeks) are at risk for a variety of neurodevelopmental difficulties. Executive Function (EF) has been shown to be an outcome measure with real world functional correlates. The goal is to explore the risk factors related to EF in preschoolers born very preterm.

**Participants and Methods:** Participants included 61 very preterm preschoolers 3-4.5 years old. Performance measures of EF (Dimensional Change Card Sort-Separated task (DCCS-Sep), Gift Peek, Gift Open) and parent report of EF (BRIEF-P) were utilized. Multiple regression analyses were adjusted for age and examined the relationship between the EF measures and the following risk factors: gestational age, maternal education, family income and maternal Beck Depression Inventory (BDI) score.

**Results:** Gestational age alone predicted performance on the DCCS-Sep task. The BRIEF-P Flexibility Index and performance on Gift Open were associated with maternal BDI and gestational age. Performance on Gift Peek and the BRIEF-P Global Executive Composite (GEC), Inhibitory Self-Control Index and Metacognitive Index, were uniquely associated with maternal BDI. Similar patterns of results were found when FSIQ was included as a predictor.

**Conclusion:** EF in very preterm preschoolers showed associations with some perinatal and maternal risk factors, especially gestational age at birth and maternal depressive symptoms (BDI), as well as different patterns of risk factors for different types of EF measures. Gestational age at birth was solely associated with a measure of EF related to set-shifting and maternal BDI scores were partially associated with an inhibition measure. Questionnaire measures of EF were associated with self-report BDI scores and gestational age for one index. Increasing our understanding of the relationship between specific maternal and child risk factors and EF outcomes in this vulnerable population may help us to develop enhanced interventions for children and families.

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**R. WEBER & A. JOHNSON. Risk Factors for Executive Functioning in Linguistically Diverse Children.**

**Objective:** This study examines the contributions of risk and resilience variables to the executive functioning (EF) of children in a linguistically diverse sample. While poverty is considered an indicator of risk for cognitive outcomes (Lipina & Colombo, 2009), bilingualism, and potentially dual-language exposure, may enhance specific cognitive skills, especially in low-income minority children (Engel de Abreu, Cruz-Santos, Tourinho, Martin, & Bialystok, 2012). Previous studies demonstrate that bilingualism and SES independently predict EF task performance but do not significantly interact (Calvo & Bialystok, 2014).

This study expands upon previous research by examining the contributions of caregiver education, dual language exposure, bilingual competence, and their interactions, to EF task performance and caregiver ratings of daily EF.

**Participants and Methods:** A total of 78 children (ages 4-7) and their caregivers were recruited in the Southwestern United States. Demographic data and EF ratings were collected from caregivers and all participants completed measures of receptive vocabulary and five EF tasks. Dual language exposure and bilingual competence were determined by receptive vocabulary in English and Spanish.

**Results:** Hierarchical multiple regressions examined the contributions of the variables of interest. Surprisingly, none of the variables independently contributed to models for EF performance or caregiver ratings of daily EF. A significant interaction between dual language exposure and SES emerged for two conditions of a selective attention task.

**Conclusions:** These findings are largely inconsistent with the literature base, though the interaction effect offers interesting opportunities for future research and discussion. It is likely that the tasks included in this study and the populations sampled play a large role in the deviation of these findings from previous research in this area.

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#### **T. LAFAVOR. Executive Function in Homeless and Highly Mobile Children.**

**Objective:** This study examined the relationship between homeless/highly mobile (HM) status and cognitive ability and executive function (EF). Evidence demonstrates the role EF in supporting related domains including achievement. The deleterious effects of poverty on development including deficits in EF have been well established (Blair & Razza, 2007). Less research has focused on HHM specifically, but results implicate the role of regulation (Obradovic, 2010). In studies of children reared in poverty, there are clear groups who demonstrate positive adaptation (Buckner, et al., 2003; Flores, et al., 2005; Obradovic, et al., 2009). Targeting EF in these children may be an effective way to lessen the effects of HHM on development (Alvord & Grados, 2005; Feder et al., 2009).

**Methods and Participants:** A total of 86 children (ages 9 to 11) living in emergency homeless shelters were recruited along with their caregiver. Children completed perceptual reasoning tasks and performance based measures of EF (cognitive flexibility, planning, problem solving, and self-monitoring). Parents were interviewed about demographic information, life events, and child EF, behavior, and health.

**Results:** Results demonstrate significantly lower perceptual reasoning among HHM participants compared to normative samples, and HHM status was predictive of parent-reported difficulties with shifting, emotional control, planning, and organization above and beyond IQ. HHM status was not predictive of task-based EF performance.

**Conclusions:** Results are consistent with previous findings and underscore the importance of developing targeted intervention to improve the lives of HHM children. Achievement related gaps continue to increase, with poor and HHM students disproportionately affected. Targeted EF intervention has the potential to ameliorate the effects of poverty and promote competence in success in multiple developmental domains.

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### **Poster Session 9. Emotional Processes, Genetics, HIV/AIDS, and Psychopathology/Neuropsychiatry**

10:45 a.m.–12:00 p.m.

#### **Emotional Processes**

##### **C. CHAMPAGNE, A. G. SENI, E. VERA-ESTAY & M.H. BEAUCHAMP. Attribution of moral emotions to social decision-making from childhood to early adulthood.**

**Objective:** Social decision-making and emotion processing are part of social cognition, an array of functions necessary for appropriate social interactions and susceptible to impairment after various developmental and acquired conditions. Mature moral reasoning and attribution of moral emotions, in particular, are essential to socially adaptive behaviour. The aim of this study was to study the use of basic and moral emotion attribution following moral decision-making, using a novel moral reasoning assessment tool.

**Participants and Methods:** 193 healthy participants were divided into three groups: children 6-12 years ( $n = 76$ ,  $M = 9.20$ ,  $SD = 1.67$ ), adolescents 13-17 years ( $n = 75$ ,  $M = 14.93$ ,  $SD = 1.52$ ) and young adults 18-21 years ( $n = 42$ ,  $M = 18.10$ ,  $SD = 1.54$ ). The Socio-Moral Reasoning Aptitude Level task (So-Moral, Beauchamp, Dooley & Anderson, 2013) was used to measure moral maturity and emotions in the context of visual vignettes of moral dilemmas incorporating socio-moral values.

**Results:** Frequencies of emotional attributions after moral decision-making were as follows: Children 40.35% basic emotions (BE), 51.31% moral emotions (ME) and 8.34% indifference; Adolescents 32.89% BE, 60.44% ME and 6.67% indifference; and Young adults 24.60% BE, 63.49% ME and 11.91% indifference.

**Conclusions:** Decisions taken in the context of moral dilemmas appear to be emotionally charged in all age groups. Only a minority of participants were indifferent to the decision they made regarding their involvement in a moral conflict. The use of moral emotions increased with age. Future work should verify whether this increase is associated with greater moral maturity. The presence and progression of moral emotions in the So-Moral task suggests that the dilemmas presented tap into expected levels of emotion attribution.

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##### **M. DENO, T. TACHIKAWA, K.K. FUJISAWA, S. IZAWA, M. TANAKA, M.N. NATSUAKI & J. ANDO. Salivary Stress Hormones, Emotional Responses to Stress and Trait Emotional Intelligence: A Monozygotic Twin Study.**

**Objective:** Utilizing the monozygotic-twin differences (MZ-diff) method, we examined the association between physiological and emotional reactions to psychosocial stress and trait emotional intelligence (trait EI) among MZ twin girls. The MZ-diff design allowed us to rigorously test non-shared environmental effects on these association by eliminating the confound arose from twin differences in genes and shared environment.

**Participants and Methods:** Twenty-six pairs of healthy MZ girls completed the Trier Social Stress Test for Children (TSST-C). Saliva samples were collected for cortisol levels, and subjective emotional responses before and after the TSST-C were assessed. The participants also described three subscales of trait EI; emotional self-control, emotional self-expression and awareness of other's feelings.

**Results:** MZ-diff in awareness of other's feelings was significantly associated with MZ-diff in the emotional responses to stress ( $r = .535$ ,  $p < .05$ ) but not with MZ-diff in AUCi of cortisol ( $r = .038$ , *n.s.*). In addition, MZ-diffs in emotional self-control and emotional self-expression were associated with neither MZ-diff in the emotional responses to stress (in order,  $r = .046$ ,  $.105$ , *n.s.*) nor AUCi of cortisol (in order,  $r = -.146$ ,  $.192$ , *n.s.*).

**Conclusions:** The association between one subscale of trait EI, awareness of other's feelings, and emotional responses to psychosocial stress might be explained by non-shared environment. The relation between trait EI and cortisol was not significant. The genetic and shared/non-shared environmental factors might play different roles according to the different subscales of trait EI.

**H.V. ECHLIN, E. KEATLEY, B. ZUCCATO, T.L. MCAULEY & C. ABEARE. Executive Processes in Emotion Regulation.**

**Objective:** Emotion regulation is affected by many conditions and is critical for adaptive emotional functioning. As such, it is important to gain a better understanding of the component cognitive processes that are important for emotion regulation. Therefore, this study aimed to examine the role of inhibition and working memory in emotion regulation.

**Participants and Methods:** The sample consisted of 81 undergraduate students (Mage=20.46). The measures included a demographic questionnaire, an emotion regulation self-report scale (Difficulties in Emotion Regulation Scale; DERS) and a performance-based task involving attention and working memory (Modified Emotional Face N-Back task; Modified EFNBACK).

**Results:** Bivariate correlations were performed between the EFNBACK and the DERS. The DERS Total Score positively correlated with reaction time in the Fear-no-memory-load condition  $r=.270$ ,  $p=.027$ , as well as with the total errors on the Neutral-no-memory-load condition  $r=.284$ ,  $p=.020$ . Subscales of the DERS, (i.e., Awareness, Strategies, Goals, Nonacceptance and Impulse) also demonstrated significantly positive correlations with specific reaction time speeds as well as total errors in most EFNBACK conditions.

**Conclusions:** The literature supports the use of objective measurement to better understand emotion regulation ability. According to the findings of this study, self-report difficulties in emotion regulation are associated with an objective emotion regulation measure. Such an objective tool of emotion regulation could prove to be useful in evaluating and treating clinical populations with emotion dysregulation. Future research is necessary in order to adequately validate this measure.

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**A. ELLIS, G. SALGARI, D. MIKLOWITZ & S. LOO. Neural Response to Monetary Reward versus Loss Predicts Symptoms in Mood Disordered Youth.**

**Objective:** This pilot project aimed to characterize mood symptoms based on biomarkers associated with reward and loss. Reward and loss sensitivity were assessed using event-related potentials [ERPs], the Feedback Negativity [FN] (initial processing of good v. bad outcome information) and the P300 [P3] (later controlled processing). Greater differentiation between gains and losses—indicating greater reactivity to reward stimuli—were expected to be associated with greater mania, while smaller differences would be associated with depression.

**Participants and Methods:** Symptoms of 18 adolescents (Mean age=14.67) from a mood disorders clinic were assessed by interview (Mania Rating Scale:  $M=17.38$ ,  $SD=3.10$ ; Depression Rating Scale:  $M=26.81$ ,  $SD=12.34$ ). Adolescents were administered a computerized task and told to respond as quickly and accurately to win money (25 cents). Feedback was rigged so that loss feedback was given on 40% of correct trials (loss of 25 cents). FN (FCz, Fz, Cz combined) was the mean negative amplitude 250-350ms after feedback, and P3 (Pz) was the mean amplitude 300-400ms after feedback, each averaged across win/loss trials. Analyses involved difference scores [D] (DFN= loss-gains; DP3=gain-loss), where greater values (negative and positive) reflect greater reactivity.

**Results:** Linear regression, controlling for age, examined whether the DFN or DP3 predicted symptoms. The DFN did not predict symptoms of depression ( $\beta=.19$ ,  $t=.57$ ,  $p=.58$ ) or mania ( $\beta=-.18$ ,  $t=-.56$ ,  $p=.58$ ). However, while the DP3 was not associated with symptoms of mania

( $\beta=-.35$ ,  $t=-1.42$ ,  $p=.18$ ), it did predict symptoms of depression ( $R^2=.35$ ,  $\beta=-.59$ ,  $t=-2.59$ ,  $p=.02$ ).

**Conclusions:** While early stages of appraisal of feedback for win-loss outcomes, as assessed with FN, do not predict mood symptoms in adolescents, smaller differences in P3 in response to gains versus loss were associated with greater depression. Reduced responsivity to reward in depression may be due to blunted top-down evaluation of reward stimuli.

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**M. FEIGON, M. KASSEL, L. GABRIEL, J.A. RAO, S. POCIUS, D. RAMAHI & S.A. LANGENECKER. Gender Differences in Emotional Valence on the Semantic List learning Task.**

**Objective:** Emotional valence, or how happy or sad a person feels, in hearing a specific word has been implicated in attention and recall. Memory strengthening tends to occur for more emotionally laden versus neutral information. Women typically outperform men on memory tasks and also are more likely to recall emotionally laden information. Depressed individuals, independent of gender, have also been shown to experience better recall for more negative information than for neutral or positive information. The purpose of this study was to examine gender differences and the emotional valence of specific words in healthy controls versus remitted depressed individuals on the Semantic List Learning Task (SLLT).

**Participants and Methods:** Participants ( $n=49$ ) were administered alternate versions of the SLLT (14 words, 12 categories) along with self-report measures of mood over two time points and asked to rate the valence, arousal, and dominance of each word on a 5-point Likert scale.

**Results:** Gender differences were observed only on the category of alcoholic beverages for valence. There were no differences observed on arousal or dominance of alcoholic beverages. This difference was observed independent of healthy controls or remitted depressed status. A chi-squared test revealed that “tequila” and “beer” were more emotionally laden for women than for men. Recall of the word “tequila” was significantly correlated to emotional valence for both men and women although “beer” was not. There were no differences between remitted depressed and healthy control groups in valence, arousal, or dominance ratings.

**Conclusions:** Gender differences were observed for the emotional valence of primarily negative words, specifically, types of alcoholic beverages. Gender differences were not observed between other categories of positive or neutral words. Additional studies are needed to determine if gender differences extend to recall and recognition of word items with greater emotional valence.

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**P.A. FIGUEROA, K.A. BURNETT, A.A. VAILLANCOURT, L.K. PAUL & W.S. BROWN. Cognitive and Emotional Dimensions of Empathy in Individuals with Agenesis of the Corpus Callosum.**

**Objective:** Previous research demonstrated that adults with agenesis of the corpus callosum (ACC) and normal full-scale intelligence quotients (FSIQ) have significantly reduced theory of mind and ability to accurately recognize the emotions of others (Symington, Paul, Symington, Ono, & Brown, 2010; Bridgman, Brown, Spezio, Leonard, Adolphs, & Paul, 2014), having particular difficulty recognizing negative emotions. The objective of the current study was to determine if individuals with ACC are aware of their deficiency – that is, do they nevertheless respond similar to neurotypical controls on a self-report scale of empathy.

**Participants and Methods:** The Interpersonal Reactivity Index (IRI; Davis, 1980) was administered online to 17 individuals with ACC (age range: 19-55; MFSIQ: 104) and to 24 age- and IQ-matched controls (age range: 19-64; MFSIQ: 108). The IRI is a self-report measure of

empathy along cognitive (Fantasy and Perspective Taking) and emotional dimensions (Empathic Concern and Personal Distress).

**Results:** Multivariate analysis of variance over the four dimensions of the IRI revealed no significant overall differences between ACC and neurotypical controls,  $F(4, 36) = 0.92$ ,  $p = .54$ ;  $\eta^2 = .08$ . Furthermore, univariate tests demonstrated no significant differences between ACC and neurotypical controls across the four subscales of Fantasy ( $\eta^2 = .000$ ), Perspective Taking ( $\eta^2 = .004$ ), Empathic Concern ( $\eta^2 = .052$ ), and Personal Distress ( $\eta^2 = .017$ ).

**Conclusions:** Results demonstrated that there is no difference in self-reports of empathy between individuals with ACC and neurotypical controls despite clear evidence of difference in direct tests of recognizing and understanding the emotions of others – their self-understanding differs from behavioral tests of empathy. Thus, adults with ACC, when given unlimited time to ponder over questions, have the ability to make prototypical responses in regards to social norms of empathy, but nevertheless lack insight about their own behavior.

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#### **C.L. HAAK, I. REIFE, J. KIM & L.G. TALL. Social Language Abilities as a Moderator of Child and Parent Report of Internalizing Symptoms.**

**Objective:** Previous research found that children with difficulties in pragmatic language were more likely to have poorer social skills, behavioral adjustment, and internalizing symptoms (McCabe, 2005; Calvete, 2011). Although parent report is primarily used for behavior ratings, child reports provide information about self-perceptions and differences in perceptions of behaviors among parents and children (Hope et al., 1999; Nugent et al., 2013).

**Participants and Methods:** Data from 51 participants including a two hour individual cognitive assessment, self-reports and history questionnaires were used. The Behavioral Assessment System for Children (BASC-2) was used as a self-report measure of children's internalizing symptoms as reported by children and parents. The Supralinguistic composite of the Comprehensive Assessment of Spoken Language (CASL) was used to measure social language abilities. A regression analysis was conducted to investigate whether pragmatic language ability moderates the relationship between child and parent reported internalizing scores.

**Results:** A significant relationship between children and parents' BASC internalizing scores ( $r = 0.36$ ,  $p = 0.01$ ) was found. The interaction term accounted for a significant proportion of the variance in parent reported symptoms ( $\Delta R^2 = 0.11$ ,  $\Delta F(4, 46) = 7.36$ ,  $b = 0.04$ ,  $t(46) = -2.714$ ,  $p = 0.01$ ). Results indicated that the Supralinguistic composite significantly moderated the relationship between child and parent report of internalizing symptoms.

Examination of the interaction plot showed an enhancing effect with higher CASL scores indicating a stronger relationship between child and parent reports.

**Conclusions:** Children's social language ability was found to moderate the relationship between child and parent reported internalizing symptoms, with greater social language ability strengthening the relationship. This indicates for children with weak social language ability, both child and parent report should be interpreted more in-depth to understand the child's internalizing symptoms.

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#### **K. HARRIS, V. MONTGOMERY & L.H. LU. Predictive Value of Motoric and Depressive Symptoms on Functional Impairment in Parkinson's Disease Patients.**

**Objective:** Functional impairment is associated with diminished quality of life in patients with Parkinson's disease (PD; Schrag et al., 2000). Depressive symptoms have a prevalence of about 52% in PD, though

these symptoms are often not prioritized in assessment and treatment given the prominence of motor symptoms in the disease (Reijnders et al., 2008). Although deficits to activities of daily living (ADLs) are common in PD, evaluation of the unique contribution of motoric and depressive symptoms to informant-reported functional impairment has yet to be examined in a large geographically diverse sample. We hypothesize that each of these symptom clusters will contribute to predicting functional impairment in PD.

**Participants and Methods:** We examined whether motoric and depressive symptoms predicted functional impairment using data from 438 PD participants from the National Alzheimer's Coordinating Center Uniform Data Set. We conducted exploratory analyses using stepwise regression to examine the extent to which the Unified Parkinson's Disease Rating Scale—Motor Examination (UPDRS—Motor) and Geriatric Depression Scale (GDS) predicted functional impairment as measured by the informant-based Functional Assessment Questionnaire (FAQ).

**Results:** Results indicated that a two-variable model in which the UPDRS motor scores accounted for 29.9% of the variance and GDS scores accounted for an additional 11.8% of the variance predicted FAQ ( $F(2, 68) = 24.32$ ,  $p < .001$ ).

**Conclusions:** Our results suggest that depressive symptoms accounted for a significant amount of the variance of functional impairment above and beyond that which was accounted for by motor symptoms alone. Given the impact these symptoms may have on functionality and the implications of functional impairment on caregiver burden and patients' quality of life, our findings support comprehensive evaluation and treatment of depressive symptoms in patients with PD.

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#### **J.N. IKANGA, J.L. GESS & A.Y. STRINGER. An Empirical Approach to Defining Emotional Communication Disorders (ECD).**

**Objective:** We attempted to identify subtypes of emotional communication impairment consistent with clinical literature and to specify and validate empirical criteria defining each subtype.

**Participants and Methods:** Archival review of a mixed neurological sample (76 epilepsy, 23 stroke, 4 neoplasm, 5 concussion) identified 109 patients (57 female; 82 white; 95 right-handed) examined for production, imitation, and comprehension of affective prosody and facial expression using the Affective Communication Test (ACT). Patients were divided into 2 samples equivalent on demographic and diagnostic variables. Separate cluster analyses (CA) were run to identify ECD and develop classification rules in each sample. Rules were cross-validated in the opposite sample using coefficient kappa ( $\kappa$ ) as an index of agreement. Rules showing highest agreement across samples were applied to the total group of patients, followed by calculation of sensitivity and specificity.

**Results:** CA yielded meaningful results when prosody (7 clusters in both samples) and facial affect (7 clusters in sample 1, 4 in sample 2) were examined separately, with the clusters reflecting different patterns of affect production, imitation and comprehension as expected. ACT score criteria were successfully identified that allowed minimum overlap between clusters in each sample. Cross-validation of criteria suggested better classification agreement when sample 1 criteria were applied to sample 2 ( $\kappa_{\text{Prosody}} = .861$ ,  $p < .001$ ;  $\kappa_{\text{facial}} = .402$ ,  $p < .001$ ). Applied to the entire group of patients, sample 1 criteria had high sensitivity and specificity to prosody disorder. Sample 1 criteria, however, had high specificity but low sensitivity to facial affect disorder.

**Conclusions:** CA revealed ECD subtypes consistent with many clinically described patterns. Empirical criteria showed poor sensitivity to facial affect disorder. Empirical criteria with good sensitivity and specificity were developed and cross validated for prosody disorder, but further validation in a larger sample is needed.



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**P.C. KLINEBURGER, K.M. LIPPOLD, N.M. DARDEN & D.W. HARRISON. Frontal Lobe Deactivation During Intense Music-Evoked Emotion.**

**Objective:** The Functional Capacity Theory (Klineburger & Harrison, 2015) proposes that the frontal lobes have a functional capacity that when exceeded results in the inhibitory release of the temporal and parietal lobes leading to intense emotional arousal. The Functional Capacity Theory's proposal that the relationship between emotional intensity and frontal lobe activity is nonlinear is counter to current theories of emotion. Emotionally evocative music was used to exceed frontal lobe capacity and evoke intense positive emotions.

**Participants and Methods:** Forty-eight participants listened to music and continuously rated their emotional intensity with a dial while Electroencephalogram was recorded. A repeated measure ANOVA was performed with EEG beta power as the dependent variable and TIME (baseline, music-onset, and peak-emotion), and LOCATION (left frontal, right frontal, left posterior, and right posterior) as the within-subjects factors.

**Results:** A significant LOCATION by TIME interaction was found,  $F(6, 138) = 6.72, p < .0001$ . There was a significant decrease in beta power at the left frontal region from baseline to peak emotion,  $t = 1.97, p < .05$ . During the peak-emotion phase, beta power at the left frontal site was significantly lower than the left posterior site,  $t = 2.69, p < .01$ , and beta power at the right frontal site was significantly lower than the right posterior site,  $t = 2.69, p < .01$ .

**Conclusions:** The relative changes in frontal versus posterior activity in this experiment during intense emotional arousal referred to as a peak-emotion supports the Functional Capacity Theory and may contribute to a larger understanding of how the frontal lobes and posterior sensory regions interact during intense emotions. This experiment may contribute to the music-evoked emotion and emotion-regulation literature by providing further evidence that frontal lobe activity initially increases but then decreases during intensely pleasurable emotions.

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**W.H. KRAUSE, T. MYERS, K. SAVAGE, K. FINLEY, J.T. TWAITE, R. STAFFORD, M. HOLTZMAN, O. SHEVTSOVA & J.C. BOROD. Validity and Utility of Novel Primary Emotions in Multichannel Emotion Perception Tasks.**

**Objective:** The New York Emotion Battery (NYEB; Borod, Welkowitz, & Obler, 1992) employs novel emotions (along with standard ones,—happiness, sadness, fear, disgust, and anger) to evaluate emotion perception abilities. The emotions “pleasant surprise,” “unpleasant surprise,” and “interest” used in the NYEB are rarely used in tasks assessing emotion perception. This study examines the validity and utility of using these emotions within measures of emotion perception.

**Participants and Methods:** Participants were 122 healthy, right-handed adults, aged 20 to 83 years. Participants were evenly divided distributed by decade within this age range, evenly distributed by sex and by ethnicity, and were screened for major medical, neurological, and psychiatric disorders, as well as substance abuse. Participants were administered the emotion perception tasks from the NYEB. Stimuli were presented in three communication channels (facial, prosodic/intonational, and lexical/verbal), with identification and discrimination subtests in each channel.

**Results:** Principal components analyses with varimax rotation were performed, separately, on the items comprising each subtest and on the total subtest scores. The novel emotions showed strong positive loadings on the first (general) factor in all analyses. Pleasant surprise and interest stimuli showed positive loadings, and unpleasant surprise showed negative loadings on a second factor consistent with the approach/withdrawal model of emotion (Davidson et al., 1990).

**Conclusions:** The ability to recognize interest and unpleasant surprise was consistent with the ability to recognize other primary emotions. All three novel emotions showed consistency with an approach/withdrawal model of emotion.

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**J.A. LAFO, A. MIKOS, B. SCOTT, M.S. OKUN & D. BOWERS. Startling Facts about Emotion in Essential Tremor: Blunted emotional reactivity as indexed by the startle eyeblink response.**

**Objective:** Essential Tremor is a highly prevalent movement disorder characterized by intention tremor and mild cognitive-executive changes. These features are commonly attributed to abnormal cerebellar changes, resulting in disruption of cerebellar-thalamic-cortical networks. Less attention has been paid to alterations in basic emotion processing in ET, despite known cerebellar-limbic interconnectivity. In the current study, we tested the hypothesis that a psychophysiological index of emotional reactivity, the emotion modulated startle reflex, would be muted in individuals with ET relative to controls.

**Participants and Methods:** Participants included 19 ET patients and 18 age and education-matched controls, who viewed standard sets of pleasant, unpleasant and neutral pictures (IAPS) for 6 sec. each. During picture viewing, white noise bursts (95db, 50ms) were binaurally presented to elicit startle eyeblinks measured over the orbicularis oculi. Subjective picture ratings of valence and arousal were obtained. The ET

and control groups were not demented or depressed based on cognitive and mood screening.

**Results:** At baseline, the groups did not differ in startle eyeblink latency or amplitude. A repeated measures ANOVA revealed a significant Group X Affect interaction ( $F_{2,70}=3.90, p<0.03, \eta^2=0.10$ ). Consistent with past literature, controls had larger startle eyeblink amplitudes while viewing unpleasant than neutral or positive pictures ( $p<.001$ ). In ET, startle eyeblinks were not modulated by emotion. This modulation failure was not due to medication effects, nor was it due to abnormal picture ratings.

**Conclusions:** Our hypothesis was supported. Neuroanatomically, it is unclear whether diminished startle modulation in ET is secondary to aberrant cerebellar input into limbic and/or frontal regions involved in emotional processing or to more direct disruption between the cerebellum and brainstem startle circuitry. If the former is correct, these findings may be the first to reveal dysregulation of emotional networks in ET.

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#### L. LAU, M.R. BASSO, D.R. COMBS & D. WHITESIDE. **Global-Local Visual Attention, Mood and Temperament.**

**Objective:** Visual perception of global-configural and local-detail elements seems to be biased by mood. A global bias occurs with positive mood, and a local bias coincides with negative mood. Extending these findings, we examined the association of mood with selective attention to global and local stimuli. Additionally, we examined whether temperament correlates with selective attention to global-local stimuli. In particular, the Rational-Experiential temperament (Epstein et al., 1996) may correlate with attention to global-local stimuli. Preference for experiential reasoning may correspond with a global reasoning bias, whereas a rational reasoning preference may correlate with local reasoning.

**Participants and Methods:** 60 healthy undergraduates were administered the PANAS (a measure of mood), Rational Experiential Inventory (REI: a measure of temperament), and a computer-administered global-local selective visual attention task (GLSAT). The GLSAT (Caparos et al., 2013) presents a global-configuration comprised of local-elements. Participants identified whether a target was present in global configuration or in the local elements.

**Results:** Multiple regression revealed no relationship between REI scores and GLSAT accuracy or reaction time. However, negative affect correlated significantly with global congruent ( $p \leq 0.05$ ) and incongruent accuracy ( $p < 0.05$ ) but not local accuracy. In contrast, positive affect correlated with reaction time to identify local targets that were incongruent with the global configuration ( $p < 0.05$ ).

**Conclusions:** Contrary to expectations, Rational-Experiential temperament had no relationship with global-local visual attention. Extending previous findings, global accuracy seems reduced as negative affect increases. Reaction time to identify local targets improved as positive mood increased. Whereas previous research focused upon global-local biases, these data suggest that positive and negative affect have distinct correlates with global-local visual attention.

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#### É. LEBLANC, C. CHAMPAGNE, E. VERA-ESTAY & M.H. BEAUCHAMP. **Affect Recognition as a Predictor of Rule-Breaking and Aggressive Behaviour in Childhood.**

**Objective:** Affect recognition (AR) is a sociocognitive skill that is related to prosocial and adaptive behaviour in childhood. There is some evidence that deficits in AR may be associated with the presence of maladaptive social behaviours. Childhood externalizing behaviours, such as rule-breaking and aggressive behaviours, also represent risk factors for the development of social problems later in life. Given these

associations, the aim of this study was to investigate the contribution of AR to rule-breaking and aggressive behaviour in childhood.

**Participants and Methods:** Participants ( $N=76$ ,  $M=9.2$  years old,  $SD=1.67$  years, 53% female) completed the NEPSY-II Affect Recognition subtest and rule-breaking and aggressive behaviours were measured using the Child Behavior Checklist (CBCL), completed by the primary caregiver.

**Results:** Rule-breaking and aggressive behaviours were negatively correlated with AR. Linear regressions indicate that AR is a significant predictor of externalizing behaviour problems in childhood, explaining 9.1% of rule-breaking behaviour ( $\beta = -.30, p=0.009$ ) and 5.2% of aggressive behaviour ( $\beta = -.23, p=0.049$ ).

**Conclusions:** AR represents an essential skill for the initiation and the preservation of interpersonal relationships. The results suggest that difficulties in AR, which affects social reciprocity, have an impact on rule-breaking and aggressive behaviours. Early intervention on emotional information processing may be a useful remediation target for reducing externalizing problems in childhood.

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#### T.L. MCKINNEY, A. FITZNER, A. PORTHUKARAN & C. WESTBURY. **The development and validation of the Alberta Implicit Scale of Emotional Reactivity (AISER).**

**Objective:** Emotional reactivity is a problematic construct to measure psychometrically, as existing measures are not framed by contextual information and are likely to be influenced by an individual's beliefs. The AISER is a psychological instrument that seeks to address this limitation by inferring emotionality based on reports of behaviours, rather than through self-reports of emotionality. The AISER was psychometrically validated using other measures of affect, as well as experimentally using galvanic skin conductance responses (GSR) evoked from emotionally evocative images.

**Participants and Methods:** The initial item set was developed and distributed to 171 participants for the purposes of item analysis. This final item set of 26 items was validated with the Behavioural Inhibition/Activation Scale (BIS/BAS) and the Emotional Reactivity Scale (ERS). The AISER's validation was expanded in a second study of 197 participants with additional measures: the State-Trait Anxiety Index (STAI), the Positive and Negative Affective Schedule (PANAS), and the Marlowe-Crowne Social Desirability Scale (SD). Furthermore, 53 participants participated in an experimental validation session, where their GSR was measured in relation to evocative images as an objective validation of all scales.

**Results:** The first study established the AISER as reliable ( $\alpha=0.88$ ) and valid through correlations with the ERS ( $r=0.69$ ) and the BIS ( $r=0.46$ ). This pattern was replicated in the second study, extending to state anxiety ( $r=0.57$ ) and the BAS ( $r=0.25$ ). State anxiety and the PANAS did not correlate with the AISER ( $r=0.06, 0.003$ ). The AISER had higher scores compared to the ERS in the top 15% of SD scoring participants, though this did not reach significance. The GSR scores had no significant correlations with any of the examined scales.

**Conclusions:** The AISER was developed and validated as a robust psychometric measure of emotional reactivity by inferring emotional reactivity through behavioural indices.

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#### E.P. MELTZER, J.C. BOROD & L. RABIN. **Validation of the Emotion Regulation Questionnaire (ERQ) and Cognitive Emotion Regulation Questionnaire (CERQ) in Non-Demented Older Adults with Varying Degrees of Cognitive Complaints and/or Difficulties.**

**Objective:** The 10-item ERQ (Gross & John, 2003) measures self-reported use of cognitive reappraisal and expressive suppression, and the

36-item CERQ (Garnefski et al., 2001) measures self-reported use of nine regulation strategies that can be grouped into “adaptive” and “maladaptive” approaches. The factor structures of the ERQ and CERQ have been validated in healthy adolescent and/or young adult samples (e.g., Garnefski et al., 2001; Gross & John, 2003; Melka et al., 2011), though not in older adults or in relation to cognitive functioning. We examined the factor structure of both the ERQ and CERQ in non-demented older adults, with varying degrees of cognitive problems, and attempted to replicate the findings from the younger adult samples.

**Participants and Methods:** Participants were non-demented older adults (M age=81.6±5.8, 67.7% female) with varying degrees of cognitive complaints and/or difficulties (21.5% MCI, 32.3% Subjective Cognitive Decline, & 46.2% Healthy Controls) from the Einstein Aging Study in the Bronx, New York. Participants completed the ERQ (n=196) and CERQ (n=181). Principal components analyses with varimax rotation were conducted, separately, on the ERQ and CERQ item responses.

**Results:** The original 2-factor structure (Cognitive Reappraisal and Expressive Suppression) of the ERQ was not replicated with all 10 items. However, with removal of 2 items, the two same factors were obtained. For the CERQ, the original 2-factor structure (Maladaptive and Adaptive approaches) was not clearly observed with all 36 questionnaire items, but was obtained with removal of 5 items.

**Conclusions:** The findings suggest that modified versions of the ERQ and CERQ are useful tools for measuring the use of emotion regulation strategies in older adults with varying degrees of cognitive problems. Findings have implications for appropriate assessment of emotion regulation in aging populations.

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**T.E. MYERS, K. SAVAGE, K. FINLEY, J.T. TWAITE, W.H. KRAUSE, J.L. STORBECK & J.C. BOROD. The “In-Group Advantage” for Perceiving Emotion across Demographic Groups and Communication Channels.**

**Objective:** Demographic factors impact the accuracy of emotion perception and may be influenced by the presence of an “in-group advantage” (IGA; Elfenbein & Ambady, 2002). The purpose of the current study was to investigate the characteristics of the emotion perception tasks from the New York Emotion Battery (NYEB; Borod, Welkowitz, & Obler, 1992) by examining the IGA for the demographic factors of age and gender and the effects of ethnicity and language background on emotion perception performance.

**Participants and Methods:** Using 124 healthy right-handed adults (age range: 21-88; 56% women; 54% Caucasian; 55% native English-speaking), we examined the presence of an IGA for age and gender using the facial and prosodic emotion perception tasks. In addition, we examined ethnic and language background group differences on the facial, prosodic, and/or lexical emotion perception tasks. Specific emotions (e.g., happiness & sadness) were examined as well.

**Results:** Results provided no support, overall, for an IGA based on gender or age, nor were there group differences on the basis of ethnicity or language background. Examination of specific emotions revealed that the demographic groups performed remarkably similar to each other, further supporting the conclusion that there was no IGA present in this dataset.

**Conclusions:** There are a number of reasons why we may not have found evidence for an IGA for any of the demographic characteristics examined, despite reports in the literature of an IGA for each of these demographic factors. For example, methodological differences among studies may explain this discrepancy. Results are discussed in light of the dialect theory (Elfenbein & Ambady, 2003), which is best supported by our results. This study provides information about the characteristics of emotion perception tasks as they relate to the interaction between the demographic characteristics of the expresser (i.e., those who produced the stimuli) and the perceiver of an emotion.

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**C. PARTHIBAN, F.M. ROMANO, G.D. SANTORELLI & R. READY. Emotion Dysregulation & Apathy: Subjective and Physiological Responses Following a Mood Induction.**

**Objective:** Apathy is associated with amotivation and atypical emotion experience. Apathy is common in many neurologic disorders but there is little evidence about links between apathy and emotion regulation. Effective emotion regulation is essential for many life tasks, such as effective interpersonal communication. This study determined associations between apathy and emotion regulation in healthy persons. Apathy was predicted to be associated with blunted reactivity and quicker recovery from a negative mood induction.

**Participants and Methods:** Participants (N = 56, 71.9% female) were healthy undergraduates (M age = 19.91 years, SD = 1.28) who completed the Apathy Evaluation Scale (AES). They were shown sad film clips to change mood. Subjective emotions were assessed with the PANAS-X (Negative Affect, Fear, Sadness, Guilt, Hostility, Positive Affect, Joviality, Attentiveness, Assurance) prior to the videos, immediately after, and after a recovery period. Heart rate and body temperature were monitored.

**Results:** From pre- to post-film, significant ( $p < .05$ ) emotion reactions occurred and heart rate increased. Apathy was significantly correlated with reactivity in PA ( $r = .35$ ), Assurance ( $r = .42$ ), Joviality ( $r = .27$ ), and Hostility ( $r = -.29$ ); greater apathy was associated with less emotion change from pre- to post-mood induction. Contrary to expectations, apathy was not significantly correlated with emotion recovery or physiological reactivity.

**Conclusions:** Consistent with theoretical models about amotivation and lack of emotion responsiveness, apathy was associated with blunted emotion reactivity (for positive and negative emotions) to a potent mood induction. More research is needed with neurologic populations who have greater variance in apathy. Further, more work into differential links between apathy and subjective versus physiological emotion reactivity may provide insights into a disconnect between emotion awareness and experience in persons with apathy.

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**D. PISNER, R. SMITH, A. ALKOZEI, A. KLIMOVA & W.D. KILGORE. Highways of the Emotional Intellect: White Matter Microstructural Correlates of an Ability-Based Measure of Emotional Intelligence.**

**Objective:** Individuals differ in their ability to understand emotional information and apply that understanding to make decisions and solve problems effectively — a construct known as Emotional Intelligence (EI). While considerable evidence supports the importance of EI in social and occupational functioning, the neural underpinnings of this capacity are relatively unexplored. We used Tract Based Spatial Statistics (TBSS) to interrogate the white matter correlates of EI as measured by the ability-based Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT).

**Participants and Methods:** Participants included 33 healthy adults (17 men; 16 women), ages 18 to 45 years. Participants completed the MSCEIT, which assesses individual differences in the ability to perceive, understand, manage, and facilitate emotions. Participants also underwent diffusion tensor imaging scanning at 3T. Analysis of diffusion data was carried out using FSL, whereby TBSS was employed and each of the four MSCEIT branches was separately regressed with FA.

**Results:** Understanding Emotions was associated with greater FA within sensory-affective association tracts including the inferior fronto-occipital fasciculus, inferior longitudinal fasciculus, superior longitudinal fasciculus, and anterior thalamic radiation ( $p < .05$ , FWE Corrected).

Managing Emotions was associated with greater FA within frontal-affective association tracts including the anterior forceps and uncinate fasciculus, along with frontal-parietal cingulum tracts and interhemispheric corpus callosum tracts ( $p < .05$ , FWE Corrected).

**Conclusions:** To our knowledge, the present study is the first investigation of the white matter correlates of an ability-based measure of EI. Findings show clear associations between microstructural integrity of major axonal pathways and the Strategic branches of the MSCETT, even after controlling for standard cognitive IQ scores, suggesting that the Strategic branches represent unique dimensions of human intellectual ability.

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### **I. REIFE, C.L. HAAK, J. KIM & L.G. TALL. Social Cognition and Internalizing Symptoms: A Pilot Analysis.**

**Objective:** Previous research showed that children who possess stronger social cognition skills are more likely to have positive outcomes in academics, social relations, and higher self-esteem (Barnett, 1995; Paris & Paris, 2001). Previous research has also demonstrated that impaired language abilities are related to poorer social skills and behavioral maladjustment (McCabe, 2005). This preliminary analysis seeks to explore the link between social pragmatic language and internalizing symptoms (e.g. depression and anxiety).

**Participants and Methods:** The current study used data from 51 participants who participated in a research study involving a two hour individual cognitive assessment, self-reports and history questionnaire. The Behavioral Assessment System for Children, 2nd Edition (BASC-2) was used as a self-report measure of children's adaptive and problem behaviors as assessed by children and their parents. The Supralinguistic composite of The Comprehensive Assessment of Spoken Language (CASL) and Test of Problem Solving (TOPS) Making Inferences scale were used to measure social language abilities. Hierarchical regressions using bootstrapping were utilized to investigate the relationship between social pragmatic ability and reported internalizing symptoms in children.

**Results:** The Supralinguistic composite ( $b = 0.40$ ,  $t(43) = 2.45$   $p = 0.018$ ) and TOPS scale ( $b = -0.47$ ,  $t(43) = -2.71$   $p = 0.01$ ) both significantly predicted parent reported depressive symptoms ( $R^2 = .20$ ,  $F(4, 44) = 2.81$ ,  $p = .037$ ). Only the TOPS scale ( $b = -0.31$ ,  $t(46) = -2.27$   $p = 0.03$ ) was significant for predicting child reported depressive symptoms ( $R^2 = .20$ ,  $F(4, 47) = 2.812$ ,  $p = .037$ ). Anxiety symptoms were not significantly related to social pragmatics.

**Conclusions:** Findings indicated that social language abilities were related to both parent and child report of depressive symptoms when controlling for gender and intelligence. However, social language and anxiety were not significantly related. This could be due to the limited sample size.

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### **B. SANTOSPAGO, G.D. SANTORELLI, M. MATHER & R. READY. Alexithymia, Apathy, and Depressive Symptoms: Convergence and Divergence.**

**Objective:** Apathy, alexithymia, and depressive symptoms are difficult to disentangle due to shared features. All three constructs are common in neurologic illness. The objective of this study was to determine areas of convergence and distinctiveness in these constructs.

**Participants and Methods:** Data were gathered using Amazon's online Mechanical Turk (MTurk). Participants ( $n = 624$ , ages 18-81;  $M = 36$ ,  $SD = 13$ ) completed the 20-Item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994), the Apathy Evaluation Scale (AES; Marin, 1991), and the Center for Epidemiologic Studies – Depression Scale (CES-D; Radloff, 1977) in a randomly counterbalanced order.

**Results:** TAS-20, AES, and CES-D scores were significantly correlated ( $r_s = .50$  to  $.62$ ,  $p_s < .001$ ). Exploratory factor analyses (with oblique rotation) of all items revealed the best fit was a 3-factor solution of alexithymia, apathy, and depressive symptoms. Some items loading most strongly on the apathy factor had moderate secondary loadings on the depressive factor (e.g. loss of motivation, interest, and initiative). Items most unique to the apathy factor pertained to lack of positive emotions. Some items loading most strongly on the depressive factor had moderate secondary loadings on the apathy factor (e.g., sad, depressed, and lonely). Items most unique to the depressive factor were crying, fearfulness, poor appetite, and restless sleep. Most alexithymia items had moderate cross-loadings with the apathy or depressive factors or had low loadings on all factors.

**Conclusions:** Careful analysis of symptom convergence and divergence will help clinical neuropsychologists differentiate between apathy, alexithymia, and depressive symptoms and will allow for most accurate modeling of brain-behavior associations. Apathy was most uniquely associated with lack of positive emotions. Anxiety and changes in sleep and appetite were specific to the depressive factor. Alexithymia was least likely to have variance unique from depressive symptoms and apathy.

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### **J.R. VANUK, R. SMITH, S. KNIGHT & W.D. KILLGORE. Resting RSA Correlates with Coordinated Resting State Activity Between Brain Networks Involved in Emotional Perception.**

**Objective:** A region encompassing the rostral anterior cingulate cortex (rACC) and adjacent medial prefrontal cortex (MPFC) is thought to be a critical hub within a network subserving concept-level recognition of emotions. Evidence suggests that rACC/MPFC activation is negatively correlated with arousal level and positively correlated with Respiratory Sinus Arrhythmia (RSA), which has been proposed as an index of parasympathetic influence over the body. Based on the idea that emotion recognition may reduce arousal, we hypothesized that higher levels of RSA at rest would be associated with greater resting state functional connectivity between rACC/MPFC and other regions relevant to network-level concept representation.

**Participants and Methods:** Twenty-three healthy adults (12 males; Mean: 21.61 years) had RSA recorded at rest for five minutes prior to a six-minute resting state functional connectivity neuroimaging scan. A region of interest encompassing the rACC/MPFC and parcellated regions of the cortex was interrogated using the CONN toolbox in SPM12. Functional connectivity was examined between the rACC/MPFC and two sets of a priori hypothesized cortical and subcortical regions ( $p < .05$ , FDR corrected).

**Results:** Two models were tested, one investigating areas implicated in the generation of emotional/autonomic reactions and the other targeting areas associated with concept-level emotion recognition. Higher levels of baseline RSA were associated with significantly correlated activity between the rACC/MPFC and cortical regions associated with concept-representation, most prominently the Superior Temporal Poles, right Parahippocampal Gyrus, and left Supramarginal Gyrus.

**Conclusions:** Findings suggest that between-subject variance in RSA at rest is associated with variance in resting state connectivity between rACC/MPFC and regions associated with network-level concept representation. These patterns of functional connectivity may reflect an adaptive relationship between emotion recognition and increased vagal control.

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**J.R. VANUK, A. ALKOZEI, S. MARKOWSKI & W.D. KILLGORE. Greater Resting State Functional Connectivity within the Default Mode and Task Positive Networks is Associated with Trait Emotional Intelligence.**

**Objective:** Emotional intelligence (EI) is defined as the ability to accurately perceive, understand, utilize, and regulate emotion in oneself and others; to facilitate the ability to solve emotionally driven intricacies. Some evidence suggests the ability to shift flexibly between internal and external focus may involve healthy emotional capacities. Accordingly, we hypothesized that an individual's self-reported level of EI would correlate with inverse connectivity relationships between areas related to self-reflective processing and internal focus (Default Mode Network; DMN) and external environmental focus (Parietal Task Positive Network; P-TPN), as mediated by the posterior cingulate cortex (PCC).

**Participants and Methods:** Sixty healthy adults (30 females; Mean age: 30.4 years) completed the Bar-On Emotional Quotient Inventory and a six-minute resting state functional magnetic resonance imaging (fMRI) scan at 3T. Bilateral regions of interest were placed in the PCC, along with individual regions of interest placed in regions of the parietal cortex and the ventromedial prefrontal cortex (vmPFC) as defined by the Automated Anatomical Labeling Atlas. Functional connectivity was analyzed utilizing the CONN toolbox and SPM12. All correlations approached significance at  $p < .06$ , with results FDR-seed-level-corrected.

**Results:** EI was associated with anticorrelated functional connectivity between the PCC and several parietal regions (i.e., P-TPN) but correlated positively with increased functional connectivity between the PCC and left vmPFC (i.e., DMN).

**Conclusions:** Self-rated emotional intelligence was associated with inverse resting state connectivity between TPN and DMN areas. The results suggest that one component of higher EI may involve the flexibility of transition between engagement with external stimuli and cognitive states involving internal self-reflective focus.

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**J. WADE, R.P. HART, J.H. WADE, J. BEKENSTEIN, C. HAM & J.S. BAJAJ. The Relationship Between Marital Status and Happiness in Neurological Illness.**

**Objective:** Adversarial growth describes the notion that positive change occurs when individuals are confronted by significant loss. We examined the notion that spousal loss in neurological patients would be associated with higher levels of subjective well-being. In examining the relationship between marital status and happiness we controlled for decline in intellectual ability and current level of physical functioning.

**Participants and Methods:** Fifty-four patients, between the ages of 16 to 73 years, completing an average of 14 years of education were included. Forty-two were Caucasian, and 32 were women. Twelve were single, 29 married, 6 divorced, and 7 were widowed. The most frequent neurological diagnoses were cerebrovascular disease ( $N=26$ ), followed by hypoxia ( $N=7$ ), seizure disorder ( $N=6$ ), and multiple sclerosis ( $N=6$ ). The Pemberton Happiness Index, Interpersonal Support Evaluation List-Short Form, Short Questionnaire to Assess Health-Enhancing Physical Activity, Wechsler Abbreviated Scale of Intelligence-2, and the Wechsler Test of Adult Reading were administered.

**Results:** After controlling for physical activity level, decline from pre-morbid intellectual ability, age, and ethnicity, marital status was related to happiness ( $P = .009$ ). Widows experienced significantly higher levels of happiness compared to married subjects ( $P = .035$ ). Neurological diagnosis  $P = .384$  and the interaction of neurological diagnosis with marital status ( $P = .129$ ) were not significant. Sex ( $P = .738$ ) and the interaction of sex with marital status ( $P = .505$ ) were not significant. The marital groups did not differ in terms of the amount of social support ( $P = .143$ ) they received.

**Conclusions:** The findings indicate that after experiencing the trauma of loss, the surviving partner may develop adversarial growth. Being confronted by, and forced to adapt to one of life's greatest losses, may

protect against negative emotional states in the face of future lifestyle threat.

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**C. WILLIAMS, E. CRAUN, M. JESSER & M.M. WONG. Parents' Anxiety Indirectly Predicts Children's Executive Functioning.**

**Objective:** Rates of anxiety are higher between parents and offspring than between adults and unrelated children. Anxiety can also interfere with executive functioning performance, particularly by interrupting attention. This research proposes a mediational model whereby parents' levels of anxiety indirectly influences children's executive functioning by predicting children's levels of anxiety.

**Participants and Methods:** Forty children (42.5% female) and their biological parents completed diagnostic screening interviews and a battery of executive functioning measures as part of a larger study on the influence of factors such as sleep, parental substance abuse, and emotional functioning on children's emotional and social development. Children's ages ranged from 8 to 13 ( $M = 11.00$ ,  $SD = 1.26$ ). Symptoms endorsed under the general anxiety disorder (GAD) modules of the Mini International Neuropsychiatric Interview were used as a proxy for anxiety and perseverative worry, which was used to predict neuropsychological measures that assess attention (i.e., Trails of the D-KEFS; nonverbal working memory tasks of the Stanford-Binet Intelligence Scale, 5th ed.; verbal working memory tasks of the Stanford-Binet Intelligence Scale, 5th ed.).

**Results:** Mediation models using MacKinnon's PRODCLIN analysis revealed that children's GAD symptoms significantly mediated the relationship between adult GAD symptoms and children's performance on the nonverbal working memory tasks (LL: 0.071, UL: 2.701), but the mediation was not significant when predicting verbal working memory (LL: -.528, UL: 1.044) or Trails (LL: -0.959, UL: 1.362).

**Conclusions:** Contrary to prediction but consistent with the Yerkes-Dodson law, parents' anxiety levels may selectively improve children's performance by moderately increasing vigilance and attentiveness during certain tasks. Results are contrasted with previous findings on this topic. This work was supported by NIH Grant R01 AA020364.

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## Genetics/Genetic Disorders

**R.J. FEE, E.B. LEAFFER, M. VEGA VILLAR & V.J. HINTON. Parental report on the BRIEF does not distinguish performance on clinical measures of executive function in boys with Dystrophinopathy.**

**Objective:** Dystrophinopathies are progressive genetic diseases characterized by muscle degeneration and cognitive deficits due to an abnormal expression of the protein dystrophin in both muscle and brain. Verbal working memory has been identified as a specific area of weakness for boys with dystrophinopathy, and shown to contribute to academic performance. Parents report executive difficulties in the boys. We examined whether those characterized by their parents as having poor executive functions identifies those who perform poorly on measures of working memory and/or executive function.

**Participants and Methods:** 41 boys with Dystrophinopathy, 5-17 years of age, diverse ethnicity and SES, were included. Measures: NIH Toolbox, Executive Functioning: Flanker Test (FT) and Dimensional Change Card Sort Test (DCCT); Working Memory: List Sorting Working Memory Test (LSWMT); Parent Ratings: Behavior Rating Inventory of Executive Function (BRIEF). Two groups were created based on clinical ratings cut at  $T > 67$  on BRIEF scales. A one-way (2 group) ANOVA for each BRIEF subscale was run for each cognitive measure.

**Results:** There were no between groups differences on the working memory and executive measures across the subscales of the BRIEF (Behavior Regulation Index: FT  $F(1, 34)=.92$ , DCCT  $F(1, 34)=1.55$ , LSWMT  $F(1, 34)=2.38$ ; Metacognition Index: FT  $F(1, 34)=1.13$ , DCCT  $F(1, 34)=.43$ , LSWMT  $F(1, 34)=.70$ ; Global Executive Composite: FT  $F(1, 38)=1.69$ , DCCT  $F(1, 38)=.24$ , LSWMT  $F(1, 38)=1.19$ ).

**Conclusions:** Parental report of executive dysfunction on the BRIEF does not distinguish performance on standardized clinical measures of working memory and/or executive functioning in boys with dystrophinopathy.

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**M.P. FISCHER, P.J. ORCHARD, W. MILLER, G. RAYMOND, A. MCKINNEY & J. EISENGART. Neuropsychological Profile and Initial Treatment Outcomes in a Child with Beta-Mannosidosis.**

**Objective:**  $\beta$ -mannosidosis is an extremely rare lysosomal storage disorder (approximately 20 individuals described) with varying progressive symptoms, including intellectual disability, speech impairment, hyperactivity, hearing loss, hypotonia, and skeletal deformities. A standard treatment is not defined, but based on experience with other lysosomal disorders, allogeneic hematopoietic cell transplantation (HCT) was theorized to halt disease progression. We present neuropsychological and imaging data related to disease and HCT outcomes in a 4-year-old male.

**Participants and Methods:** The patient has a history of developmental delays and autism spectrum disorder (ASD), macrocephaly, and hypomyelination. Clinical data including neuropsychological evaluations and brain imaging were reviewed before and after HCT.

**Results:** Initial testing showed average quantitative and nonverbal fluid reasoning, working memory, and multimodal learning, but below average language and fine-motor speed. Five months after HCT, testing was complicated by fatigue and significant speech and motor decline (diagnoses of ataxia and dysarthria). Nonverbal fluid reasoning and multimodal learning continued to be average, while knowledge was below average. Imaging abnormalities that were not significantly changed after HCT showed diffuse deep and subcortical white matter hypomyelination that relatively spared the basal ganglia and thalami (except the internal capsules) and the brainstem (except the medial lemnisci dorsally).

**Conclusions:** The patient's history of developmental delays, speech difficulties, and abnormal imaging are consistent with  $\beta$ -mannosidosis literature, while his features of ASD and areas of average cognitive functioning are unusual. To our knowledge, this is the first patient to receive HCT for this rare disorder. Initial treatment response includes motor and speech decline, and some unchanged neurocognitive functioning. Follow-up evaluation will be crucial to characterize outcomes.

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**L. HAMPTON & R.S. ZIEGLER. Association of Russell-Silver Syndrome Phenotype and Autism Spectrum Disorder: A Review of Two Case Studies.**

**Objective:** Russell Silver Syndrome (RSS) is a growth disorder with a heterogeneous genetic, physical and cognitive presentation. Previous research suggests that heritable RSS includes symptoms consistent with Autism Spectrum Disorder (ASD). We present case reviews of two unrelated males with the RSS phenotype without genetic evidence.

**Participants and Methods:** Patient A was a 4-year, 8-month old male with complex developmental and physical concerns diagnosed with RSS based upon clinical presentation of intrauterine growth restriction (IUGR), growth delays, facial gestalt, and café au lait macules. Patient B was a 5-year, 11-month old male diagnosed with RSS based upon clinical presentation of early failure to thrive, prominent head size, crowded dentition, limb length discrepancy, and café-au-lait macules. Genetic

testing was negative across cases. Comprehensive neurodevelopmental assessment was completed in association with parent rating measures of behavioral and adaptive functioning.

**Results:** Patient A's overall neurodevelopmental performance yielded impairment across multiple domains, including cognitive skills, language development, motor skills, adaptive skills, and social functioning. There was also concern regarding symptoms consistent with ASD, including repetitive and restricted behaviors, severe language impairment, and limited interest in toys or cooperative play. Patient B presented with a neuropsychological profile in the below average to average range, with difficulties seen in fine motor skills, visual spatial/visual reasoning skills, and attention. ASD symptoms were not indicated by clinical observations, parent report or clinical history.

**Conclusions:** The results highlight the heterogeneity of RSS and suggest that symptoms of ASD may present in children without genetic correlates. Findings emphasize the need for further clarification in the neuropsychological profiles of RSS.

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**L. HAMPTON, N. SMILEY & R.S. ZIEGLER. Neuropsychological Outcome Across Phenotypes in Sialic Acid Storage Disease: Case Review of Two Affected Male Siblings.**

**Objective:** Sialic Acid Storage Disease (SASD) is an autosomal recessive lysosomal storage disorder characterized by cognitive and motor impairment associated with demyelination in cerebral white matter. Phenotypic presentations (Infantile SASD, Salla Disease, and sialuria) vary in severity, with the infantile form the most severe. The present case review focused on the clinical presentation of SASD in two affected siblings.

**Participants and Methods:** Two male siblings, ages 4 years and 8 months, presented with SASD. Patient A (age 4 years 1 month) was diagnosed with Salla disease at approximately 2.5 years of age following presentation of nystagmus as well as early motor and language delays. At the time of evaluation, he was unable to walk independently and language was limited to one word. Patient B (age 8 months) was diagnosed with infantile SASD in utero and demonstrated early motor delays. Language development was within normal limits. Comprehensive neurodevelopmental assessment was completed in association with parent rating measures of adaptive functioning.

**Results:** Patient A's overall neurodevelopmental performance was within the impaired range, with greatest deficits demonstrated in the domains of expressive language and gross motor functioning. Results of direct testing were consistent with parent ratings of his adaptive functioning. Patient B presented with average cognitive development, with discrepancy between his low average language skills and impaired motor skills. Parent ratings of adaptive functioning were commensurate with testing.

**Conclusions:** Both siblings presented with motor delays characteristic of SASD. Contrary to the existing literature, the presentation of infantile SASD in this study was not associated with significant impairment across domains. Findings suggest that longitudinal neurodevelopmental evaluation is required to establish a consistent neuropsychological profile for each disease phenotype.

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**D. HARLEY, A. KARYDAS, G. COPPOLA, J. YOKOYAMA, M. WYNN & J.H. KRAMER. Influence of CETP on Executive Functioning in Healthy Aging Adults.**

**Objective:** The cholesteryl ester transfer protein (CETP) plays a key role in lipid pathways. Studies of the gene regulating CETP suggest that homozygosity may be associated with longevity and better memory. Despite the gene's putative role in vascular health and the established connection between cerebrovascular disease and executive functioning,

the relationship between CETP and executive functioning is poorly understood. Our objective was to test the hypothesis that healthy older adults who are homozygous for the CETP would have better executive functions than heterozygotes.

**Participants and Methods:** We studied 197 functionally intact older controls from the UCSF Memory and Aging Center (mean age=72; mean MMSE=29). Factor scores for executive functioning, episodic memory, and processing speed were derived from a comprehensive neuropsychological battery. The cohort was divided into those who were homozygous for the CETP gene (A/A or G/G; n= 105) and those who were heterozygous (A/G; n=92).

**Results:** There were no demographic differences between the groups. GLM analyses showed that the homozygous group performed significantly better than the heterozygous group on executive functioning ( $F(1,195)=6.419, p=.012$ ) but not episodic memory ( $p>.9$ ) or processing speed ( $p>.10$ ). A follow-up analysis showed that controlling for whole brain white matter volumes, an MRI marker of cerebrovascular health, did not alter the relationship between CETP and executive functioning.

**Conclusions:** This study highlights that in healthy aging, a gene regulating a lipid pathway protein is associated with better executive functioning with an advantage of homozygosity over heterozygosity. We further found that this effect is specific to executive functioning, with no relationship found for processing speed or memory. The relationship between the gene and executive functioning was not mediated by white matter volumes, indicating that further work is needed to understand how the gene might influence cognition.

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**E.B. LEAFFER, J. SAMPSON, S. ASSURAS, V. LABODE & V.J. HINTON. Reversal of cognitive decline in a case of myotonic dystrophy treated for sleep problems.**

**Objective:** To examine benefit of treatment for sleep apnea in a patient with myotonic dystrophy type 1 (DM1) who presented with symptoms suggestive of a neurodegenerative pathology. DM1 is a dominantly inherited, tri-nucleotide repeat disorder with multisystemic involvement, including progressive muscle weakness, myotonia, cognitive deficits, fatigue, hypersomnolence, cardiac and vision problems. Patients are often not correctly diagnosed due to the variety of manifesting symptoms. DM1 patients report the most debilitating aspects of the disorder are fatigue and sleepiness, with 91.5% of adults reporting excessive daytime sleepiness. The cognitive phenotype of DM1 includes deficits in attention, executive and visuospatial function. We believe the attention and executive deficits are likely secondary to symptoms of sleepiness in DM1, and treatment of the sleep-related symptoms may result in improved cognitive performance.

**Participants and Methods:** A 57-year-old man with a reported 4-year history of progressive cognitive deficits (forgetting details, repeating himself, word finding difficulty, and inattention) and history of visual disturbance was initially evaluated and given a diagnosis of Mild Cognitive Impairment consistent with possible dementia with Lewy bodies or Alzheimer's Disease. He was found to have DM1 after his daughter's diagnosis, as well as sleep apnea. Follow-up neuropsychological examination was done after one year of consistent use of CPAP for sleep apnea.

**Results:** Significant improvements in attention, delayed verbal recall, mental flexibility, and naming were observed, with no substantial changes in visual memory. Anecdotally, the patient's wife stated that he "vastly improved" after being treated for sleep apnea.

**Conclusions:** The findings suggest that treatment of associated sleep disturbance in patients with DM1 can have substantial benefits on cognitive performance, particularly in areas of attention and executive function, although may not improve etiologically specific visuospatial disturbances.

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**O. MORIN-MONCET, J. THERRIEN-BLANCHET & H. THEORET. BDNF Val66Met Polymorphism, Motor Learning and Intermanual Transfer of Sensorimotor Skills: A Neurophysiological TMS Study.**

**Objective:** Recent data suggest that the Val66Met polymorphism of the BDNF gene can alter cortical plasticity, short-term motor learning and intermanual transfer of procedural skill. Here, we investigated the impact of the polymorphism on sensorimotor learning and intermanual transfer with Rapid Tapping (RT), Precision Grip Strength (PGS) and the Grooved Pegboard (GP) by comparing Val and Met groups' performances to controls who performed the same tasks with their right or left hand only.

**Participants and Methods:** 40 right-handed healthy adults (10 Val; 10 Met; 10 CR; 10 CL).

L1 consisted in 3 blocks of RT, PGS and GP with the left hand. R1 and R2 each comprised 10 blocks of RT, PGS and GP with the right hand. L1 was retested post-practice (L2). Val and Met groups performed L1, R1, R2 and L2. CL group performed L1 and L2 conditions only. CR group performed R1 and R2 conditions only.

MEP, SICI and IHI were measured with TMS over the left (LH) and right (RH) M1 before and after practice.

**Results:** Repeated measures ANOVA were used to compare performances at time 1 and time 2 between groups.

**Learning:** Results showed significant effects of Time for the Val ( $t=2.64; p<.05$ ) and CR ( $t=3.75; p<.01$ ) groups on RT, of Group ( $F=11.96; p<.001$ ) on PGS and Time ( $F=52.7; p<.001$ ) on the GP.

**Transfer:** Results showed significant effects of Time ( $F=7.21; p<.05$ ) on the RT, and Time ( $F=16.08; p<.001$ ) and Group ( $F=4.39; p<.05$ ) effects on the GP.

**TMS:** Results showed a significant effect of Time ( $F=5.01; p<.05$ ) for the SICI-LH. No effects were obtained for the CL group. The CR group showed significant effects of Time for the MEP-LH ( $F=7.21; p<.05$ ), SICI-LH ( $F= 8.92; p<.05$ ) and IHI ( $F=6.07; p<.05$ ).

**Conclusions:** Val66met was associated with differences in sensorimotor learning and did not alter intermanual transfer. The initial practice with the left hand was associated with increased performances with the right hand and the changes in cortical excitability associated with motor practice were not present when participants practiced with both hands. Correspondence: *Olivier Morin-Moncet, Ph.D., Psychology, University of Montreal, 2030 ave. Aird apt.101, Montreal, QC H1V3S7, Canada. E-mail: olivier.morin-moncet@umontreal.ca*

**A. TSAPANOU, N. SCARMEAS, Y. GU, J. MANLY, N. SCHUPF, Y. STERN & S. BARRAL. Examining the association between Apolipoprotein E-ε4 and self-reported sleep disturbances in non-demented older adults.**

**Objective:** We aimed to examine the association between apolipoprotein E (APOE) and sleep disturbances in a large number of community-based older adults.

**Participants and Methods:** This is a cross-sectional study, from the Washington Heights-Inwood Community Aging Project (WHICAP). A total of 1,944 non-demented older adults took part in the study. Sleep dysfunction was measured using sleep categories derived from the RAND Medical Outcomes Study Sleep Scale. Genetic association between APOE-ε4 genotype and sleep disturbances was assessed using unadjusted linear regression models. Secondary analyses were conducted adjusting for age, sex, education, ethnicity and body mass index (BMI).

**Results:** In the unadjusted model, individuals carrying the APOE-ε4 allele showed lower levels of snoring ( $\beta=-0.02, SE=0.01, p=0.010$ ) and sleep apnea ( $\beta=-0.01, SE=0.01, p=0.037$ ) when compared to non-ε4 carriers. After covariates' adjustment, ε4 carriers demonstrated stronger association with lower levels of both snoring ( $\beta=-0.02, SE=0.01, p=0.006$ ), and sleep apnea ( $\beta=-0.01, SE=0.01, p=0.018$ ).

**Conclusions:** Our results suggest that APOE- $\epsilon 4$  is associated with decreased problems in snoring and sleep apnea, in a large number of non-demented older adults. Levels of vitamin D might play a significant role in this association. Further longitudinal research is needed in order to shed more light on the biological mechanisms underlying the role of APOE- $\epsilon 4$  gene in sleep's pattern.

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## HIV/AIDS/Infectious Disease

**A.R. AMBROZIAK, X. DI, B. BISWAL, K.D. KARUNAKARAN, A. PLUTA, T. WOLAK, M. RUSINIAK, E. LOJEK, R. BORNSTEIN, S.M. RAO, B. SZYMANSKA, A. HORBAN, E. FIRLAG-BURKACKA, M. SOBANSKA, N. GAWRON, A. DESOWSKA, M. CHOINSKI, J. CZARNECKI, P. BIENKOWSKI, H. SIENKIEWICZ-JAROSZ & A. SCINSKA-BIENKOWSKA. Depression and HIV: effects on regional activity in resting state fMRI and cognitive performance.**

**Objective:** Depression is a common comorbidity in HIV. Current literature suggests that both, depression and HIV infection are related to altered brain and cognitive function. It remains unclear whether these two conditions have interactions.

**Participants and Methods:** A total of 63 Polish males (10 HIV-seropositive (HIV+) depressed, 26 HIV+ non-depressed, 10 HIV-seronegative (HIV-) depressed and 17 HIV- nondepressed), were retained for current preliminary analysis. Mean age was 38 years with 16 years of education. Groups were comparable on demographic, illness- and treatment-related variables. Depression was measured with CES-D. MRI and R-fMRI was performed using 3T Siemens scanner with 32-channel head coil, registering 41 slices at 240 time points with TR of 2 sec. Following standard data preprocessing, we computed regional homogeneity (ReHo), a data driven method to examine local synchronization of the dynamic BOLD time series. Standardized neuropsychological tests constituting a comprehensive measure of cognitive functioning were performed.

**Results:** 2 (HIV) by 2 (depression) ANOVA (cluster size=50 voxels;  $p=0.01$ ) presented that HIV+ depressed group showed interaction effect of increased ReHo in left middle frontal gyrus (-38, 8, 50). Depression was associated with ReHo increases in left superior frontal gyrus (-20, 68, 2), while HIV with ReHo decreases in medial frontal (-6, 48, 4), superior temporal (-48, 16, -12) and cingulate (-4, 22, 44) gyri, and cuneus (-12, -80, 32) of left cerebrum. MANOVA indicated no depression-HIV interaction on cognitive functions. Depressed vs. nondepressed subjects showed decreased executive functioning. HIV+ vs. HIV- individuals performed worse on nonverbal fluency, verbal and visuo-spatial memory tasks.

**Conclusions:** This study showed effect of depression-HIV interaction on brain regional homogeneity. Depression and HIV were also associated with independent alterations suggesting simultaneous occurrence of additive and synergistic effects of the two factors on the brain and cognition.

**M. ARCE RENTERIA, H. GOUSE, V. JONAH, J. JOSKA & R.N. ROBBINS. Functional Assessment of HIV+ Adults in South Africa: Utility of the Patients' Assessment of Own Functioning Questionnaire and Instrumental Activities of Daily Living Scale.**

**Objective:** Effective screeners of neurocognition and functional impairment are crucial to assessing HIV-Associated Neurocognitive Disorders (HAND) in primary health care and limited-resource settings such as South Africa where prevalence rates of HAND remain high. Although the IHDS may be an effective screener to capture gross neurocognitive impairment, it is unclear whether it can effectively capture difficulties in daily functioning. The Patients' Assessment of Own Functioning (PAOFI) and the Lawton and Brody Instrumental Activities of Daily

Living (IADLs) Scale Modified Version are widely used to assess functional impairment in the staging of HAND among populations in the United States. However, their usefulness in South African populations as potential screeners used in conjunction with the IHDS has yet to be evaluated.

**Participants and Methods:** Sixty-seven Black South African HIV+ adults (84% female; mean age=32yrs [SD=6.1]; 79.5% not completing high school) completed comprehensive neuromedical and neurocognitive evaluations in which the IHDS, PAOFI, and IADL were administered.

**Results:** Forty-six percent of the sample was neurocognitively impaired based on the IHDS, 18% demonstrated functional impairment based on the PAOFI, and 0% on IADLs. A Fisher's exact test revealed that the percentage of PAOFI impaired participants was significantly higher in the IHDS impaired group ( $p = .03$ ; OR = 4.5, CI = 1.1, 18.5).

**Conclusions:** HIV+ adults that reported functional impairment were 4 times more likely to have neurocognitive impairment. These results indicate that the PAOFI may be an appropriate measure to use in conjunction with the IHDS when screening for HAND in South Africa. The modified IADL scale, however, failed to provide any additional information. Future studies should evaluate the predictive utility of the IHDS and PAOFI in conjunction to accurately screen for HAND.

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**R.N. ROBBINS, H. GOUSE, V. JONAH, M. ARCE RENTERIA, K. THOMAS & J. JOSKA. An Evaluation of the Construct Validity of a Neuropsychology Tablet App for Lay Health Workers to Screen for HAND in South Africa.**

**Objective:** Tablet computers with touchscreens offer a new platform to assess neurocognition. NeuroScreen is an Android tablet app with eight embedded neuropsychological (NP) tests assessing the domains of learning, memory, processing speed, attention, executive functions, and motor functions. NeuroScreen was developed as a screening tool for HIV-associated neurocognitive disorder (HAND) and for specific administration by lay health workers in South Africa. It takes approximately 20 minutes to complete, is highly automated, does not require paper, pencils, other equipment (e.g., stopwatch), or highly trained personnel to administer, and requires the use of standardized instructions. This study examined the construct validity of each NeuroScreen subtest.

**Participants and Methods:** Sixty-four, black South African, HIV+ adults (51 female, 31.89 years of age on average), were administered NeuroScreen by a lay health worker. Then, participants completed a full NP battery, consisting of well-established paper-and-pencil tests, administered by a trained research psychometrist.

**Results:** Pearson correlation coefficients were calculated between the NeuroScreen tests and paper-and-pencil NP tests. We observed weak to strong, statistically significant correlations between NeuroScreen and paper-and-pencil tests tapping the domains of verbal memory ( $r=.36$ ,  $p<.01$ ), processing speed ( $r=.34$ ,  $p<.01$ ;  $r=.56$ ,  $p<.01$ ;  $r=.57$ ,  $p<.01$ ), attention ( $r=.34$ ,  $p<.01$ ;  $r=.23$ ,  $p<.05$ ), executive functions ( $r=.32$ ,  $p<.01$ ), and motor functioning ( $r=.40$ ,  $p<.01$ ).

**Conclusions:** Preliminary psychometric evidence suggested that the NeuroScreen tests tap the NP domains of memory, attention, processing speed, executive functions, and motor speed. Although NeuroScreen may be a useful tool to screen for HAND in clinical settings by lay health workers, further research is needed to further evaluate the psychometric properties of the app's subtests and determine how well the app can detect the neurocognitive impairment associated with HIV.

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**N.S. BANERJEE, G. IRONSON & B.E. LEVIN. Executive Functioning, Coping and Depression in HIV.**

**Objective:** Executive dysfunction and depression are common and disabling neuropsychological sequelae in HIV. Coping style is a cognitive factor that has been shown to impact depression in HIV. This study examined the relationship between executive functioning, coping style and depression in HIV.

**Participants and Methods:** A diverse sample of 123 HIV+ asymptomatic individuals (Mage = 37.77; 67.5% male; 80% graduated high school; 43% African American, 30% Hispanic) completed Trail Making Test (TMT), BDI, and Brief COPE. Active and avoidant coping styles were operationalized using subscales of the Brief COPE. A coping index was computed by subtracting avoidant coping z-scores from active coping z-scores. An average BDI composite score was derived from multiple time points.

**Results:** Controlling for age, gender, ethnicity, education, and CD4 cell count, TMT B was related to BDI ( $\beta = .22, p = .02$ ), avoidant coping ( $\beta = .34, p < .01$ ) and coping index ( $\beta = -.28, p < .01$ ), but not active coping ( $\beta = -.07, p = .51$ ). Mediation analyses revealed that the effect of TMT B on depression was mediated by avoidant coping. In the mediation model ( $R^2 = .22, F(7,111) = 4.33, p < .01$ ), the effect of avoidant coping on depression remained significant ( $\beta = .39, p < .01$ ) while the effect of TMT B did not ( $\beta = .09, p = .38$ ). A separate analysis examining the coping index confirmed the mediation model.

**Conclusions:** This study is one of the first to examine the relationship between executive functioning and coping style in HIV. Our results suggest that executive dysfunction is associated with disproportional use of avoidant coping, and that avoidant (maladaptive) coping is associated with depression in HIV. These findings call attention to the influence of cognitive functioning on coping style in HIV, and highlight the utility of assessing executive function as an important correlate of emotional well-being. HIV+ patients with executive dysfunction may benefit from assessments and interventions targeting coping skills.

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**N.A. DASHER, P. VIK & D. HACHEY. Nonverbal versus Verbal Learning and Memory in Asymptomatic HIV Patients.**

**Objective:** Human immunodeficiency virus (HIV) has been associated with memory impairments characterized by slow encoding, poor retrieval, but generally intact recognition. However, much research examining this profile has relied on auditory or predominantly verbally mediated material. Given evidence indicates that verbal and nonverbal encoding and retrieval functions are in part linked to distinct brain regions, it is plausible HIV may not uniformly impact these domains. The present study directly compared verbal and nonverbal learning and memory profiles in those with HIV.

**Participants and Methods:** Twenty-five HIV+ adults were compared to an age-matched sample of 25 healthy adults. Both samples completed the California Verbal Learning Test (CVLT-II), North American Adult Reading Test (NAART), and Northwest Trail Test (NWTT), a nonverbal analog to the CVLT-II designed to measure learning and recall of visuospatial information and minimize the impact of verbal mediation during encoding.

**Results:** ANCOVAs, controlling for age, sex, and NAART, revealed that those with HIV performed significantly worse on visuospatial learning and recall (NWTT scores, all  $ps < .05$ ) but did not statistically differ from controls on measures of verbal learning and recall (CVLT scores, all  $ps > .05$ ). There were no significant differences in regard to verbal or visuospatial recognition (all  $ps > .05$ ).

**Conclusions:** HIV patients performed worse than controls on a measure of visuospatial memory that limits verbally mediated encoding but performed similarly on a measure of verbal learning. The pattern of performance resembled a subcortical profile, which is in accordance with HIV's affinity for compromising frontostriatal function. In addition, those infected were all receiving anti-retroviral therapy and were

relatively asymptomatic (i.e., mean current and nadir T-cell counts above 200). Consequently, assessing for non-verbally mediated memory impairments in HIV patients could allow for earlier detection of neurocognitive risk and impact treatment options.

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**K.L. DOYLE, S. WOODS, C.R. MCDONALD, K.M. LEYDEN, H.M. HOLDEN, E.E. MORGAN & P. GILBERT. Verbal Memory Profiles in HIV-associated Neurocognitive Disorders: A Comparison with Huntington's Disease and Temporal Lobe Epilepsy.**

**Objective:** Up to 65% of individuals with HIV-associated neurocognitive disorders (HAND) evidence episodic memory impairment that is characterized as a mixed encoding/retrieval profile consistent with a "subcortical" presentation. The current study evaluated this hypothesis by comparing the extent to which the pattern of HIV-associated episodic memory deficits correspond with those of populations with traditional subcortical (i.e., Huntington's disease) versus cortical (i.e., temporal lobe epilepsy) profiles.

**Participants and Methods:** Seventy-seven individuals with HAND, 47 with Huntington's disease (HD), 21 with temporal lobe epilepsy (TLE), and 45 healthy participants who were matched on age, education, and ethnicity were administered the California Verbal Learning Test - 2nd Edition (CVLT-II). CVLT-II profiles were classified as reflecting a primary encoding deficit (poor free recall and recognition, intrusion errors), retrieval deficit (impaired acquisition and free recall but intact recognition), or normal (i.e., intact acquisition, recall and recognition) using the Massman et al. (1992) discriminant function algorithm.

**Results:** A logistic regression adjusting for sex revealed that group membership was a significant predictor of memory profile type ( $p < .01$ ). The HD group evidenced the lowest proportion of individuals with normal profiles (13%), with HAND (38%) and TLE (38%) groups falling intermediate to the healthy group (78%). Among participants with a CVLT-II deficit, the HAND group showed the highest rates of retrieval versus encoding profiles (71% vs. 29%), followed by HD (59% vs. 41%), TLE (46% vs. 54%), and healthy (50% vs. 50%) groups.

**Conclusions:** Findings suggest that HIV-associated verbal memory impairments are most consistent with a traditional subcortical, retrieval deficit profile. Nevertheless, there is significant profile heterogeneity across clinical groups, which may reflect neuropathological variability, measurement error, and/or the influence of secondary variables (e.g., cognitive and brain reserve).

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**K.L. DOYLE, S. WOODS, E.E. MORGAN, J. IUDICELLO & M. CAMERON. The Effects of HIV-associated Neurocognitive Disorders Across An Integrated Functional Model of Health Literacy.**

**Objective:** HIV-associated neurocognitive disorders (HAND) are associated with deficits in health literacy, a multifactorial construct encompassing abilities that are essential for making optimal health decisions. However, the impact of HAND across different functional levels of health literacy is not known. The present study adopted Sorensen's (2012) integrative health literacy theory to examine the potential differential effects of HAND across core health literacy domains.

**Participants and Methods:** Thirty-seven HIV+ individuals with HAND (HAND+) and 44 HIV+ individuals without HAND (HAND-) who were matched on demographic, psychiatric, and HIV disease characteristics completed standardized neuromedical, psychiatric, and neurocognitive research evaluations, alongside a comprehensive health literacy battery that assessed Sorensen's (2012) core domains of motivation, knowledge, competence, understanding, and appraisal/application.

**Results:** A mixed model ANOVA controlling for education revealed a significant interaction between HAND and health literacy domains ( $p < .01$ ), such that the HAND+ group evidenced poorer scores than the HAND- group within domains of knowledge, competence, understanding, and appraisal/application ( $ps < .05$ , Cohen's  $d$  range = .64–1.23), but not motivation ( $p > .05$ , Cohen's  $d = .45$ ). Within the HAND+ group, deficits in these four domains were associated with worse performance on measures of learning and executive function ( $ps < .01$ ).

**Conclusions:** Findings suggest that individuals with HAND evidence lower health literacy across some, but not all core domains, including both lower- (e.g., knowledge) and higher-order (e.g., appraisal/application) abilities, all of which depend on learning and executive functions (e.g., cognitive flexibility). Evaluation of established learning (e.g., spaced retrieval, interleaving) and executive function (e.g., goal-management training) strategies to enhance aspects of health literacy in HIV may be warranted.

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**P.L. FAZELI, K.B. CASALETTO, R.C. MOORE & D.J. MOORE. The Montreal Cognitive Assessment to Screen for HIV-associated Neurocognitive Disorders in Older Adults: Sensitivity, Specificity, and External Validity.**

**Objective:** Given the increased incidence and prevalence of HIV among older adults, and the heightened risk for cognitive impairment in this population, brief cognitive screening tools are needed to identify those who require a comprehensive neuropsychological (NP) evaluation.

**Participants and Methods:** We examined the Montreal Cognitive Assessment (MoCA) to identify HIV-associated neurocognitive disorders in 100 older adults ( $\geq 50$  years) with HIV. Participants completed the MoCA, along with a comprehensive "gold-standard" (GS) battery (NP, daily functioning, and neuromedical assessments). GS NP impairment was classified via clinical ratings using Frascati criteria. Using receiver operating characteristic curve analyses (ROC), the area under the curve (AUC) was calculated for the most optimal MoCA cut-point, balancing sensitivity and specificity. We then compared the MoCA Impaired vs. MoCA Normal groups on several demographic, HIV-disease, psychiatric, and everyday functioning variables.

**Results:** ROC analysis revealed a MoCA cut-point of  $\leq 26$  as the most optimal balance of sensitivity (84.2%) and specificity (55.8%), with an AUC value of 0.70 ( $p < 0.01$ ); the positive predictive value was 71.6%, the negative predictive value was 72.7%, and the accuracy was 72%. The MoCA Impaired group (67% of sample) had a greater number of instrumental activities of daily living (IADL) ( $p = 0.03$ ) and cognitive ( $p = 0.04$ ) complaints, and greater percent of IADL Dependence (37% vs. 15%;  $p = 0.02$ ) than the MoCA Normal group. The MoCA groups did not differ on clinico-demographic factors.

**Conclusions:** A derived MoCA cut-point yielded good sensitivity, but suboptimal specificity, in detecting NP impairment among older adults with HIV. Participants identified as impaired by the MoCA showed greater daily functioning difficulties suggesting that the MoCA may serve as an adequate cognitive screener until instruments with greater specificity are developed.

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**N. KABUBA, J. MENON, D. FRANKLIN, R.K. HEATON & K. HESTAD. The Use of Neuropsychological Tests in assessing HIV-associated neurocognitive disorders in Zambia.**

**Objective:** To determine the applicability of a comprehensive Western developed neuropsychological (NP) test battery with Zambian norms in distinguishing clade C HIV positive (HIV+) participants on antiretroviral therapy (ART) from healthy HIV negative (HIV-) controls and to study how HIV infection inflicts on neurocognitive performance. It is estimated that 13 percent of adults in Zambia are infected with HIV and

yet like most countries in sub-Saharan Africa, Zambia has no specific test that measures HIV-associated neurocognitive disorders.

**Participants and Methods:** This was a cross-sectional study carried out in Urban Zambia a country located in Sub-Saharan Africa. The study comprised 266 HIV+ participant recruited from six urban clinics that routinely offer ART; these were compared to a previously collected sample of 324 HIV- controls. NP performance was assessed using demographically corrected for T-scores with a mean of 50 (SD=10) and Global Deficit Scores (GDS) were used to assess impairment levels. Participants were considered impaired if they had a deficit score of  $\geq 0.5$ .

**Results:** HIV+ participants performed worse (Mean=46.28, SD=5.66) than the HIV-controls (Mean=49.77, SD=5.14)  $t(588) = 7.826$   $p < .001$  Cohen's  $d$  effect size .64 and GDS confirms the same, (HIV+ Mean=.460, SD=.50 (HIV- Mean=.249, SD=.27)  $t(392.03) = -6.15$   $p < .001$  Cohen's  $d$  effect size .52. The impairment levels of the HIV+ sample was at 34.6%.

**Conclusions:** Results obtained confirmed that the Western developed NP test battery, using local norms is applicable in Zambia. This is an important finding for Zambia because it offers a viable means of assessing HIV-associated cognitive disorders in this resource limited country ravaged by HIV.

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**R. KAMAT, S. WOODS, M. CAMERON & J. IUDICELLO. Apathy Is Associated with Lower Mental and Physical Quality of Life in Persons Infected with HIV.**

**Objective:** Relative to the general population, HIV-infected individuals consistently report lower levels of health-related quality of life (HRQoL), which is a multidimensional concept that characterizes an individual's well-being across physical, mental, emotional and social functioning. The extent to which apathy, a sequela of HIV infection, plays a key role in lower HRQoL in HIV disease remains undetermined, as the only two existing studies on this topic have produced mixed results. Thus, this study investigated the role of apathy in mental and physical HRQoL in the context of biologic, psychiatric, and functional factors.

**Participants and Methods:** Eighty HIV+ individuals completed a comprehensive neuromedical and neurobehavioral evaluation, which included the RAND SF-36, a self-report measure of mental and physical HRQoL. Current apathy was measured using a composite of the apathy subscale of the Frontal Systems Behavioral Scale and the vigor-activation subscale of the Profile of Mood States.

**Results:** A series of multiple regressions indicated that apathy was a significant independent predictor of lower physical ( $\beta = -.46$ ,  $p < .001$ ) and mental HRQoL ( $\beta = -.47$ ,  $p < .001$ ), even while controlling for major depressive disorder, neurocognitive impairment, functional status, and current CD4 count. The only other significant predictors of lower physical and mental HRQoL were lower CD4 counts ( $\beta = .25$ ,  $p = .01$ ) and a history of depression ( $\beta = .20$ ,  $p = .05$ ), respectively.

**Conclusions:** These findings provide support for Wilson & Cleary's (1995) conceptual model of HRQoL, which highlights a significant role of neuropsychiatric disturbances (e.g., apathy) in perceived well-being. In addition, they highlight the importance of assessing and managing apathy among individuals with HIV disease in an effort to maximize health outcomes and improve overall quality of life.

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**V. KORDOVSKI, S. WOODS, E. WEBER, K.L. DOYLE & M. CAMERON. Prospective Memory Is Related To Job Performance in Persons With HIV Infection.**

**Objective:** Prospective memory (PM; i.e. remembering to remember) influences how individuals are able to function efficiently in many real-world behaviors and has previously been associated with employment status in HIV disease. The present study extends this literature by

examining whether HIV-associated deficits in PM are associated with self-perceived performance in the workplace as a function of increased work responsibility, which was hypothesized to amplify the effects of PM on performance.

**Participants and Methods:** The sample was comprised of 48 individuals with HIV infection who were administered a comprehensive neuropsychological test battery, including the Memory for Intentions Screening Test (MIST) and Prospective and Retrospective Memory Questionnaire (PRMQ). Participants also completed a 12-item questionnaire that assessed work performance over the past month. Participants were also classified as to whether work-related responsibility had increased ( $n=15$ ) or decreased/not changed ( $n=33$ ). These two subgroups did not differ on any demographic, psychiatric, or HIV disease factors, including the prevalence of HIV-associated neurocognitive disorders (all  $ps>0.05$ ).

**Results:** Given the non-normal distributions of the study variables, Spearman rank-order correlations were conducted to assess the relationship between the work performance and PM measures. In HIV+ participants who reported increased responsibilities, work performance was strongly related to environmentally-cued PM symptoms on the PRMQ ( $\rho=0.67$ ) and the naturalistic 24-hr delay ( $\rho=0.63$ ) item on the MIST. No significant relationships between PM and work performance were present in the HIV+ group who did not report increased responsibilities ( $ps>0.10$ ).

**Conclusions:** These preliminary findings suggest that PM's role in workplace performance in HIV-infected persons may vary as a function of changes in work-related demands.

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**T. KUHN, D. SCHONFELD, P. SAYEGH, N.S. THALER, A. ARENTOFT, C. HINKIN, S. BOOKHEIMER, E.J. SINGER & A.D. THAMES. The Effects of HIV and Aging on Subcortical Shape Alterations: A 3D Morphometric Study.**

**Objective:** Prior neuroimaging studies have demonstrated extensive atrophy of subcortical structures among individuals with HIV. However, to our knowledge, no study has investigated the role of aging on morphometrically specific subcortical shape alterations in a sample of HIV+ and HIV-seronegative individuals. Measures of subtle neurostructural differences have potential for use in clinical diagnosis as well as tracking disease-related change over time.

**Participants and Methods:** Structural MRI/3D morphometry methods were used to compare subcortical structures between HIV+ individuals ( $n = 59$ ) and HIV-seronegative ( $n = 20$ ) controls. We examined the effects of HIV-infection, recent CD4 count and HIV viral load on shape differences in the nucleus accumbens, amygdala, caudate, hippocampus, pallidum, putamen and thalamus. We also examined age effects on subcortical shape alterations within our HIV status groups.

**Results:** Significant between-group differences were found in the shape of the right caudate and nucleus accumbens as well as the left pallidum and hippocampus, indicating that HIV-serostatus is associated with subcortical shape abnormalities (i.e. thinning, shrinking) in these structures. Within the HIV+ group, recent CD4 count was associated with shape alterations in left thalamus, nucleus accumbens and bilateral caudate while viral load was associated with altered shape of the right pallidum. Additionally, increasing age was associated with shape abnormalities in numerous structures within both HIV status groups. Finally, the interactive effect of HIV and age also significantly related to subcortical shape change. Importantly, these associations were significant after controlling for recent CD4 count and HIV viral load.

**Conclusions:** These results are consistent with our knowledge of HIV effects on subcortical neurodegeneration, which in the context of advancing age may place HIV+ individuals at increased risk for cognitive compromise.

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**C. MIRANDA, M. ARCE RENTERIA, A. FUENTES & M. RIVERA MINDT. The Roles of Health Literacy, Neuropsychological Functioning, and Demographics in Health Disparities among HIV+ Adults.**

**Objective:** Latino individuals living with HIV have worse health outcomes than their non-Hispanic White counterparts. The present study investigated disparities in health literacy, neuropsychological (NP) performance, and education in order to better understand disparities in health outcomes between White and Latino HIV+ adults.

**Participants and Methods:** One hundred twenty-nine HIV+ Latino ( $n=92$ ) and White ( $n=37$ ) adults (69% Male; M Age=48 years [ $SD=8$ ]; M Education=13 years [ $SD=3$ ]) completed the Test of Functional Health Literacy in Adults (TOFHLA), and comprehensive NP and neuromedical (HIV viral load count) evaluations.

**Results:** Latino adults had significantly lower levels of health literacy, global NP performance, and education, and significantly higher HIV viral loads than White adults (all  $p's<.05$ ). A logistic regression model investigating the effects of health literacy, NP performance, education, and ethnicity on the likelihood that participants had undetectable viral loads was significant ( $X^2(4)=13.14, p<.05$ ), and explained 8% of the variance in viral load category. However, health literacy was the only significant predictor ( $p<.05$ ), and higher health literacy was associated with an increased likelihood of having undetectable viral load.

**Conclusions:** Consistent with research documenting health disparities between Latino and white HIV+ adults, Latino participants in this study had higher HIV viral loads than their White counterparts, suggesting less well managed disease and worse health outcomes. Concurrently, Latino participants had lower levels of health literacy, NP performance, and education than White participants. Of these variables, only health literacy was a significant predictor of undetectable viral load. This is notable as health literacy is a modifiable variable that may contribute to the goal of minimizing health disparities across ethnically diverse groups in regards to HIV treatment outcomes.

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**E.E. MORGAN, S. WOODS, J. VILLALOBOS, K.L. DOYLE, P. GILBERT, J. IUDICELLO, I. GRANT & M. CAMERON. HIV-seropositive Individuals are at Risk for Misattributing the Source of Health-Related Information.**

**Objective:** Health illiteracy is common in HIV infection (HIV+), particularly among persons with neurocognitive disorders. Source memory, or memory for the context in which information was learned, is also impaired in HIV and may play an important role in the acquisition and credibility of health-related information. This study evaluated the effect of HIV on item and source memory for novel health-related information.

**Participants and Methods:** Thirty-eight HIV+ and 16 demographically-comparable HIV- participants completed a health-related source memory task in which 16 facts about a hypothetical new disease were randomly paired with one of four sources (i.e., doctor, pharmacist, friend, neighbor) and shown sequentially on a computer. Participants were randomly assigned into either an experimental condition in which they were instructed to attend to the source of the facts or a control condition in which no source instructions were provided. After a 10-minute delay, a 32-item recognition trial (16 targets, 16 foils) assessed both item (i.e., disease facts) and source (e.g., doctor) memory.

**Results:** A mixed-model ANOVA revealed an interaction of HIV, condition, and memory type ( $p<.05$ ). Follow-up analyses revealed no effects on item memory, yet for source memory the HIV+ persons instructed to attend to the source scored better than HIV+ controls ( $p<.05$ ); in contrast, there was no effect of source instructions in the HIV- group ( $p>.10$ ). An error analysis suggests that HIV+ individuals were more likely to misattribute disease facts to health professionals when the correct source was a lay-person ( $p<.05$ ).

**Conclusions:** This study demonstrated that HIV+ individuals are at risk for mistaking the source of newly learned health-related information. This type of misattribution error may be problematic or even dangerous

in the real world if erroneous lay information is treated with similar confidence as advice from a medical professional. HIV+ individuals may benefit from a simple reminder to attend to the source of health information.

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**L.C. OBERMEIT, B.S. MCKENNA, I. BABAKHANYAN, K.L. DOYLE, E.E. MORGAN, J.E. IUDICELLO & R.K. HEATON. Frontal Systems Behaviors Significantly Impact Everyday Functioning Outcomes in HIV Disease and Methamphetamine (MA) Dependence.**

**Objective:** HIV and MA use often co-occur and are associated with neurocognitive impairment (NCI), which is linked to everyday functioning (EF) problems (e.g., unemployment). However, significant EF variance with HIV and MA remains unaccounted for by NCI. Elevated frontal systems behaviors (FSBs; i.e., apathy, impulsivity/disinhibition, and sensation-seeking) are also prevalent and can impact EF. This study examined the unique impact of FSBs on EF outcomes in HIV/MA, while considering the effects of NCI.

**Participants and Methods:** Participants (N=180) were classified by MA dependence (M+/M-) and HIV serostatus (H+/H-) into four groups: H-M- (n=49), H-M+ (n=48), H+M- (n=45), and H+M+ (n=39). The groups were similar in age and ethnicity ( $p > 0.10$ ), though the H-M-group had more females and the H-M+ group was less educated relative to the other groups ( $ps < 0.05$ ). Participants completed a comprehensive neuropsychological evaluation and self-report measures of FSBs and EF outcomes [i.e., cognitive complaints (CCs), activities of daily living (ADLs), and HIV transmission risk behaviors].

**Results:** Regression models predicting EF outcomes were significant ( $R^2 = 0.33-0.45$ ). FSBs accounted for significant variance in CCs ( $\Delta R^2 = 0.09$ ,  $p < 0.001$ ), ADLs ( $\Delta R^2 = 0.03$ ,  $p = 0.01$ ), and HIV risk behaviors ( $\Delta R^2 = 0.10$ ,  $p < 0.001$ ) beyond that accounted for by other significant predictors (e.g., NCI, mood). Specifically, higher apathy and impulsivity/disinhibition significantly predicted increased CCs, problems with ADLs, and HIV risk behaviors; while higher sensation-seeking predicted increased HIV risk behaviors.

**Conclusions:** Findings demonstrate a significant association between elevated FSBs and EF declines in HIV and MA, beyond the effects of other common contributors to poorer functional outcomes in these risk groups (e.g., NCI). Elucidating factors that may contribute to EF problems in HIV and MA is important given the considerable public health implications. These results highlight FSB disturbances as important targets for early detection and intervention.

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**L.C. OBERMEIT, J.L. BELTRAN, K.B. CASALETTO, D. FRANKLIN, S. LETENDRE, R. ELLIS, C. FENNEMA-NOTESTINE, F. VAIDA, D. SMITH, A. COLLIER, C. MARRA, D. CLIFFORD, B. GELMAN, N. SACKTOR, S. MORGELLO, D. SIMPSON, J.A. MCCUTCHAN, I. GRANT & R.K. HEATON. Self-Reported Attribution of Everyday Dysfunction: Defining Functional Dependence in HIV.**

**Objective:** The current criteria for symptomatic versus asymptomatic HIV-associated neurocognitive disorder (HAND; Antinori et al., 2007) requires that clinicians evaluate 1) the presence of daily functioning dependence (DFD; e.g., driving) and 2) if their DFD is attributable to cognitive (e.g., cannot remember directions) or strictly physical (e.g., cannot see the road) problems. Many providers rely only on patient self-report (SR) to evaluate these criteria. However, the validity of SR may be limited (e.g., Blackstone et al., 2012). This study evaluated the validity of SR DFD and causative attributions by examining the similarities between SR variables and objective findings.

**Participants and Methods:** SR (questionnaires) and objective variables of daily functioning (e.g., employment), physical problems on

medical examinations, and cognitive deficits on neuropsychological testing were compared between HIV+ DFD (n=501; >2 declines on the ADL) and non-DFD (n=725) groups. Within the DFD group, the same variables were evaluated between cognitive versus physical attributors.

**Results:** The DFD and non-DFD groups had similar demographics but the DFDs had higher rates of AIDS, lower nadir CD4, and worse performance on all objective physical, cognitive, and daily functioning measures ( $ps < .01$ ). Among DFD, physical versus cognitive attributors had similar demographics, and did not differ on AIDS prevalence, or any objective physical, cognitive, or daily functioning measures ( $ps > .01$ ).

**Conclusions:** Results suggest that, while patients appear to accurately report loss of independence in daily functioning, they may struggle to identify the physical versus cognitive causes of such loss. The latter distinction may require objective cognitive and physical examinations.

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**P. OLSEN, M. RIVERA MINDT, D.A. BYRD & S. MORGELLO. Non-Verbal Ability As An Estimator Of Premorbid Intelligence: Does It Remain Stable Among Ethnically Diverse HIV+ Adults?**

**Objective:** The General Ability Measure for Adults (GAMA) is an established non-verbal measure of premorbid ability. However, its long-term reliability is not well documented, particularly in diverse populations with CNS-relevant disease. We examined test-retest reliability of the GAMA over time in an ethnically diverse sample of HIV+ adults.

**Participants and Methods:** Participants (N= 79) completed a comprehensive neuropsychological battery, including the GAMA, on at least two separate study visits. Intraclass correlation coefficients (ICCs) were computed using scores from baseline and follow-up assessments to determine the test-retest reliability of the GAMA across racial/ethnic groups and across changes in medical (immunological) and clinical (neurocognitive) factors. Additionally, Fisher's Z tests were used to determine the significance of the differences between ICCs.

**Results:** The average test-retest interval was 47.2 months (SD= 29.9). The overall GAMA test-retest reliability was satisfactory ( $r = .68$ ,  $p < .001$ ), and remained robust across most demographic, medical, and clinical variables (all  $r > .68$ ). Intraclass correlation coefficients did not differ significantly between the subgroups tests (all Fisher's Z  $p$ 's  $> .05$ ).

**Conclusions:** Overall, this study supports the appropriateness of non-verbal measures, such as the GAMA, for use as stable premorbid IQ estimates among ethnically diverse groups. Moreover, this study supports the reliability of this measure in the context of change in health and neurocognitive status, and in lengthy inter-test intervals. These findings offer strong rationale for nonverbal tests, even in the presence of a chronic, variable disease such as HIV.

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**E. SCHELL, K.N. DEVLIN, T. GIOVANNETTI, D.J. LIBON, W. DAMPIER, V. PIRRONE, M.R. NONNEMACHER, J. KURCZEWSKI, C. LAMBERSON, J.M. JACOBSON & B. WIGDAHL. Relations Between Poverty and Neurocognitive Function in HIV+ Adults.**

**Objective:** Socioeconomic status (SES) has been associated with disease progression, comorbidity, and quality of life in HIV+ adults. SES and home environment have been associated with neurocognitive function in HIV+ children. However, the relationship between SES and neurocognitive function in HIV+ adults remains unclear. In this study, we examined the relation between poverty and neurocognitive ability in HIV+ adults while controlling for literacy, an estimate of premorbid neurocognitive function.

**Participants and Methods:** Adults enrolled in the Drexel Medicine CNS AIDS Research and Eradication Study (CARES) Cohort (N=158; ages 26-71; 66% male; 97% on antiretroviral therapy) completed tests

of executive function, motor and psychomotor speed, language, episodic memory, and visuoconstruction. Word reading was used as an estimate of premorbid neurocognitive function. Participants' self-reported household income level was categorized according to U.S. federal poverty guidelines; fifty-nine percent of the sample was at or below the poverty line.

**Results:** Thirteen neurocognitive parameters adjusted for age, education, gender, and race were entered in multiple linear regression models as a function of poverty, controlling for word reading. Poverty was associated with reduced fine motor speed in the dominant hand ( $\beta = -.24, p < .05$ ) and was marginally associated with reduced performance in delayed visual recognition memory ( $\beta = -.13, p = .09$ ).

**Conclusions:** Individuals affected by poverty may be at a higher risk of motor impairment, even when controlling for premorbid neurocognitive ability, supporting the need for policies and resources to reduce poverty among HIV+ persons. Future research should examine the mechanism of the relation between poverty and motor impairment, and the effects of other psychosocial hazards, such as those in the community environment, in HIV+ persons. NIH R01 NS32092, R01 DA19807, R01 NS089435, T32 MH079785.

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#### **D.P. SHEPPARD, S. WOODS, K.L. DOYLE & M. CAMERON. Random Number Generation in HIV Disease.**

**Objective:** HIV infection is commonly associated with dysregulation of frontostriatal circuitry that frequently manifests as executive dysfunction. The present study evaluated whether HIV-infected individuals evidence deficits in random number generation, which is an executive demanding task requiring the paced, rule-guided production of single digits.

**Participants and Methods:** Participants included 74 adults with HIV disease and 54 seronegative comparison subjects with broadly comparable demographics who completed a comprehensive research neuropsychological battery. All participants were asked to verbally produce a sequence of digits between 1 and 10 in a random fashion (i.e., avoiding any order) for 100 seconds at a steady pace of 1 digit per second. Output was scored for intrusions, repetitions, order seriation (e.g., 1-2-3-4), and cycling (i.e., median length of gaps between repeating digits).

**Results:** Controlling for estimated verbal IQ, a series of multiple regressions showed that HIV disease was associated with significantly higher levels of seriation and cycling ( $ps < .05, ds = 0.54, 0.48$ ), but not errors or repetitions ( $ps > .10$ ). Within the HIV+ group, seriation was significantly positively correlated with composite scores of auditory attention and verbal learning and memory, whereas cycling was significantly positively correlated with verbal fluency ( $ps < .05, r$  range .30-.43).

**Conclusions:** HIV disease is associated with moderate difficulties in the cognitively demanding process of inhibiting statistically unlikely non-random sequences during a number generation task, which neuroimaging research shows is dependent on prefrontal systems. The pattern of correlational findings suggests that higher non-randomness in the HIV group may be indicative of underlying deficits in higher-order verbal abilities (e.g., learning and fluency). The ecological relevance of random number generation in HIV disease (e.g., health literacy) remains to be determined.

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#### **J. VILLALOBOS, E.E. MORGAN, K.L. DOYLE, M. CAMERON, I. GRANT & S. WOODS. Social Cognition is Associated with Greater Conflict on Social Aspects of a Medical Decision-Making Task.**

**Objective:** Social cognition plays a pivotal role in navigating many real-world activities, including aspects of healthcare (e.g., shared

decision-making). HIV is associated with mild deficits in social cognition, particularly on emotion-based tasks. The present study examined the association between deficient social cognition and medical decision-making among people living with HIV.

**Participants and Methods:** 89 HIV-seropositive individuals completed a comprehensive neurobehavioral battery, which included the Cogstate Social-Emotional Cognition Task (SECT) and the Decisional Conflict Scale (DCS). The SECT is a computerized task that assesses the emotional processing (i.e., facial affect discrimination) and theory of mind aspects of social cognition. The DCS involves selecting a treatment option in response to a hypothetical medical decision-making scenario and completing 16 items that measure self-perceptions of that treatment decision. Given the non-normal distribution of the DCS, a dichotomous (median split) independent variable representing "low conflict" ( $n = 43$ ) versus "high conflict" ( $n = 46$ ) groups was used.

**Results:** DCS groups did not differ on demographic, psychiatric, HIV disease, or global neurocognitive factors. Participants in the "high conflict" group scored significantly lower on SECT accuracy than participants in the "low conflict" group ( $p = .04; d = -0.41$ ). Spearman's rho correlations revealed a significant association between the SECT and the DCS social support subscale ( $\rho = -0.3; p = .005$ ) but not the DCS uncertainty, informed, values clarity, or effective decision subscales ( $ps > .05$ ).

**Conclusions:** Our findings indicate that lower social cognition is associated with greater difficulty, or conflict, with medical decision-making in HIV+ individuals. In particular, individuals with poorer social cognition may lack adequate social support to comfortably choose among the available medical treatment options, which may put them at higher risk of failing to consider the full array of potentially effective treatment options.

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#### **K. WACLAWIK, S. MAXEY, N.Y. WANG, K. GICAS, C. GIESBRECHT, T.A. O'CONNOR, H.A. BAITZ, F. VILA-RODRIGUEZ, O. LEONOVA, A. BARR, R. PROCYSHYN, D. LANG, C. SMITH, W. MACEWAN, W. PANENKA, W. HONER & A.E. THORNTON. The Contributions of Viral Infections, Substance Use and Psychiatric Diagnosis to Change in Memory over One Year in a Marginally Housed Sample.**

**Objective:** People who reside in marginal housing often incur viral infections, psychiatric illness and substance use disorders that compromise cognition. We identified the impact of various morbidities on change in memory in a one-year longitudinal design.

**Participants and Methods:** Participants were recruited from single-room occupancy hotels and followed for one year ( $N = 226; 175$  male;  $Mage = 45.42$ ). Memory functioning was evaluated at baseline and re-assessed at follow-up using alternate, counterbalanced versions of the Hopkins Verbal Learning Test-Revised (HVLT-R). At baseline, psychiatric diagnoses, HIV status and exposure to other viruses were established. Depressive and psychotic symptoms were also assessed. Substance use patterns were ascertained monthly via interview over the follow-up duration. Acute substance use at the time of memory assessment was detected by urinalysis.

**Results:** Hierarchical regression revealed that viral exposure contributed a significant amount of variance to change in HVLT-R scores,  $\Delta R^2 = .06, F(5, 220) = 2.78, p < .05$ , with this result being driven primarily by HIV status,  $\beta = -.23, t = 3.32, p < .05$ . The HIV seropositive group demonstrated a slight decrease in number of words recalled from baseline to follow-up ( $M = -1.26, SD = 5.57$ ), in contrast to the seronegative group who demonstrated a relative improvement ( $M = 0.95, SD = 5.31$ ). Psychiatric factors did not emerge as significant predictors in the current model of memory changes over one year, while substance use contributed minimally.

**Conclusions:** In a sample of marginally housed individuals with comorbid viral infections, psychiatric illness and substance use, only viral exposure substantially contributed to change in memory over one year. Persons with HIV showed a decline in verbal memory in contrast to

seronegative persons. This suggests that future investigation of persons with multimorbidities may target the clinical management of HIV infection, including plasma viral load, to determine its relevance to neurocognitive trajectories.

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**E. WEBER, S. WOODS, Y. LI, I. GRANT, M.R. BASSO, P. GILBERT & S. LOFT. Self-generation improves prospective memory performance in HIV-infected adults.**

**Objective:** Prospective memory (PM), or “remembering to remember”, is frequently impaired in individuals with HIV infection and impacts everyday functioning (e.g., medication adherence). Self-generation is a potentially powerful approach to improve PM as it should strengthen PM cue encoding and subsequent cue accessibility, reducing the strategic demands of the PM task.

**Participants and Methods:** The present study examined whether self-generated encoding improves PM among 56 HIV+ and 21 HIV- adults. PM was assessed using a computer-administered variation of the classic McDaniel & Einstein PM paradigm. Participants were administered a comprehensive neurocognitive, psychiatric and neuromedical evaluation.

**Results:** A mixed model ANOVA revealed a significant within-subjects factor of encoding condition (i.e., didactic or self-generated PM cue; [ $F(1,78)=8.82$ ;  $p=0.004$ ]), such that individuals were more likely to remember to perform the PM task in the self-generated condition (Hedge’s  $g=0.36$ ). There were no significant HIV or interaction effects ( $ps>0.10$ ). A similar pattern was observed for the PM recognition (within-subjects factor: [ $F(1,78)=15.55$ ;  $p<0.001$ ;  $g=0.44$ ]; all other factors  $ps>0.10$ ). Ongoing task performance was significantly quicker under self-generated conditions ( $g=0.18$ ;  $p=0.033$ ). Within the HIV+ sample, neurocognitively impaired adults demonstrated greater benefit from self-generation than their cognitively normal counterparts ( $g=0.42$ ). These findings were not better explained by relevant demographic, disease, or psychiatric factors ( $ps>0.10$ ).

**Conclusions:** The improved PM and reduced costs suggest that self-generation may be an effective means to improve PM in HIV infection by enhancing encoding of the PM cue and thereby reducing the strategic demands of the PM task. Future research should examine the applicability of this manipulation to other clinical populations with PM deficits (e.g., TBI), as well as combine with interventions aimed at improving other PM component processes (e.g., monitoring).

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### Psychopathology/Neuropsychiatry (Including Schizophrenia)

**B. BLANCHETTE, L. HANA, B. GREENBERG & N. MCLAUGHLIN. Impaired Cognitive Abilities in a Lifetime Obsessive-Compulsive Disorder Sample.**

**Objective:** To test for differences in prefrontal function between participants with a lifetime diagnosis of obsessive-compulsive disorder (OCD) and healthy controls (HC). It was hypothesized that the OCD group would show worse performance on neuropsychological tests, [the Iowa Gambling Task (IGT), Wisconsin Card Sorting Test (WCST), and the Self-Ordered Pointing Task (SOPT)] indicating prefrontal cortex deficits.

**Participants and Methods:** 46 subjects, 22 OCD (8 female, 14 male) and 24 HC (13 female, 11 male), were enrolled. OCD age ranged from 27 to 65 ( $M=44.32$ ,  $SD=11.11$ ) and HC from 18-64 ( $M=39.25$ ,  $SD=13.96$ ). Years of education ranged from 11 to 18 ( $M=15.23$ ,  $SD=2.25$ ) in OCD and 12-20 in HC ( $M=15.54$ ,  $SD=2.40$ ). Each subject

completed two computerized (IGT, WCST) and one paper (SOPT) task for between-group comparison.

**Results:** OCD patients completed fewer categories on the WCST ( $p=0.038$ ) and nearly made more total errors ( $p=0.051$ ) than HC. OCD patients also had lower accuracy on the SOPT 12 stimuli subtest ( $p=0.038$ ) compared to HC.

**Conclusions:** The OCD group displayed executive function deficits consistent with theories of dorsolateral prefrontal cortex (DLPFC) and ventrolateral prefrontal cortex (VLPFC) dysfunction in OCD. Fewer categories completed by OCD patients on the WCST indicates ineffective inhibitory processes. Patients were less likely to spontaneously generate organizational strategies effectively due to their lessened performance on the SOPT-12 in comparison to HC. While the data are limited by the small sample size, decreased task performance in the OCD group on the WCST and SOPT, but not the IGT, may be attributed to the more recently incorporated DLPFC and VLPFC into anatomical models of OCD.

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**E.W. TWAMLEY, C.Z. BURTON & L. VELLA. Neuropsychological Correlates of Performance-Based Measures of Functional Capacity and Social Skills in Severe Mental Illness.**

**Objective:** Neuropsychological (NP) abilities may underlie successful performance of everyday functioning and social skills. We aimed to determine the strongest NP predictors of performance-based functional capacity and social skills performance in a sample of individuals with severe mental illness (SMI).

**Participants and Methods:** Unemployed outpatients with SMI (schizophrenia, bipolar disorder, or major depression;  $n=153$ ) were administered NP (expanded MATRICS Consensus Cognitive Battery), functional capacity (UCSD Performance-Based Skills Assessment; UPSA), and social skills (Social Skills Performance Assessment; SSPA) assessments at the beginning of a supported employment study.

**Results:** Bivariate correlations between NP tests and UPSA and SSPA total scores showed that most NP tests were significantly associated with each performance-based measure. Multiple regressions were conducted entering NP tests that were significant at the bivariate level as predictors of UPSA and SSPA performance. Only premorbid IQ emerged as a significant predictor of UPSA performance, in a model that explained 34% of the variance. Letter fluency and sustained attention (Continuous Performance Test-Identical Pairs) were significant predictors of SSPA performance, in a model explaining 23% of the variance. In models accounting for diagnosis (psychosis or mood disorder), only diagnosis predicted UPSA performance, in a model explaining 45% of the variance; letter fluency and sustained attention remained significant predictors of SSPA performance.

**Conclusions:** Functional capacity, as measured by the UPSA, is positively associated with NP functioning, but may be strongly determined by diagnosis, with mood disorder participants outperforming those with psychosis. Social skill performance, as measured by the SSPA, appears to be positively associated with verbal fluency and sustained attention regardless of diagnosis. Improving verbal fluency and sustained attention may improve social skill performance in people with SMI.

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**C.Z. BURTON, L. VELLA, O. PUIG-NAVARRO, K.R. THOMAS, S. MCGURK & E.W. TWAMLEY. Effects of Cognition and Psychiatric Symptom Severity on Work Outcomes in Severe Mental Illness.**

**Objective:** Neuropsychological (NP) abilities are highly linked to employment patterns across neuropsychiatric disorders. We aimed to determine the strongest NP predictors of work outcomes in a supported

employment program to help individuals with severe mental illness (SMI) re-enter the workforce.

**Participants and Methods:** Unemployed outpatients with SMI (schizophrenia, bipolar disorder, or major depression;  $n=136$ ) were administered NP (expanded MATRICS Consensus Cognitive Battery), psychiatric symptom severity, and functional capacity assessments at the beginning of a two-year supported employment study. Work outcomes at two years included competitive job attainment (Yes/No) and weeks worked.

**Results:** About half the participants obtained competitive work during the study. Job attainment was modestly associated with better global NP functioning, working memory, processing speed, and prospective memory performance ( $r_s=.22-.24$ ,  $p_s<.01$ ), and the same variables (except working memory) predicted weeks worked. Diagnosis (mood vs. psychotic disorder), positive and negative symptom severity, and functional and social skill performance were also associated with work outcomes. Multiple regression analyses examining modifiable predictors of work outcomes showed that in the context of multiple predictors, only negative symptom severity predicted job attainment, and only positive and negative symptom severity predicted job tenure. Worse symptoms were associated with worse work outcomes.

**Conclusions:** NP functioning at baseline was modestly associated with work outcomes at two years in this sample of outpatients with SMI participating in supported employment. Participants with mood disorders were more likely to obtain work and worked more weeks than did those with psychotic disorders; in a multivariate context, only positive and negative symptom severity was associated with work outcomes. Reducing psychiatric symptom severity may improve work outcomes in people with SMI, particularly for people with psychosis.

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**J.L. CALLAHAN, C.J. RUGGERO, K. LIU, K.M. BAIN, Y. SHTEYNBERG & R. KOTOV. Verbal Learning and Memory Impairments Among World Trade Center Responders: Differential Correlates Among PTSD Sub-dimensions.**

**Objective:** PTSD is associated with verbal memory impairment (Johnsen & Asbjørnsen, 2008), but it remains unclear which dimensions of the syndrome (i.e., intrusiveness, avoidance, numbing, and/or hyperarousal) are most responsible for effects, and whether they remain important after controlling for depression. It has been suggested that memory impairments may result from excessive internal arousal (i.e., hyperarousal) interfering with initial acquisition and encoding processes, rather than recall failure (Sandi & Pinelo-Nava, 2007), but little research has examined this possibility (Diener, Flor, & Wessa, 2010). Moreover, few studies have considered whether verbal learning and memory impairments occur among disaster responders. The present work tested for the unique associations between PTSD dimensions and verbal memory impairment in a sample of first responders to the 9/11 attacks on the World Trade Center (WTC).

**Participants and Methods:** Seventy-five first responders to the World Trade Center (WTC) disaster were assessed in 2015 with the California Verbal Learning Test-II (CVLT-II) as well as the PTSD Checklist for DSM-IV (PCL), but modified to ask about symptoms specific to the 9/11 attacks.

**Results:** Total PTSD symptoms, as well as all three of four PTSD dimensions, were significantly associated with impaired learning (PCL total  $r = .32$ ; avoidance  $r = .24$ ; numbing  $r = .30$ ; hyperarousal  $r = .39$ ,  $p's < .05$ ) in 9/11 responders. However, after controlling for depression, only hyperarousal remained a significant predictor of impaired learning (semipartial  $r = .24$ ,  $p < .05$ ).

**Conclusions:** More than 13 years after the attacks on the WTC, PTSD symptoms specific to the events of 9/11 among rescue and recovery responders were significantly associated with impaired learning on the CVLT-II. Even after controlling for effects from depression, hyperarousal symptoms in particular remained uniquely associated with

disrupted learning, suggesting they may play an etiological role in cognitive impairments associated with PTSD.

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**T.K. CHOUDHURY, J.E. DAVIDSON, A. VISWANATHAN & A.M. STRUTT. Deep brain stimulation (DBS) for treatment of therapy-refractory obsessive compulsive disorder (OCD): a case study highlighting neurocognitive and psychiatric changes.**

**Objective:** To assess longitudinal changes in neurocognition, psychiatric status, and quality of life (QOL) after DBS; to examine the viability of DBS as a treatment option for severe OCD

**Participants and Methods:** AH was a 45-year-old Caucasian female at the time of the DBS intervention. Prior to the procedure, she underwent extensive neuropsychological assessment to establish baseline status, as well as neuroimaging and psychiatric consultation. Following the DBS, she underwent follow-up neuropsychological assessment, at 35 months and 51 months subsequently.

**Results:** Postoperative neuropsychological results evidenced significant improvements in the cognitive domains of processing speed, attention, and executive functioning, as well as memory. AH provided qualitative feedback to her treating psychiatrist which also consistently reflected a reduction in her OCD symptoms and consequently, improved quality of life (QOL).

**Conclusions:** As the longest-studied patient in currently published literature, AH and her ongoing progress are compelling. As an emerging experimental therapy, DBS for OCD has generated promising outcomes but still requires extensive evaluation in order to validate the safety and reliability of the procedure.

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**L.S. CZEPIELEWSKI, J. BUCKER & C.S. GAMA. Cognitive Performances and Neuroanatomical Volumes at Early and Late Stages of Bipolar Disorder.**

**Objective:** Bipolar disorder (BD) is a psychiatric disease known to present cognitive deficits, although literature is not consistent with which domains or levels of dysfunction may be associated with it. It is controversial whether this may increase or not with illness progression. Clinical staging model of BD differentiates early and milder clinical phenomena from those that accompany illness chronicity. Neuroprogression is the pathological reorganization of the central nervous system along the course of severe mental disorders. Our goal was to test this model, comparing cognitive performances and total cortex, frontal cortex and hippocampus volumes of early and late stages of BD with healthy controls (HC).

**Participants and Methods:** 37 euthymic BD and 53 HC matched for age and years of education, divided in early and late stage groups according to ISBD proposed model, underwent psychiatry and neuropsychological assessment. Diagnostic or absence of it was confirmed with SCID, and euthymia with YMRS and HAMD  $\leq 7$ . T1-weighted MRIs were acquired with Philips Achieva 1.5 Tesla scanner and volumetric segmentations performed with Freesurfer image analysis suite v.5.1.0. Intracranial volume was regressed out from total cortex, frontal cortex and hippocampus volumes. Variables were analyzed using independent samples t-tests or mann-whitney test, and relationship between them was obtained by Spearman rank coefficient test.

**Results:** Both early and late stage BD performed worse on episodic memory and attention compared to their HCs ( $p<.05$ ). However, early stage BD had similar total cortex, frontal cortex and hippocampus volumes than HC ( $p>.38$ ). Late stage BD had smaller volumes than HC ( $p<.05$ ). Cognitive performance was correlated with total cortex and frontal cortex volumes in BD ( $p<.001, r=.61$ ), but not in HC ( $p>.16, r<.24$ ).

**Conclusions:** Cognitive impairments may appear early in the course of BD, although its impact on brain might occur later. Therefore, it highlights the importance of early interventions to prevent illness progression.

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**M.K. DAHLGREN, K.A. SAGAR, M.T. RACINE, M.W. DREMAN & S.A. GRUBER. Inhibitory Task Performance Is Not Worsened by Comorbid Marijuana Use in Patients with Bipolar Disorder.**

**Objective:** Bipolar Disorder (BPD) is a common, debilitating mood disorder. Previous research has demonstrated cognitive impairment in BPD including problems with concentration, attention, and executive function. Comorbid substance use, particularly marijuana (MJ), is common in BPD, underscoring the importance of assessing the potential additive effect of MJ use in these patients and determining if MJ use results in additional cognitive impairment. Thus far, investigations have reported inconsistent findings, and the specific impact of comorbid MJ use in BPD remains unclear.

**Participants and Methods:** Twelve individuals with BPD who use MJ (MJBP), 17 individuals with BPD who do not use MJ (BPD), and 21 healthy controls (HC) completed the Multi-Source Interference Task (MSIT), a measure of cognitive interference and inhibitory processing. Univariate analyses of variance (1-tailed) assessed the individual impact of BPD as well as the additive impact of MJ use in BPD.

**Results:** As a group, all BPD participants (BPD + MJBP) made more errors of commission across the task ( $F(1,47)=5.520, p=.012, \eta^2=.105$ ), particularly during the interference condition ( $F(1,47)=4.975, p=.016, \eta^2=.096$ ); this contributed to a trend for lower interference performance accuracy ( $F(1,47)=2.241, p=.071, \eta^2=.046$ ) relative to HC participants. The BPD group made more total commission errors ( $F(1,35)=3.336, p=.038, \eta^2=.087$ ), with a trend for more commission errors during the interference condition ( $F(1,35)=2.667, p=.055, \eta^2=.071$ ) relative to the HC group. Interestingly, a comparison of the BPD and MJBP groups indicated that they were not significantly different with regard to MSIT performance.

**Conclusions:** These data suggest that BPD significantly impairs executive function and inhibitory control, regardless of MJ use status. Further, the potential additive effect of having both BPD and MJ use did not emerge, underscoring the need for additional research to identify potential mediating factors, such as partial mood stabilization.

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**E. ESTEVIS, M.R. BASSO, R. PURDIE, P. CANDILIS & D.R. COMBS. Neuropsychological Correlates on Decisional Capacity for Informed Consent among Depressed Inpatients.**

**Objective:** Ability to consent to medical treatment or medical research participation may be degraded by several neuropsychiatric and medical conditions. Major depressive disorder (MDD) is a neuropsychiatric condition in which cognitive dysfunction occurs. Such impairment may compromise ability to provide consent, but few studies have evaluated this possibility. The current study examined medical decision-making capability in a group of depressed inpatients and a healthy-comparison group. This study also examined whether neuropsychological impairment predicts impaired decisional capacity and if an educational intervention enhances these abilities.

**Participants and Methods:** 20 depressed inpatients and 20 healthy-comparison participants were administered a neuropsychological battery and a measure of medical decision-making, the MacCAT-CR.

**Results:** A mixed factor ANOVA revealed that the inpatients exhibited diminished capacity involving understanding and appreciation

abilities. Choice expression and reasoning abilities were equivalent between groups. Multiple regression revealed that neuropsychological impairment was a salient predictor of understanding and reasoning abilities, exceeding the impact of depressive severity. Mixed factor ANOVAs showed that the remediation intervention improved understanding performance, but not appreciation and reasoning abilities.

**Conclusions:** Depressed inpatients are vulnerable to making incompetent decisions regarding medical research participation, and, by extension, medical treatment options. Neuropsychological impairment emerged as a salient predictor of diminished decision-making capacity. Although remediation improved some aspects of poor decision-making, other facets remained unchanged. These findings address important clinical and ethical issues that should be taken into consideration when working with this population group.

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**M. FEIGON, J. WILSON, S.A. PARIKH, L.M. SILVA, J. DIGANGI, E. BERMAN & N. PLISKIN. Detecting PTSD in Individuals with an Electrical Injury.**

**Objective:** Detecting symptoms of Post-Traumatic Stress Disorder (PTSD) is often an important part of a neuropsychological evaluation. Individuals who have experienced an electrical injury (EI) often experience higher rates of PTSD than in the general population. The purpose of this study was to examine the utility of the Trauma Symptom Inventory (TSI), the Impact of Events Scale (IES), and the PTSD-Checklist Civilian Version (PCL-C) in detecting PTSD in individuals who have experienced an EI.

**Participants and Methods:** Individuals with a diagnosis of PTSD were compared against individuals without evidence of PTSD using logistic regression analysis. There were 124 individuals in total out of whom 124 were administered the IES, 31 were administered the TSI, and 10 were administered the PCL-C. Individuals were assigned a diagnosis of PTSD based on a semi-structured interview by a board certified psychiatrist, as part of a neuropsychological evaluation. There were no differences between groups on age, education, gender, or handedness.

**Results:** The total score on the IES was significantly related to a diagnosis of PTSD. Only two of the five TSI subscales, Intrusive Experiences (IE), and Defensive Avoidant (DA) were significantly correlated with a diagnosis of PTSD. The PCL-C was not predictive of a diagnosis of PTSD.

**Conclusions:** The detection of PTSD in individuals who have experienced an EI was detectable only by the IES and select subscales of the TSI. Additional studies are needed to examine potential causes for these differences and the sensitivity and specificity of each measure as well as to examine the potentially unique profile of PTSD in EI patients.

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**M. FORTE, D.T. NEWELL & P.G. NESTOR. Attentional Control Deficits in Schizophrenia.**

**Objective:** We examined the role of attentional control, a key function of working memory, in the neuropsychological disturbance of schizophrenia (SZ). Trails B of the Trail Making Test (TMT) and perseverative errors of the Wisconsin Card Sorting (WCS) served as measures of attentional control and the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) as an index of overall neuropsychological functioning.

**Participants and Methods:** WAIS-III, WCS, and TMT were available for 85 medicated patients with schizophrenia (72 males, 13 females), mean age of 41.81 (SD=9.4), mean equivalent chlorpromazine (CPZ) equivalent daily dose of 436.10 mg (SD=369.56), and mean duration of illness of 15.9 years (SD=10.33).

**Results:** Mean scores were Full-Scale IQ=90.27 (SD= 13.84), Trails A= 49.11secs (SD= 19.77), Trails B=126.38 secs (SD= 67.55), WCS



perseverative errors = 25.89 (SD= 21.57), non-perserative errors =18.58 (SD= 11.33). As predicted, Trails B but not Trails A correlated with WCS perseverative errors ( $r = .465$ ,  $p < 0.001$ ) but not with WCS non-perserative errors. Multiple regression indicated Trails B ( $F = 9.55$ ,  $df = 1, 75$ ,  $p = .003$ ) and WCS perseverative errors ( $F = 7.23$ ,  $df = 1, 82$ ,  $p = .009$ ) each predicted IQ.

**Conclusions:** Intellectual abilities in SZ may be highly influenced by executive attentional control functions related to response inhibition and shifting mental sets.

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### **J. FOX, S.V. ABRAM, E.C. ALDEN & M. SMITH. Default Mode Functional Connectivity Predicts Working Memory in Low Functioning Schizophrenia.**

**Objective:** Working memory (WM) is theorized to recruit brain regions from the default mode network (DMN), which include the medial prefrontal (mPFC) and dorsolateral prefrontal (dlPFC) cortices. We evaluated whether DMN functional connectivity predicted WM in low functioning schizophrenia (LF-SCZ), high functioning schizophrenia (HF-SCZ), and healthy controls (CON).

**Participants and Methods:** LF-SCZ ( $n=13$ ), HF-SCZ ( $n=15$ ), and CON ( $n=32$ ) completed a 5-minute resting-state scan and WM tasks. Resting data was processed using Independent Component Analysis. Within-network connectivity metrics were computed for each subject. We identified two anterior DMN networks (i.e. a dlPFC and mPFC metric). A WM domain score was computed for each subject. We used multivariable regression to predict WM performance. The model included the dlPFC metric, the mPFC metric, and group status. We controlled for parental socioeconomic status and movement. We determined the presence of any group X connectivity metric interactions. We followed-up the interaction model with separate regression models for each group.

**Results:** We found a significant dlPFC X group interaction and a trending mPFC X group interaction when predicting WM ( $F_{10,45}=3.86$ ,  $p<.001$ ). Follow-up results indicated the dlPFC predicted WM among LF-SCZ ( $p=.01$ ) but not HF-SCZ ( $p=.58$ ) or CON ( $p=.33$ ). The mPFC metric also predicted WM in LF-SCZ ( $p=.01$ ) but not HF-SCZ ( $p=.50$ ) or CON ( $p=.96$ ).

**Conclusions:** Our results suggest that DMN connectivity relates to WM in with LF-SCZ but not HF-SCZ or CON. Prior research indicates that DMN connectivity predicts WM in individuals with schizophrenia but not controls. Our study suggests these associations may be most relevant for LF-SCZ. Thus, increased within-network DMN connectivity may a treatment target to improve WM abilities in LF-SCZ.

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### **R. FUKUNAGA, C.A. WEBB, E.A. OLSON, W.D. KILLGORE, S.L. RAUCH & I.M. ROSSO. Reduced Rostral Anterior Cingulate Volume is Associated with Greater Frequency of Negative Automatic Thoughts in Adults with Major Depressive Disorder.**

**Objective:** Chronic negative thinking is a core feature of major depressive disorder (MDD) and has been linked to deficits in the neural circuitry underlying self-referential processing. Functional imaging studies have shown that reduced rostral anterior cingulate (rACC) activity impedes the inhibition of negative information thereby perpetuating negative automatic thoughts (NATs) in MDD. The relationship between NATs and rACC morphology, however, remains unclear. We hypothesized a relationship between reduced rACC volume and greater frequency of NATs, measured by the Automatic Thoughts Questionnaire (ATQ), in adults with MDD.

**Participants and Methods:** Fifty-three participants with DSM-IV MDD (20 male, 33 female) and 44 healthy controls (18 male, 24 female) were interviewed using a clinician-administered SCID and the Hamilton

Rating Scale for Depression (HRSD), and completed the ATQ. Participants underwent MRI scanning at 3T, and rACC volumes corrected for intracranial volume were determined using Freesurfer software. Multivariate analyses were performed to relate age, gender, and ATQ scores to left and right rACC volumes separately for each group.

**Results:** Adults with MDD had more frequent NATs than healthy subjects ( $t(57.11)=-14.29$ ,  $p<.001$ ). rACC volumes did not differ between groups. After controlling for age, gender, and HRSD scores in the MDD group, higher ATQ scores were associated with decreased rACC volume ( $F(2,47)=3.71$ ,  $p=0.03$ ); this effect was significant for the right ( $F(1,48)=6.36$ ;  $p=0.02$ ) but not the left rACC. ATQ scores were not significantly associated with rACC volume in healthy controls.

**Conclusions:** In the MDD group, the frequency of NATs was higher in individuals with reduced right rACC volume. Our findings provide morphometric evidence that the right rACC, a region implicated in the stimulus encoding of self-referent information, may play a central role in facilitating negative self-referential processing and related cognitive biases in the maintenance of depression.

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### **S. GAT-LAZER, R. GEVA, E. GUR & D. STEIN. Harm Avoidance and Reward Dependence in Patients with Eating Disorders.**

**Objective:** Personality dimensions have crucial impact on eating disorders (ED). Our objective was to evaluate harm avoidance (HA) and reward dependence (RD), which was further divided into sensitivity to reward (SR) vs. sensitivity to punishment (SP) in patients with binge purge type eating disorders (B/P EDs).

**Participants and Methods:** Participants were assessed upon admission to specialized ED departments (T1) and at discharge (T2). 50 B/P EDs patients and 34 demographically matched healthy controls were recruited; 34 participants from each group participated in the T2 assessment. ED and comorbidities evaluations included body mass index (BMI), Beck Depression Inventory (BDI) and State Trait Anxiety Inventory (STAI). Personality assessment was performed by the Tridimensional Personality Questionnaire (TPQ), sensitivity to reward and punishment questionnaire (SPSRQ) and gambling task (GT).

**Results:** Patients with B/P EDs had lower BMI and elevated depression and anxiety on admission compared to controls (all  $p<0.001$ ). No between-group differences were found at discharge. B/P EDs patients were characterized with lower TPQ-HA ( $p<0.05$ ) and higher TPQ-RD ( $p<0.01$ ) on both T1 and T2. Specifically, B/P EDs patients showed lower SPSRQ-SP and SPSRQ-SP ( $p<0.001$  and  $p<0.05$ , respectively). Positive correlation was found between HA and SP and negative between RD and SP (both  $p<0.001$ ). Non-advantageous cards selection on the GT decreased on recurrent exposure among controls ( $p<0.1$ ), but not in B/P EDs patients.

**Conclusions:** The low TPQ-HA of patients with B/P EDs has been found in the present study to be associated with reduced SPSRQ-SP rather than with increased SPSRQ-SR. These unique traits, along with continuous disadvantageous cards selection in the GT, remain stable the stabilization of disordered eating at T2, reflecting the persistent pathologic decision making and performances of patients with B/P EDs.

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### **Z.S. GELUZ, B. BOWNE, L. DUCHARME, A. DAVIS & K. KEE. Neurocognitive Correlates of Internet Addiction in University Students.**

**Objective:** Fundamental questions about the nature and scope of internet addiction are currently not fully known. However, a few recent studies have provided insight into which neurocognitive processes might be associated with problematic internet use. These findings indicated that internet addiction might be linked to attentional deficits and

impulsive tendencies. The current study examined a comprehensive profile of neurocognitive processes (i.e., impulsivity, self-control, attentional blink, executive functioning, memory span, cognitive interference, and inhibition) to determine the correlates of internet addiction in 54 undergraduate students.

**Participants and Methods:** Neurocognitive processes were measured using the Barratt Impulsivity Scale, Tangney Self-Control Scale, Williams Inhibition Test, Berg's Card Sorting Test, Attentional Blink Test, Stop-it, and Corsi's Block Test, whereas internet addiction was assessed using the Internet Addiction Test.

**Results:** A series of Pearson's product-moment correlations revealed significant associations between number of times subjects correctly identified both letters during the attentional blink task ( $r = -0.24$ ,  $p = 0.038$ ,  $R\text{-squared} = 0.058$ ) and the mean of stop-signal delay recorded during the stop-signal inhibition task ( $r = -0.28$ ,  $p = 0.019$ ,  $R\text{-squared} = 0.078$ ) with internet addiction. None of the other correlations between impulsiveness, self-control, executive functioning, memory span, and cognitive interference with internet addiction were statistically significant.

**Conclusions:** Preliminary findings from the present study could potentially expand our understanding of the links between impairments in attentional processes and lack of inhibition with problematic internet use in university students.

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#### **M. GORLYN, J.G. KEILP, A. BURKE, M. OQUENDO & J. MANN. Neurocognitive Impairment in Depression is an Independent Symptom Dimension.**

**Objective:** Neuropsychological studies of major depression find deficits in cognition but fail to detect a consistent association between depression severity and neurocognitive dysfunction. In part, this is attributable to the multifactorial nature of depression rating scales that combine symptoms into heterogeneous aggregate scores. Using factor analysis, we have found symptom clusters that more closely align with underlying neurobiology. Our objective was to determine if neurocognitive dysfunction is more strongly associated with these symptom dimensions than global depression scores.

**Participants and Methods:** Medication-free patients with current major depressive disorder (MDD) ( $n = 198$ ) were compared to healthy volunteers ( $n = 107$ ) on a battery of neuropsychological tests (reaction time, attention, psychomotor speed, memory, working memory, abstraction, language fluency and impulse control). Depression severity was assessed via the Hamilton Depression Rating Scale and Beck Depression Inventory, decomposed into factors previously found to be differentially associated with cerebral glucose metabolism (Milak et al., 2006, 2010), suicidal ideation (Keilp et al., 2013) and suicidal behavior (Grunebaum et al., 2006). Correlations were computed between test scores and symptom severity scores in the patient sample.

**Results:** MDD patients exhibited mild neurocognitive deficits in multiple areas of functioning relative to non-patients. None of these measures, however, correlated at a level greater than .20 ( $p < .01$ ) with total or factor scores from depression rating scales.

**Conclusions:** MDD patients' neurocognitive deficits were only weakly associated with depressive symptom dimensions. Neurocognitive impairment is a core feature of depression, but distinct from mood and vegetative symptoms. Neurocognitive dysfunction represents an independent component of illness reflecting related but distinct pathophysiological processes that require additional evaluation using objective measures, and may require separate pharmacological intervention.

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#### **K.H. HINRICHS, R. EASTER, P. BABU, K. ANGERS, B.D. PESTER, D.F. MARSHALL, S.A. LANGENECKER, M.G. MCINNIS & K. RYAN. Baseline Intellectual Ability is Protective Against Decline in Neuropsychological Functioning: Support for a Cognitive Reserve Process.**

**Objective:** This study measured change in neuropsychological functioning over 5 years among individuals with Bipolar Illness (BP) and Healthy Controls (HC), as well as the influence of Cognitive Reserve (CR). CR has only recently been applied to psychiatric disorders, and CR factors may be protective against cognitive decline. We hypothesized that no substantial differences would exist between the BP and HC groups in terms of cognitive change over time and that CR factors would influence the rate of cognitive decline.

**Participants and Methods:** Participants included 160 individuals diagnosed with BP and 76 HCs recruited as part of a longitudinal study of BP. Participants underwent a neuropsychological evaluation at the time of their enrollment and again 5 years later. Differences between baseline scores and year 5 scores were calculated to determine an index of overall change. Follow up analyses were completed to determine the impact of CR factors on change over time.

**Results:** Results of ANOVA revealed no differences in change scores between the BP and HC groups, with the exception of a visual memory score, which revealed an improved performance for BP, but not HC ( $p = .003$ ). "Decliners" were identified as individuals with change scores at least 1 standard deviation below the HC mean - 83% of the decliners were from the BP group. Among the BP "decliners," lower baseline intellectual ability was associated with greater likelihood of decline over 5 years ( $p = .028$ ; Decliners IQ  $M = 108$ , Non-decliners IQ  $M = 113$ ). Decline was not associated with age, education, psychotic symptoms, rapid cycling symptoms, age of onset, or suicidal ideation.

**Conclusions:** The BP group did not demonstrate accelerated cognitive decline over 5 years compared to the HC group and our results do support the theory of CR in BP. Although the trajectory of cognitive change over time is similar between BP and HC, lower baseline intellectual ability may be a risk factor for increased cognitive decline over time.

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#### **L.B. KEATS & D. SITZER. The Relevance of Online and Offline Theory of Mind (ToM) Processes in Predicting Social Skill Capacity among Inpatients with Schizophrenia-Spectrum Disorders.**

**Objective:** Individuals with schizophrenia show significant limitations in social functioning. Theory of Mind (ToM), defined as the ability to attribute mental states to oneself and others, has strong associations with one's ability to function optimally in his or her social environment. In real-time social interaction, it has been suggested that the ability to quickly and automatically attribute mental states (i.e., online ToM) may be more important than the ability to consciously reason about mental state information "offline" (i.e., explicit ToM). The current study aimed to examine the relationship between online and offline ToM processes and social capacity. Online ToM was hypothesized to have a stronger association with social capacity than offline ToM.

**Participants and Methods:** Thirty-eight inpatients diagnosed with schizophrenia or schizoaffective disorder were recruited. Online and explicit ToM were assessed by the Frith-Happé Animations and by false belief stories, respectively. Social capacity was measured by performance on the Social Skills Performance Assessment (SSPA). A correlational design was employed to assess the strength of relationships between predictor (ToM) and criterion (social capacity) variables.

**Results:** There was a strong positive relationship between both online ( $r = .58$ ,  $p < .01$ ) and offline ToM ( $r = .53$ ,  $p < .01$ ) and the SSPA. ToM processes accounted for 41% of the variance in social skill capacity. Online ToM uniquely accounted for 23% of the variance and offline ToM uniquely accounted for 16% of the variance in social capacity.

**Conclusions:** These results suggest both online and offline ToM processes have relevance in predicting inpatient's social aptitude. The

ability to quickly and automatically attribute mental states has significance in that remediation may also generalize to offline processes. Future studies may assess the efficacy of targeted remediation of ToM processes on social capacity.

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**B. KOO, L. ZAJAC & R. KILLIANY. Functional coherence along the hippocampal longitudinal axis fingerprints episodic memory problems in Schizophrenics.**

**Objective:** In this study, we assessed functional activation and coherence pattern along the hippocampal long axis to understand whether memory deficits in schizophrenic subjects relies on either discrete functionality or regional integrity among different hippocampal subregions. **Participants and Methods:** Ten patients with schizophrenia and 11 healthy subjects took part in the study. Subjects performed a face-name pair memory task during fMRI. Four hippocampal sub-regions (ROIs) were automatically labeled bilaterally to assess functional coherence (asymmetry index) of the hippocampal long axis in the encoding and recall conditions separately. Whole brain activation pattern was also assessed to provide large-scale information about episodic memory.

**Results:** Schizophrenics showed lowered activation and opposite coherence patterns compared to controls in and between ROI 1 (most anterior) and 3 (intermediate). In whole brain analysis, schizophrenics also showed hypo-activation in lingual gyrus, right BA44/45 and left para-cingulate region while highly overlapped pattern were confirmed in fusiform, BA44/45, superior parietal regions. In recall, schizophrenics revealed slightly lowered activation in bilateral ROI3 and enhanced activation in ROI1. Whole brain activation revealed considerable overlap between schizophrenics and controls.

**Conclusions:** Compared to the large scale activation assessments, synchronization between hippocampal subregions as well as regional switching on their functionality in different functional tasks provide more clear explanation on the difference between groups. Addition to the recent findings on the gradient pattern of the long axis in terms of gene expression and extrinsic connectivity, pinpointing the key sub-regional foci and their functional and anatomical relationships may provide a key to understand and develop better treatments on the disease.

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**K.E. LEWANDOWSKI, J. BAKER, J.M. MCCARTHY, L.A. NORRIS, R. JUELICH & D. ONGUR. Cognitive Variability in Psychosis: Cluster Solution Replication and Association with Resting State Networks.**

**Objective:** Substantial cognitive variability exists across the psychoses, and a clear profile of cognitive strengths and weaknesses has not emerged. Cluster analysis permits data-driven grouping of individuals, in contrast to use of predetermined grouping criteria. Cognitive clusters may reveal stronger associations with biological variables; however, clusters solutions are dependent upon the measures used to generate them. We aimed to: a) replicate a cross-diagnostic cluster analysis using a different cognitive battery in a separate sample and b) examine associations between clusters and resting state networks using fMRI.

**Participants and Methods:** Participants with psychosis (n=105) and healthy controls (n=24) were assessed using the MATRICS Battery, clinical measures, and fMRI resting state connectivity (RSFC) analysis. MATRICS data were analyzed using a K-means cluster approach and canonical discriminant function analysis. RSFC data were acquired using fMRI. Clusters were compared on diagnosis and measures of clinical symptoms, community functioning, and network connectivity.

**Results:** A four-cluster solution provided adequate fit, and – similar to our previous report – yielded a ‘neuropsychologically normal’ cluster,

a globally and significantly impaired cluster, and two clusters of mixed cognitive profiles. Clusters differed on several clinical variables; diagnoses were distributed amongst all clusters, although not evenly. Clusters differed on RSFC measures.

**Conclusions:** This replication in an independent sample using a different but related cognitive battery suggests that these clusters identify meaningful groupings and are not simply a function of the measures used to derive them. Clusters were associated with RSFC in networks associated with relevant cognitive processes. Identification of groups of patients who share similar neurocognitive profiles may help pinpoint relevant clinical and neural abnormalities underlying these traits.

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**A. MAKSIMOVSKIY, A. RIECKMANN, C.B. FORTIER, R. MCGLINCHEY, D.H. SALAT, W.P. MILBERG & M. OSCAR-BERMAN. Synergistic Impact of Drinking and Smoking on White Matter Integrity and Cognitive Function in Young Veterans.**

**Objective:** Pathological alcohol consumption has been linked to cerebral and cognitive deficits. Changes in white matter integrity (WMI; Fortier, 2014) and reaction-time variability (RTV; Jacobson, 1994) are amongst the commonly reported findings. Nicotine exposure has been shown to affect similar domains (Pritchard, 1992; Gons, 2011). Since drinking and smoking are highly comorbid (Kalman, 2005), particularly within the U.S. Veteran population (Gierisch, 2012), we sought to examine the effects of cigarette smoking and alcohol consumption on WMI and cognitive function. We hypothesized that comorbid drinking and smoking would have a larger effect on RTV and anterior WMI than alcohol consumption alone.

**Participants and Methods:** The participants were 208 U.S. Veterans (56 smokers [SM] mean age 29.55) and 152 non-smokers [NS] mean age 32.35) from the longitudinal TRACTS study. We examined measures of lifetime alcohol consumption (SM: mean 1803.48 oz; NS mean: 969.74 oz), diffusion tensor imaging, as well as a simple reaction time task, in which participants were instructed to respond to a cue, allowing us to measure their RTV.

**Results:** Multiple regression analysis demonstrated a significant interaction between lifetime drinking and smoking status on RTV, suggesting that higher amounts of drinking were related to increasing RTV only within SM (Estimate = 10.82,  $p < 0.05$ ). WMI appeared to mediate this relationship, since it decreased as a function of alcohol consumption (anterior corona radiata; Estimate = -6.49,  $p < 0.05$ ) and also was related to increased RTV (Estimate = -168.39,  $p < 0.05$ ). A formal mediation model confirmed a small but significant effect of WMI on drinking and RTV within SM only ( $p < 0.05$ ).

**Conclusions:** Alcohol consumption and smoking synergistically impacted WMI and cognition in a different way than drinking alone. These results warrant further investigation into the nuanced impact of comorbid substance abuse on brain structure and neuropsychological functions.

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**L. MORRA, S.K. SULLIVAN, K.M. WHEARTY & G.P. STRAUSS. The Role of Metabolic Abnormalities in the Generalized Neurocognitive Deficit in Schizophrenia.**

**Objective:** Individuals with schizophrenia have been found to display neurocognitive deficits of a similar magnitude across a wide range of cognitive domains. These deficits typically fall around one standard deviation below the mean for healthy controls, with no clear pattern of cognitive deficits characterizing the majority of individuals with schizophrenia. Such findings have led some to suggest that schizophrenia is characterized by a “generalized” neurocognitive deficit, where a common underlying etiology impacts all cognitive domains. Central nervous

system accounts of the generalized deficit have been proposed; however, there may also be more diffuse “general systems” abnormalities that affect brain function, such as metabolic dysfunction.

**Participants and Methods:** Participants included 30 patients with schizophrenia (n=21) or schizoaffective disorder (n=9) and 33 demographically matched healthy controls. Participants completed various metabolic measurements, including fasting blood glucose, pulse pressure, and abdominal obesity. Neuropsychological measures included a measure of premorbid intellectual functioning and the MATRICS Consensus Cognitive Battery.

**Results:** Results indicated that higher pulse pressure predicted the generalized neurocognitive deficit in schizophrenia, but not healthy controls; however, blood glucose and abdominal obesity did not predict cognitive performance in either group. Further, pulse pressure was negatively correlated with several individual cognitive domains in patients, including attention/vigilance, verbal and visual learning, and an index of global cognition.

**Conclusions:** These findings provide support for the role of metabolic abnormalities in the generalized neurocognitive deficit in schizophrenia, and suggest that treatment of hypertension may be a novel target for remediating cognitive deficits in this population.

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**L. OKRUSZEK, M. JARKIEWICZ, P. SZRUBARZ, K. JEDNORÓG, A. MARCHEWKA, A. WICHNIAK & E. LOJEK. Memory of basic emotions in schizophrenia.**

**Objective:** Recent research has shown that patients with schizophrenia display atypical patterns of performance with reduced top-down control of learning processes and lack of emotion-driven effects while performing directed forgetting task. However, little is known about the impact of specific emotions on learning in schizophrenia. The aim of this study was to analyze the effects of basic emotion on directed forgetting in schizophrenia.

**Participants and Methods:** Fourteen patients (12 male; age: 31+/- 8 years old) diagnosed with schizophrenia according to ICD-10 criteria completed a directed forgetting procedure during which they were asked to either remember or forget visual affective stimuli selected from Nencki Affective Picture System and International Affective Picture System databases. Two hundred forty pictures with content which had been classified as neutral or eliciting one of the negative basic emotions (sadness, fear, disgust) were presented during the encoding phase of the study. After short (10 minutes) delay participants were asked to recognize the previously presented stimuli among 480 (240 old and 240 matched new stimuli).

**Results:** The main effect of instruction ( $F(1,13) = 7.4; p < 0.05$ ) with higher recognition rate for the to-be-remembered (56%) than to-be-forgotten (52%) stimuli was observed. The effects of the picture content ( $F(3, 11) = 12.4; p < 0.001$ ) were also observed - each of the basic emotions was recognized more accurately than neutral stimuli. Additionally, more disgust-eliciting stimuli (62%) were recognized than sadness-eliciting stimuli (52%). No two-way interactions were observed.

**Conclusions:** We observed that emotional learning may be modulated by emotion type in schizophrenia. Results of this study are in line with previous reports showing enhanced encoding for disgust related stimuli in healthy participants. Thus, effects of basic emotions on emotion-cognition interaction in schizophrenia should be examined in further studies.

**E.A. OLSON, R. FUKUNAGA, C.A. WEBB, I.M. ROSSO, W.D. KILLGORE & S.L. RAUCH. Delay Discounting and Anhedonia are Independently Associated with Suicidal Ideation in Depression.**

**Objective:** Identifying factors related to suicidal ideation (SI) in major depressive disorder (MDD) is a critical need. Recently, alterations in

reward-processing systems have been identified as a possible risk factor. Delay discounting (DD) combines aspects of reward valuation with future-oriented thinking. DD rates are elevated in SI, consistent with preferential valuation of immediate rather than long-term consequences. However, the extent to which elevation of DD rates in SI might be attributable to reduced reward sensitivity (anhedonia) versus other processes involved in DD has not been explored. We examined anhedonia, DD, and demographic variables to identify independent predictors of SI in MDD.

**Participants and Methods:** 31 MDD participants and 25 healthy controls (HC) age 18-45 were included in the analysis and completed a computerized DD task along with measures of anhedonia (SHAPS) and distress (K10). Current SI was coded as present (n = 13) or absent (n = 18) based on responses to items on the SCID, PHQ-9, and MASQ. Probit regression was used to classify SI group based on demographic factors (age, sex), psychological factors (anhedonia, distress), and DD.

**Results:** As expected, MDD participants had greater distress and anhedonia. Compared to the HC group, the MDD group also showed elevated rates of DD,  $t(54) = -2.236, p = 0.029$ . Within the MDD group, the omnibus test of the probit regression was significant, Chi-Square (5) = 19.093,  $p = 0.002$ . Increased anhedonia (Wald Chi-Square (1) = 4.037,  $p = 0.045$ ) and elevated DD rates (Wald Chi-Square (1) = 4.228,  $p = 0.040$ ) were both associated with SI.

**Conclusions:** DD and anhedonia are independently associated with SI in adults with MDD, after controlling for age, sex, and distress. These results suggest that decreased reward valuation does not completely account for the relationship between DD and SI; this may be related instead to other cognitive processes involved in DD such as impulsivity and/or time perception.

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**T. OVERLY, D. DELVALLE, W. COSSAIRT, B. WESTEMEIER & K. KEE. Neurocognitive Correlates of Schizotypal Personality Traits in University Students.**

**Objective:** Schizotypal Personality Disorder (SPD) is considered to be an attenuated form of schizophrenia. Studies have demonstrated that SPD is characterized by impairments in neurocognitive processes, social interaction, and behavioral flexibility/imagination. However, the relationships between these impairments and SPD in non-clinical samples remain unclear. The current ongoing study examined a comprehensive profile of neurocognitive processes (i.e., attentional blink, impulsivity, self-control, inhibition, emotional memory, and emotional creativity) to determine the correlates of schizotypal personality traits in 51 university students.

**Participants and Methods:** Participants' schizotypal personality traits were assessed using the Schizotypal Personality Questionnaire (SPQ-B). Neurocognitive processes were measured using the Attentional Blink Test, Barratt Impulsivity Scale, Tangney Self-Control Scale, Stop-It Inhibition Test, Immediate Serial Recall Task for emotional memory, and Emotional Creativity Inventory.

**Results:** A series of Pearson's product-moment correlations revealed multiple significant associations between schizotypal tendencies with the neurocognitive functions of motor impulsivity ( $r = 0.29, p = 0.019, R\text{-squared} = 0.085$ ), attentional impulsivity ( $r = 0.27, p = 0.029, R\text{-squared} = 0.071$ ), non-planning impulsivity ( $r = 0.24, p = 0.049, R\text{-squared} = 0.055$ ), self-control ( $r = 0.54, p = 0.0001, R\text{-squared} = 0.288$ ), and the novelty component of emotional creativity ( $r = 0.25, p = 0.04, R\text{-squared} = 0.062$ ). Specifically, higher scores on the SPQ-B were linked to more quick shifts in participants' attention and a greater tendency to act in an instantaneous and unplanned way. Also, higher SPQ-B scores were related to more self-control and willingness to explore novel emotions.

**Conclusions:** These preliminary findings could provide new insights of the potential roles of specific aspects of neurocognitive processes in predicting schizophrenia risk factors in healthy individuals.

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**S.A. PARIKH, J. WILSON, L.M. SILVA, J. DIGANGI, M. FEIGON, E. BERMAN & N. PLISKIN. ROC Analysis of the Trauma Symptom Inventory in Assessing PTSD in Patients with Electrical Injury.**

**Objective:** Electrical injuries (EI) are associated with a variety of long-term psychological sequelae such as anxiety, depression, and PTSD (Chaudasama et al., 2010; Piotrowski et al., 2013; & Singerman, Gomez, and Fish, 2008). It is important for health practitioners to distinguish PTSD from other sequelae in order to deliver appropriate patient centered care. This study evaluated whether the Trauma Symptom Inventory (TSI; Briere, 1995) had adequate classification accuracy for a diagnosis of Post-Traumatic Stress Disorder (PTSD) in a sample of EI patients. Previous research found that both the Anxious Avoidance (AA) and Defensive Avoidance (DA) scales had the largest effect sizes in identifying PTSD in trauma exposed community residents (McDevitt-Murphy et al, 2005). The hypothesis was that select scales on the TSI would accurately predict a diagnosis of PTSD.

**Participants and Methods:** A diagnosis of PTSD was assigned based on DSM-IV criteria, diagnostic interview and assessment conducted by a board certified psychiatrist. Based on this criteria, participants were placed into a PTSD ( $n = 19$ ) or non-PTSD group ( $n = 12$ ) and were administered the TSI along with additional tests of neuropsychological functioning. There were no differences between groups on years of education or age. The average age and education of participants was 40 and 12.6 years, respectively. 87% of participants were Caucasian while 6.5% were Hispanic. 12.94% of the sample was female and 87% were male. **Results:** A logistic regression analysis was used to calculate the combined variable consisting of two TSI scales (AA and DA). Receiver operating characteristic (ROC) analysis indicated that the TSI had good classification accuracy, with Area Under the Curve (AUC) = .76. Using an optimal cutoff score of .68, sensitivity was 57% when specificity was set at 91%.

**Conclusions:** The results suggested that the combined TSI variable might have some utility in aiding diagnostic procedures for patients who have experienced EI.

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**J. PAULSON, K. SAMUELSON, T. NEYLAN, L. CHAO, M. WEINER & A. O'DONOVAN. Verbal Memory and Inflammation in Veterans with PTSD, Past PTSD, and No PTSD.**

**Objective:** Posttraumatic stress disorder (PTSD) has been associated with verbal memory impairments, but it is unclear if memory impairments persist once PTSD symptoms improve. We hypothesized that veterans with current PTSD would show poorer verbal memory performance compared to veterans with past PTSD and controls, and that veterans with past PTSD would perform similarly to controls. Further, we hypothesized that there would be differences in Interleukin-6 (IL-6) and soluble receptor II of Tumor Necrosis Factor (sTNF-RII) between groups, and that inflammatory markers would be related to PTSD severity.

**Participants and Methods:** In a sample of Gulf War veterans with current PTSD ( $n = 45$ ), past PTSD ( $n = 40$ ), and controls with no history of PTSD ( $n = 156$ ), we evaluated immediate memory and delayed memory using the California Verbal Learning Test (CVLT), Wechsler Memory Scales II Logical memory subtest, IL-6 and sTNF-RII.

**Results:** There were no significant differences on verbal immediate memory between groups on either the CVLT or Logical Memory. In contrast, on measures of delayed memory, veterans with current PTSD retained less information on both CVLT,  $F(2, 222) = 3.30, p = .039$ , and Logical Memory,  $F(2, 230) = 3.63, p = .028$ , whereas veterans with past

PTSD performed similarly to controls. Participants with current PTSD did not have higher IL-6 or sTNF-RII mean levels than participants without PTSD or with past PTSD. However, there was a significant negative relationship between PTSD severity and IL-6 ( $r = -.263; p = .029$ ). Further, higher sTNF-RII was related to poorer verbal learning on the CVLT and immediate and delayed memory on the Logical Memory subtest in participants with current PTSD only; IL-6 was not associated with memory performance in any group.

**Conclusions:** Overall, these results suggest verbal memory deficits remit when PTSD symptoms remit, and that there is altered inflammatory activity in participants with higher PTSD symptom severity.

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**J.R. PERAZA, J.R. SADEK, M.S. GOODKIND, D.T. CASTILLO & K.Y. HAALAND. Does Neurocognitive Ability Predict Treatment Success for PTSD?**

**Objective:** It is well known that posttraumatic stress disorder (PTSD) is associated with neurocognitive weaknesses. Two types of psychotherapy [cognitive processing therapy (CPT), prolonged exposure (PE)] have been shown to improve PTSD symptoms, but it is not known if neurocognitive weaknesses influence outcome. Only one study examined this issue finding that better pre-treatment verbal learning was associated with greater improvement in PTSD symptoms after cognitive behavior therapy. The purpose of the current study was to (1) replicate this finding, (2) determine if other neurocognitive functions influenced therapeutic efficacy, and (3) determine if the relationship between pre-treatment neurocognitive functions and therapeutic efficacy were different for CPT, PE, and skills training. We predicted executive functions, which have been associated with maintenance of PTSD (e.g., difficulty inhibiting maladaptive responses to trauma stimuli) and verbal learning would be associated with treatment success for CPT and PE.

**Participants and Methods:** Fifty-one female veterans with PTSD (31.4% white, 36.6 mean age) underwent neuropsychological assessment (attention, working memory, inhibition/switching, verbal learning) before group treatment for PTSD (PE, CPT, skills training). Symptoms of PTSD were assessed before and after each treatment modality with the PTSD Symptom Checklist (PCL).

**Results:** Baseline neuropsychological test performance was not significantly correlated with PCL change for any treatment (e.g., inhibition/switching with PE,  $r = .17$ , CPT,  $r = -.02$ ; verbal learning with PE,  $r = -.10$ , CPT,  $r = -.09$ ) despite clinical improvement. It would take sample sizes ranging from 444 to 32,482 to find significant effects for these correlations.

**Conclusions:** There were no significant relationships between pre-treatment neurocognitive functions and symptom outcome. The null hypothesis that neurocognitive abilities are unrelated to treatment change was accepted as power analyses indicated such small effect sizes.

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**J. PETERSEN & K. OSIPOWICZ. Diffuse Cortical Differences in Schizophrenia: A Resting-State fMRI Study.**

**Objective:** In this study we examined whole-brain functional connectivity in patients with schizophrenia compared to normal controls using resting-state functional magnetic resonance imaging (fMRI). Studies demonstrating dysfunctional integration of brain regions suggest schizophrenia might arise from abnormal or reduced connection between brain regions. We hypothesized global functional disconnectivity with higher degrees of disconnectivity in the mesial temporal lobe system, as the hippocampus and surrounding structures have been implicated in the neuropathology of schizophrenia.

**Participants and Methods:** Participants included 71 patients with previous diagnoses of schizophrenia (12 females; age range: 18-64,  $M = 37$ ,

SD=13) and 69 healthy controls (20 females; age range: 18-65, M=36, SD=12). The two groups showed no statistically significant differences on the basis of age, gender, or handedness.

**Results:** Our results provide evidence of global, reduced functional connectivity in schizophrenia. Diffuse cortical differences included marked disconnectivity in the mesial temporal lobe system, particularly in the left hippocampus and bilateral parahippocampus. Increased connectivity was shown in the cerebellum.

**Conclusions:** The understanding of functional connectivity abnormalities in schizophrenia, gleaned through neuroimaging techniques, will aid in the identification of key brain regions that should be further analyzed through neuropsychological assessment. Multidisciplinary cooperation and research in the fields of neuroimaging and neuropsychology will provide insights into understanding and helping of patients with schizophrenia.

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**M.A. PIMONTEL, G.S. ALEXOPOULOS, L. VICTORIA, A.T. STEIN, M.J. HOPTMAN, C. POLLARI & F. GUNNING. Cortical Predictors of Persistence of Apathy in Late-life Depression.**

**Objective:** Apathy often co-occurs with depression in older adults, and is associated with increased disability and persistence of depressive symptoms. Furthermore, apathy is less responsive to SSRI treatment than other symptoms of depression. Apathy can be defined as a "reduction of voluntary, goal-directed behavior". Abnormalities within the salience network (SN) result in a reduced ability to detect and respond to relevant stimuli in a way that allows purposeful, goal-directed action. Abnormalities within the SN may contribute to apathy in older depressed adults. In this study, we predicted that cortical abnormalities within the SN would be associated with persistent apathy following SSRI treatment in older adults. Specifically, we hypothesized that baseline cortical thickness within the insula and dorsal anterior cingulate would predict apathy severity following 12-weeks of escitalopram treatment.

**Participants and Methods:** Our sample consisted of 29 older adults with a primary diagnosis of non-psychotic major depression. Participants were treated with 12 weeks of escitalopram at a target daily dose of 20 mg. Apathy was quantified using the Apathy Evaluation Scale (AES). Depression severity was assessed using the 24-item Hamilton Depression Rating Scale (HDRS). Cortical thickness was obtained using an automated MRI segmentation technique (FreeSurfer).

**Results:** Controlling for age and level of depression, right insular cortical thickness at baseline predicted total apathy scores in depressed older adults following 12 weeks of treatment with escitalopram ( $r(25) = -.44, p = .02$ ).

**Conclusions:** Gray matter abnormalities within the SN are associated with persistence of apathy following SSRI treatment. Interventions that target salience processing may be useful to treat apathy in older depressed adults.

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**M. PINSONNEAULT, S. PARENT, N. CASTELLANOS-RYAN, P. ZELAZO, R. TREMBLAY & J. SÉGUIN. Transactional Relationships Between Vocabulary and Physical Aggression during the Transition to Formal Schooling.**

**Objective:** This study examines the transactional relations between vocabulary and externalizing behaviors (physical aggression, hyperactivity and inattention) during the preschool to primary school transition (42, 60, 72 and 84 months).

**Participants and Methods:** The sample includes 572 children from the Quebec Longitudinal Study of Child Development. Repetitive measures of vocabulary (Peabody Picture Vocabulary Test-Revised) and externalizing behaviors (Social Behavior Questionnaire) were used in the present study and analysed using cross-lagged panel model analyses.

**Results:** Two cross-lagged path coefficients emerged as significant for physical aggression: lower vocabulary scores at 60 mo predicted higher physical aggression scores at 72 mo ( $\beta = -.11, p < .05$ ), and higher physical aggression scores at 72 mo predicted lower vocabulary scores at 84 mo ( $\beta = -.12, p < .01$ ). For non-violent externalizing behavior, only one cross-lagged path emerged as significant: lower vocabulary scores at 60 mo predicted higher hyperactivity ( $\beta = -.09, p < .05$ ) and inattention ( $\beta = -.20, p < .001$ ).

**Conclusions:** Results suggest longitudinal associations during the transition to formal schooling, where poor verbal skills in preschool predict physical aggression, hyperactivity and inattention assessed during kindergarten. The transition to school is a major developmental challenge for children. Children who enter elementary school with poor verbal skills can make these challenges more difficult. Results also suggest a transactional association between cognition and behavior but only for violent externalizing behavior, where vocabulary and physical aggression are sequentially and reciprocally related to each other: poor verbal skills in preschool predict physical aggression in kindergarten, which in turn predicts lower verbal skills in 1st grade. For children who exhibit physical aggression, academic and social participation in the school environment could be hindered in such a way that it limits opportunities for learning new vocabulary.

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**C. SARAPAS, H. LIU, L.N. LIEBERMAN, E.S. STEVENS & S. SHANKMAN. Relationships Between Attention and Anxiety in Low- and High-Stress Contexts.**

**Objective:** Neuropsychological studies have generally not found relationships between anxiety and attention. One hypothesis is that anxiety interferes with attention only under stress, making the relationship difficult to capture in controlled laboratory or clinical settings. We therefore examined whether anxiety was more strongly predictive of attention deficits in threatening than safe contexts.

**Participants and Methods:** Participants were 38 individuals with current panic disorder and 37 healthy controls (70.7% female, mean age = 28.4, SD = 9.2). Participants completed the Attention Network Test (ANT), a computerized task assessing efficiency of attentional alerting, orienting, and executive control. To investigate whether attention is differentially disrupted under stress among anxious individuals, we administered the ANT under both Safe (no shock) and Threat (mild electric shock to wrist at any time) conditions. Participants also completed self-report measures of broad anxiety (Beck Anxiety Inventory [BAI]); panic-related symptoms (Inventory of Depression and Anxiety Symptoms [IDAS] Panic Subscale); and anxiety sensitivity (Anxiety Sensitivity Index – 3rd Edition [ASI-III]).

**Results:** Measures of anxiety and attention during Safe were not correlated. However, attentional alerting during Threat was correlated with panic symptoms,  $r(72) = -.31, p < .01$ ; broad anxiety,  $r(72) = -.23, p = .05$ ; and anxiety sensitivity,  $r(72) = -.30, p = .01$ . Moreover, individuals with panic disorder trended towards poorer alerting than controls during Threat,  $F(1, 72) = 3.13, p < .10$ , but not during Safe.

**Conclusions:** Results suggest that for anxious individuals, efficiency of attentional alerting is disrupted in stressful contexts. This indicates that (1) anxious individuals' attention may be especially poor in settings where it is most needed, and (2) this deficit may not be adequately captured by traditional neuropsychological assessment in controlled environments.

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**S.K. SULLIVAN, K.M. WHEARTY, L. MORRA, K.L. OSSENFORT, K.H. FROST & G.P. STRAUSS. Impaired Effort-Cost Computation in Schizophrenia is Associated with Avolition.**

**Objective:** Motivational symptoms in schizophrenia (SZ) are associated with a range of clinical outcomes and functional ability. Emerging evidence suggests that SZ are less willing to expend high effort for high rewards, and that reduced willingness to expend effort for high rewards is associated with severity of negative symptoms. The current study examined whether effort-cost computation on a progressive ratio task was associated with negative symptoms of SZ.

**Participants and Methods:** Participants included outpatients diagnosed with SZ ( $n = 27$ ) and demographically matched healthy controls ( $n = 32$ ) who completed a progressive ratio task that required incrementally greater amounts of physical effort to obtain monetary reward. Breakpoint, the point at which participants were no longer willing to exert effort for a certain reward value, was examined as an index of effort-cost computation.

**Results:** There were no group differences in breakpoint for low, medium, or high value rewards on the progressive ratio task. However, lower breakpoint scores were associated with greater severity of avolition and anhedonia symptoms in SZ patients.

**Conclusions:** Findings provide further evidence that impaired effort-cost computation is linked to motivational abnormalities in SZ. Future research in this area may help to clarify the role that effort-cost computation plays in the development and maintenance of motivational symptoms in SZ.

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**O. PUIG-NAVARRO, K.R. THOMAS & E.W. TWAMLEY. Predictors of Work Attainment After a Combined Treatment of Compensatory Cognitive Training and Supported Employment in Severe Mental Illness: Preliminary Results.**

**Objective:** To study whether cognition and age group predicted work outcome in the context of a supported employment intervention augmented with a 12-week Compensatory Cognitive Training (SE+CCT) for participants with severe mental illness (SMI). CCT focused on addressing attention, learning, prospective memory, and executive functioning, which are related to work functioning.

**Participants and Methods:** Forty unemployed outpatients with SMI (25 with severe mood disorders, 15 with schizophrenia-spectrum disorder) completed the SE+CCT intervention (mean age=47.2). Age groups included 7 young (20-35), 15 medium-age (36-50) and 18 older patients (51-66). Cognitive functioning was measured at baseline and after CCT. Work outcome was defined as obtaining a job during the 24 month study. Logistic regression analysis were conducted with work outcome as the dependent variable and improvement in cognitive domains (post-pretreatment scores) and age group as potential predictors. Baseline cognition, premorbid intelligence, diagnostic group, clinical symptom severity, and years of education were controlled for as potential confounders.

**Results:** Almost half of the participants got a job (19, 47.5%) during the study. Improvement in attention/vigilance (Continuous Performance Test-Identical Pairs) emerged as a significant predictor of work attainment ( $B=2.35$ ,  $SE=1.16$ ,  $p=0.043$ ). Age group was also a significant predictor, with younger and older participants being more likely to obtain work compared with medium-aged participants ( $B=4.03$ ,  $SE=1.43$ ,  $p=0.005$ ;  $B=2.16$ ,  $SE=0.93$ ,  $p=0.021$  respectively). The results were maintained after controlling for potential confounders.

**Conclusions:** Improved attention and age group were associated with better work outcome after a combined treatment of SE+CCT. Improving attention may be an important target for improving work outcome. Younger and older participants seemed to benefit more from the combined treatment of SE+CCT in terms of work attainment.

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**M.R. TIMPANO SPORTIELLO, C. PARRINI, S. TOCCHINI & D.M. CAMMISULI. Neurocognitive Profile of Patients with Obsessive-compulsive Disorder: Role of Executive Dysfunction.**

**Objective:** To clarify if the cognitive impairment of patients with Obsessive-compulsive disorder (OCD) consists of a combined deficit of memory, visuospatial abilities and executive functioning or if executive dysfunction determines instrumental deficits.

**Participants and Methods:** 30 subjects with OCD (M:F=70:30%, age  $42 \pm 14$ , education  $9 \pm 3$  yrs) were assessed by the Maudsley Obsessive Compulsive Inventory (MOCQ/R), Wechsler Memory Scale-IV (WMS-IV), Apraxia Constructive Test, Block Design, Tower of LondonDX (ToLDX), Brixton Test and Stroop Test. Friedman and Wilcoxon Tests (Bonferroni corrected) were used to compare performances on neuropsychological tests. Pearson's correlations were performed between scores obtained by patients on neuropsychological tests and MOCQ/R Total score.

**Results:** The OCD patients performed more poorly on visual than verbal memory ( $p < .05$ ) of WMS-IV. MOCQ/R scores positively correlated with the following WMS-IV subtests: Logical Memory I ( $r = .72$ ), II ( $r = .58$ ) and Recognition ( $r = .65$ ); Pairs Associates Learning Immediate Recall ( $r = .82$ ), Delayed Recall ( $r = .83$ ) and Recognition ( $r = .73$ ); Designs I ( $r = .57$ ), ( $p < .01$ ). Within executive domain, mental flexibility was more deteriorated than planning ( $p < .05$ ), as showed by comparing scores on Brixton Test and Total Move Score, Total Execution Time and Total Violation Time. ToL Initiation Time negatively correlated with the Doubting subscale of MOCQ/R ( $r = -.58$ ,  $p < .05$ ).

**Conclusions:** The OCD patients show difficulties in encoding and strategical organization of non-verbal memory stimuli rather than in storage. According to the revision of ToLDX, the cited subtests measure planning efficiency and they support cognitive components of mental flexibility. Moreover, OCD patients with high level of doubting do not spend more time to initiate tasks but they impulsively act. The neuropsychological profile of OCD patients is suggestive of a predominant executive dysfunction that affects instrumental abilities by depicting a typical neurocognitive endophenotype.

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**I. TORRES, S. MACKALA, S.S. AHN, C. HIDIROGLU, G. ALAMIAN & L. YATHAM. Metacognitive Monitoring in Bipolar Disorder.**

**Objective:** Patients with bipolar disorder show poor concordance between subjective and objective cognitive functioning, suggesting impaired metacognition. However, this has primarily been studied when patients make subjective ratings of their general cognitive functioning in daily life. The extent to which patients show unawareness of cognitive functioning while engaging in specific cognitive tasks, however, is poorly understood. The present study evaluated metacognitive monitoring accuracy on an item-to-item basis during performance of a specific cognitive task.

**Participants and Methods:** Seventy-six clinically stable patients diagnosed with DSM-IV Bipolar Disorder and 40 demographically similar healthy volunteers were administered a modified version of the 208 item Halstead Category Test. On each trial, subjects were asked to rate their level of confidence on a scale from 0 (just guessing) to 100 (completely confident) that quantified the degree to which they believed that their response was correct. Outcomes included 1) relative accuracy: the relationship between confidence ratings and performance across the task, 2) absolute accuracy: the degree of discrepancy between confidence

ratings and performance, and 3) bias: the degree of over- or under-confidence in ratings.

**Results:** Patients showed poorer overall Category Test performance,  $t(114)=2.3$ ,  $p<.05$ , as well as lower mean confidence ratings ( $t(114)=2.3$ ,  $p<.05$  than controls. However, there was no significant difference in any of the metacognitive monitoring measures between groups (all  $p>.10$ ).

**Conclusions:** Findings suggest that the previously observed poor awareness of cognitive functioning in patients with bipolar disorder may be restricted to self-ratings of general or daily cognitive functioning. In contrast, patients show preserved ability to monitor the accuracy of performance during a specific cognitive task. This preserved metacognitive monitoring may be used to help modify inaccurate self-perceptions of general cognitive ability in patients.

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#### **T.A. TZOURIS & S. ROGERS. The Effect Of Hallucinations on Cognition in Alzheimer's and Parkinson's Disease.**

**Objective:** Significant research has been conducted on the differences in symptomatology between PD and AD; however, less clear are the unique effects of hallucinations on cognition within the two pathologies. This study aims to explore how hallucinations impact cognition in patients with AD and PD.

**Participants and Methods:** 174 older adults (77 women, M age = 74, M education = 14.93 years) participated in neuropsychological assessment as part of outpatient neurology evaluations. Measures completed included the HVLTR, BVMT-R, Trailmaking, BNT, RCFT, and subtests from WAIS-IV, WMS-IV, and DKEFS. Participants also indicated the presence and type of hallucinations in clinical interviews and questionnaires.

**Results:** Hallucinations were reported by 75% of those with PD and 10% of those with AD. Those with AD and hallucinations performed significantly worse than those without hallucinations on Trails A,  $p < .01$ , RCFT Copy,  $p < .03$ , and Trails B,  $p < .04$ . Those with PD and hallucinations performed significantly worse on Trails A,  $p < .01$ , DKEFS Word Reading,  $p < .03$ , HVLTR Total Trials 1-3,  $p < .03$ , BVMT Delayed Recall,  $p < .03$ , WAIS-IV Block Design,  $p < .03$ , Trails B,  $p < .03$ , and RCFT Copy, 3", and 30",  $ps < .01$ , than those without hallucinations.

**Conclusions:** The cognitive profiles of those with AD and PD appear to vary with the presence of hallucinations. Those with AD who experience hallucinations have significantly greater difficulties in processing speed and select visuospatial and executive skills than those with AD who are not experiencing hallucinations. Among those with PD, significantly greater difficulties in attention, all visuospatial abilities, learning and delayed recall, and select executive skills occur when hallucinations are present. This suggests that neuropsychiatric features should not be seen merely as symptomatology of AD and PD, but also as correlates or factors influencing cognitive profiles.

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#### **T.A. TZOURIS & S. ROGERS. The Effects of Hallucinations and Delusions on the Cognition of Older Adults.**

**Objective:** Neuropsychiatric symptoms impact cognition, but less has been done to examine the relationship between cognition and both hallucinations and delusions. This study explores how the presence and type of hallucination and delusion impacts cognition in older adults.

**Participants and Methods:** 174 older adults (97 men, M age = 74, M education = 14.93 years) participated in neuropsychological assessment as part of outpatient neurology evaluations. Measures completed included the HVLTR, BVMT-R, Trailmaking, BNT, RCFT, and subtests from WAIS-IV, WMS-IV, and DKEFS. Participants also indicated the presence and type of hallucinations and delusion in clinical interviews and questionnaires.

**Results:** Those with hallucinations performed worse than those without on Trails A, DKEFS Color Naming and Word Reading, WAIS-IV Block Design, ROCF Copy, and Trails B, all  $ps < .01$ . Patients with auditory compared to visual hallucinations showed worse WAIS-IV Digit Span and BNT,  $ps < .03$ . Those with delusions performed worse than those without on WAIS-IV Digit Span and Similarities, BNT, and HVLTR Trials 1-3 Total, all  $ps < .04$ . Lower scores on HVLTR Total Trials 1-3 and Delayed Recall, BVMT-R Delayed Recall, WAIS-IV Picture Completion, and RCFT Copy, all  $ps < .03$ , were experienced by those with persecutory relative to other delusions.

**Conclusions:** Older adults with hallucinations and delusions appear to experience unique deficits in cognition. Those with a history of hallucinations have greater difficulties in processing speed and select visuospatial and executive abilities. Those with a history of delusions experience greater difficulties in attention, verbal list learning, confrontation naming, and verbal abstraction. Having auditory compared to visual hallucinations and persecutory compared to other delusions seems to be associated with worse cognitive functioning. The presence and type of hallucination and delusion therefore seem to uniquely relate to cognition in a way that may aid assessment and treatment.

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#### **N.P. VADHAN, C.M. CORCORAN, G. BEDI, J.G. KEILP & M. HANEY. Acute Neurocognitive Effects of Smoked Marijuana in Prodromal Psychosis.**

**Objective:** Marijuana (MJ) use is thought to be psychogenic in individuals who are at-risk for psychosis. The purpose of this novel study was to examine the acute neurocognitive effects of smoked MJ in MJ users at clinical high-risk for psychosis (CHR) and healthy MJ-using controls, under controlled laboratory conditions.

**Participants and Methods:** Five CHR MJ users, as ascertained by formal criteria, and 6 control MJ users participated in this 2-session outpatient study. The groups were similar ( $p>0.05$ ) in demographic characteristics (mean age=23.8; SD=3.3) and MJ use (mean weekly occasions =3.9; SD=1.8); no participant was seeking treatment for MJ abuse. In each session, volunteers completed a battery of measures before and after smoking half of a single MJ cigarette using a standardized procedure. MJ cigarettes were provided by the National Institute on Drug Abuse, and administration order (0.0 or 5.5%  $\Delta 9$ -THC) was randomized and double-blind. Data from computerized tasks measuring selective attention, working memory and subjective effects, as well as heart rate data, were analyzed.

**Results:** Following active MJ (relative to placebo), the CHR group exhibited: 1) increased reaction time on the Stroop Color-Word ( $p<0.05$ ) and "A not B" Logical Reasoning ( $p=0.06$ ) tasks, and 2) self-ratings of psychotic-like states ( $p<0.05$ ); the control group did not ( $p>0.05$ ). Both groups exhibited  $\Delta 9$ -THC – dependent increases ( $p<0.05$ ) in heart rate, and ratings of intoxication ("I feel high"), with the effects more pronounced in the CHR group. All drug effects returned to baseline by the end of each session, and no serious adverse effects of study participation occurred.

**Conclusions:** Consistent with our hypotheses, the CHR marijuana smokers exhibited temporary decreases in cognitive performance and increases in self-rated psychotic states during marijuana intoxication, while control MJ smokers did not. These results may be consistent with a psychogenic role for MJ use in individuals who are already in the prodromal phase of psychosis.

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**N.Y. WANG, K. WACLAWIK, K. GICAS, C. GIESBRECHT, T.A. O'CONNOR, S. MAXEY, H.A. BAITZ, F. VILA-RODRIGUEZ, O. LEONOVA, A. BARR, R. PROCYSHYN, D. LANG, C. SMITH, W. MACEWAN, W. PANENKA, W. HONER & A.E. THORNTON. The Role of Neurocognition, Psychiatric Symptoms, and Substance Use in Predicting Social and Occupational Functioning in a Marginally Housed Sample.**

**Objective:** Neurocognition is an important predictor of social and occupational functioning in several clinical populations, but its influence on “real world” functioning in a marginally housed population with complex multimorbid health issues is unclear. This study investigated the role of neurocognition in predicting functioning, after accounting for substance use, psychiatric symptoms and diagnoses, and viral infections. **Participants and Methods:** Participants were recruited from single-room occupancy hotels (N = 192; age: 23-67; 148 M). Baseline assessments of neurocognitive function, psychiatric disorders, positive and negative symptoms of schizophrenia, and viral infection were conducted, as well as monthly assessments of substance use. Ratings with the Social and Occupational Functioning Assessment Scale were performed at 6 months. Hierarchical regression was used to examine the extent to which baseline neurocognition explained variance in functioning at 6-month follow-up, after accounting for the effects of substance use, psychiatric illness, and viral infections.

**Results:** Better cognitive control (i.e., Stroop Color-Word task;  $\beta = .21$ ;  $p < .01$ ) and less heroin use ( $\beta = -.23$ ,  $p < .01$ ) predicted better functioning, whereas having more positive and negative symptoms and the presence of a schizophrenia or schizoaffective diagnosis predicted poorer functioning ( $R^2 = .13$ ,  $F(3,186) = 4.48$ ;  $p < .01$ ). Importantly, cognitive control explained an additional 3.7% of the variance, after accounting for the other health-related variables ( $F(1,185) = 8.16$ ;  $p < .01$ ).

**Conclusions:** In this multimorbid sample, cognitive control, substance use, and psychiatric factors, but not viral infections, influenced ratings of social and occupational functioning, and are potential targets for intervention to improve the real world function of marginalized populations. Importantly, aspects of executive functioning (i.e., cognitive control) predicted functioning within the context of other health issues. Correspondence: *Nena Y. Wang, Psychology, Simon Fraser University, #210-601 North Road, Coquitlam, BC V3J1P1, Canada. E-mail: nenaw@sfu.ca*

**C.B. WOOLVERTON, N. BREITBORDE & E. GLISKY. Self-imagining Improves Memory in Individuals with First-episode Psychosis.**

**Objective:** A form of self-referential processing called self-imagination provides a significant mnemonic benefit for memory in both individuals with traumatic brain injury and older adults. Previous studies of self-referential processing in individuals with psychosis have found mixed results in this population, often finding no benefit for memory as a result of relating to-be-learned material to the self. The present study investigates the effectiveness of self-imagination, a technique that combines self-reference with imagery, in individuals with first-episode psychosis (FEP) as compared to individuals without psychosis.

**Participants and Methods:** Our current sample of 14 individuals with FEP met DSM-IV criteria for a schizophrenia-spectrum disorder or affective disorder with psychotic features with a first onset of symptoms within the past 5 years. Participants encoded neutral and emotional (negative) sentences under three processing conditions: baseline (counting syllables), semantic elaboration, and self-imagination, followed by a yes/no recognition test.

**Results:** Overall, memory performance was highest in the self-imagination condition for both groups, although there was an interaction between condition and group. Recognition for sentences in the self-imagination condition among individuals with FEP was significantly better than baseline, but not better than semantic elaboration, whereas individuals without psychosis showed better performance in self-imagination relative to the semantic and baseline conditions.

There was also a main effect of emotion, which interacted with group: Although both groups showed better memory for emotional than neutral sentences, the emotion enhancement effect was greater in individuals with FEP than individuals without psychosis.

**Conclusions:** These results demonstrate that individuals with FEP benefit from self-imagination, although to a lesser extent than controls. In addition, they show a substantial emotion enhancement effect, greater than that seen in individuals without psychosis.

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## Paper Session 12. Executive Functions/Frontal 2

**Moderator: Stuart Hall**

**10:45 a.m.–12:15 p.m.**

**P.T. CIRINO, J. MICIAK, Y. AHMED, E.H. GERST & P. TAYLOR. A Structural Framework for Executive Functions in Children.**

**Objective:** Executive functions (EF) are domain general control processes important for managing goal directed behavior. EFs have traditionally been approached in neuropsychology via their relation to the frontal lobes, but similar constructs have also considered from the perspective of cognitive psychology (e.g., working memory), or from developmental or educational perspectives (e.g., self-regulation). There have been older (e.g., Brown, 1987) and newer (e.g., Ylvisaker & Feeney, 2002) attempts to integrate these perspectives. The goal here is to evaluate the structural relations among 8 domains of EF.

**Participants and Methods:** The sample included 846 students in grades 3 to 5, from 19 public schools. The sample was evenly boys and girls, and diverse ethnically (Hispanic, 52%; African American, 29%; White, 18%); most were low income (79% reduced lunch). There were 34 measures selected from 8 domains (working memory, inhibition, shifting, planning, fluency, self-regulated learning, metacognition, and behavioral regulation) reflecting different perspectives on EF. The primary approach was confirmatory factor analysis, with and without a bifactor component.

**Results:** The structure was similar to the proposed framework, with some exceptions. A correlated factor model produced strong latent correlations among several of the factors. The best fitting model was a bifactor model with 6 specific factors (shifting, working memory storage/planning, working memory update/inhibition, fluency, self-regulated learning, metacognition),  $\chi^2(301) = 604$ , RMSEA = .035, SRMR = .063, CFI = .947.

**Conclusions:** These results extend previous work in preschool children (where unitary models predominate), and in adults (where separable factors predominate). Results are conceptually consistent with the unity/diversity model of Miyake and Friedman (2012), though with different patterning of specific factors. The results emphasize the challenge of combining specific measurement with global inferencing, with both theoretical and clinical implications.

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**K.E. JONES, T. KORIAKIN, H. SCHNEIDER, M. MAHONE & L.A. JACOBSON. Preliminary Validation of the BRIEF-2: Examination of Profiles Among ADHD Subtypes.**

**Objective:** The BRIEF-2 introduces changes to the original BRIEF including reduced number of items and reorganized scales and indices. BRIEF-2 indices include Behavior Regulation (BRI), Emotion Regulation (ERI), Cognitive Regulation (CRI) and the Global Executive Composite. The present study investigated patterns among scales and indices of the BRIEF-2 in youth with and without symptoms of ADHD.

**Participants and Methods:** Participants included caregivers of 1,846 youth (65.2% male), ages 5 to 18 years ( $M=10.41$ ,  $SD=3.18$ ), referred for outpatient neuropsychological assessment at a hospital-based clinic, for whom ADHD Rating Scale-IV, Impairment Rating Scale, and BRIEF data were available. Participants were categorized using DSM-5 ADHD criteria, caregiver-report symptom count on the ADHD Rating Scale-IV, and impairment in at least one domain. Four groups were obtained: inattentive (ADHD-I;  $n=504$ ), hyperactive/impulsive (ADHD-HI;  $n=79$ ), combined (ADHD-C;  $n=313$ ), and non-ADHD clinical comparison ( $n=950$ ).

**Results:** Children with higher activity/impulsivity ratings (ADHD-C:  $M=74.12$ ; ADHD-HI:  $M=71.37$ ) were rated as higher than those without (ADHD-I:  $M=60.28$ ; Non-ADHD:  $M=54.66$ ) on the BRI (all  $p<0.001$ ). For the new ERI, children with higher activity/impulsivity ratings (ADHD-C:  $M=70.94$ ; ADHD-HI:  $M=68.35$ ) were rated as showing greater emotional dyscontrol than those without (ADHD-I:  $M=61.85$ ; Non-ADHD:  $M=57.09$ ; all  $p<0.001$ ). Children with higher inattention ratings (ADHD-I:  $M=71.08$ ; ADHD-C:  $M=71.91$ ) showed greater elevation on the CRI than less inattentive children (ADHD-HI:  $M=6.52$ ; non-ADHD:  $M=59.05$ ; all  $p<0.001$ ). A similar pattern was observed across the subscales that comprise the respective indices.

**Conclusions:** Results suggest that reorganization of the indices on the BRIEF-2 may be helpful in distinguishing associated characteristics of DSM-5 ADHD subtypes. Additional work is needed to investigate the degree to which the ERI and BRI are dissociable in clinical populations. Correspondence: *Kelly E. Jones, Ph.D., Department of Neuropsychology, Kennedy Krieger Institute, 1750 E. Fairmount Ave, Dept of Neuropsychology, 3rd Floor, Baltimore, MD 21231. E-mail: joneskel@kennedykrieger.org*

**J. GREENE, M. MESSER, P.K. ISQUITH, G.A. GIOIA, L. KENWORTHY & S. GUY. Profiles of Everyday Executive Function with the BRIEF2.**

**Objective:** We examined profiles of everyday executive function in children with different developmental disorders on the BRIEF2.

**Participants and Methods:** Three separate profile analyses, one for each of the Parent, Teacher and Self-Report Forms, compared BRIEF2 ratings among children diagnosed with ADHD-C ( $n = 218$  parents; 110 teachers; 22 self-report), ADHD-I ( $n = 159$  parents; 113 teachers; 71 self-report), ASD ( $n = 262$  parents; 106 teachers; 22 self-report), LD ( $n = 113$  parents; 100 teachers; 27 self-report), and gender matched typically developing children ( $n = 752$  parents; 429 teachers; 142 self-report) via mixed-model MANOVA with diagnostic group as the between and BRIEF2 scales as the within subjects variables.

**Results:** All main effects and interactions were significant ( $p < .001$ ) for each of the Parent, Teacher, and Self-Report forms. Profiles of scale elevations varied between diagnostic groups. The groups differed in overall level of elevation with ADHD-C and ASD groups rated as having much greater executive difficulties overall. ADHD-C was defined by highest scores on Inhibit across all three raters while the ASD group had the highest scores on the Shift scale, and both had the highest elevations on the Self-Monitor scale relative to other groups. Most groups were similarly elevated on the Working Memory, Plan Organize, and Task-Monitor scales with the exception of the LD group which had more modest elevations. The highest elevation for all clinical groups on the Self-Report Form was on the Task Completion scale.

**Conclusions:** Findings are consistent with the notion that different diagnostic groups may have characteristic profiles of executive function strengths and weaknesses. That these are measurable on the BRIEF2 contributes to the body of evidence for valid interpretation of BRIEF2 scores in children with a wide range of disorders.

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**P.K. ISQUITH, G.A. GIOIA, S. GUY, L. KENWORTHY, J. GREENE & M. MESSER. Development and Validation of Screening Forms for the BRIEF2.**

**Objective:** International growth in educational, medical and research use of the BRIEF led to need for concise clinical screening to identify children at risk for executive deficits. We describe the development and validation of screening forms for the BRIEF2.

**Participants and Methods:** BRIEF2 items were examined in over 5000 normative and clinical cases. Factor analysis and item-total correlations identified small but sensitive item sets reflecting behavior, emotion and cognitive regulation. Reliabilities were examined in standardization samples ( $N=1,400$  Parent /Teacher Versions;  $N=803$  Self Report Version). Test-retest reliabilities were examined in 163 parent, 173 teacher and 190 self-report forms. Validity was evaluated based on item content, internal structure, relations with other measures, prediction of BRIEF2 scores, and clinical sensitivity.

**Results:** Parallel 12-item Parent, Teacher and Self-Report screening forms had good internal consistency (.87-.91), interrater (.40-.80) and test-retest (.79-.87) reliabilities in normative samples. CFA statistics indicated appropriate internal structure. Screening form scores correlated well with externalizing scales of behavior measures (e.g., BASC2) but less so with internalizing scales and very little with IQ measures (e.g., RIAS). BRIEF2 Screening Form scores correlated highly (>.90) with the BRIEF2 Global Executive Composite. Base rates of elevated scores were very low in typically developing children and significantly higher in clinical groups.

**Conclusions:** Evidence supports use of BRIEF2 screening forms for identifying children at risk for executive function difficulties who may need further assessment. The screening forms are not stand-alone comprehensive measures of executive function, but are useful for research and broad educational screening where reduced respondent burden is prioritized and a global estimate of executive function is desired. The full BRIEF2 is recommended for individual clinical or school assessments. Correspondence: *Peter K. Isquith, Ph.D., Department of Psychiatry, Dartmouth Medical School, 221 US Route 5 S Unit 15, Norwich, VT 05055. E-mail: Peter@QPsych.com*

**Symposium 14. Driving is More Than Cognition: Integrating Evidence Across Neuropsychological Populations**

**Chair: Maria T. Schultheis**

**10:45 a.m.–12:15 p.m.**

**M.T. SCHULTHEIS, E. WHIPPLE, A. RAPHAEL, A.C. GRAEFE, K. PATRICK & M.T. SCHULTHEIS. Driving is more than cognition: Integrating evidence across neuropsychological populations.**

**Symposium Description:** Driving an automobile is a complex behavior. Assessment of driving after neurological compromise is a challenging task faced by many clinicians, including neuropsychologists. Despite being a common clinical concern, the neuropsychological driving research has been primarily limited to identifying neurocognitive tests for predicting this everyday function. However, neuropsychology can provide essential information about brain-behavior relationships related to this complex behavior that go well beyond only assessing cognition. This symposium will include findings from studies conducted over the past 8 years, which have focused on driving capacity in neuropsychologically-compromised populations. The symposium integrates findings across various clinical group, including discussion of degree of clinical compromise and additional contributions (e.g., emotional, social, motor) to driving performance. Specifically, the symposium will present 1) how using driving simulation technology across populations can provide new evidence-based metrics to better define the complexity of driving ability, 2) research with veterans with TBI/PTSD that demonstrate the intermittent but relevant impact of anxiety and other psychological

conditions on driving, 3) research with drivers with MS that demonstrate the importance of integrating medical measures to capture both cognitive and physical impairments and to monitor the need for repeated driving assessment, 4) findings from drivers with ADHD that highlight how driving performance may not be directly associated with hallmark cognitive deficits of disorders, and 5) research with novice drivers with autism that demonstrate the importance of early assessment to inform driver training goals for young drivers. The presentation will conclude with a question and answer session to encourage dialogue challenges in contributing to the driving assessment process (e.g., new tools for evidence-based clinical recommendations and informing policy).

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#### **E. WHIPPLE, M.T. SCHULTHEIS & K.M. ROBINSON. The relationship between anxiety and driving performance in combat veterans with PTSD and TBI.**

The emotional and cognitive sequelae of both traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD) appear to contribute to combat veterans' increased risk of motor vehicle accidents, yet research defining how these factors concurrently impact driving has been limited. This presentation will include examination of this relationship at two levels: self-report data and objective measurement of driving performance on a virtual reality simulator. The first phase of this study examined combat veterans' driving behaviors, emotions, and anxiety levels using a novel self-report measure developed specifically for this population. Results suggest that veterans with TBI and PTSD report higher levels of anxiety in specific roadside environments than healthy combat veterans,  $t(31) = 3.45$ ,  $p = .01$ ,  $d = 1.24$ . The second phase of this study includes measures of emotional, physical, and neuropsychological function, followed by simulated driving tasks that include complex situations and combat-salient auditory stimuli. Skin conductance, heart rate, and subjective ratings of anxiety serve as distress variables. We will present case studies illustrating the relationship between external stimuli, physiological and subjective arousal levels, and changes in driving performance. Implications for rehabilitation efforts aimed at reducing risky driving in this population will be discussed, with a particular focus on the importance of emotional status behind the wheel. Correspondence: *Elizabeth Whipple, MS, 505 S Sartain St, Philadelphia, PA 19147. E-mail: whipple.elizabeth5@gmail.com*

#### **A. RAPHAEL, K.L. VICKERS, J.D. MCKEEVER, C. MORSE & M.T. SCHULTHEIS. The Effect of Symptom Severity on Driving in Multiple Sclerosis: The Interaction Between Cognitive and Physical Impairments in a Functional Task.**

Multiple sclerosis (MS) is a progressive disorder that affects cognitive and physical abilities. Previous research has demonstrated that MS related impairment can negatively impact everyday functioning such as driving, a complex behavior that relies on cognition (i.e., attention, information processing speed) and physical ability (i.e., turning wheel, pushing pedals). This presentation will briefly summarize our previous research examining driving behaviors among individuals with MS. Specifically, we will focus on recent findings utilizing a virtual reality driving simulator (VRDS) to objectively examine driving behaviors and its relationship with cognitive and physical symptoms at varying levels of severity. The results indicate that individuals with MS demonstrated reduced lane management as MS symptoms became more severe when measured with the Multiple Sclerosis Functional Composite (MSFC;  $r = -.45$ ,  $p = .02$ ). By contrast, when MS symptoms were measured with the Expanded Disability Status Scale (EDSS), a commonly used measure of severity, the relationship was not found ( $r = -.16$ ,  $p = .59$ ). The difference in findings may be due to the EDSS's primary focus on physical impairment, whereas the MSFC captures both cognitive and physical impairment. Combined, the data underscore the need for defining the best metrics for measuring functional behaviors, such as driving, and

the benefit of examining functional performance across the spectrum of severity. The benefits of VRDS and value of reassessing driving ability among drivers with MS will be discussed.

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#### **A.C. GRAEFE, K. VICKERS & M.T. SCHULTHEIS. Neurocognitive Mediators of Virtual Reality Driving Behaviors and ADHD Symptomatology in Young Adults.**

Objective: Adults with attention-deficit/hyperactivity disorder (ADHD) have higher rates of motor vehicle accidents, citations, and license revocations when compared to healthy adult drivers, yet few studies have directly examined the impact of this disorder's cognitive hallmarks on negative driving outcomes. The current study systematically explores the relationship between cognitive performance and driving behavior in healthy control (HC) young adults ( $n = 17$ ) and in those diagnosed with ADHD ( $n = 21$ ) using a Virtual Reality Driving Simulator (VRDS). Method: Participants were administered a battery of neuropsychological tests of sustained attention, working memory, mental flexibility, processing speed, risky decision making, and response inhibition, self-reported measures of driving behaviors and history, and a challenging VRDS Risky Driving Task (RDT) requiring them to independently navigate a virtual environment under timed conditions.

Results: During the RDT, participants in the ADHD group showed significantly more variability in lane position, longer time stopped at a stoplight, and faster speed in a curved road segment when compared to the HC group. ADHD participants were also more likely to fail to stop at a stop sign. Multiple parallel mediation analyses showed that ADHD diagnosis indirectly influenced lane variability through sustained attention and working memory.

Conclusions: Though the results suggest that the ADHD group showed poorer driving behavior than the HC group on several VRDS driving measures, neuropsychological functioning mediated the relationship between ADHD symptomatology and driving outcomes in only lane variability. These results suggest that understanding the relationship between ADHD symptomatology and driving performance requires both further understanding of the neuropsychological profile of ADHD and the cognitive demands of different driving environments.

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#### **K. PATRICK, F. AGATE, M.D. MCCURDY, F. HUREWITZ & M.T. SCHULTHEIS. Autism Spectrum Disorders and Driving: Cognitive and Social Impairment May Impact Driver Training.**

Autism spectrum disorder (ASD) is associated with impairments in a variety of skills that are likely to impact driving performance including social functioning, processing speed, attention, and executive functioning. Although individuals with ASD and their parents report more difficulty with driving than typically developing peers (Cox et al., 2012; Daly et al., 2014), driving behaviors of novice drivers with ASD have yet to be objectively measured. This presentation will include findings from virtual reality driving simulator data of 50 novice drivers with ASD (age range: 16-26) compared to typically developing controls matched on age, gender, IQ, and driving history. Participants first completed a baseline rural drive and then drove the same route while engaging in realistic distractor tasks (e.g., adjusting radio, holding conversation). During the baseline, young adults with ASD demonstrated significantly more variability in speed than controls ( $p = .02$ ) and nearly significantly more variability in lane positioning ( $p = .09$ ). While completing distractor tasks, ASD participants demonstrated significantly more variability in speed ( $p = .009$ ) and lane positioning ( $p = .05$ ). For ASD participants, variability in speed increased from 1.68 mph to 1.93 mph and variability in lane positioning increased from 1.94 feet to 2.44 feet. However, variability in speed and lane positioning did not change for controls. For ASD participants, higher social impairment (ADOS) and poorer neurocognitive performance (SDMT, Stroop) were associated with greater

driving difficulties ( $p < .05$ ). Results suggest that basic driving skills may be more difficult for novice drivers with ASD, particularly those with greater ASD severity and neurocognitive impairment. Implications for driving training, including using a gradual, hierarchical approach to driver's education and limiting distractions, will be discussed.

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### Paper Session 13. Acquired Brain Injury (ABI), Child

10:45 a.m.–12:15 p.m.

**J. FABER, E.A. WILDE, X. LI, G. HANTEN, J.V. HUNTER, L. EWING-COBBS, M. AITKEN, M.C. MACLEOD, Z. CHU & H.S. LEVIN. Facial Recognition Memory and Diffusion Tensor Imaging in Children with TBI.**

**Objective:** Memory complaints are common among children with traumatic brain injury (TBI).

**Participants and Methods:** The Good Teacher Test of Non-Verbal Recognition Memory (GTT; Roberson & Hanten, 2003), a test which measures facial recognition memory, was administered to 21 (7F/14M) children aged 10–18 years, who sustained moderate to severe TBI as toddlers and were scanned 5–15 years later. The comparison group was 20 (6F/14M) typically-developing children, matched on gender, age, SES, and ethnicity. We examined group differences in GTT performance and diffusion tensor imaging (DTI)-derived fractional anisotropy (FA) and apparent diffusion coefficient (ADC) of the corpus callosum (CC), frontal white matter (FWM), performat pathways (PP) and inferior frontal occipital fasciculi (IFOF). DTI metrics were correlated with GTT measures, including the number of correct “no” responses, number of correct “yes” responses, and the total number of correct responses.

**Results:** On the GTT, the number of correct responses significantly differed between the TBI and controls groups ( $p=0.019$ ), and the number of correct “yes” ( $p=0.079$ ) and “no” responses ( $p=0.092$ ) marginally differed. The TBI group demonstrated lower FA in the corpus callosum, performat pathways (PP), and left frontal white matter ( $p<0.05$ ), and marginally lower FA in the left IFOF ( $p<0.1$ ). Higher ADC was found in the CC, frontal, and performat pathway white matter ( $p<0.05$ ). In the TBI group, total correct “yes” responses was correlated with CC FA and ADC ( $p=0.05$ ), and correlated with right IFOF ADC ( $p<0.05$ ), such that poorer performance was associated with decreased white matter integrity.

**Conclusions:** Deficits in visual recognition memory may persist for years following injury and may deleteriously impact academic and social functioning. These deficits may be related to injury-induced changes in white matter structure. These changes may be the neural mechanism mediating poor visual recognition memory in TBI.

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**L.L. HOLLOWELL, E.A. WILDE, J. FABER, I. HYSENI, X. LI, G. HANTEN, J.V. HUNTER, L. EWING-COBBS, M. AITKEN, M.C. MACLEOD, Z.D. CHU & H.S. LEVIN. Adaptive Functioning Skills and Diffusion Tensor Imaging in Children with TBI.**

**Objective:** Many children with traumatic brain injury (TBI) experience difficulties with adaptive behavior skills, including expressive and receptive communication skills, activities of daily living, and socialization.

**Participants and Methods:** The Vineland Adaptive Behavior Scales – II (VABS) was administered to 21 (7F/14M) children aged 10–18 years, who sustained moderate to severe TBI as toddlers and were scanned 5–15 years later. The comparison group was 20 (6F/14M) typically-developing children, matched on gender, age, SES, and ethnicity. We examined group differences in VABS performance and diffusion tensor imaging (DTI)-derived fractional anisotropy (FA) and apparent

diffusion coefficient (ADC) of the corpus callosum (CC), frontal white matter (FWM) and inferior frontal occipital fasciculi (IFOF). CC DTI metrics were correlated with Daily Living Skills, FWM measures were correlated with Social Skills and Communication, and IFOF measures were also correlated with the Communication index.

**Results:** Although the Adaptive Behavior Composite did not significantly differ between groups, subscale index scores were lower in the TBI group for Communication ( $p=0.011$ ) and Social Skills domains ( $p=0.035$ ). Lower FA was evident in the CC ( $p=0.010$ ) and left FWM ( $p=0.050$ ), and marginally lower in the left IFOF ( $p=0.063$ ), and higher ADC was found in the CC ( $p=0.0006$ ), left FWM ( $p=0.007$ ) and right FWM ( $p=0.006$ ) in the TBI group. Daily Living Skills was correlated with CC FA ( $p=0.049$ ), Social Skills was correlated with right ( $p=0.007$ ) and left ( $p=0.0006$ ) FWM FA, and Communication was related to right and left FWM FA ( $p=0.011$ ) and right IFOF FA ( $p=0.012$ ). Similar relations were also seen for ADC in these regions' corresponding domains

**Conclusions:** White matter changes resulting from TBI, detected by DTI, may contribute to deficits in adaptive behavior skills later in life. Future studies should examine how imaging-detected changes could predict response to therapeutic strategies targeting adaptive behavior skills in young children.

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**I. HYSENI, E.A. WILDE, L.L. HOLLOWELL, J. FABER, J.V. HUNTER, X. LI, L. EWING-COBBS, M. AITKEN, M.C. MACLEOD, Z.D. CHU, G. HANTEN & H.S. LEVIN. Atypical Tractography in Children Sustaining Traumatic Brain Injury at a Young Age: The Possible Role of Plasticity.**

**Objective:** Plasticity is often implicated in understanding post-traumatic brain injury (TBI) development in young children. However, many analyses utilizing DTI have assumed a linear relation between brain structure and function and do not adequately address this concept.

**Participants and Methods:** Cingulum bundle (CB) and performat pathway (PP) integrity was examined using diffusion tensor imaging (DTI) in 21 (7F/14M) children aged 10–18 years, who sustained moderate to severe TBI as toddlers and were scanned 5–15 years later. The control group was 20 (6F/14M) typically-developing children, matched on gender, age, SES, and ethnicity.

**Results:** Despite decreased fractional anisotropy (FA) and increased mean diffusivity (MD) in the CB and PP in group-level analyses (previously reported), we found striking qualitative differences in the tractography-generated pathways of this group of children injured during a critical period of brain development. Over half of the TBI group exhibited embellished or elaborated CB in relation to the control group, and the number of streamlines in the tract negatively correlated with age at injury, where younger age was significantly associated with greater hypertrophy ( $r=-0.42$  for right,  $r=-0.48$  for left), particularly in late-developing frontal regions of the CB, though streamlines did not relate to performance on the D-KEFS CWIT. We also observed unique tractography patterns for the PP in the TBI group. For this structure, there was no relation to age at injury, but the number of streamlines was significantly related to CVLT-C total score ( $r=0.56$ ), and short ( $r=0.59$ ) and long-delay ( $r=0.54$ ) free recall scores.

**Conclusions:** DTI tractography may provide insight into dynamic post-TBI development. While traditional DTI metrics demonstrate expected relations to performance on cognitive measures in group-based studies, the structures themselves reflect altered growth in some. Whether this plasticity is adaptive or maladaptive, and whether this may be structure specific, warrants further investigation.

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**A.L. WARE, P.A. KULESZ, J.S. ORKISZ, C. ARRINGTON, M. DENNIS & J.M. FLETCHER. Age of initial shunt operation and shunt revisions predict long-term IQ and fine motor dexterity in myelomeningocele.**

**Objective:** Surgical shunt intervention is routinely performed in patients with spina bifida myelomeningocele (SBM) as treatment for hydrocephalus. While deleterious effects of hydrocephalus and resultant shunt treatment on intelligence (IQ) are established in cross-sectional cohorts, limited longitudinal studies have examined lifespan effects of age of initial shunt operation or number of shunt revisions on domains of IQ or fine motor dexterity. The current study utilized a large cohort of children and adults with SBM to determine whether shunt history related to indices of intelligence and fine motor dexterity.

**Participants and Methods:** Participants with shunt treated hydrocephalus were internationally recruited as a part of two larger studies examining neurobehavioral outcomes of SBM at two time points: T1 and T2. Participants completed neuropsychological evaluations that included estimates of full scale (FSIQ), performance (PIQ), verbal (VIQ) IQ and fine motor dexterity. Age of initial shunt operation and number of shunt revisions at each time point were examined in relation to T2 IQ estimates and fine motor dexterity.

**Results:** Age of initial shunt insertion was not significantly associated with number of shunt revisions at T2. Earlier age of initial shunt operation significantly predicted better fine motor dexterity at T2 similarly for children and adults. Greater number of shunt revisions between study time points was significantly associated with higher PIQ at T2.

**Conclusions:** Contrary to expectations, an earlier age of initial shunt operation did not predict greater number of shunt revisions, although it did significantly predict better fine motor dexterity at T2 after shunt revisions were statistically controlled. Greater number of shunt revisions between evaluations was associated with higher PIQ scores at T2 regardless of age of initial shunt operation. These findings may indicate better functional outcomes with consistent and well-managed treatment for hydrocephalus.

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**S. AFSHAR, M. PORTER, B. BARTON & M. STORMON. Time Spent Waiting for Liver Transplantation Predicts Long-Term Cognitive Outcomes in Children with End-Stage Liver Disease.**

**Objective:** Liver transplantation is now standard therapy for children with end-stage liver disease. With survival rates improving in recent years, focus has shifted to long-term outcomes. While it was previously assumed that patient health would recover to pre-morbid status after a successful transplant, recent research suggests that end-stage liver disease during the vulnerable period of brain development may impart irreversible health deficits despite transplantation and medical stabilisation. Furthermore, longer waiting times increase exposure to the neurotoxic effects of liver disease. The aim of the study was to investigate the impact of waiting time on outcomes for children post liver transplantation.

**Participants and Methods:** Forty-three children (21 male) aged 6-16 years were assessed using a comprehensive neuropsychological battery at least one-year post-transplant. Medical factors of interest included days spent on organ waiting list, disease severity, and days spent in PICU. Parent, teacher and child psychosocial questionnaires were collected. Eight children also completed MRI scans.

**Results:** Backward regression analyses reveal that longer waiting times are a key predictor of poorer performance across intellectual and academic abilities: overall intelligence, verbal and perceptual intelligence, working memory, reading, spelling, and mathematics. Participants perform significantly worse compared to the population on measures of attention, working memory, fine motor skills and mathematics, with 40% meeting criteria for a learning disability in mathematics. Questionnaires also suggest significantly poorer psychosocial functioning and quality

of life. MRI scans reveal overt neuropathology in the basal ganglia in children considered stable and functioning normally.

**Conclusions:** This study demonstrates that longer waiting times at transplantation predict poorer long-term cognitive outcomes.

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**C. MORSE, M. COLVIN, J.C. SHERMAN, P. GOLDENBERG & J. SCHMAHMANN. The Cerebellar Cognitive Affective Syndrome: Insights from Joubert Syndrome.**

**Objective:** The role of the cerebellum in the regulation of cognition and emotion is increasingly recognized and has been described as the cerebellar cognitive affective syndrome (CCAS). The current study characterizes the neuropsychological profile associated with Joubert syndrome (JS), a genetic disorder that is associated with atypical development of the cerebellum (hypoplasia of the cerebellar vermis). The disorder results in atypical development of cognitive and motor functions, but a specific neuropsychological profile has not been well defined and provides an opportunity to understand how particular cerebellar networks regulate specific aspects of behavior. The current case presentation describes the patterns of cognitive and psychiatric functioning in three brothers with JS who presented for clinical neuropsychological evaluation.

**Participants and Methods:** Three biological brothers (ages 25, 27, and 32) diagnosed with JS underwent a comprehensive neuropsychological evaluation at Massachusetts General Hospital. Medical records were reviewed, including genetic testing data, brain imaging, medications, and clinical notes. Neuropsychological evaluation included assessment of cognitive, academic, motor, psychiatric, and adaptive functioning.

**Results:** All patients exhibited global developmental delay. Within this context, patients demonstrated a pattern of strengths and weaknesses implicating disruption of pathways involving the cerebellum and frontal-subcortical networks. Specifically, the most remarkable difficulties were in executive functioning, motor control, affective dysregulation, and social skill development. Notably, all patients exhibited similar neuropsychiatric symptoms and it was these symptoms that brought them to medical attention.

**Conclusions:** Findings of the present work are the first to show that the cognitive and psychiatric profiles in JS map onto the diagnostic patterns of CCAS. Additionally, it furthers our understanding of the heterogeneous manifestations of atypical cerebellar development.

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**S.L. NICHOLS, M.C. CHERNOFF, B. KAMMERER, P.A. SIROIS, P.A. GARVIE, S. WOODS, C. YILDIRIM, P.L. WILLIAMS & K.M. MALEE. Associations of Memory and Executive Functioning with Academic and Adaptive Functioning among Youth with Perinatal HIV Exposure and/or Infection.**

**Objective:** Perinatal HIV infection (PHIV) confers risk for neurocognitive impairment, potentially affecting school performance and long-term functional independence. This study examined associations of memory and executive functioning (EF) with academic and adaptive skills for youth with PHIV and perinatally HIV-exposed uninfected (PHEU) youth.

**Participants and Methods:** Participants included youth, ages 9-19 years, from the Pediatric HIV/AIDS Cohort Study Memory Substudy who completed Word Reading (reading) and Numerical Operations (math) subtests of the Wechsler Individual Achievement Test, 2nd Ed., Abbreviated; caregivers completed the Adaptive Behavior Assessment System, 2nd Ed. (ABAS-II). Retrospective (RetM) and prospective (ProM) memory and EF were evaluated in relation to these outcomes using logistic regression models adjusted for sociodemographic characteristics.

**Results:** Participants (N=258, mean age=14.1 years) were 46% male, 77% black, 18% Hispanic. Of PHIV youth (n=173), 45 (26%) had a

CDC Class C (AIDS-defining) diagnosis (PHIV-C). The PHIV-C group had lower adjusted mean reading scores than PHIV-nonC (86.9 vs 93.8,  $p=0.02$ ) and PHEU youth (86.9 vs 93.2,  $p=0.04$ ); mean math scores did not differ by group. ABAS-II mean scores were within age expectations across all groups with no significant group differences. RetM, ProM, EF, and some demographic variables were associated with significantly higher reading and math scores; e.g., each additional point for individual RetM scores was associated with increases of 2-3 points in math and 1-2 points in reading (each  $p<0.001$ ). The ABAS-II Composite was associated with immediate and delayed verbal memory, design recognition, ProM, some EF measures, and caregiver education.

**Conclusions:** Academic and adaptive competencies were associated with specific memory and executive functioning indices and social contextual factors, as expected, and in the case of reading, with HIV status. Identifying areas of risk and contributing factors may inform prevention and intervention efforts.

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### Symposium 15. Resilience to Brain Aging and Alzheimer's Disease: Evidence from Imaging and Biomarker Studies

Chair: **Ozioma C. Okonkwo**

10:45 a.m.–12:15 p.m.

**O.C. OKONKWO, P. VEMURI, A. SOLDAN, D.M. RENTZ, S.A. SCHULTZ, S. BELLEVILLE & O.C. OKONKWO. Resilience to Brain Aging and Alzheimer's Disease: Evidence from Imaging and Biomarker Studies.**

**Symposium Description:** It is now well established that there is considerable interindividual heterogeneity in the propensity for accruing the brain and biomarker alterations associated with normal aging and Alzheimer's disease (AD). Furthermore, the relationship between AD pathology and cognitive function is imperfect. Some individuals continue to exhibit intact cognition despite harboring substantial AD pathophysiology. The concept of resilience has gained traction as a harmonizing framework for describing these phenomena. Even so, some key knowledge gaps persist. For example, there is a need to isolate the finite set of factors that confer such resilience, and the timing of their maximal impact. Similarly, it is unclear whether these factors only influence initial levels of functioning or whether they also modify trajectories. Importantly, it is yet to be determined whether and to what extent resilience can be cultivated via targeted interventions. This symposium brings together an international collective of scientists to address these and related questions. Dr. Prashanthi Vemuri will kick off the session with a discussion of the potential for intellectual enrichment to mitigate the accumulation of AD pathology. Dr. Anja Soldan will describe variations in longitudinal cognitive trajectory as a function of education and reading ability whereas Dr. Dorene Rentz will present data indicating that education and reading ability modify the effects of amyloid and tau pathologies on cognitive function. Ms. Stephanie Schultz will show that aerobic fitness attenuates the impact of AD susceptibility genes on cerebrospinal fluid biomarkers of AD. Dr. Sylvie Belleville will discuss the effects of early- and late-life cognitive stimulation on brain structure and function among persons with subjective cognitive decline. Finally, Dr. Ozioma Okonkwo will lead a discussion focused on the ways these findings inform the national mandate to prevent and effectively treat AD by 2025

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**P. VEMURI, T. LESNICK, S. PRZYBELSKI, M.M. MACHULDA, D. KNOPMAN, V. LOWE, M. MIELKE, R. ROBERTS, J. GUNTER, M.L. SANKJEM, Y. GEDA, W. ROCCA, R.C. PETERSEN & C.R. JACK JR.. Effect of Intellectual Enrichment on AD Biomarker Trajectories.**

**OBJECTIVE:** Intellectual lifestyle enrichment throughout life is increasingly viewed as a protective strategy against cognitive decline in the elderly. In this work we wanted to investigate the effect of age, sex, APOE4 genotype, and intellectual enrichment (Education/occupation, midlife cognitive activity, and midlife physical activity) on Alzheimer's disease biomarker trajectories using longitudinal imaging data (brain A $\beta$ -amyloid load via PIB-PET and neurodegeneration via FDG-PET and Structural-MRI) in a non-demented elderly population.

**PARTICIPANTS AND METHODS:** In the Mayo Clinic Study of Aging (MCSA), we studied 393 non-demented (340 cognitively normal, 53 MCI) participants (70 years and older), who had cognitive and physical activity measures; and at least two visits with imaging biomarkers. We dichotomized subjects into high ( $\geq 14$  years) and low ( $< 14$  years) education levels using the median. For the entire cohort and the two education strata, we built linear mixed models to investigate the effect of the predictors on each of the biomarker outcomes.

**RESULTS:** Age was associated with amyloid and neurodegeneration trajectories, APOE4 status appears to influence only the amyloid and FDG trajectories but not hippocampal volume trajectory. In the high education stratum, high midlife cognitive activity was associated with lower baseline amyloid deposition in APOE4 carriers. APOE4 status was associated with lower FDG uptake in the entire cohort and in subjects with lower education but not the high education cohort.

**CONCLUSIONS:** There were minimal effects of cognitive reserve on AD biomarker trajectories (specifically rates). Lifetime intellectual enrichment (high education, high midlife cognitive activity) is associated with lower baseline amyloid in APOE4 carriers. High education is protective from the APOE4 effect on FDG metabolism.

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**A. SOLDAN, C. PETTIGREW, Q. CAI, M. WANG & M. ALBERT. Relationship between Cognitive Reserve and Longitudinal Change in Cognition in Middle-Aged and Older Adults.**

**Objective.** We examined if baseline level of cognitive reserve (CR) modifies the rate of change in cognition over time among middle-aged and older individuals with normal cognition at baseline.

**Participants and Methods.** This study included 300 individuals from the BIOCARD cohort who were cognitively normal at baseline (M baseline age = 57 years) and have been followed prospectively for up to 19 years (M = 10 years) with annual clinical and cognitive assessments; 70 participants have developed MCI or AD dementia over time.

CR was indexed with a composite score combining education and baseline scores on the National Adult Reading Test and vocabulary. Cognitive performance was measured by a composite based on four tests previously shown to predict progression from normal cognition to mild impairment. Mixed linear regression models were used to test if the trajectories of cognitive performance differed as a function of CR, adjusting for age, gender, and APOE-4 status. Separate analyses were performed for the total sample and the subgroup of individuals who developed cognitive impairment.

**Results.** In the total sample, higher CR was associated with better cognitive performance, but the rate of change in cognition over time did not differ as a function of CR. Likewise, in the subgroup of individuals who progressed to MCI or AD dementia, cognitive trajectories did not differ as a function of CR prior to the onset of clinical symptoms. However, higher CR was associated with a greater decline in cognitive performance after the clinical symptom onset of MCI.

**Conclusions.** These results suggest that higher CR is associated with better cognitive performance, but CR does not modify the rate of change in cognition prior to the onset of clinical symptoms of MCI. The data also suggest that individuals with higher levels of CR show a more rapid

decline in cognition after the emergence of clinical symptoms, consistent with previously published imaging data, and theoretical models of CR. Correspondence: *Anja Soldan, Ph.D., Johns Hopkins School of Medicine, Division of Cognitive Neuroscience, 1620 McElderry Street, Reed Hall 1 West, Room 104A, Baltimore, MD 21205. E-mail: asoldan1@jhmi.edu*

**D.M. RENTZ, R. BETENSKY, E.C. MORMINO, R.E. AMARIGLIO, K.V. PAPP, A. SCHULTZ, R.A. SPERLING & K.A. JOHNSON. Cognitive Resilience in Preclinical Alzheimer's disease: The Association of Tau and Amyloid Burden on Cognitive Performance.**

**Objective:** To determine the independent and reciprocal relationships of amyloid and tau burden on cognition and whether cognitive reserve (CR) modifies this relationship across a sample of cognitively normal elderly (CN), and patients with mild cognitive impairment (MCI) and Alzheimer disease (AD) dementia.

**Participants and Methods:** A total of 126 subjects (CN=111, MCI=17, mild AD=6), (mean age=74.1±7.4; mean education=15.9±3.1) underwent neuropsychological testing (NP) and positron emission tomography examining amyloid beta (A $\beta$ ) deposition using Pittsburgh Compound B (PiB PET) and inferior temporal tau deposition using T807 Tau PET (INF Tau). Education and the AMNART IQ were explored separately as a proxy of CR. Multiple Linear Regression models related NP to T807 Tau deposition in the inferior temporal lobe (IFT Tau) and to PiB PET A $\beta$  in an aggregate of AD cortical regions. In separate models predicting NP we examined both the CR x A $\beta$  interaction and the CR x INF Tau interaction (controlling for age, education, AMNART IQ and clinical status).

**Results:** In separate models, both higher A $\beta$  ( $\beta$ =-1.8,  $p$ <0.002) and INF Tau ( $\beta$ =-4.2,  $p$ <0.0001) predicted lower NP. When A $\beta$  and INF Tau were together in the model, INF Tau remained significant ( $\beta$ =-3.7,  $p$ <0.0001) but A $\beta$  was non-significant ( $\beta$ =-0.5,  $p$ =0.383). CR modified the relationship of A $\beta$  and NP ( $\beta$ =0.1,  $p$ =0.042) as well as INF Tau and NP ( $\beta$ =0.1,  $p$ =0.003).

**Conclusions:** Higher A $\beta$  and INF Tau were both associated with lower NP, however, higher INF Tau had a stronger and more direct association with poorer cognition than A $\beta$  burden. These findings support the hypothetical AD model that A $\beta$  deposition occurs at an earlier stage than INF Tau but that INF Tau deposition is more directly concurrent with cognitive decline. CR modified the association between NP, A $\beta$  and INF Tau burden suggesting that CR may be protective against A $\beta$  and INF Tau-related cognitive impairment.

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**S.A. SCHULTZ, E.A. BOOTS, B.F. DARST, H. ZETTERBERG, K. BLENNOW, C.M. CARLSSON, C.L. GALLAGHER, B.B. BENDLIN, S. ASTHANA, M.A. SAGER, B.P. HERMANN, S. JOHNSON, D. COOK, C.D. ENGELMAN & O.C. OKONKWO. Cardiorespiratory Fitness Modifies the Association between a Polygenic Risk Score and CSF Biomarkers in Preclinical Alzheimer's Disease.**

**OBJECTIVE:** The APOE  $\epsilon$ 4 allele is the strongest genetic risk factor for late-onset Alzheimer's disease (AD). However, recent studies suggest that CLU and ABCA7 which, like APOE, are in the lipid metabolism pathway may also play an important role in AD. Furthermore, exercise is a promising approach for altering AD-related changes. Accordingly, we examined (1) whether a polygenic risk score (PRS), derived from APOE, CLU, and ABCA7, is associated with cerebrospinal fluid (CSF) biomarkers of AD, and (2) whether higher cardiorespiratory fitness (CRF) modifies the association between the PRS and CSF biomarkers. **PARTICIPANTS & METHODS:** Ninety-five enrollees in the Wisconsin Registry for Alzheimer's Prevention were genotyped for APOE, CLU, and ABCA7, from which a PRS was calculated for each participant. They underwent lumbar puncture for collection of CSF. Amyloid- $\beta$ 42 (A $\beta$ 42), A $\beta$ 40, total tau (t-tau), and phosphorylated tau (p-tau) were immunoassayed. A $\beta$ 42/A $\beta$ 40 and tau-to-A $\beta$ 42 ratios were also computed. CRF was estimated using a validated equation incorporating sex,

age, body-mass index, resting heart rate, and self-report PA. Covariate-adjusted regressions tested for associations between the PRS and CSF biomarkers. Where significant, we tested whether these associations were modified by CRF by including PRS\*CRF term in the models.

**RESULTS:** A higher PRS was associated with lower A $\beta$ 42/A $\beta$ 40 ( $p$ <.001), higher t-tau/A $\beta$ 42 ( $p$ <.001), and higher p-tau/A $\beta$ 42 ( $p$ =.001). Furthermore, we observed significant PRS\*CRF interactions for A $\beta$ 42/A $\beta$ 40 ( $p$ =.014), t-tau/A $\beta$ 42 ( $p$ =.002), and p-tau/A $\beta$ 42 ( $p$ =.001). Specifically, the deleterious effect of the PRS on these CSF biomarkers was diminished in those with higher CRF.

**CONCLUSION:** In a late-middle-aged cohort, aerobic fitness attenuates the adverse influence of genetic vulnerability on CSF biomarkers. These findings support the notion that leading a physically-fit lifestyle may be beneficial to those at increased genetic risk for AD.

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**S. BELLEVILLE, B. BOLLER, S. MELLAH & E. OUELLET. Early- and Late-Life Cognitive Stimulation: Effects on Brain Structure and Function and Relation to Reserve Models.**

**OBJECTIVES:** Individuals vary in their resistance to age-related brain changes. One hypothesis is that exposure to favourable lifestyles—here, cognitive stimulation—determines brain differences that contribute to resilience. However, the neurobiological mechanisms by which this occurs remain elusive. Cognitive stimulation can be provided early in life through formal education, or later in life through cognitive training. In this conference, we will assess the brain changes that are produced by memory training and compare these with the brain differences associated with different levels of education.

**PARTICIPANTS:** Community-dwelling older adults with a subjective cognitive complaint and different levels of formal education.

**METHOD:** In study 1, older adults were scanned with a Siemens 3-T MRI to assess corrected brain volume (grey and white matter) and regional cortical thickness, as a function of level of formal education. In study 2, participants were trained with the method of LOCI (6 sessions). Functional activation was measured at three time points: pre-, mid-, and post-training, to assess the effects of training on task-related activation, and whether formal education modulates functional brain responses to cognitive training.

**RESULTS:** Study 1 showed an age by education interaction on grey-matter volume. The age-related effect on grey matter volume was only found in those with lower education. There was no education effect on white matter volume. In study 2, education was found to be related to the pattern of memory-related activation, and it had a major impact on training-related brain activation.

**DISCUSSION:** Education has a significant effect on brain structure and function. Cognitive training was found to increase functional activation, but the effect is stronger and occurs more rapidly in those with higher education. Thus, memory training might potentiate rather than mitigate the effects of brain reserve.

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## SATURDAY AFTERNOON, FEBRUARY 6, 2016

**Poster Session 10. ABI (Adult) and Language/  
Speech**

12:45–2:00 p.m.

**Acquired Brain Injury (TBI/  
Cerebrovascular Injury & Disease - Adult)**

**R.J. ANDREWS, C.E. JACKSON, C.B. FORTIER, W.P. MILBERG & R. MCGLINCHEY. Prediction of Neurobehavioral Symptom Inventory Total Score Using Psychological and TBI Measures.**

**Objective:** Evidence indicates that factors not related to a TBI may affect post-concussive symptom (PCS) reporting. The Neurobehavioral Symptom Inventory (NSI) is a 22-item self-report measure of PCS. The current study aimed to identify the best predictors of total score of the NSI from multiple TBI, psychiatric, and physical health symptoms.

**Participants and Methods:** Participants included 369 Veterans of Operations Enduring Freedom (OEF), Iraqi Freedom (OIF), and New Dawn (OND) enrolled in the VA RR&D TRACTS longitudinal research study. Structured clinical interviews assessed TBI (Boston Assessment of TBI-Lifetime; BAT-L), and psychiatric conditions (Clinician-Administered PTSD Scale; CAPS). Self-report questionnaires assessed functioning (Depression Anxiety Stress Scales; DASS and McGill Pain Questionnaire). Linear regression models predicting NSI total score were created to determine which measures were most predictive of NSI total score. Three linear regression models were evaluated: 1) TBI factors, 2) non-TBI factors, and 3) a combined TBI and non-TBI model.

**Results:** TBI factors alone significantly predicted NSI total score ( $p < .001$ ), but only accounted for 8.6% of the variance in NSI total score. Non-TBI factors accounted for 79.7% of the variance ( $p < .001$ ). The combined TBI and non-TBI factor model accounted for 80.6% of the variance ( $p < .001$ ). In the final combined model, current CAPS score, DASS (Anxiety, Depression, Stress subscales), and McGill Pain current total score, as well as the number of blast-related TBIs were significant predictors of NSI total score.

**Conclusions:** These results exemplify the robust impact of non-TBI factors, particularly PTSD, anxiety, depression, stress, and pain, on post-concussive reporting. Findings underscore the need to evaluate and consider the possible effects of these non-TBI factors on post-concussive reporting, particularly given the health implications and possible secondary gain if an individual is identified as experiencing lasting symptoms related to a TBI.

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**B. ASKEN, M. MCCREA, J.R. CLUGSTON, A.R. SNYDER, Z. HOUCK & R.M. BAUER. "Playing Through It": Delayed Reporting and Removal from Athletic Activity Following Concussion Predicts Prolonged Recovery.**

**Objective:** Preclinical research has suggested a window of vulnerability for exacerbated injury when activity is resumed or continued in the immediate aftermath of concussion. The extent to which these findings translate to humans is unknown. This study examined the impact on recovery time of delayed reporting/removal from athletic activity after concussion.

**Participants and Methods:** We employed a cross-sectional design using retrospective injury records from college athletes. Ninety-seven (97) athletes who sustained a sport-related concussion between 2008 and 2015 were analyzed (age=20.4±1.3 years). Two groups were formed: athletes who reported concussion symptoms immediately (I-RFA) vs. those who did not (D-RFA). The number of days between the concussion event and clearance for return to participation was recorded. Group

differences in incidence of Prolonged (8 or more days) versus Normal (7 or fewer days) recovery were also analyzed.

**Results:** Fifty (51.5%) of the 97 athletes did not immediately report concussion symptoms and remained active in the immediate aftermath. D-RFA athletes averaged 4.9 more Days Missed than I-RFA athletes. RFA group significantly predicted Days Missed even after controlling for gender, concussion history, LD/ADHD diagnosis, psychiatric diagnosis, and acute symptom severity ( $R^2$  change=.097,  $\beta$ =.319,  $p$ =.002). D-RFA athletes were approximately 2.2 times more likely to have a prolonged recovery than were I-RFA athletes ( $\chi^2$ =10.268,  $p$ =.001,  $\phi$ =.325, medium effect size).

**Conclusions:** Athletes who did not immediately report concussion had prolonged recovery compared to athletes who immediately reported symptoms and were removed from activity, as predicted by preclinical models of acute post-injury vulnerability. Continuing to participate in athletic activity during the immediate post-concussion period potentially exposes the already injured brain to additional neuronal stress that can compound injury neuropathophysiology and prolong recovery.

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**I. BABAKHANYAN, W.R. COLE, P. SARGENT, B. IVINS, K. SCHWAB & J.M. BAILIE. Construct Validity and Factor Structures of the Automated Neuropsychological Assessment Metrics.**

**Objective:** The Automated Neuropsychological Assessment Metrics version 4 (ANAM4) is a computerized neurocognitive test used by the Department of Defense as a pre-deployment screening tool to establish baseline performance and screen for cognitive changes following head injury. The purpose of this study is to explore the construct validity and identify underlying factor structures of the battery.

**Participants and Methods:** ANAM4 cognitive module consists of 7 measures (basic speed 1 & 2=SRT & SR2, memory=CDS, delayed memory=CDD, processing speed=PRO, working memory=MTH, visuospatial memory=MSP). Each measure provides 2 distinct scores, reaction time (RT) and accuracy. Participants were service members (SM) at Fort Bragg. Non-TBI group consisted of 1206 SM with no history of TBI; mean age of 28.6 years (SD=6.9). TBI group consisted of 150 SM with acute TBI; mean age of 25.5 years (SD=6.2). Groups were comparable in level of education, years of active duty service, and history of deployment outside of the US.

**Results:** RT was significantly slower for the TBI group for all ANAM4 measures ( $p$ 's  $< .0001$ ). Large effect sizes were observed for CDS ( $d$ =.80), PRO ( $d$ =.96), MSP ( $d$ =.89), CDD ( $d$ =.85), and SR2 ( $d$ =1.15). Accuracy scores were significantly different for 4 of the 7 scales (PRO, MTH, MSP, SR2), with small effect sizes ( $d$ <.26). RT was able to differentiate between TBI and non-TBI better than Accuracy; therefore the 7 RT variables were entered into exploratory factor analysis (EFA). EFA resulted in a 2-factor solution accounting for 99% of the total variance. Factor 1 included RT for speeded tasks and Factor 2 included RT for memory related tasks.

**Conclusions:** This study extended evidence for the construct validity of the ANAM4 by demonstrating that RT measures are particularly sensitive to TBI. Factor analysis indicates that seven RT measures can be summarized extremely well by two factors (Speeded Tasks and Memory Tasks). This factor structure should be validated in confirmatory analyses.

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### V. BALASUBRAMANIAN. Lexical and Syntactic Processing in Left and Right Brain Damaged Adults.

**Objective:** This study verifies the prediction that damage to anterior or posterior areas of the left hemisphere (ALH, PLH) or damage to the right hemisphere (RH) will not result in significant differences among these groups in auditory comprehension of sentences with lexical, or deep structure ambiguities (LA & DSA). Comprehension of such sentences depends on, besides the cognitive resources, the activation of lexical meanings, and logical, underlying structures, respectively. Bilateral processing of lexical ambiguity and complex sentence structures were reported in earlier literature (Klepousniotou, Gracco, & Pike, 2014; Just et al, 1996; Chiarello et al, 2001).

**Participants and Methods:** Eight normal controls (NO), seven right hemisphere damaged (RH), eleven anterior left hemisphere damaged (ALH) and eight posterior left hemisphere damaged patients served as subjects in this study. A set of 20 ambiguous sentences, 10 in each type was pooled from previous studies. A set of four pictures was drawn for each sentence (two of them truly represented the two meanings of the target sentence, one shared some aspects of the meaning and the other was quite unrelated to the target sentence. On hearing each stimulus sentence the subject was to point to the two pictures from among the four that represented the two meanings of the sentence. Each correct response (pointing to two appropriate pictures for each sentence) was given one point.

**Results:** Multiple comparison tests (Games-Howell) at the  $\alpha = 0.05$  level of significance indicates that on test DSA the normal scores were significantly higher than those of the other groups, but the other three groups were not significantly different from each other. On the LA test, however, the NO scores were not significantly different from the RH, PLH, and ALH scores.

**Conclusions:** Processing sentences with DSA requires bilateral hemispheric participation, a finding that confirms previous studies. Lexical ambiguity task was apparently not challenging to the brain damaged groups.

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### S.J. BANKS, J.B. MILLER & C. BERNICK. Admitted Anabolic-Androgenic Steroid Use in Professional Fighters: Relationship with Hippocampal Volume and Cognition.

**Objective:** Anabolic-androgenic steroid (AAS) use occurs in competitive sports, but there is very little published research on the impact of these drugs on brain and cognition in humans. Animal studies suggest a specific impact of AAS use on hippocampal activity and function. Here we report on differences in hippocampal volume between admitted steroid users and deniers in a large cohort of professional boxers and mixed martial arts fighters.

**Participants and Methods:** 30 fighters who admitted to AAS use, and 430 fighters who denied use, were compared. There were more MMA fighters compared to boxers in the steroid admitter group. Thus, we analyzed both the whole group together, and boxers and MMA fighters separately. We used t tests to compare mean volumes of the hippocampus and thalamus, and scores on four cognitive scores.

**Results:** There were no differences in mean age (mean age: AAS admitters = 27.85, deniers = 28.25), education, or experience fighting. No differences were evident between groups on cognitive scores. However, there were significant differences in the left thalamus ( $p = .045$ ), left hippocampus ( $p = .007$ ), and right hippocampus ( $p = .005$ ), and a trend level difference in the left amygdala. In all cases, steroid admitters had larger structures on average.

**Conclusions:** A small percentage of our fighter population admitted to AAS use. Given the stigma and legalities involved, it is likely that some of those who denied had, in fact, used AAS. Despite this likely impure sample, we found significant differences in brain structure volume

between the two groups. Potential explanations and ramifications for these findings will be discussed.

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### C. BEAULIEU, F. CARRIER-TOUTANT, A. TURCOTTE-GIROUX, A. BOMBARDIER & L. DE BEAUMONT. BDNF Val66Met polymorphism effects on neuropsychological function in concussed athletes.

**Objective:** Studies on the long-term effects of sport concussion on neuropsychological function have yielded mixed results. The brain-derived neurotrophic factor (BDNF) is implicated in cortical reorganization after brain injury. The Val66Met polymorphism of the BDNF gene considerably reduces BDNF levels and has been shown to negatively impact cognitive function in at-risk populations. The BDNF Val66Met polymorphism could therefore negatively affect cognitive function recovery after a concussion. The present study aims to explore the fate of the BDNF Val66Met polymorphism on neuropsychological tests function in asymptomatic concussed athletes who sustained their last concussion more than 3 months prior to testing.

**Participants and Methods:** 117 athletes (60 men, mean age = 20.68;  $SD = 2.03$ ) from Canadian university varsity teams took part in this study. The protocol included a comprehensive neuropsychological tests battery in addition to collecting a saliva sample for genetic profiling. Participants were divided into 4 groups based on their history of concussion (concussed / unconcussed) and BDNF polymorphism (Val66Val / Val66Met and Met66Met). Concussed athletes were asymptomatic at the time of testing.

**Results:** 2 X 2 mixed ANOVA revealed significant group (concussed / unconcussed) by BDNF polymorphism (Val66Val / Val66Met and Met66Met) interactions on 4 distinct neuropsychological tests measures, namely the Symbol Digit Modalities Test ( $F(3, 113) = 5.33$ ;  $p = .23$ ), the Trail Making Test, part 1 ( $F(3, 113) = 4.76$ ;  $p = .031$ ) and part 5 ( $F(3, 112) = 4.75$ ;  $p = 0.31$ ) and the categorical verbal fluency ( $F(3, 113) = 6.95$ ;  $p = .01$ ). Main effects of BDNF polymorphism or Group did not reach statistical significance.

**Conclusions:** Overall, while concussion sustained more than 3 months prior to testing did not change neuropsychological function in BDNF Val66Val carriers, the BDNF Val66Met polymorphism detrimentally interacted with concussion history to induce pervasive performance alterations on frontally-mediated neuropsychological function.

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### L. BENNETT & D. LECHUGA. The Impact of Primary Playing Position and Athletic Exposure on Performance Across Cognitive Domains in Disability-Seeking Retired NFL Players.

**Objective:** Each year, between 1.75 and 3.5 million sports-related concussions occur. Concussion rates among players in the NFL are higher than most other sports, with a rate of 0.41 concussions per game. Moreover, a player receives an estimated 900 to 1500 subconcussive impacts each season. Playing position (PP) has been identified as an important risk factor for sustaining a concussion. Those in certain positions (e.g., linebackers) are at greater risk of incurring both concussive and subconcussive impacts. Athletic exposure (AE), calculated using years of NFL-play and the known risk associated with primary PP (based on positional differences in magnitude and/or frequency of head impacts), approximates a player's exposure to potentially damaging head impacts. Significant discrepancies between various levels of AE and PP were predicted on all neuropsychological outcome variables, with tasks measuring attention, memory, executive functioning, mood impact, and motor coordination representing the most significant inverse correlations between AE/PP and performance.

**Participants and Methods:** 97 retired NFL players underwent neuropsychological examination as part of a worker's compensation evaluation in the state of California. Means, medians, and ranges for 15 neurocognitive assessment measures were obtained and contrasted using SPSS Statistics software.

**Results:** One-way ANOVAs were used to examine differences between various levels of AE and PP groups on all neuropsychological outcome variables. When F was significant, Tukey post-hoc tests were used to examine differences between PP and AE groups. All outcome variables were examined using GLM regressions to determine whether differences between AE and/or PP groups may be attributable to other demographic factors.

**Conclusions:** Significant AE and PP group differences were found across numerous domains of cognitive functioning including fine motor speed, memory, and aspects of executive functioning. Predicted impacts of AE and PP across all neuropsychological domains were not seen.

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**C.K. BLOCK, A.S. ROSENBLATT, K. O'BRIEN & S. KOTHARI. An Individualized Quantitative Behavioral Assessment (IQBA) Can Detect Consciousness Following Brain Injury Prior to Standardized Assessments.**

**Objective:** To demonstrate how brief individualized assessments can detect consciousness following brain injury earlier than the most widely used standardized assessment.

**Participants and Methods:** The study patient was a 21-year-old Caucasian male with no notable premorbid history who sustained a severe traumatic brain injury and subsequent anoxic injury following cardio-pulmonary arrest 106 days post-injury. Methods included bi-weekly administration of the JFK Coma Recovery Scale-Revised and an Individualized Quantitative Behavioral Assessment (IQBA) to assess command following. The IQBA included 3 conditions: two 30-second trials each of the correct command (X, turn your head to the right), contra-command (X, hold still), and observation-only conditions.

**Results:** The IQBA was administered 22 times over 12 days, with 7 protocols removed secondary to administration errors for a total of 15 valid administrations. Receiver Operating Characteristic (ROC) analyses indicated good discriminability between the correct/contra-command conditions (AUC = 0.74) and correct/observation conditions (AUC = 0.71). Responses between contra-command and observation conditions were not significantly different, and when these conditions were collapsed, a statistically significant relationship emerged between the command condition and frequency of movements,  $X^2(1) = 6.94, p < .03$ . Using the IQBA, the first signs of consciousness were observed 26 days after the patient's admission and only 12 days following IQBA institution. In contrast, the CRS-R was done 14 times starting on the day of admission and the first signs of consciousness noted 26 days after the IQBA (52 days after admission). Prior to the IQBA no qualitative signs of consciousness were noted by providers/family.

**Conclusions:** We were able to demonstrate that a briefer, individualized assessment could be successfully employed for the detection of consciousness following brain injury, and much earlier than the current gold standard assessment, the CRS-R.

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**A. BOUCHARD & W.D. SPAULDING. Estimating Premorbid Intellectual Functioning in TBI Survivors with a Schizophrenia-Spectrum Diagnosis: the Clinical Utility of the Wide Range Achievement Test.**

**Objective:** This study examines the utility of the Wide Range Achievement Test (WRAT) as an indicator of premorbid intellectual functioning

in survivors of traumatic brain injury (TBI) who carry a schizophrenia-spectrum diagnosis. Word reading tests, including the Reading subtest of the WRAT, are commonly used to estimate premorbid intelligence in TBI survivors. However, people with schizophrenia-spectrum disorders commonly exhibit cognitive impairments that interfere with performance on these tests, raising questions about their ability to accurately estimate premorbid intellectual functioning.

**Participants and Methods:** Outpatients diagnosed with a schizophrenia-spectrum disorder (N=68) were administered the Reading subtest of the Wide-Range Achievement Test, Revised 2 (WRAT-R2). History of TBI was determined via chart review. Among this sample, 20 individuals had sustained a TBI without loss of consciousness (LOC), and 8 had sustained a TBI with LOC. The remaining 40 individuals had no known history of TBI. Groups' mean scores were compared using one-way analysis of variance.

**Results:** Groups did not differ on average in terms of mean performance on the Reading subtest of the WRAT-R2,  $F(2,65)=2.42, p$  ns. However, a declining trend was noted commensurate with injury severity, such that mean scores were highest in the group with no TBI history (M=69.13, SD=11.93), lower in the TBI without LOC group (M=63.16, SD=17.45), and lowest in the group with a history of TBI with LOC (M=57.67, SD=24.10).

**Conclusions:** Findings support the use of WRAT-R2 in survivors of mild TBI who carry a schizophrenia-spectrum diagnosis. Although groups did not differ on average in terms of their performance on the WRAT-R2, the general trend was for individuals who sustained a TBI with LOC to score lower on the WRAT-R2. This may reflect a power issue, as there were only 8 individuals in the sample who had a history of TBI with LOC. Future studies should explore the relationship between severity of injury and WRAT-R2 performance in this population.

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**C.N. BRYSON, R.J. CRAMER & A. SCHMIDT. Applying the Interpersonal Theory of Suicide to a Traumatic Brain Injury Sample.**

**Objective:** A history of Traumatic brain Injury (TBI) has been widely reported to be associated with a heightened risk of suicide and suicidal behavior. Little research has examined this relationship within the context of an empirically valid theory of suicide such as the Interpersonal Theory of Suicide (IPTS) (Joiner, 2005). The IPTS proposes suicide as a confluence of acquired capability (AC), thwarted belongingness (TB), and perceived burdensomeness (PB). The current study examined the IPTS in a group of undergraduates endorsing a history of TBI compared to a matched control group. We hypothesized the IPTS would perform similarly within both groups.

**Participants and Methods:** Participants were 84 undergraduates (42 endorsing a history of TBI and 42 controls matched on age, sex, ethnicity, and suicide exposure). Participants completed measures for PB and TB (Interpersonal Needs Questionnaire) and AC (Acquired Capability for Suicide Scale).

**Results:** Multivariate regression indicated the IPTS performed as expected within the entire sample (i.e., AC, TB, and PB all contributed to suicide risk). There were also main effects for depression and TBI in the model. When groups were analyzed separately, control participants demonstrated a similar pattern as in the full sample. However, within the TBI group, AC and TB were no longer significant predictors of suicide risk (i.e., PB and depression accounted for most of the increase in suicide risk within the TBI group).

**Conclusions:** The present findings suggest a history of TBI decreases the influence of AC and TB on suicidality whereas depression and burdensomeness have a unique, heightened influence on suicidality within individuals sustaining a TBI. Results point to a potential exception to empirical support for IPTS as a universal model of suicide risk and underscore the need for researchers and clinicians to address feelings of burdensomeness within the family and social system of TBI survivors.

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#### **A. BUCHHOLZ, E.B. LARSON & D. RIPLEY. Actual and Perceived Performance on Cognitive Tasks as Correlates of Subjective Fatigue in Traumatic Brain Injury.**

**Objective:** Though fatigue is frequently reported in patients with traumatic brain injury (TBI), the mechanisms underlying this relationship remain unclear. To better clarify factors related to reported fatigue in TBI patients, subjective cognitive difficulty and objective performance on cognitive tests is examined, within the context of a larger study of TBI.

**Participants and Methods:** Participants included 11 individuals with TBI who underwent extensive evaluation including cognitive test administration and subjective symptom reporting. Cognitive tasks included two measures of sustained attention, the paced auditory serial addition task (PASAT) and the Conners' Continuous Performance Test (CPT). Performance on the PASAT was measured by change in accuracy across trials. Performance on the CPT was measured by total omissions. Self-report measures included the TBI Quality of Life (TBI QOL) and the Neurobehavioral Functioning Inventory (NFI). An eight-item cognitive fatigue factor, based on face validity of item content, was created from the TBI QOL.

**Results:** We ran correlational analyses examining the associations between both subjective report of difficulty with attention (a subscale of the NFI) and performance on cognitive measures of attention and self-report measures of fatigue. Subjective ratings of attentional difficulty were positively correlated with subjective fatigue, such that greater self-reported attentional difficulty was correlated with increased reported fatigue. Indexes of actual poor performance on attention tasks were negatively correlated with subjective reports of fatigue. Inaccuracy on the PASAT was negatively correlated with subjective fatigue; greater accuracy was associated with increased reported fatigue. CPT omissions were negatively correlated with subjective fatigue; fewer omissions were associated with increased reported fatigue.

**Conclusions:** In sum, subjective fatigue may be positively associated with perceived difficulty and negatively associated with actual difficulty on cognitive tasks.

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#### **M.S. CANNIZZARO, M. BREIDENSTEIN & C. CROVO. Prefrontal Cortical Activity During Discourse Processing: Implications for Cognitive-Communicative Impairments.**

**Objective:** Impaired function of the prefrontal cortex (PFC) is a common occurrence following traumatic brain injury (TBI) and is often implicated in the disruption of cognitive process that directly or indirectly interfere with complex discourse communication (e.g., conversation, description, narrative, etc.). However, there is a paucity of information with regard to the underlying cognitive architecture and processing demands associated with the various forms of discourse. This is, in part, due to methodological constraints of many neuroimaging technologies (e.g., fMRI) that severely limit ecologically typical communication acts such as listening and speaking during scanning. To overcome these limitations, functional near infrared spectroscopy (fNIRS) was used to identify patterns of neural activity related to the comprehension and production of discourse.

**Participants and Methods:** Hemodynamic activity in the prefrontal cortex was monitored during natural discourse communication using continuous wave fNIRS in thirteen neurologically healthy adult participants. Tasks were chosen to reflect clinically useful discourse elicitation procedures for the assessment and treatment of persons with cognitive-communicative (CC) impairments secondary to TBI. Within and

across participant comparisons were made for changes in oxygenated hemoglobin changes across discourse tasks types.

**Results:** Results indicate that the comprehension of well-organized discourse text is minimally demanding on the prefrontal cortex. However, discourse production places a significant burden on the PFC and these processing demands generally reflect the relative complexity of the discourse task. Variability in the extent and location of these processing demands was seen on an individual level using a statistical parametric mapping approach.

**Conclusions:** These findings are discussed in terms of potential clinically relevant implications with regard to the elicitation, assessment and remediation of CC impairments in clinical populations.

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#### **K.S. CHIOU, A. BECKER, H.M. GENOVA & N.D. CHIARAVALLI. Functional Activation During Metacognitive Confidence Judgments After Traumatic Brain Injury.**

**Objective:** Metacognitive retrospective confidence judgments (RCJs) are assessments of performance immediately following completion of a cognitive task. Inaccuracies in RCJs have been observed in adults with traumatic brain injury (TBI), but the neural mechanisms underlying these impairments remain unclear. This study utilized functional magnetic resonance imaging (fMRI) to document patterns of activation associated with making metacognitive RCJs after TBI.

**Participants and Methods:** Adults with TBI ( $GCS \leq 12$ ) and healthy adults (HC) completed a visual recognition (REC) task in a 3T scanner. After each item of the REC task, participants reported a RCJ based on a 4-point scale of confidence. Timing of REC and RCJ trials were extracted to model the hemodynamic response function during these events. fMRI data were preprocessed and analyzed using FSL FEAT software. Cluster based thresholding was applied at the  $p < 0.05$  level. Metacognitive accuracy was assessed by subtracting percent accuracy of REC performance from average RCJ ratings.

**Results:** Compared to the REC trials, adults with TBI showed more activation when making RCJs in the bilateral inferior parietal lobules, bilateral middle temporal gyri, left middle frontal gyrus, right frontal pole, bilateral precuneus (including the cingulate gyrus), and right occipital areas. Adults with TBI showed metacognitive inaccuracies and underestimated their abilities compared to HCs ( $p = 0.03$ ). They also showed less activation than HCs in the bilateral superior frontal gyri, left frontal pole, left paracingulate gyrus, right precuneus, and right superior parietal when making RCJs.

**Conclusions:** The results document a network of frontal, parietal, and precuneus involvement in metacognitive functioning after TBI. However, adults with TBI show less activation than HCs while completing RCJs, which may account for observed metacognitive deficits.

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#### **C. COOK & J. SUHR. Effects of Screening for Postconcussive Syndrome (PCS) on PCS Symptom Self-Report and Neuropsychological Test Performance.**

**Objective:** Many non-neurological factors are related to postconcussive syndrome (PCS) symptom report and neuropsychological test performance in mild Traumatic Brain Injury (MTBI). The use of MTBI screening instruments may also contribute to report of PCS symptoms and neuropsychological performance. We hypothesized that false positive PCS screening feedback would lead to higher PCS symptom report and worse neuropsychological performance in individuals with no history of MTBI.

**Participants and Methods:** Participants were 152 young adults with no history of MTBI who scored between the 25th and 27th percentile on a PCS measure (as determined in a pre-study screening). Participants

were randomly assigned to receive feedback that they had scored 1) higher than average on a PCS screener (false positive feedback), 2) lower than average on a PCS screener, or 3) no PCS screener feedback. They then completed the PCS screener again (items in a new random order) and then completed the Auditory Verbal Learning Test, with the Paced Auditory Serial Addition Test serving as a delay. They were then given a brief medical interview, including questions about prior head injury history.

**Results:** Contrary to expectations, participants receiving false positive feedback did not endorse more PCS symptoms than participants in the other conditions; however, consistent with expectations, they demonstrated poorer verbal learning ( $p = .005$ ) and delayed recall ( $p = .04$ ) than participants in the “low average” feedback condition and reported higher rates of retrospective recall of MTBI ( $p = .01$ ) than participants in the neutral condition.

**Conclusions:** Results suggest that feedback from screening measures can influence individuals’ cognitive performance and retrospective recall of their personal TBI history. Findings have implications for the use of screening measures for PCS in clinical and research settings.

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**E.C. CREW, B. ASKEN, M. SULLAN, J.R. CLUGSTON & R.M. BAUER. Acute Sleep Changes Following Sport-Related Concussion are Associated with Increased Intra-Individual Cognitive Variability on the ImPACT.**

**Objective:** Increased variability in across-domain cognitive performance has been observed following sport-related concussion (SRC). Key factors affecting post-concussion performance variability have not been thoroughly explored. We examined whether one common symptom—changes in sleep following SRC—affects within-domain (WD; a.k.a., inconsistency) and across-domain (AD; a.k.a., dispersion) cognitive performance variability on the ImPACT.

**Participants and Methods:** 30 college athletes (age=20.3±1.3 years) who sustained a SRC between 2007 and 2014 were grouped based on presence ( $n=16$ ) or absence ( $n=14$ ) of reported changes in sleep post-concussion. Baseline and acute post-concussion cognitive functioning (ImPACT) and sleep-related symptoms (Post-Concussion Scale) were assessed. Standard scores were computed for the five composite scores (Verbal Memory, Visual Memory, Visual Motor Speed, Reaction Time, Impulse Control) and for each component of the six ImPACT subtests. We derived indices of baseline/post-concussion WD and AD performance variability and analyzed results using paired t-tests and repeated measures ANCOVAs.

**Results:** For all athletes, AD variability increased significantly following SRC. WD variability increased significantly for Verbal Memory and Visual Motor Speed (all  $ps < .05$ ). After covarying for days since injury and magnitude of change in sleep patterns, athletes who reported sleep changes showed greater changes in AD variability relative to baseline ( $F[1,26]=98.0, p=.023, \eta^2=.182$ ). WD changes did not differ significantly between the two groups.

**Conclusions:** Intra-individual variability may provide unique insight into cognitive functioning post-injury. Athletes who reported acute changes in sleep patterns following SRC had greater AD but not WD cognitive variability relative to athletes with unaffected sleep. Further investigation into how post-injury sleep changes influence neurocognitive recovery from concussion is warranted, as sleep-related interventions could facilitate return to normative functioning.

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**L.D. CROCKER, S.M. JURICK, C. HAYS & A.J. JAK. The Role of Depression and Posttraumatic Stress Disorder Symptoms in Cognitive Functioning in Veterans with a History of Mild Traumatic Brain Injury.**

**Objective:** Accumulating evidence indicates that mental health conditions contribute to cognitive dysfunction observed in individuals with a history of mild traumatic brain injury (mTBI) reporting persistent cognitive complaints. However, it is not known whether this is due to general distress or disorder-specific symptoms. Thus, the present study examined relationships between symptoms of posttraumatic stress disorder (PTSD) and depression and neuropsychological functioning.

**Participants and Methods:** Participants were Veterans with a history of mTBI ( $N=260$ ) seeking outpatient services who completed a clinical neuropsychological evaluation. Correlation and regression analyses were conducted to examine the overlapping and unique contributions of symptoms of depression and PTSD on several domains of cognitive functioning.

**Results:** General distress was negatively correlated with objective measures of executive functioning, verbal learning and memory, and attention. When considering disorder-specific symptoms jointly, symptoms of PTSD were unrelated to cognitive functioning, whereas symptoms of depression were negatively correlated with executive functioning and verbal memory, even when accounting for mTBI-related injury characteristics and other aspects of cognition that contribute to neuropsychological performance (e.g., premorbid intellectual functioning, processing speed). Cognitive complaints were correlated with mental health symptoms but were unrelated to objective cognitive functioning.

**Conclusions:** Both high levels of general distress and depression-specific symptoms (e.g., anhedonia) appear to play a role in objective and subjective cognitive functioning in individuals with a history of mTBI experiencing persistent post-concussive symptoms. Therefore, depression-focused treatment in these individuals will likely lead to improvements in cognitive functioning in conjunction with decreases in mental health symptoms.

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**J. DEDERER, K. NAYLON & E.B. LARSON. Self-reported Fatigue and Cognition in Veterans with History of Concussion and PTSD.**

**Objective:** To identify cognitive correlates of self-reported fatigue in individuals with a history of concussion and PTSD.

**Participants and Methods:** Participants ( $n = 25$ ) previously diagnosed by structured interview with PTSD and history of concussion, underwent neuropsychological assessment and completed a self-report measure of post-concussive symptoms, including fatigue. Measures included: Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Stroop Color-Word Interference Test, Paced Auditory Serial Addition Task (PASAT), Trails A & B, Wechsler Test of Adult Reading (WTAR), and the Rivermead Post-Concussive Symptoms Questionnaire (RPSQ). The construct of fatigue was measured by item 6 on the RPSQ.

**Results:** A multiple regression analysis indicated that performance on neuropsychological measures accounted for 78% of the variance in reported fatigue levels ( $R^2 = .786$ ). Findings indicate that severity of neuropsychological deficits were strongly associated with increased levels of self-reported fatigue ( $F = 4.39, p = .007$ ). Supplemental bivariate correlational analyses showed significant associations with RBANS immediate memory ( $r = -.402, p = .046$ ), RBANS delayed memory ( $r = -.508, p = .01$ ), PASAT ( $r = -.413, p = .04$ ), and Stroop ( $r = -.704, p < .001$ ).

**Conclusions:** Van Zomeren et al. (1984) suggest that in people with TBI, compensation for cognitive impairment depletes resources resulting in fatigue. The present data are consistent with that theory since severity of cognitive impairment was associated with increased fatigue, however psychiatric etiologies should also be considered. Increases in both cognitive deficits and fatigue may be symptomatic of emotional distress associated with PTSD and post-concussion disorder. This is

consistent with previous work by Norrie et al. (2010) which found that, in individuals with concussion, psychological factors of depression and anxiety accounted for 59.6% of variance in fatigue severity 6 months post-injury.

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**A. SPIROU, G. WYLIE & E. DOBRYAKOVA. Investigating the relationship between depression and motivation in TBI.**

**Objective:** Individuals with traumatic brain injury (TBI) usually suffer from neuropsychological symptoms, including depression. Depression has the potential to not only decrease a patient's quality of life within social, functional and occupational realms, but also the positive effects of rehabilitation. Motivational deficits have been shown to be associated with depression, since these constructs rely on the fronto-striatal network. In this study, the levels of depression and motivation were measured in order to see if a relationship exists in TBI.

**Participants and Methods:** Ten individuals with TBI and 10 healthy controls (HC) completed the Behavioral Inhibition & Behavioral Activation (BIS/BAS) scale and the Chicago Multiscale Depression Inventory (CMDI) scale. There were no demographic differences between groups.

**Results:** A between-subjects t-test between the TBI and HC groups showed that for the BIS/BAS scale, there were significant differences on the total output of the BAS ( $p=.016$ ), specifically with the BAS Drive subscale ( $p=.004$ ), which contains items pertaining to the persistent pursuit of desired goals, and a trend towards significance with the BAS Reward Responsiveness subscale ( $.064$ ), which contains items that focus on positive responses to the anticipation/occurrence of reward. The two groups were found to be marginally different for the BIS, or punishment sensitivity scale ( $p=.08$ ). As for the CMDI, significant differences were found in all three sections of the scale: Mood ( $p=.008$ ), Evaluative ( $p=.036$ ), and Vegetative ( $p=.006$ ) scales. A strong negative correlation was found across groups between the two questionnaires.

**Conclusions:** The TBI group reported higher levels of depressive symptoms and lower levels of motivation compared to HC. Identifying these important differences between groups may transform clinical and rehabilitative care for the TBI population.

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**M.J. DOIRON, E. KHOSROSHAHI, K.L. VICKERS, D. SALVUCCI, K.J. MANNING & M.T. SCHULTHEIS. Machine Learning Algorithms and Virtual Reality: Using Technology to Inform Our Understanding of Cognition and Driving in TBI.**

**Objective:** New technologies, such as Virtual Reality Driving Simulators (VRDS) offer vast amounts of data; however, identifying the most meaningful variables from these large datasets can be difficult. Machine-learning algorithms (MLA) can be employed to solve such data reduction problems. The current study uses MLA to define VRDS metrics that can best predict whether a driver has previously experienced a TBI.

**Participants and Methods:** 50 experienced drivers with valid driver's licenses (22 TBI, 28 HC) were recruited as part of a larger study. Participants were administered a standardized VRDS task, which included two simulated driving challenges: construction zone navigation (CZN) and truck following (TF). Throughout the duration of both tasks, the VRDS collected data related to many aspects of different driving behaviors (e.g., speed, lane positioning, and stopping behaviors). A recursive feature elimination support vector machine (an MLA technique) was used to create predictive value rankings for all driving performance variables during the CZN and TF tasks (35 and 39 variables, respectively). Additional MLA analyses were used to inform which combination of CZN and TF variables created the most predictive and parsimonious models for differentiating TBI from HC drivers.

**Results:** MLA techniques indicated the most accurate model for differentiating TBI from HC on CZN was comprised of 6 variables (e.g., number of collisions, speed variability, time in oncoming traffic lane, etc.), and yielded an accuracy of 88%. For TF, the most accurate model was comprised of 5 variables (e.g., max distance from center lane, number of collisions, time in oncoming traffic lane, etc.), and yielded an accuracy of 74%.

**Conclusions:** MLA methods offer a data driven approach for examining novel variables generated by VRDS to differentiate diagnostic groups. Importantly, these driving performance metrics are not currently available through existing clinical measures and further validate the clinical contribution of VRDS.

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**M. EDMUNDSON, P. ARBISI, P. THURAS, M. KRAMER, C. ERBES & M. POLUSNY. Impact of Mild Traumatic Brain Injury on Personality.**

**Objective:** Research on personality changes following mild traumatic brain injury (mTBI) are mixed, with some studies noting personality changes (e.g., Kurtz et al., 1998) and others finding no change (e.g., Rush et al., 2006). As personality disruptions are distressing and interfere with functional outcomes and a significant number of OEF/OIF veterans sustain mTBIs, it is important to examine mTBI-precipitated changes to personality in veteran populations.

**Participants and Methods:** The present study aimed to (1) examine personality, assessed prospectively (before and after mTBI), using a dimensional measure that blends clinical and normal perspectives of personality (MMPI-2-RF PSY-5 scales) and (2) examine changes in personality when accounting for possible moderating variables, such as combat exposure, distress, somatic preoccupation, and compensation-seeking. The sample included 241 Minnesota National Guard soldiers with pre- and post-deployment MMPI and mTBI screening data.

**Results:** Change in PSY-5r scales was significantly predicted by post-deployment distress (NEGE-r, AGGR-r:  $p\leq.01$ ), post-deployment somatic preoccupation (NEGE-r, INTR-r, PSYC-r:  $p<.01$ ), age (INTR-r:  $p<.01$ ), and gender (DISC-r, AGGR-r:  $p<.05$ ). mTBI and involvement in C&P evaluation did not significantly predict personality change ( $p>.05$ ) when accounting for distress and somatic preoccupation.

**Conclusions:** Findings suggest self-reported personality changes relate to distress, somatic preoccupation, and demographics rather than being a direct effect of mTBI.

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**N.D. EVANGELISTA, A.L. CLARK, M.L. WERHANE, S. SORG, D.M. SCHIEHSER, R.T. KIM, M.W. BONDI, K.J. BANGEN & L. DELANO-WOOD. Brain-Derived Neurotrophic Factor (BDNF) Genotype is Related to Executive Function But Not Memory Performance in Veterans with History of Mild Traumatic Brain Injury.**

**Objective:** Brain-derived neurotrophic factor (BDNF) plays a role in neurogenesis and synaptic plasticity of hippocampal and forebrain areas; however, its expression is largely influenced by genotype. Compared with individuals without a BDNF Met allele, research shows Met-allele carriers have decreased BDNF secretion. However, whether BDNF genotype is related to cognitive outcome, and how any association is modified by history of traumatic brain injury (TBI) is unclear. We therefore sought to clarify the relationship between BDNF genotype and cognition in Veterans with and without a history of mild TBI (mTBI).

**Participants and Methods:** 117 Veterans (mTBI=72, Military Controls [MCs]=45) underwent BDNF genotyping and were divided into (1) Met+ (n = 34 mTBI; n = 12 MCs), and (2) Met- (n = 41 mTBI; n = 33 MCs) carriers. Participants completed psychiatric symptom inventories and were administered neuropsychological tests that were reflected

as the following composite scores in analyses: memory (CVLT: Total Learning, and Short and Long Delay Free Recall) and executive function (DKEFS: Verbal Fluency Switching Total Switching, Trails Number-Letter Sequencing; and WCST Perseverative Responses).

**Results:** ANCOVA, controlling for psychiatric symptoms, revealed a significant Group x Genotype interaction for the executive function composite ( $p = .01$ ). Examination of simple main effects revealed TBI+/Met- carriers performed significantly worse than TBI+/Met+ carriers, but no such association was found across genotype in the MC group. No significant interaction was observed for memory performance.

**Conclusions:** Results show Met- carriers may be especially vulnerable to executive dysfunction after neurotrauma. Although this association is counterintuitive from findings in healthy samples, available evidence suggests this association differs in TBI samples. Importantly, our results support this emerging view and future studies are needed to further explore the epigenetic implications of BDNF on cognitive outcome in the context of head injury.

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**S. FATOORECHI, W.D. LOPEZ, J. LARA-RUIZ, H. KAKAVAND, B. MANGASSRIAN, Y. CERVANTES, P.Z. STARK, A. WALKER, B. HONG, D. WONG, A. SOTO, F. MARTINEZ, K.B. BOONE, D.J. HARDY, P. VESPA, D. HOVDA, D. MCARTHUR, T. GLENN, J. FUSTER, D. PLURAD, E. WOO & M.J. WRIGHT. Relationship between Performance Validity and Perceived Workload in Healthy Adults and Adults with Traumatic Brain Injury.**

**Objective:** We conducted the current study to determine how scores on measures of performance validity tests (PVTs) relate to subjective workload in healthy adults and survivors of moderate-to-severe traumatic brain injury (TBI).

**Participants and Methods:** A healthy adult group ( $n = 32$ ) and an adult TBI group (1+ years post-injury;  $n = 31$ ) completed two PVTs, the Dot Counting Test (DCT) and the Rey Fifteen Item Test (ReyFIT) in conjunction with The NASA Task Load Index (NASA-TLX). The NASA-TLX was administered following each PVT.

**Results:** As the groups differed in age, univariate analyses of variance with age as a covariate were utilized to determine group differences. Pearson product-moment correlations were used to evaluate associations. The threshold for significance was set at  $p < .05$ . The groups were similar in education, estimated premorbid intelligence, mood, and sex. The groups evidenced valid test performances and performed similarly on the PVTs. The healthy adult group demonstrated correlations between the DCT E-score and subjective performance demands, while the TBI group showed no associations between the DCT E-score and subjective workload ratings. The healthy adult group indicated negative correlations between the ReyFIT combination score and subjective physical demands, frustration, and overall workload ratings. The TBI group only showed a negative correlation between the ReyFIT combination score and subjective frustration.

**Conclusions:** The current data indicate that healthy adults and adults with TBI perceive PVTs differently. Additionally, these data suggest that studies of perceived workload across PVTs may be beneficial for the detection of malingering in various populations.

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**M.P. FAYTELL, H.J. HANNAY & P. TAYLOR. Using Disability Rating Scale Recovery Curves to Predict Performance on the PASAT After Closed Head Injury.**

**Objective:** To determine whether the rate of recovery of global functioning after closed head injury (CHI) predicts cognitive outcome at six months post-injury. Specifically, the rate of change of Disability Rating Scale (DRS) scores over time was hypothesized to be more predictive

of cognitive performance on the Paced Auditory Serial Addition Test (PASAT) than the intercept. Age and severity of injury were expected to moderate these associations.

**Participants and Methods:** Archival data of DRS scores and six month PASAT scores were analyzed from 91 individuals with complicated mild, moderate and severe CHI. Growth curve analysis was used to fit and compare individual growth curves to DRS scores taken at acute care hospital discharge and at one, three, and six months post-injury. Parameters of the best-fit model were analyzed for their ability to predict cognitive performance at six months post-injury on the PASAT. Age, Glasgow Coma Scale score, and other demographic and severity of injury measures were included in the model to determine whether they moderate the predictive ability of the best-fit model.

**Results:** Changes in DRS scores over six months post-injury were best fit by a quadratic growth curve model with random intercept, linear and curvilinear parameters. Only the intercept (level of DRS score) at one month post-injury significantly predicted six month PASAT scores, with higher intercepts associated with lower cognitive performance. Age significantly modified this relationship, with older participants producing lower PASAT scores.

**Conclusions:** Contrary to expectations, global functioning on the DRS at one month post-injury was more predictive of cognitive outcome on the PASAT at six months post-injury than the rate of recovery. The extent to which this pattern holds for less demanding neuropsychological measures remains to be determined.

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**B. FECHTER, K.A. MUSIELAK & B. ABLITZ. Examining Predictors of Growth in Traumatic Brain Injury Rehabilitation.**

**Objective:** To examine the influence of biopsychosocial factors on changes in cognitive skills, psychological adjustment, and life participation following comprehensive rehabilitation after traumatic brain injury (TBI).

**Participants and Methods:** Participants included 343 adults ages 18-80 with mild to severe TBI who completed a comprehensive rehabilitation program. Ratings at admission and discharge on an adapted version of the Mayo-Portland Adaptability Inventory-4 were used to create change scores, which reflected progress during rehabilitation. Regression analyses were conducted to examine the influence of age, sex, socioeconomic status, level of education, previous psychiatric history, TBI severity, and length of service on overall, cognitive, psychological adjustment, and life participation change scores.

**Results:** Level of education significantly influenced scores reflecting overall change,  $\beta = -.194$ ,  $p < .01$ . Level of education,  $\beta = -.168$ ,  $p < .05$ , and length of stay,  $\beta = .148$ ,  $p < .05$ , significantly influenced scores reflecting change in abilities. TBI severity,  $\beta = .214$ ,  $p < .01$ , significantly influenced scores reflecting change in psychological adjustment. None of the aforementioned variables significantly influenced scores reflecting change in participation.

**Conclusions:** Level of education attained before injury may be one of the more important predictors of overall and cognitive rehabilitation progress post injury, whereas TBI severity may be one of the more important predictors of rehabilitation progress related to psychological adjustment. A better understanding of predictors of growth may be useful for identifying those clients who may be in need of additional services based on pre-injury functioning.

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**A.A. FEDIO, S. EFANOV, J.N. STILLMAN, S. CUMMINGS, V. VILLASEÑOR, K. SHEYS & P. FEDIO. Addressing Anger and Aggression during Recovery from Traumatic Brain Injury.**

**Objective:** Recovery from traumatic brain injury (TBI) typically involves patients' feelings of anger as part of the grieving process and

may involve aggressive behaviors, particularly when the frontal lobes are involved. The present study examined how self-ratings of anger and aggression related to patients' self-concept, quality of life (QOL), and motivation for treatment following TBI.

**Participants and Methods:** Fourteen individuals with moderate-severe TBI (8M/6F, mean age: 36; 4 years post injury) rated their physical, cognitive, and emotional status (Neurobehavioral Functioning Inventory [NFI]). They also completed self-ratings of satisfaction with their recovery, QOL Inventory, Tennessee Self-Concept Scale (TSCS-2), and Motivation for Rehabilitation Questionnaire.

**Results:** NFI, TSCS, and overall QOL placed within the average range, with the exception of individuals' perceived value as a family member, which scored below expectations ( $t(13) = -3.67, p < .005$ ). Patients' lower ratings of aggression related to their endorsement of fewer physical complaints ( $r = .73$ ), greater satisfaction with cognitive/emotional functioning ( $r = .75$ ), enhanced QOL regarding pro-social activities ( $r = .80$ ), feelings of being a good person ( $r = .79$ ) and of interacting well with others ( $r = .87$ ). Ratings of less anger related to patients' positive perception of their behavior ( $r = .70$ ), a willingness to rely on professional help ( $r = .81$ ), and interest in rehabilitative treatment ( $r = .91$ ).

**Conclusions:** Reducing aggression and maladaptive anger should always be goals following TBI, with present findings suggesting benefits of enhanced personal functioning and sense of self-worth. Working with angry thoughts and feelings is a necessary part of treatment, and, in fact, directly relates to patients' motivation for rehabilitation. Treatment of individuals following TBI should explicitly address anger and aggression, with the goals of acknowledging, processing, and accepting losses and adjusting to a renewed sense of self.

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#### **J. FONDA, J. GRADUS, R. MCCLINCHEY, S. BROGLY & L. FREDMAN. Association between Traumatic Brain Injury and Opioid Overdose.**

**Objective:** Pain syndromes are highly prevalent in Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) Veterans due to deployment-related incidences causing musculoskeletal problems and headaches (e.g., blast exposure). Many are prescribed opioids for pain management. This study evaluated the association between traumatic brain injury (TBI) and opioid overdose among OEF/OIF/OND Veterans.

**Participants and Methods:** The sample included 8,868 OEF/OIF/OND Veterans (89% male) receiving care at Veterans Affairs (VA) from 2007 to 2012, aged 18 to 40 at the VA primary TBI screen, and no history of bipolar disorder or schizophrenia. TBI was defined as a confirmed diagnosis according to VA TBI comprehensive evaluation (CTBIE); no TBI was defined as a negative primary TBI screen (i.e. no head injury). Non-fatal, opioid overdose was defined using ICD-9 codes recorded in emergency room visits or inpatient hospitalizations. We used Cox-proportional hazard regression to analyze the contribution of TBI to the rate of opioid overdose, adjusting for demographic characteristics. We conducted mediation analyses to determine the direct and indirect association between TBI and opioid overdose through the psychiatric conditions of post-traumatic stress disorder, depression, anxiety, and substance abuse.

**Results:** There were 79 opioid overdoses recorded: Veterans with TBI were more likely to overdose than those without TBI (1.3% vs. 0.6%, respectively). The adjusted Hazards Ratio (aHR) was 2.00, 95% Confidence Interval (CI) = 1.26, 3.16. This association was attenuated in mediation analyses (aHR = 1.38, 95% CI = 0.94, 2.01). Moreover, 56% of the effect of TBI on opioid overdose was mediated by co-occurring psychiatric conditions.

**Conclusions:** This study suggests that OEF/OIF/OND Veterans with deployment-related TBIs are at increased risk of opioid overdose, and is largely attributable to co-morbid psychiatric conditions. Veterans

with co-morbid TBI and psychiatric conditions are at greater risk than those with TBI alone.

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#### **C. FUNES, S.J. IRELAND, G. AGUILA-PUENTES & I. TOURGEMAN. Population Objective, Population Subjective (POPS): Gender Differences in the Importance of TBI Community ReIntegration Variables.**

**Objective:** This study examined subjective and objective community reintegration variables following Traumatic Brain Injury (TBI) as part of a longitudinal study addressing the efficacy of our rehabilitation program in facilitating community reintegration. This study hypothesized that the importance of reintegration variables differed by gender.

**Participants and Methods:** 35 Male and 14 Female (N = 49) Moderate and Severe TBI participants participated in this study.

The Population Objective, Population Objective (POPS; Brown, 2006) measure was used to collect reintegration data regarding participation in a wide variety of community-based activities following TBI.

The survey was collected at the time of outpatient registration by the Neuropsychology Service at a large urban community hospital.

**Results:** ANOVA analyses were used to compare gender ratings across community-based activities.

Community reintegration variables rated as clinically significant post-injury varied by gender.

A one-way ANOVA was used to assess differences between group means. Community reintegration variables rated as clinically significant post-injury varied by gender.

Female participation in shopping for groceries  $F(47,1) = 7.948, p = .007$ , cooking  $F(47,1) = 17.567, p = .000$ , and cleaning  $F(47, 1) = 31.964, p = .000$  was significantly higher.

Male desire to return to work  $F(45, 1) = 11.285, p = .002$  and importance of work  $F(45,1) = 5.721, p = .21$  was significantly higher.

Women rated private transportation as a significant need  $F(47,1) = 4.737, p = .035$ .

Men rated their desire  $F(47,1) = 6.125, p = .017$  and level of importance  $F(47,1) = 4.971, p = .031$  for public transportation as significant.

Men also reported significantly more engagement in sexual relationships post-injury  $F(45, 1) = 8.596, p = .001$ .

**Conclusions:** Results indicated that community reintegration variables were valued differently by gender.

Interdisciplinary interventions in rehabilitation settings need to be assessed and tailored to meet the differing needs of men and women following TBI.

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#### **C.S. GASS, D. ROGERS & E. KINNE. Psychological Characteristics in Acute Traumatic Brain Injury: An MMPI-2 Study.**

**Objective:** This study used the MMPI-2 to explore detailed psychological features of adults with acute and predominantly mild TBI, including personality, behavioral, emotional, and psychosocial characteristics. Acute TBI has seldom been studied in such detail, despite empirical evidence of the relevance of these factors for psychological adjustment and early therapeutic intervention.

**Participants and Methods:** Participants were 67 persons who were hospitalized as a result of predominantly mild acute traumatic brain injury mostly due to vehicular accidents on the roadway. Participants were screened from amongst consecutive TBI admissions for pre-injury neurological, psychiatric, or substance abuse histories. Ages averaged 36.4 years (SD = 14.7). Their education averaged 12.8 years (SD = 2.4). The racial/ethnic composition was White nonhispanic (66%), Black

nonhispanic (22%), White Hispanic (7%), Other (5%). Most participants had a mild TBI and were tested within three days of admission.

**Results:** The results revealed diverse psychological problem areas, the most common of which were (1) somatic and cognitive complaints, (2) compromised insight and a naively optimistic self-perception, (3) hypomanic activation, and (4) depression. Men were more likely than women to report perceptions of social inadequacy and depression, and antisocial features were associated with lower education. Injury severity was unrelated to psychological variables.

**Conclusions:** In the absence of a premorbid history of psychopathology or substance abuse, acute TBI is commonly associated with mild and relatively benign psychological symptoms, including diminished self-insight, somatic discomfort, cognitive inefficiency, and a disturbance of mood. These results sharply contrast with non-prospective MMPI-2 studies of chronic TBI cases in which the psychopathology is substantially more severe. The mediating influence of demographic variables on psychological status in acute TBI was generally weak, and injury severity was unrelated to psychological status.

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**L.S. GAYNOR, B. ASKEN, J.R. CLUGSTON & R.M. BAUER. Base Rates of Concussion-like Symptoms in Healthy Collegiate Athletes: a Predictive Tool for Post-Concussive Recovery Time.**

**Objective:** Sports concussion research supports the importance of baseline testing in collegiate athletes. Subjective symptom reporting scales reveal variable rates of concussion-related symptoms in this population even at baseline with some athletes appearing to meet concussion symptom criteria for ICD-10 Post-Concussion Syndrome (PCS) prior to injury. In athletes meeting symptom criteria for PCS diagnosis at baseline, we evaluated whether symptom burden was associated with specific medical history variables and whether it predicted a longer post-concussion recovery time when a concussion occurred.

**Participants and Methods:** 542 healthy collegiate athletes (335 male, 207 female, 18.9 ± 0.7 years old) completed either the Post-Concussion Scale or the SCAT3 Symptom Evaluation at baseline, in addition to medical history questionnaires. Baseline concussion symptoms were categorized as somatic, cognitive, psychological/emotional, and insomnia/sleep-related. Subsequently, 113 athletes sustained a concussion and were grouped based on Normal (7 or fewer days) or Prolonged (8 or more days) recovery times.

**Results:** Data were analyzed using descriptive statistics and chi-square analyses. Overall, 16.2% of athletes met PCS criteria at baseline. Females (25.1%) were 2.5 times more likely than males (10%) to meet criteria ( $\chi^2=19.438, p<.001$ ). Reported history of psychiatric disorder, ADHD diagnosis, previous history of concussion and migraine were not associated with PCS symptoms. Athletes who met PCS criteria at baseline were almost twice as likely to have a prolonged post-concussion recovery time ( $\chi^2=4.142, p=.042$ ).

**Conclusions:** (1) A clinically significant number of collegiate athletes meet PCS criteria at baseline. (2) Females are more likely than males to report these symptoms. (3) Previous or concurrent medical conditions were not associated with this reported symptom profile. (4) Presence of concussion-like symptoms at baseline may be a risk factor for prolonged post-concussion recovery.

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**J.M. GULLETT, M. SULLAN, R.M. BAUER & D. FITZGERALD. Increased Delta Wave Sleep Associated with Central Apnea Events in Mild Traumatic Brain Injury.**

**Objective:** Central apnea events during sleep are often observed in populations with moderate and severe traumatic brain injury (TBI), but are not well understood in patients with mild TBI. Increased time spent in

delta, or cognitively restoring sleep, may reflect neuronal compensation for inefficient sleep. The objective of this study was to use a mediational analysis to determine the frequency at which central apneas occur in a mild TBI population, and whether their presence was associated with alterations in sleep staging.

**Participants and Methods:** Nine OEF/OIF veterans with a history of varying degrees of Loss of Consciousness (m: 1.44, sd: 2.06) underwent overnight polysomnography, MR imaging, neuropsychological testing, and interview.

**Results:** The predictor variable (LOC) was significantly related to both the proposed mediator (Central Apneas;  $R=.84, p=.005$ ) and the outcome variable (Percent of Delta Sleep;  $R=.74, p=.023$ ). Additionally, central apneas were significantly related to Percent of Delta Sleep ( $R=.85, p=.003$ ). The overall mediation equation was significant;  $R=.84, F(1, 7) = 16.54, p=.004$ . Central apnea's relationship with Percent of Delta Sleep was trending on significance even while controlling for LOC (Beta = .12;  $t = 2.03, p=.08$ ). Most importantly, the direct relationship between LOC and Percent Delta Sleep was weaker and insignificant (Beta = .21;  $t = 0.193, p=.84$ ) compared to the stronger and significant indirect relationship (Beta = 1.80), suggesting full mediation. Loss of consciousness remained significantly related to central apneas even after controlling for age, body mass index, and obstructive events..

**Conclusions:** Loss of consciousness appears to be associated with increased central apnea events that lead to a significantly increased amount of time spent in delta wave sleep. Thus, TBI patients may experience a higher rate of anoxic and apneic events during sleep, which are compensated for with increased time spent in the restorative stages of sleep.

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**M.G. HALL, S.C. WOLLMAN, L.A. FRAZIER & B.J. SCHROCK. Motor Perseveration Predicts Ideational Perseveration on the Wisconsin Card Sorting Test.**

**Objective:** Perseveration has generally been described as in appropriate continuation of a behavior that may occur in multiple different output modalities, thus potentially resulting in differential error types. Lesions of the basal ganglia, commonly associated with motor perseveration, have been demonstrated to adversely impact executive function. However, it remains to be seen if there is an association between motor perseveration and ideational perseveration. Utilizing a qualitative graphomotor test, this study explored the possible impact of motor perseveration on ideational perseveration, as measured by the Wisconsin Card Sorting Test (WCST).

**Participants and Methods:** This pilot study utilized data from participants that were drawn from a larger adult archival data source comprised of neurologically compromised individuals, referred for neurorehabilitation. After excluding conditions such as Parkinson's disease and multiple cerebral vascular accidents, the final sample included 21 patients with motor perseveration and 30 patients without. An independent samples t-test was conducted to examine the influence of motor perseveration on perseverative errors from the WCST.

**Results:** Groups were similar in gender, lesion acuity, and loci of lesion. Further, groups did not significantly differ on demographic variables, such as age and education. Results indicated that patients with motor perseveration displayed significantly lower perseverative error T-scores on the WCST, when compared to those individuals who did not display motor perseveration ( $t(49) = 2.3, p=.02, r=.31$ ).

**Conclusions:** These results appear to suggest that motor perseveration is significantly associated with higher order cognition. Further, the two perseverative types may share similar underlying neuroanatomical mechanisms. Motor perseveration tasks are not always administered in clinical settings, but may be easily implemented and appear to predict ideational perseveration.



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### **J. HAMMOND & S. HALL. Bicycle Helmet Use Among College-Aged Individuals.**

**Objective:** This study examined bicycle helmet use attitudes and behaviors. Traumatic brain injury is a serious public health problem in the United States, and cycling represents the largest category of sports-related brain injuries. Helmets can significantly lower the risk of brain injury for cyclists. Yet, the incidence of traumatic brain injury as a result of a bicycle-related injury remains high. This study examined the rate of reported helmet use and attitudes towards helmets (the value placed on Pros and Cons of helmet use) of a high-risk age-group.

**Participants and Methods:** A survey of bicycle helmet use behaviors and attitudes was administered to undergraduate students in 2013 and 2015. There were no significant differences in demographics between the groups in terms of gender and age.

**Results:** In 2013, 23.1 percent of respondents indicated that they consistently wear a bike helmet, while 27.5 percent indicated the same in 2015. This was not a statistically significant difference ( $p = .299$ ). In 2013 and 2015, respondents indicated that the most important Pros of helmet use were (1) Helmets decrease head injuries and (2) Helmets protect the rider from cars. Furthermore, participants indicated that the most salient Cons of helmet use were (1) Wearing a helmet is uncomfortable and (2) People tease people who wear helmets.

**Conclusions:** This research demonstrates consistently low base rates of bicycle helmet use in the college-aged population. Current intervention models, without a theory-driven approach, use a mass message to address the complex process of unintentional injury prevention. Instead, it is important to understand individual forces that impact behavior change, such as the weighing of the Pros and Cons of a behavior. This research extends our current understanding of helmet use behaviors and attitudes, and provides insight into brain injury prevention through helmet promotion.

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### **C.E. JACKSON, C.B. FORTIER, L. NORDSTROM, W.P. MILBERG & R. MCGLINCHEY. Post-concussive Symptom Reporting Among OEF/OIF/OND Veterans: Comparison Between Research and Clinical Contexts.**

**Objective:** Non-TBI factors may contribute to post-concussive symptom reporting. In the Veterans Health Administration (VHA), individuals who screen positive for deployment-related TBI are referred for a Comprehensive TBI Evaluation during which they complete the Neurobehavioral Symptom Inventory (NSI), a 22-item self-report measure of post-concussive symptoms (PCS). The current study compared NSI total and subscale scores, as well as an embedded measure of validity, in a sample of 91 participants enrolled in a longitudinal research study and also seen for a clinical Comprehensive TBI Evaluation.

**Participants and Methods:** Participants were Veterans of Operations Enduring Freedom (OEF), Iraqi Freedom (OIF), and New Dawn (OND) who were enrolled in the Translational Research Center for TBI and Stress Disorders (TRACTS) at VA Boston. During participation in TRACTS, Veterans completed the NSI item-level responses, obtained during the Comprehensive TBI Evaluation, were also extracted from Veterans' medical records.

**Results:** Significant differences in NSI total score ( $p < .0001$ ) and all subscale scores (vestibular, somatic/sensory, cognitive, emotional) were identified ( $p$ 's ranged between .001 and  $< .0001$  for all subscales); individuals reported greater symptomatology during their clinical evaluation compared to their research evaluation, even after adjusting for time between visits. More than twice the number of individuals failed an NSI embedded measure of validity (Validity-10; Vanderploeg, 2013)

when it was completed during their clinical evaluation compared to their research evaluation.

**Conclusions:** The current findings suggest that OEF/OIF/OND Veterans may over-report PCS in a clinical versus research context. Given the health and financial implications of diagnosis of TBI among OEF/OIF/OND Veterans, these results raise concern over the use of a self-report inventory as a measure of PCS during the Comprehensive TBI Evaluation due to possible over-reporting of symptomatology based on evaluation context.

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### **J. JONES, T.J. FARRER, S. MERNOFF, M. SPENCER & M. SULLIVAN. White matter integrity and self-reported sleep complaints in OEF/OIF/OND Veterans with deployment-related mild TBI.**

**Objective:** Acute and chronic sleep changes are common in mTBI. The current study included OEF/OIF veterans with ( $n=5$ ) and without ( $n=8$ ) deployment-related mTBI to examine the relationship between self-reported sleep quality and structural integrity of cerebral white matter regions (WM) important for sleep regulation.

**Participants and Methods:** Participants (age 22-35) underwent MRI with DTI and completed self-report measures of post-concussion symptoms, PTSD, depression, and sleep quality. Region-of-interest (ROI) analysis, based on the JHU Atlas, included measurement of fractional anisotropy (FA), mean diffusivity (MD) and radial diffusivity (RD) in regions involved in sleep neurocircuitry, including the right and left posterior thalamic radiations and pontine crossing fibers. Tractography analysis involved brainstem segment of the ascending reticular activating system (ARAS).

**Results:** Veterans with mTBI reported obtaining fewer hours of sleep and reported more symptoms of PTSD and depression. Compared to controls, the mTBI group showed increased FA in the pontine crossing fibers ( $.05 < p < .10$ ), but not the thalamic radiations. Self-reported hours of sleep significantly and negatively correlated with FA in pontine crossing fibers ( $r = -0.71$ ,  $p = .01$ ) for the entire sample and remained significant when controlling for depression ( $p = .02$ ) and marginally significant when controlling for PTSD ( $p = .06$ ). ARAS analysis showed no significant group differences in FA, number of fibers, or mean fiber length.

**Conclusions:** Decreased self-reported sleep duration was counter-intuitively related to increased FA in the pontine crossing fibers. This finding may be related to a small sample size. Alternatively increased FA could represent injury-related decrease in pontine crossing fibers. Investigation of the relationship between WM integrity and sleep duration in a larger sample of veterans is needed.

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### **H. KAKAVAND, J. LARA-RUIZ, W.D. LOPEZ, S. AMAYA, E. ROMERO, D. WONG, B. HONG, Y. CERVANTES, F. MARTINEZ, D. BUDDING, D.J. HARDY, P. VESPA, D. HOVDA, D. MCARTHUR, T. GLENN, J. FUSTER, D. PLURAD, E. WOO & M.J. WRIGHT. Cognitive Components of Verbal Encoding Deficits Following Traumatic Brain Injury.**

**Objective:** Verbal memory dysfunction following traumatic brain injury (TBI) is largely due to encoding deficits and these deficits are related to reduced semantic clustering. Other data has shown that TBI participants have intact, but slowed lexical access. The current study sought to determine if category fluency and/or switching during category fluency contribute to encoding deficits for verbal material following TBI.

**Participants and Methods:** A TBI group ( $n=24$ ) and a healthy comparison group ( $n=29$ ) completed a brief interview and a neuropsychological assessment that included the California Verbal Learning Test-II (CVLT-II), the Category Fluency (CF) and Category Switching (CS)

subtests of the Delis–Kaplan Executive Function System. Encoding, consolidation, and retrieval deficit scores were derived from the CVLT-II via the Item Specific Deficit Approach (ISDA).

**Results:** Independent samples T-tests were used to evaluate group difference and hierarchical and stepwise regressions were used to determine associations. The threshold for significance was set at  $p < .05$ . All participants provided valid performances. The comparison group outperformed the TBI group with regard to common CVLT-II indices. The comparison group also showed better encoding and consolidation than the TBI group. Encoding deficits accounted for 53% of the variance in the delayed recall of the TBI group. Finally, CF accounted for 42% of the variance and CS accounted for 12% of the variance in TBI-related encoding deficits.

**Conclusions:** TBI participants evidenced deficits in verbal encoding and consolidation. Only ISDA encoding deficit scores predicted delayed recall following TBI, accounting for 53% of the variance. The encoding deficits displayed by the participants with TBI were primarily accounted for by CF (42%) and secondarily by CS (12%). The current results suggest that verbal memory encoding deficits following TBI are largely due to slowed lexical access.

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**H. KAKAVAND, W.D. LOPEZ, J. LARA-RUIZ, D. WONG, S. AMAYA, E. ROMERO, S. FATOORECHI, D.J. HARDY, J. FUSTER, D.F. KELLY, C. WANG, R. SWERDLOFF, R. CANTU, K. GUSKIEWICZ, E. WOO & M.J. WRIGHT. Memory Process Deficits for Verbal Material in Retired Professional Football Players.**

**Objective:** Previous work has shown that verbal memory dysfunction is common in retired professional football players with a history of sports-concussion. The current study sought to determine the memory process deficits responsible for verbal memory dysfunction in retired professional football players.

**Participants and Methods:** A group of retired professional football (FB) players (most with 3 or more sports-related concussions;  $n = 23$ ) and a healthy comparison group ( $n = 29$ ) completed a brief interview, questionnaires, and a neuropsychological assessment that included the California Verbal Learning Test-II (CVLT-II). Memory process scores (encoding, consolidation, and retrieval deficit scores) were derived from the CVLT-II via the Item Specific Deficit Approach (ISDA).

**Results:** As the groups slightly differed in age, univariate analyses of variance with age as a covariate were utilized to determine group differences on scores that were not normed. One-way ANOVAs were used to evaluate group difference on normed scores that accounted for age. The threshold for significance was set at  $p < .05$ . All participants provided valid performances. The comparison group outperformed the FB group on the CVLT-II short-delayed free recall score. The comparison group also showed better retrieval ability than the FB group, suggesting that the FB groups difficulties on the CVLT-II were driven by retrieval deficits.

**Conclusions:** FB participants evidenced difficulties on the CVLT-II short-delayed recall trial and the retrieval deficit index of the ISDA. The current results suggest that persons with a history of sports-concussion may exhibit mild verbal memory difficulties that are related to retrieval deficits.

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**S.M. KARK, V.T. HO, M.K. YEE, K.S. GILBERT & Y. BOGDANOVA. Sleep Quality vs Quantity: Differential Effects on Cognitive and Functional Status in Veterans with TBI and PTSD.**

**Objective:** Earlier work has indicated that sleep quality is more related to measures of health and well-being than sleep quantity in young

adults. Given the complex relationship between sleep and functional outcome in returning Veterans, the current study evaluates Sleep Quality and Sleep Quantity in relation to cognitive and neuropsychiatric symptoms and quality of life in Veterans with TBI and PTSD.

**Participants and Methods:** Fifty-four OEF/OIF/OND Veterans underwent one week of actigraphy (ACT) and were administered the PTSD Checklist-Military (PCL-M) and Pittsburgh Sleep Quality Index (PSQI) as well as measures of cognitive and functional status (Dysexecutive Questionnaire [DEX], Attention Rating and Monitoring Scale [ARMS], and Quality of Community Integration Questionnaire [QCIQ]). Measures of post-traumatic amnesia (PTA) were collected as an indicator of blast-induced TBI severity. Sleep Quality measures were PSQI Total and ACT Sleep Efficiency. Sleep Quantity measures were PSQI Total Sleep Time and ACT Total Sleep Time. Participants were divided into PTSD (PCL-M  $\geq 50$ ;  $n = 30$ ) and no-PTSD (PCL-M  $< 50$ ,  $n = 24$ ) groups.

**Results:** Both patient groups showed a strong correlation between Sleep Quality (PSQI Total) and QCIQ Cognitive Quality of Life Satisfaction score, even after controlling for PTA and PTSD symptoms severity. Additionally, Sleep Quality measures were significantly correlated with DEX and ARMS in the no-PTSD group only. In contrast, Sleep Quantity was not related to any of the cognitive or functional status measures in both groups.

**Conclusions:** These findings suggest that Sleep Quality is more related to measures of cognitive and functional status than Sleep Quantity in returning Veterans with TBI and PTSD. While Sleep Quality was related to daily cognition measures in Veterans without PTSD, Sleep Quality appears to be tightly linked with cognitive quality of life measures regardless of PTSD status or blast TBI severity. Evaluation of Sleep Quality is important for treatment planning and outcome in this population.

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**R.E. KEELAN, L.J. RAPPORT, S.I. KROHNER, R.J. KANSER, R.A. HANKS, M.A. LUMLEY & S.A. LANGENECKER. Diminished Auditory Emotion Perception Accuracy in Moderate to Severe Traumatic Brain Injury.**

**Objective:** Poor emotion perception (EP) following TBI may contribute to impaired interpersonal functioning and relational distress. EP accuracy among adults with TBI was compared to healthy adults. Neuropsychological correlates of auditory EP were explored to parse out global versus domain-specific deficiencies following TBI.

**Participants and Methods:** Participants were 26 individuals with moderate-to-severe TBI and 19 healthy adults serving as the comparison group (HC). Groups were equivalent in age and education. Participants completed a comprehensive neuropsychological assessment that included an auditory emotion perception test (EPT). The EPT is comprised of standardized sentences that lack emotional content but are read aloud with an emotional tone. Participants are asked to classify sentences into one of five categories based on the reader's emotional tone rather than sentence content.

**Results:** Independent t tests revealed that the TBI group committed significantly more EPT errors than did the HC group. Cohen's  $d$  effect sizes were medium to large for group differences in errors interpreting Anger, Fear, and Happy expressions, but were small for Sad and Neutral expressions. The most common error in both groups was mistaking emotion as neutral (i.e., missing emotional content). Among individuals with TBI, Pearson correlations revealed that EPT errors were related to poor performance on tasks of attention, executive functioning, and to a lesser extent, visual perception.

**Conclusions:** Impaired auditory EP is associated with poor performance on cognitive domains often compromised after TBI. These preliminary findings suggest a pattern of specific deficits in attention and executive functioning, rather than one of global decline seen after TBI. The tendency for individuals with TBI to misperceive anger, fear, and happy emotions in people's voices, taken with the tendency for all

individuals to misinterpret emotional content as neutral, may contribute to relational distress and interpersonal conflicts for individuals with TBI. Correspondence: *Rachel E. Keelan, M.A., Clinical Psychology, Wayne State University, 5057 Woodward Ave, Detroit, MI 48202. E-mail: kayrach@wayne.edu*

**R.T. KIM, S. SORG, L. DELANO-WOOD, M.J. MELOY, A.L. CLARK, N. LUC, N.D. EVANGELISTA, L.T. EYLER & D.M. SCHIEHSER. Is Subjective Disinhibition Associated With Response Inhibition Performance in Veterans with Mild-Moderate Traumatic Brain Injury?**

**Objective:** Veterans with history of mild-moderate traumatic brain injury (mTBI) frequently endorse greater levels of neurobehavioral symptoms related to executive dysfunction/disinhibition and negative mood. However, the relationship between subjective complaints and objective disinhibition/executive function in the context of highly co-morbid psychiatric symptomatology remains unclear.

**Participants and Methods:** 44 Veterans with post-acute (>8 months) mTBI who passed performance validity testing were administered the Frontal Systems Behavior Scale (FrSBe), a measure of subjective Disinhibition and Executive Dysfunction, the computerized Go/NoGo Task, a measure of objective response inhibition, and the Beck Depression Inventory-II and PTSD Checklist, measures of depressive and PTSD symptomatology.

**Results:** Correlational analyses revealed that the FrSBe Disinhibition subscale, but not the Executive Dysfunction subscale, was significantly associated with inhibition response accuracy ( $d'$ ) ( $r = -.339, p = .02$ ) on the Go/NoGo Task. Higher levels of depression and PTSD were associated with greater subjective disinhibition ( $p$ 's < .001), while only depression negatively correlated with  $d'$  ( $p < .01$ ). Hierarchical analysis revealed that depression, but not PTSD, nor subjective complaints, predicted poorer response inhibition.

**Conclusions:** In this sample of mTBI Veterans, greater endorsement of disinhibition, but not subjective executive dysfunction, was associated with poorer performance on an objective task of response inhibition. Subsequent analyses showed that higher levels of self-reported depression best accounted for objective performance over and beyond subjective complaints and PTSD. These results underscore the importance of assessing the subcomponents of executive dysfunction (specifically disinhibition) and depressive symptomatology when evaluating the subjective cognitive complaints of mTBI Veterans. Furthermore, results provide potential treatment targets for neurobehavioral symptoms related to disinhibition in mTBI.

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**A. KLIMOVA, D. PISNER & W.D. KILLGORE. Neural Correlates of Cognitive and Emotional Impairments in Acute Versus Chronic Mild Traumatic Brain Injury: a Diffusion Tensor Imaging Study.**

**Objective:** Mild traumatic brain injury (mTBI) is a neurological insult, commonly associated with physical complaints, emotional problems and cognitive deficits. MTBI has been frequently referred to as an "invisible injury" as it can be hard to diagnose while potentially having devastating effects on the individual. Recent studies suggest that neural and psychological profiles of this condition may be time-dependent. In the present study we examined white matter (WM) integrity of individuals in the acute versus chronic phases of mTBI.

**Participants and Methods:** Thirty healthy controls and 26 mTBI participants (14 acute (<3 months post-injury); 12 chronic (>6 months post-injury to 1 year)). A 3T spin-echo DTI-Echo Planar Imaging sequence was used to acquire diffusion-weighted images (DWIs). Seventy contiguous, axial, 2.0 mm-thick slices were acquired in 72 directions. Data were analyzed using Tract-Based Spatial Statistics (TBSS) and correlated with several behavioral outcome measures.

**Results:** Both acute and chronic mTBI were associated with reduced WM integrity as indicated by reduced FA compared to healthy controls ( $p < .05$ ; family-wise error (FWE) corrected). There was also a trend increase in FA in the acute mTBI group compared to the chronic group in the right superior corona radiata ( $p < .1$ ; FWE corrected). Across all mTBI participants, decreased FA was associated with significantly increased sleep impairment, greater post concussive symptoms, decreased vigilance, greater hostility and lower resilience. In the acute group, decreased FA was associated with increased aggression, whereas there was no such association in the chronic group.

**Conclusions:** Results indicate that both acute and chronic mTBI are characterized by compromised WM coherence with a trend towards decreased WM integrity among patients with chronic versus acute mTBI. These WM reductions are associated with increased cognitive and emotional problems, particularly among those in the chronic stage.

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**E. HIRSCH, T.S. SHEIKH, Y. KUMAR, D. DURAN & R. KRISHNA. Using DTI to Narrow the Diagnosis of TBI in Cases of Global Cognitive Disorder.**

**Objective:** Diffusion tensor imaging (DTI) is a powerful imaging technique used to assess the microstructure of cerebral white matter (WM). Fractional anisotropy (FA) is a common measure in DTI, which indicates the directionality of diffusion processes in WM. Lower FA values are correlated to axonal injury and demyelination. This case study will examine the use of DTI to narrow the diagnosis of mild TBI in a case of global cognitive disorder.

**Participants and Methods:** The patient L.Y. is a 42-year-old female who was struck in the head by falling ceramic tiles and rendered unconscious for 5-10 minutes. After the accident she complained of persistent headache, dizziness, impaired concentration and memory, irritability, loss of motivation, and distressing memories of the accident. She underwent a neuropsychological evaluation two months after the accident and was diagnosed with post-concussion syndrome and global cognitive disorder. The presentation of global cognitive disorder suggested the patient had sustained injury to multiple brain regions. A DTI study was ordered to assess the location of TBI.

**Results:** DTI revealed multiple chronic white matter hyperintensities within the subcortical white matter of both hemispheres of the frontal lobe, correlated with areas of decreased FA. These findings suggest extensive axonal injury to the frontal lobe.

**Conclusions:** In this case the patient presented with global cognitive disorder, which typically involves damage to multiple regions of the cortex. However, DTI revealed that damage was localized to bifrontal regions of the brain and excluded involvement of the temporal and parietal lobes. Frontal lobe injury is the most common form of mild TBI and also produces the most diverse array of clinical presentations (Kolb & Wishaw, 1990). Damage to to both hemispheres of the frontal lobe can lead to a particularly broad range of impairments (Bonnier et al. 2010). This case demonstrates that DTI can be used to narrow and enhance the diagnosis of mild TBI in cases of global cognitive disorder. Correspondence: *Ranga Krishna, MD, Neurology, Methodist Hospital, 1513 Voorhies Ave, Brooklyn, NY 11235. E-mail: eric61594@yahoo.com*

**M. LANCASTER, L. MUFTULER, D.V. OLSON, A. LAROCHE, L.D. NELSON & M. MCCREA. Acute White Matter Changes Following Sport-Related Concussion: A Longitudinal Diffusion Tensor and Diffusion Kurtosis Imaging Study.**

**Objective:** Previous studies indicate that following sport-related concussion (SRC) the brain undergoes anatomical and physiological changes that may linger past the point of clinical recovery, and white matter (WM) tracts are especially vulnerable to this type of injury. Advanced neuroimaging techniques like diffusion tensor imaging (DTI) and diffusion kurtosis imaging (DKI) are pivotal to understanding WM changes

following SRC. Most studies, however, have not captured concussed athletes immediately after injury, perhaps missing valuable information about acute neuropathological processes.

**Participants and Methods:** In this study, 26 high school and college football players (mean age = 17.6; SD = 1.5) underwent MRI imaging and assessment of symptoms, balance, and cognition within 24 hours of SRC and one week later (8 days post injury). 26 matched control athletes (mean age = 18.0; SD = 1.5) completed identical protocols. DTI and DKI were analyzed using Tract-Based Spatial Statistics.

**Results:** At 24 hours post injury, the SRC group reported significantly more concussion symptoms than the Control group and performed worse on a cognitive screening measure. There were no group differences on these measures at 8 days post injury. On DTI, the SRC group demonstrated a widespread decrease in mean diffusivity, and to a lesser extent decreases in axial and radial diffusivities, compared to control subjects at 24 hours post injury. These DTI changes became more widespread at 8 days post injury. On DKI, the SRC group had increased axial kurtosis at 24 hours post injury relative to controls that also became more widespread after 8 days.

**Conclusions:** These findings suggest that, while acute clinical symptoms of SRC returned to baseline over one week following injury, areas of restricted diffusion and increased axon complexity were evident beyond the point of clinical recovery, likely due to axon swelling and beading. The current study has implications for determination of recovery following SRC and return-to-play management.

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**J. LARA-RUIZ, W.D. LOPEZ, H. KAKAVAND, Y. CERVANTES, D. WONG, B. HONG, S. FATOORECHI, S. MANGASSRIAN, A. WALKER, A. SOTO, P.Z. STARK, F. MARTINEZ, D. BUDDING, D.J. HARDY, P. VESPA, D. HOVDA, D. MCARTHUR, T. GLENN, J. FUSTER, D. PLURAD, E. WOO & M.J. WRIGHT. Differential Association of Activity Memory Components and Memory Process Deficits Following Traumatic Brain Injury.**

**Objective:** Persons with traumatic brain injury (TBI) demonstrate difficulty recalling completed activities, but show intact source and temporal order memory (TOM) for activities. Encoding deficits might be responsible for TBI-related problems with activity recall. We conducted the current study to determine how activity memory is related to memory process deficits following TBI.

**Participants and Methods:** A TBI group (n=23) and a comparison group (n=28) were administered a battery of neuropsychological tests that served as to-be-remembered activities. Participants rated their subjective workload after each test. Participants' recall, recognition, and TOM for each test were assessed. Memory process scores were derived from the California Verbal Learning Test-II via the Item Specific Deficit Approach (ISDA).

**Results:** Univariate analyses of variance with age as a covariate were utilized to determine group differences. Regressions were computed to evaluate associations between activity memory and memory processes. The comparison group demonstrated greater recall of activities in contrast to the TBI group. The groups did not differ in TOM or recognition for the activities. Encoding deficits, accounting for 42% of the variance, emerged as the sole predictor of activity recall in the TBI group. Retrieval deficits, accounting for 26% of the variance, emerged as the sole predictor of TOM for activities in the TBI group.

**Conclusions:** The TBI group demonstrated poorer activity recall than the comparison group, but the groups were equivalent in TOM and recognition for activities. Activity recall in the TBI group was predicted by encoding deficits. TOM for activities in the TBI group was related to retrieval deficits.

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**Y. LEE, Y. MATSUZAWA, J. CREIGHTON, F. FRASER, H. GLUBO, K. KINGSLEY, B. MARKS, O. TRUBETCKAIA & D. LANGENBAHN. Does Psychoeducation Promote Recovery for Patients with Persistent Concussion Symptoms?**

**Objective:** Benefits of psychoeducation immediately following concussion have been reported (Ponsford, 2012). Further, we found that group psychoeducation intervention significantly reduced symptom severity and increased concussion knowledge in individuals within the early stage of recovery (Matsuzawa et al., 2015). In the current study, we examined whether individuals beyond 6 months post-injury benefited from group treatment. Outcomes for participants within the period of most rapid recovery (3-6 months; Mittenberg, 1993) vs. at later stages of recovery were compared.

**Participants and Methods:** Eleven participants within 6 months and 16 participants beyond 6 months of sustaining a single concussion participated in an 8-week psychoeducation group at an urban outpatient rehabilitation center. Study design involved a case series with pre- and post-testing across four group cohorts. Data collection utilized questionnaires assessing concussion knowledge, the types/severity of symptoms, affective functioning, perception of concussion impact, and life satisfaction.

**Results:** Paired t-test analyses indicated decrease in symptom severity,  $p < .05$ , and impact on daily life,  $p < .05$ , among participants 6 months post-injury. In addition, moderate effect size of increased concussion knowledge ( $d = .66$ ), moderate-to-large effect size of reduced belief of symptom duration ( $d = .76$ ), and large effect size of reduction in concerns about their concussion ( $d = 1.03$ ) were found. These findings are consistent with our results for patients in early stage recovery (Matsuzawa et al., 2015). Independent sample t test showed no significant differences in improvements between participants within vs. beyond 6 months post-injury.

**Conclusions:** Providing psychoeducation in a group format is beneficial for individuals beyond the initial rapid recovery phase. No distinctions were found between those receiving psychoeducation in the early vs. later stage of recovery. This type of treatment may facilitate recovery for concussion patients with persistent symptoms.

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**E. LEVEILLE, S. GUAY, C. BLAIS, P. SCHERZER & L. DE BEAUMONT. Emotion Recognition in Concussed Athletes.**

**Objective:** The majority of studies have focused on the cognitive symptoms associated with concussion. Recently, studies have identified an increased risk of depression and anxiety after concussion, and this risk is accentuated in females. Patients with anxiety and/or depression symptoms were shown to be particularly tuned to recognize emotional elements in their environment. The purpose of this study was to investigate sex differences in emotion recognition in collegiate concussed athletes.

**Participants and Methods:** A total of 22 concussed athletes (11 males; 11 females) and 22 unconcussed athletes (11 males; 11 females) were tested. Participants completed the Post-Concussion Symptom Scale (PCSS), the Beck Depression Inventory-II (BDI-II) and the Beck Anxiety Inventory (BAI). They also completed a morphed emotion recognition task. Pictures of a male face expressing basic emotions (anger, disgust, fear, happiness, sadness, surprise) morphed with another emotion were randomly presented. After each face presentation, participants were asked to indicate the emotion expressed by the face. Emotion recognition accuracy (proportion of trials in which the emotion was recognized when it was dominant in the morph stimulus) and threshold (emotional intensity needed to detect an emotion on 50% of the trials in which it was presented) were computed.

**Results:** A significant Group X Sex interaction was found across all four negative emotions. Descriptive statistics showed an increase in threshold with a concomitant decrease in accuracy in concussed male athletes, while concussed female athletes exhibited the reverse results pattern.

**Conclusions:** These results indicate that relative to unconcussed counterparts of the same sex, concussed males needed greater emotional intensity in order to correctly recognize a negative emotion, while concussed females required less intensity. These findings identify emotion recognition as a potential contributor to the reported increased risk of anxiety and depression in female concussed athletes.

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**N. MADIGAN, A. STILLMAN, N. SWAN & M. ALEXANDER. Factors Contributing to Executive Functioning Symptoms in mTBI.**

**Objective:** Though concussion is very common, and most patients recover, a subset (~10%) experience lingering symptoms that seem disproportionate to the injury. Identification and management of factors that contribute to persistence should improve outcome. The purpose of the current study was identification of factors contributing to cognitive symptoms in a civilian cohort.

**Participants and Methods:** 87 consecutive clinical referrals (age: M=39.8, SD=12.7, 31M/56F, days post injury: M=72.3, SD=37.2) to a hospital-based outpatient specialty clinic were screened to exclude more severe injury; concussion severity was stratified by AAN 1997 criteria. Prior psychiatric history was noted. Participants reported significant concussive symptoms (Rivermead M=28.9, SD=12.3). Measures: Subjective cognitive dysfunction (BRIEF-A self-report); Focused cognitive/psychological assessment (Trails B, CVLT-2, ROCF, CPT-2; BDI-2, BAI, PCL-C).

**Results:** BRIEF-A General Executive Composite (M=57.8 SD=12.1) and its two Indices were overall in the nonclinical range, though 38.2% of patients had clinically significant scores (T>65). Cognitive measures: Mean normative scores were in the average range. Psychological measures: All scores were elevated (BDI-2, M=15.2, SD=8.8; BAI M=12.2, SD=10.1; PCL-C, M=36.5, 15.8).

1) There were no significant correlations of BRIEF-A scores with concussion severity or any subject demographic variable (except for education [ $r=-.25$ ] for one Index); 2) Trails B was the sole cognitive correlate with BRIEF-A scores ( $r = -.25$  to  $-.29$ ); 3) All self-report mood measures correlated with BRIEF-A scores ( $r = .45$  to  $.81$ ); 4) In stepwise multiple regression analysis, only mood measures were a significant predictor of subjective executive symptoms; depression (BDI-2) was the critical contributor ( $\beta=.74$ ,  $p < .001$ ).

**Conclusions:** In this civilian cohort, subjective executive symptoms after concussion appear to be due to psychological distress more than to demonstrable executive deficits or to subtle clinical differences in injury severity.

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**L. MANDERINO & J. GUNSTAD. Athletes with ADHD or History of Academic Difficulties Show Intact Performance on Baseline ImPACT Testing.**

**Objective:** ADHD and other academically-relevant diagnoses have been identified as modifiers of cognitive testing in sport-related concussion, such as ImPACT. As a result, these conditions may produce a test profile suggestive of suspected low effort. The present study examines group differences on the ImPACT in student-athletes with preexisting ADHD or academic difficulties compared to those without.

**Participants and Methods:** Three consecutive seasons of baseline ImPACT protocols from 173 NCAA Division I football players (average age=19.2y; 21.1% ADHD diagnosis; 16.2% academic difficulties) were analyzed. Only the first collegiate, baseline protocol from each player was examined.

**Results:** Neither student-athletes with ADHD (Pillai's Trace=.01,  $F(5)=.37$ ,  $p=.87$ ) nor those with history of academic difficulties (Pillai's Trace=.01,  $F(5)=.30$ ,  $p=.91$ ) performed worse on ImPACT composite

scores than those without. Similarly, student-athletes with ADHD diagnosis ( $\chi^2(1)=.12$ ,  $p=.55$ ) and with history of academic difficulties ( $\chi^2(1)=.00$ ,  $p=.66$ ) were no more likely to produce invalid baseline protocols than those without these histories.

**Conclusions:** These findings suggest that student-athletes reporting ADHD diagnosis or history of academic difficulties do not show worse performances on ImPACT composite scores or validity protocols than those without such difficulties. However, many traditional neuropsychological tests do show poorer performances for adults with ADHD and failure to find these group differences raises the possibility that the ImPACT may not detect all poor effort performances. Future studies should examine ImPACT's low effort score thresholds to confirm their sensitivity and specificity. Relatively little is known about the validity indices of the ImPACT and convergent validity with traditional validity tests should be investigated both pre- and post-injury.

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**R. MARTIN, N.J. PASTOREK, B. MILLER, J. ROMESSER, A. SIM & J. LINCK. Effect of Modifications in ICD-10 Criteria on Diagnostic Rates for Post-Concussive Syndrome.**

**Objective:** Post-concussive syndrome (PCS) includes cognitive, affective, and physical symptoms after a TBI. Diagnostic rates of PCS based on ICD-10 criteria are known to be high relative to other classification systems due in part to no requirement for evidence of objective impairment. This study aims to examine the effect of modifications of ICD-10 criteria (i.e. objective evidence of cognitive impairment and valid reporting/performance) on diagnostic rates.

**Participants and Methods:** 257 consecutively-referred Veterans (242 males; mean age=32.2) who screened positive for TBI were seen for neuropsychological testing. 67 Veterans were ultimately not considered to have had a TBI. PCS was diagnosed based on ICD-10 criteria with items from the Neurobehavioral Symptom Inventory. Objective cognitive impairment were scores 1 standard deviation or more below the mean on either CVLT-II delayed recall or WAIS-IV Digit Span. Symptom and performance validity were examined with MMPI-2 FBS and Word Memory Test. Descriptive statistics were used to demonstrate the effect of modifying the ICD-10 criteria.

**Results:** Using standard ICD-10 criteria, 233 of 257 Veterans met criteria, including 60 of 67 without TBI. Adding the additional requirement of objective cognitive impairment, 103 of 257 met criteria, including 27 of 67 without TBI. When diagnostic rates were re-examined using only valid data based on objective indicators of performance and symptom validity, 84 of the original 257 Veterans remained in the sample. 68 of 84 met ICD-10 criteria including 15 of 22 without TBI. When the requirement of objective impairment was added, 9 of 84 met criteria, including 5 of 22 without TBI.

**Conclusions:** The study showed large differences in diagnostic rates of PCS in those with and without TBI with modifications of evidence of impairment and valid data. Future research validating ICD-10 PCS criteria should consider how slight modifications might enhance the relation of this diagnosis to objective indicators of community functioning. Correspondence: *Rebecca Martin, Emory University, 922 Rock Springs Ct NE, Atlanta, GA GA. E-mail: rmartin29@gmail.com*

**Z. BRUBACK, K. MAXWELL, T. NGUYEN, A. ZARTMAN, J.R. JARAMILLO, J. WESTHAFFER & B. ARDOLF. Examining Psychological Diagnoses and Memory Performance in Relationship with Performance Validity within Veterans Presenting with History of Mild Traumatic Brain Injury (mTBI).**

**Objective:** Mild traumatic brain injury (mTBI) is an ongoing concern within the military. Individuals with a history of mTBI frequently complain of difficulties in attention and memory. However, these veterans often have comorbid psychiatric conditions which can result in cognitive complaints and most individuals with a prior mTBI return to baseline cognitive functioning. Previous research regarding performance

validity tests (PVT) (i.e. motivation, engagement, and/or malingering) has found that individuals with a reported mTBI are more likely to perform below expectations on PVTs. The purpose of the current study was to examine rates of psychological diagnoses in a mTBI sample and possible variability in memory scores given their performance on PVTs. Hypotheses were that Veterans reporting mTBI would be more likely to perform below expectations on PVTs, a majority would not receive diagnosis for a cognitive disorder, and that there would be a significant difference in delayed memory between those who passed PVTs vs. those who performed below expectations.

**Participants and Methods:** 62 Veterans completed neuropsychological testing at a VA hospital between 2013-2015 and reported a history of at least one mTBI.

**Results:** 48% performed below established cutoffs on PVTs. 15% met diagnosis for a neurocognitive disorder, while 74% did not, but met diagnosis for a psychological disorder, and the remaining 11% met diagnoses for neither. There was no statistically significant difference between Wechsler Memory Scale IV (WMS-IV) Logical Memory scores for individuals who passed PVTs vs. those who performed below expectations ( $t = .35$ ).

**Conclusions:** Implications regarding these findings will be discussed. Correspondence: *Kendal Maxwell, MS, Psychology, University of North Texas, 3915 Hawthorne Ave, Dallas, TX 75219. E-mail: kmaxwell1987@gmail.com*

#### **M. MELLINGER, T. HUDSON & C.V. FLAHERTY. Assessment and Remediation of Adult Abulia Following Severe Traumatic Brain Injury in Infancy.**

**Objective:** Abulia is a lack of motivation associated with one's ability to perform activities of daily living (ADL's) (Hastak, Gorward, & Mishra, 2005). We assessed neurocognitive status and applied behavioral treatment strategies in a 23-year-old abulic male who had sustained a severe traumatic brain injury (TBI) during infancy, with consequent damage to his bilateral pre-frontal, limbic and occipital brain regions. Our goal was to improve verbal output, which had regressed following discontinuation of formal schooling.

**Participants and Methods:** Cognition was assessed by administration of the NEPSY-II, with interpretation of findings based upon normative standards for 10 years of age. We then applied 'smart space' technologies to monitor verbal output throughout the process of applying an approach to enhance motivation to communicate.

**Results:** Preserved capacities included functional abilities for visuo-motor precision (5th percentile), design copy for local features (50th percentile), non-verbal category fluency (16th percentile), and spatial judgment (vectors) (9th percentile). Preserved language and memory capacities included auditory comprehension (5th percentile), sentence repetition (37th percentile), verbal memory for paragraph material (25th percentile), and delayed memory for faces (9th percentile). He was able to correctly recognize 'Angry' (51-75th percentile) and 'Disgusted' (51-75th percentile) expressions, suggesting relative preservation of personal survival oriented - but not interpersonal oriented - emotional facial expression processing. Over a period of 12 weeks, with verbal output measured as words and sentences, we found a statistically significant degree of improvement in initiation of spontaneous speech at the word ( $P=.000$ ) and sentence ( $P=.000$ ) level as well as improvements in prosody of speech.

**Conclusions:** Our evidence based approach has application to adults with abulia consequent to both pediatric and adult TBI, intractable to conventional pharmacological approaches in the chronic course.

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#### **Z. MERZ, R. VAN PATTEN, K. MULHAUSER & R. FUCETOLA. Exploratory Analysis of the Reintegration to Normal Living Index in a Stroke Population.**

**Objective:** Stroke is a common and often debilitating health-care problem which frequently leads to decrements in overall functioning capacity. The reintegration to normal living index (RNLI) is a global assessment of patient quality of life often utilized in stroke populations. Despite its common use, psychometric validation studies of the RNLI have not been sufficiently validated in stroke populations. This study is believed to represent the first factor analysis of the RNLI using an exclusively stroke sample. Given the lack of previously published data regarding this population, the current investigation represents an exploratory analysis of the RNLI. Previous studies in different general disability samples have consistently reported a two-factor solution with the RNLI.

**Participants and Methods:** We retrospectively examined RNLI scores of 928 adults with strokes of varying severities as part of a multidisciplinary, interinstitutional collaboration across an academic medical center, acute care hospital, and rehabilitation center. We utilized both a principal components factor analysis and parallel analysis to evaluate the factor structure of the RNLI.

**Results:** Mean RNLI scores  $\pm$  SD for the sample was  $75.26 \pm 19.85$ , ranging between 20 and 100. The Cronbach  $\alpha$  was .94. A scree test for factor retention strongly suggested a single factor solution, explaining 64.50% of the total variance. Follow-up Horn's parallel analysis also suggested a single factor solution.

**Conclusions:** Previous factor analyses on the RNLI utilizing general disability samples commonly report a two-factor solution. Our data supports the presence of a single factor solution across the RNLI within a significant stroke population. This suggests that the RNLI acts as more of a unitary measure of quality of life within a stroke sample relative to other disabled samples. Future research should cross-validate the reported factor structure in stroke samples using confirmatory analyses. Correspondence: *Zachary Merz, Saint Louis University, 9906 heritage drive, apt c, Saint Louis, MO 63123. E-mail: merzz@slu.edu*

#### **J.B. MIELKE & K. HIGHLAND. Correlation of the ToPF and the WAIS-IV IQ scores in a High Functioning, Active Duty, Military Population.**

**Objective:** As part of the diagnostic evaluation at the National Intrepid Center of Excellence (NICoE), active duty service members (SMs) with a history of mild traumatic brain injury (mTBI) and psychological health issues complete a neuropsychological assessment. The ACS Test of Premorbid Function (ToPF) can be used to predict patient performance on cognitive measures. If the ToPF is not highly correlated with the SMs actual intellectual abilities, subtle relative deficits in cognitive functioning may be missed without full IQ testing. This study looks at the relationships between the SMs ToPF score, current Wechsler Adult Intelligence Scale-IV (WAIS-IV) scores, and symptoms of anxiety.

**Participants and Methods:** SMs ( $N=52$ ) with a history of TBI completed the WAIS-IV, ToPF, and Beck Anxiety Inventory (BAI). Correlations tested relationships between WAIS-IV full-scale (FSIQ), subscales [verbal comprehension (VC), working memory (WM), perceptual reasoning (PR), processing speed (PS)], and ToPF scores. Cluster analyses identified two groups based on subscale scores, average (AP) ( $n=24$ , Mean FSIQ=105, SD=7) and superior (SP) ( $n=27$ , Mean FSIQ=121, SD=6) performing. Within-group linear regressions examined the relationship between FSIQ and ToPF, controlling for BAI scores.

**Results:** Overall, ToPF was positively correlated with VC and WM, but not PR or PS. ToPF was positively correlated with FSIQ in the AP group, not the SP group. ToPF was associated with FSIQ when controlling for BAI in the AP group, but not in the SP group.

**Conclusions:** The ToPF may be cautiously used as a proxy for estimating premorbid cognitive abilities in SMs with average IQ in SM presenting with mTBI, even when accounting for self-reported anxiety. The ToPF does not appear to be a good indicator of IQ for higher-performing SMs with TBI. Administration of the WAIS-IV FSIQ could help

reveal relative deficits that may exist in the high-performing SMs that may be missed when relying on the ToPF alone.

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**D. MILLER, J.P. HAYES, G. LAFLECHE, D.H. SALAT & M. VERFAELLIE. White Matter Abnormalities in Blast-Related mTBI are Associated With an Overall Index of Cognitive Impairment.**

**Objective:** Blast-related mild traumatic brain injury (mTBI) is a common injury of the Iraq and Afghanistan Wars. Research has suggested that blast-related mTBI is associated with chronic white matter abnormalities, and that these TBI-related abnormalities are associated with impairment in neurocognitive function. However, findings are inconsistent as to which domains of cognition are affected by TBI-related white matter abnormalities. Recent evidence that white matter abnormalities associated with blast-related mTBI are spatially variable raises the possibility that the associated cognitive impairment is also heterogeneous. Thus, the goals of this study were to examine (1) whether the extent of mTBI-related white matter abnormalities is associated with an overall index of cognitive impairment that takes into account heterogeneity across individuals, and (2) whether white matter abnormalities provide a mechanism by which mTBI influences cognitive function.

**Participants and Methods:** Ninety-six OEF/OIF veterans who reported blast exposure within 100 meters were assigned to one of three groups: a no-TBI group, a mTBI without loss of consciousness (LOC) group (mTBI-LOC), and a mTBI with LOC group (mTBI+LOC). Participants were given a battery of neuropsychological tests that focused on the domains of attention, executive function, verbal and visual memory, and motor function.

**Results:** Results showed that the number of white matter abnormalities was associated with the odds of having impairment in one or more cognitive domains, even after accounting for posttraumatic stress disorder (PTSD) symptom severity. A mediation analysis revealed that mTBI+LOC was indirectly associated with cognitive impairment through its effect on white matter integrity.

**Conclusions:** These results suggest that cognitive difficulties in blast-related mTBI can be linked to injury-induced neural changes when taking into account the variability of injury as well as the heterogeneity in cognitive deficits across individuals.

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**G.G. MONCRIEF, M.E. ONEIL, S. TUN & D. STORZBACH. Cognitive Reserve and Postconcussive Symptoms Reported by Blast Exposed Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans.**

**Objective:** Examine the influence of cognitive reserve on self-reported postconcussive symptoms in a sample of OEF/OIF Veterans with blast exposure.

**Participants and Methods:** Participants were 92 previously deployed OEF/OIF Veterans at the Portland VA grouped according to blast exposure history (no history of exposure and history of blast exposure). Cognitive reserve level was based on education and performance on the RIST and WTAR. Cognitive reserve proxy variables were converted to a composite z-score. We compared raw scores on the British Columbia Postconcussion Symptom Inventory (BC-PSI) for each group. We conducted a two-stage hierarchical multiple regression comparing total raw BC-PSI scores for Veterans based on blast exposure and cognitive reserve.

**Results:** Significant results were found for group membership and estimated cognitive reserve for predicted postconcussive symptoms with history of blast exposure and lower cognitive reserve level associated with higher BC-PSI scores. History of blast exposure accounted for 31%

of the variation in total raw BC-PSI scores. Addition of cognitive reserve to the regression analysis explained an additional 3.5% of variation in reported symptoms indicating a small effect.

**Conclusions:** Higher levels of cognitive reserve may serve as a protective factor against developing postconcussive symptoms in Veterans with a history of blast exposure. Given this result, health care providers may be better equipped to identify and provide treatment for Veterans at greater risk for developing postconcussive symptoms following blast exposure.

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**R. MOORE, L. DELANO-WOOD, R.T. KIM, K.L. HANSON, S. SORG, A.L. CLARK, Z.Z. ZLATAR, P.L. FAZELI, L.T. EYLER & D.M. SCHIEHSER. Engagement in an Active Lifestyle is Associated with Better Neurocognitive Functioning Among Veterans with Mild Traumatic Brain Injury.**

**Objective:** Mild traumatic brain injury (mTBI) is common among military personnel, and there is mounting evidence that a history of mTBI elevate risk for poor long-term cognitive outcomes. We therefore examined whether engagement in physical, mental, and social activity was related to better neurocognition (NC) among a well-characterized cohort of Veterans with a history of mTBI.

**Participants and Methods:** 41 mTBI Veterans (mean age=33, 88% male) underwent a comprehensive assessment of neurobehavioral and cognitive functioning. Participants were excluded if they failed symptom validity tests. A global NC score was derived using demographically-adjusted scores from the following domains: executive functioning, learning and memory, attention and processing speed, and language. Participants were classified based on the number of self-reported Active Lifestyle Factors (ALFs; Mental, Physical, and Social), and relationships to global NC and specific cognitive domains were explored.

**Results:** Participating in more ALFs was associated with better global NC ( $F=3.7$ ;  $p=0.02$ ), executive functioning ( $F=3.0$ ,  $p=0.04$ ), and attention and processing speed ( $F=2.9$ ,  $p=0.05$ ). Post hoc analyses revealed engagement in all 3 ALFs was related to the highest global NC. The relationships with ALFs and global NC ( $F=3.3$ ,  $p=0.03$ ) and executive functioning ( $F=2.8$ ,  $p=0.05$ ) remained significant after adjusting for depressed mood and post-traumatic stress disorder (PTSD).

**Conclusions:** In our sample of Veterans with mTBI, findings suggest that an active lifestyle is associated with better global cognition. This relationship was most pronounced for executive dysfunction. Specifically, results show that greater activity engagement in everyday life is associated with enhanced objective cognitive performance, even after adjusting for levels of depressive symptomatology and PTSD in patients with history of head trauma. Findings have implications for the refinement of intervention strategies to optimize clinical outcome in Veterans in the aftermath of head injury.

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**K. NAYLON, J. DEDERER & E.B. LARSON. Impact of Cognitive Fatigue on Reported Post-Concussive Complaints.**

**Objective:** To investigate the variability in reported post-concussive symptoms as explained by direct neuropsychological assessment of cognitive fatigue controlling for premorbid intelligence and for acquired cognitive impairment.

**Participants and Methods:** Participants ( $n = 17$ ) previously diagnosed with concussion underwent neuropsychological assessment, including: Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Wechsler Test of Adult Reading (WTAR), Paced Auditory Serial Addition Task (PASAT), and Rivermead Post-Concussive Symptoms Questionnaire (RPQ). Post-concussive symptom severity was measured the RPQ-3 (an RPQ factor subscale). Cognitive fatigue

was measured by PASAT fatigue—a direct measurement of decline in accuracy between the first and last 7 items of a PASAT trial.

**Results:** Hierarchical regression analysis demonstrated that after entering the WTAR and the RBANS Total Index, adding PASAT fatigue improved the proportion of explained variance from 38% to 67% ( $R^2 \Delta .288$ ,  $F^{\text{Change}}(1,13) 11.204$ ,  $p = .005$ ).

**Conclusions:** Previous work on the relationship between post concussive symptoms and cognitive functioning found a weak but significant relationship (Dean & Sterr, 2013). The importance of controlling for premorbid factors in post-concussive syndrome has been previously identified (Bigler, 2008). The current study found a neuropsychological measure of cognitive fatigue has additional unique power to explain post-concussive symptoms, without relying on self-report measures.

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**T.A. O'CONNOR, D.J. LANG, W. PANENKA, C. GIESBRECHT, K. GICAS, N.Y. WANG, K. WACLAWIK, H.A. BAITZ, F. VILARODRIGUEZ, O. LEONOVA, A. BARR, R. PROCYSHYN, G. SMITH, W. MACEWAN, W. HONER & A.E. THORNTON. The Impact of Traumatic Brain Injury and Aggregate Comorbidities on Cognitive Functioning in a Marginally Housed Sample.**

**Objective:** Individuals living in marginal urban housing face numerous mental and physical health risks that impair cognition. From a cognitive reserve framework, this results in less capability to deal with further brain insult. This study examines the effect of self-reported traumatic brain injury (TBI) on cognition in persons with differential levels of neurocognitive burden.

**Participants and Methods:** Two hundred and ninety-three participants (age: 37-51; 225 M, 68 F), recruited from single-room occupancy hotels (government-owned low-income housing) underwent neurocognitive testing from which a composite cognitive score was derived on the basis of tests of attention, inhibition, and verbal learning and memory. Additionally, a statistically weighted neurocognitive-burden index was created that reflected the aggregate extent to which non-TBI comorbidities (vascular health, mental health, substance use, viral infection, neurological illness) and demographics (age, education, premorbid IQ) were associated with cognition. This index was investigated for its moderating influence on the relationship between self-reported TBI history (loss of consciousness of 30 minutes or more) and neurocognition.

**Results:** Hierarchical linear regression was used to predict cognition. Independent variables included the burden index (Block 1), history of TBI (Block 2), and their interaction (Block 3). As expected, the burden index accounted for 26% of the total variance in cognition ( $F(1, 176) = 61.94$ ,  $p < .000$ ). No further variance in cognition was accounted for by TBI or the neurocognitive burden by TBI interaction.

**Conclusions:** In this complex multimorbid sample, neurocognitive burden was a strong associate of composite cognitive functioning. In contrast, TBI was not associated with cognition regardless of level of burden. These findings indicate that self-reported TBI history has minimal value in signifying cognitive dysfunction in multimorbid marginally housed individuals.

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**L. OHLHAUSER, C. BROADBENT, M.R. TWOMEY, D. LEITNER, J. UPSHAW, A.F. PARKER, A.M. SCHUSTER, M. LIBBEN, H. MILLER & N. GANSNER. Predictors of Length of Hospital Stay, Rate of Functional Improvement, and Functional Abilities at Discharge Following Stroke.**

**Objective:** Functional and cognitive abilities at admission to hospital following stroke are important predictors of recovery outcomes. This study examined the ability of the Functional Independence Measure (FIM) and neuropsychological (NP) tests to predict (1) length of stay in

hospital (LOS), (2) rate of functional improvement, and (3) functional abilities at discharge.

**Participants and Methods:** Participants ( $N=51$ ) were hospital inpatients admitted to a rehabilitation unit following stroke. The FIM was used to assess functional abilities (both motor and cognitive) at admission and discharge from hospital. NP tests were used to assess cognition across multiple domains (e.g., memory, visuospatial, and executive function). Three separate hierarchical multiple linear regression models were examined using the FIM and NP tests as independent variables to predict rate of functional improvement, LOS, and functional abilities at discharge.

**Results:** Age and the FIM motor subscale (FIMm) significantly predicted LOS,  $F(3,31)=27.551$ ,  $p<.001$ ,  $R^2=.78$ . The FIM cognitive subscale (FIMc) and NP tests did not significantly add to the model. Age, education, admission FIM scores, and NP tests were not significant predictors of rate of functional improvement. FIMm and FIMc at admission explained 59.6% of the variance in FIM discharge scores. Adding in NP testing results only slightly improved the model, explaining a total of 70.5% of the variance in FIM discharge scores,  $F(4,30)=13.52$ ,  $p<.001$ ,  $R^2=.70$ . Only the NP tests assessing memory added significantly to the model.

**Conclusions:** The FIM is an important clinical tool for assessing functional abilities following stroke. The FIM at admission was a significant predictor of LOS and of functional abilities at discharge. NP test results were not predictive of LOS in hospital, rate of improvement, or functional abilities at discharge. Results suggest that motor abilities are more important predictors of LOS and future functional abilities in stroke patients than NP tests.

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**K.L. OSBORNE-CROWLEY, S. MCDONALD & J.A. RUSHBY. Can Reversal Learning Deficits Explain Social Disinhibition Following Severe Traumatic Brain Injury?**

**Objective:** Acquired social disinhibition after a severe traumatic brain injury (TBI) is a distressing behavioural syndrome for the individual, their family and the community. It has been postulated that reversal learning deficits, or the inability to update behaviour when reinforcement contingencies change, may underlie socially disinhibited behaviour. The current study aimed to determine whether these reversal learning impairments were associated with social disinhibition in a TBI sample.

**Participants and Methods:** Twenty-one participants with TBI (19 males, mean age 46.9 years) and 21 control participants (18 males, mean age 45.29 years) completed both a social and non-social reversal learning task. Number of errors and the feedback-related negativity (FRN), an event-related potential component of the electroencephalogram which reflects reward prediction error signals, were examined. Participants were also rated on their level of social disinhibition by two independent, blind raters based on a videotaped interview.

**Results:** The TBI group made more reversal errors,  $F(1,40)=9.54$ ,  $p=.004$ ,  $\eta^2=.19$ , and produced smaller amplitude FRN's,  $F(1,39)=8.97$ ,  $p=.005$ ,  $\eta^2=.19$ , than did controls across both the social and non-social versions of the reversal learning task. Further, those TBI subjects high on social disinhibition made more reversal errors than did TBI subjects low on disinhibition on the social task,  $F(1,21)=9.23$ ,  $p=.007$ ,  $\eta^2=.34$ . On the other hand, FRN amplitude was not related to social disinhibition.

**Conclusions:** These results suggest that impairment in the ability to update behaviour when social reinforcement contingencies change plays a role in social disinhibition after TBI. However, that FRN amplitude was not associated with disinhibited behaviour suggests that reward prediction error signals are not necessarily a signal used for flexibly updating behaviour when social reinforcement contingencies change.



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**K.L. OSBORNE-CROWLEY & S. MCDONALD. Hyposmia, But Not Emotion Perception Impairment, Predicts Psychosocial Outcome after Severe Traumatic Brain Injury.**

**Objective:** Behavioural changes have often been reported to be among the most distressing outcomes of TBI for the individual and their close others. Social disinhibition is a particularly debilitating behavioural syndrome which is thought to result from injury to the orbitofrontal region of the brain. The current study aimed to determine whether two variables associated with orbitofrontal damage, emotion perception deficits and hyposmia (olfactory impairment), can predict social disinhibition and psychosocial outcome after traumatic brain injury (TBI).

**Participants and Methods:** An emotion labelling task, an emotion intensity rating task, the Brief Smell Identification Test (BSIT), and an observational measure of social disinhibition were completed by 23 individuals with severe TBI. The disinhibition domain of the Neuropsychiatric Inventory (NPI-D) and the interpersonal relationships subscale of the Sydney Psychosocial Reintegration Scale (SPRS-IR) were completed by a close other. Fifteen control participants provided norms against which to assess performance on the emotion intensity rating task.

**Results:** Hyposmic participants with TBI were rated as having experienced more change to interpersonal relationships on the SPRS-IR than those without a smell deficit. Hyposmia, though, was unable to predict informant-reported or observed social disinhibition. An impairment in accuracy scores on both emotion perceptions tasks was found for participants with TBI, yet intensity ratings did not differ between groups. Finally, emotion perception was not related to disinhibition or change in interpersonal relationships.

**Conclusions:** These findings support previous claims that olfactory deficit has prognostic significance following TBI. However, although hyposmia was predictive of interpersonal difficulties, the relationship does not appear to be driven by an association with social disinhibition. Emotion perception impairment measured by standardised tasks does not appear to be an important factor in psychosocial outcome after TBI. Correspondence: *Katherine L. Osborne-Crowley, B. Psych (Hons), Psychology, University of New South Wales, Unit 8 / 86 Cope St, Waterloo, Sydney, NSW 2017, Australia. E-mail: k.osbornecrowley@unsw.edu.au*

**J. PAXTON, N.D. CHIARAVALLI, G. JIVIDEN & G. WYLIE. Executive Control and Memory Acquisition in Traumatic Brain Injury.**

**Objective:** Deficits in memory acquisition are among the most debilitating cognitive symptoms following traumatic brain injury (TBI). The current study investigated whether individuals with TBI demonstrate memory impairment due to executive control difficulties in prioritizing the acquisition of relevant instead of irrelevant information.

**Participants and Methods:** TBI and healthy adult (HC) participants completed neuropsychological tests and an experimental task-switching/memory paradigm (TSM). In the TSM paradigm, participants simultaneously viewed word and picture stimuli and were cued to attend to and classify either the word or the picture. Then, acquisition of relevant (cued) and irrelevant (not cued) stimuli was assessed with a recognition test.

**Results:** On the recognition test, TBI participants showed significantly greater difficulty prioritizing words instead of pictures when cued to attend to words. Thus, TBI participants produced significantly lower recognition ratings for relevant words compared with HCs. Although TBI and HC participants did not differ significantly in number of words recalled on the California Verbal Learning Test-Second Edition (CVLT-II), TBI participants demonstrated significantly greater false positive responses and lower discriminability performance on the

CVLT-II recognition test. Further, in the sample of TBI participants, those producing false positive responses on the CVLT-II demonstrated significantly greater difficulty in prioritizing words instead of pictures on the TSM recognition test compared with TBI participants who did not produce false positive responses on the CVLT-II.

**Conclusions:** Results suggest that the ability to encode verbal information post-TBI may be related to difficulties inhibiting irrelevant stimuli, especially when relevant and irrelevant information is presented simultaneously.

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**S.K. PETERSON, H.K. RAU, D.K. MORELLI, E. PESKIND, M. RASKIND & K. PAGULAYAN. Attention and Working Memory in OEF/OIF/OND Veterans with Mild Traumatic Brain Injury.**

**Objective:** Literature suggests that 15-20% of Veterans deployed during Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) have sustained at least one blast-related mild traumatic brain injury (mTBI). Although perceived attentional difficulties are common in this population, most of these complaints have not been objectively verified. The purpose of this study was to examine different types of attention and working memory in this population using standardized neuropsychological measures.

**Participants and Methods:** 75 OEF/OIF/OND Veterans participated in the study; 23 deployed controls (no mTBI) and 52 with a history of blast-related mTBI. Neuropsychological measures included the Ruff 2&7 Selective Attention Test, Auditory Consonant Trigrams (ACT), and Test of Everyday Attention (TEA). Self-reported cognitive difficulties were assessed with the Frontal Systems Behavior Scale (FrSBe).

**Results:** Compared to controls, Veterans with a history of mTBI performed significantly worse on measures of active working memory (ACT 18 second delay,  $p=.007$ ), selective attention (Ruff automatic detection accuracy  $p=.042$ ), and divided attention (TEA dual task time per target,  $p=.019$ ; weighted time per target,  $p=.015$ ; and dual task decrement scaled score,  $p=.048$ ). Veterans with mTBI also reported significantly more cognitive complaints on the FrSBe (total score,  $p=.002$ ).

**Conclusions:** Consistent with research examining non-blast mTBI populations, results from this study indicate that OEF/OIF/OND Veterans with a history of mTBI exhibit significantly more attentional difficulties and subjective cognitive difficulties compared to Veterans without mTBI. Future research should explore the relationship between discrete attentional weaknesses and other cognitive domains, such as memory and learning.

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**D. PISNER, P. SINGH, A. FRIDMAN & W.D. KILLGORE. Resilience Following Mild Traumatic Brain Injury is associated with Gray Matter Volume in the Left Precentral Gyrus.**

**Objective:** The ability to rebound from disruptive life challenges, often referred to as "cognitive resilience," is known to contribute to more successful outcomes following mild traumatic brain injury (mTBI). Since the neurobiological profile of resilient individuals following mTBI has yet to be established, the present study investigated the relationship between resilience and gray matter volume (GMV) in individuals who have recently incurred an mTBI.

**Participants and Methods:** Twenty-six right-handed mTBI participants (11 males, mean age = 23.4) underwent high resolution T1 structural neuroimaging and completed the Connor-Davidson Resilience Scale (CD-RISC), a Likert-type self-report assessment of personality traits that enable one to thrive in the face of adversity. Controlling for time since injury, intra-cranial volume, age, and gender, a voxel-based morphometric (VBM) multiple regression analysis was used to explore the association between GMV in the frontal lobe and CD-RISC scores.

**Results:** Utilizing a small volume correction (SVC) for the frontal lobe, CD-RISC scores were found to be positively correlated with greater GMV in the left precentral gyrus (13 voxels,  $p < .05$ , FWE corrected). Exploratory analysis further revealed that this association is significantly more prominent in the acute (less than 3 months), as opposed to the chronic stage (between 3 and 12 months) following an mTBI.

**Conclusions:** The present findings suggest that GMV in the left precentral gyrus may predict cognitive resilience following an mTBI. Although the precentral gyrus is primarily thought to be responsible for voluntary movement, studies have shown that the left precentral gyrus may be associated with subthreshold depression risk and negative self-attributional bias in response to adverse life events. Early identification of gray matter deficits in this region following mTBI may therefore alert clinicians to the need to devote greater attention towards cultivating cognitive resilient skills.

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**H.K. RAU, S.R. THORGUSEN, S.K. PETERSON, D.K. MORELLI, E.R. PESKIND, M. RASKIND & K. PAGULAYAN. Intra-individual Variability on Neuropsychological Measures in OEF/OIF/OND Veterans: Associations with Blast-related mTBI and PTSD.**

**Objective:** Approximately 15-20% of US Service Members deployed during Iraq and Afghanistan conflicts have sustained a mild traumatic brain injury (mTBI). Many service members report persistent cognitive difficulties, yet objective evidence of cognitive weaknesses remains equivocal. This study examined intra-individual variability (IIV) on neuropsychological tests as an alternative method for detecting subtle cognitive difficulties in this population.

**Participants and Methods:** Participants included 55 male OEF/OIF/OND Veterans: 17 without TBI or PTSD, 10 with mTBI but no PTSD, and 28 with comorbid mTBI/PTSD. Self-reports included the FrSBe and PCL-M. Neuropsychological tests included the ACT, Ruff 2&7, WAIS-III Letter-Number Sequencing, CVLT-II, and BVMT-R. An IIV score (standard deviation of test scores around person-means) was calculated for each participant. Group differences were examined via one-way ANOVAs.

**Results:** A significant group effect emerged for IIV scores ( $p = .02$ ) but not average T scores ( $p = .13$ ) on neuropsychological tests, as well as for self-reported cognitive difficulties and PTSD symptoms ( $p < .001$ ). Post-hoc analyses revealed that Veterans with comorbid mTBI/PTSD exhibited significantly higher IIV and greater perceived cognitive difficulties compared to the other groups. Across groups, IIV scores were positively associated with FrSBe ( $p = .03$ ) and PCL-M ( $p = .01$ ) scores; after controlling for PTSD, the relationship between IIV score and FrSBe score was no longer significant ( $p = .56$ ).

**Conclusions:** In this study, neuropsychological test variability corresponded to cognitive complaints. Veterans with comorbid mTBI/PTSD demonstrated the most objective and subjective cognitive weaknesses, suggesting an additive effect of PTSD. Future research should examine whether neuropsychological IIV is uniquely associated with PTSD and whether IIV reflects lasting pathophysiological effects of mTBI observed via modern imaging techniques (i.e., diffusion tensor imaging).

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**M.E. ROBINSON, L.J. RADIGAN, L.J. GRANDE, W.P. MILBERG & R. MCCLINCHEY. Close-Range Blast Exposure is Associated with Greater Clinical Burden.**

**Objective:** Previous work has demonstrated that close-range blast exposures (CBE), while not necessarily producing concussion symptoms at the time of the event, are associated with demonstrable changes in brain function. The effects of these exposures are further explored to understand their role in the various co-occurring maladies that characterize this cohort.

**Participants and Methods:** Participants were Veterans and pre-deployed service members from the conflicts in Iraq and Afghanistan who were enrolled in the TRACTS VA Center of Excellence where clinical measures were assessed. Associations with CBE were assessed while controlling for age, gender, education, and Deployment Risk and Resiliency Inventory – Other score.

**Results:** CBE was associated with more severe pain ( $p = 0.003$ ), sleep impairment ( $p = 0.013$ ), anxiety ( $p = 0.038$ ), depression ( $p = 0.044$ ), stress ( $p = 0.008$ ), and neurobehavioral symptom inventory score ( $p = 0.031$ ). There were trend-level effects on posttraumatic stress disorder symptom severity ( $p = 0.054$ ). There was no significant difference in total WHODAS score, although some subscores significantly differed. Participants with CBE also were more likely to report tinnitus ( $p = 0.015$ ) hearing impairment ( $p = 0.021$ ), but were no more likely to report headaches, migraines, dizziness, or fainting ( $p > 0.05$ ).

**Conclusions:** Although the methods used in this study can only assess correlation and not causation, it appears that CBE is associated with greater clinical burden in Veterans than would be expected from their deployment history alone. Given the alarming number of soldiers that are exposed to these blasts, a greater understanding of the effects of exposure, even without associated concussion, is necessary to provide the most effective treatment.

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**S.L. WARREN, M. MELINDER & N. ROTHONG. Neuropsychological Associations of Mild Traumatic Brain Injury and Psychopathology.**

**Objective:** Military personnel involved in the current conflicts are sustaining mild TBI (mTBI; i.e., concussion) at unprecedented rates. While many individuals who sustain mTBI do not experience ongoing symptoms, research suggests that some individuals experience persistent cognitive sequelae and/or mental health problems. There is considerable controversy as to whether the etiology of enduring cognitive disruptions can be attributed to mTBI, or if these neuropsychological consequences are better explained by the presence of anxiety and/or depressive symptoms. Accordingly, this study examined the contribution of remote mTBI, anxiety, and depression to cognitive disruptions in a Polytrauma/TBI Veteran population.

**Participants and Methods:** A retrospective chart review was conducted of Veterans seen in the Polytrauma/TBI Clinic of the VA St. Louis Health Care System from 12/1/2006 through 1/6/2015. Participants included 267 Veterans who participated in the clinical interview and neuropsychological evaluation. Hierarchical linear regressions were conducted to investigate the relationships between mTBI, anxiety, and depression across a comprehensive battery of neuropsychological tests.

**Results:** Mental health symptoms mediated the relationship between mTBI and neuropsychological performance.

**Conclusions:** Clinicians are confronted with many challenges in the care of Veterans with co-occurring mild TBI, PTSD, and depression, as differential diagnosis is complicated by common symptoms among these phenomena. Elucidating the source(s) of enduring cognitive disruptions in mTBI has implications for the development and implementation of effective treatment interventions, such as psychoeducation about typical mTBI recovery and the impact of mental health symptoms on everyday cognitive functioning.

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**V. SAMARINA, T.L. MERKLEY, E.A. WILDE, S. MCCAULEY, A. BARNES, G. HANTEN & H.S. LEVIN. Cognitive, Somatic, and Emotional Changes in Patients with Mild Traumatic Brain Injury (mTBI) and Orthopedic Injuries at Baseline and 3 Months Post-Injury.**

**Objective:** Postconcussive symptoms are non-specific as they can be seen across various clinical populations and can be impacted by numerous factors including emotional distress, premorbid cognitive difficulties, or litigation involvement. Some studies indicate that most mild traumatic brain injury (mTBI) patients appear to experience a full recovery by 3 months, while others suggest that sequelae may persist longer following injury. The present longitudinal study investigated potential cognitive, somatic, and emotional changes in adolescents and young adults of comparable demographic background at 96 hours and 3 months post-injury following either an orthopedic injury (OI) or mTBI. **Participants and Methods:** The groups were comparable for age and other demographic factors. Individuals with either a history of mTBI (N=53) or orthopedic injuries (N=38) were administered tests of visual and verbal memory and phonemic verbal fluency.

**Results:** Cognitive performance did not differ between the mTBI and OI groups at either 96 hours or 3 months. On self-rating questionnaires, compared to the OI group the mTBI patients endorsed more symptoms on the Posttraumatic Stress Disorder Checklist Scale (PCL) at 96 hours ( $p=0.001$ ) and at 3 months ( $p<0.001$ ). More symptoms were also endorsed on the Rivermead Post Concussion Symptoms Questionnaire at both time points ( $p's<0.001$ ). More specifically, the mTBI group reported more cognitive and somatic problems both at 96 hours and 3 months (all  $p's<0.001$ ), although their reported cognitive symptoms did not correspond with their observed performance on memory and verbal fluency tasks. There was a trend for endorsement of more emotional symptoms in the mTBI group at 96 hours ( $p=0.054$ ), and this discrepancy became more apparent at 3 months ( $p=0.003$ ) in comparison to the OI group.

**Conclusions:** The current findings suggest that mTBI patients may demonstrate a good cognitive recovery in these domains, although patients may continue to endorse cognitive, emotional, and somatic sequelae.

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**M. SANDERSON-CIMINO, S.M. JURICK, L.D. CROCKER, A. KELLER, A. RAUCH, C. JOHNSON & A.J. JAK. Use of the TOMM Response Consistency Indices in Veterans with History of Mild Traumatic Brain Injury and PTSD.**

**Objective:** The Test of Memory Malingering (TOMM) is used to assess neuropsychological performance validity. The Alabama Consistency Index (ACI) and the Invalid Forgetting Frequency Index (IFFI) were developed to increase TOMM sensitivity rates by measuring response consistency across trials of the TOMM. The IFFI distinguishes valid learning patterns from inconsistent responding, whereas the ACI does not. We sought to compare the cognitive performance of those who displayed differing patterns of ACI and IFFI performance and to determine if those with subtle learning impairments on the TOMM demonstrate difficulty on other measures of learning and memory.

**Participants and Methods:** 30 OEF/OIF Veterans with a history of mild to moderate traumatic brain injury and post-traumatic stress disorder underwent a comprehensive neuropsychological battery and were separated into 3 groups based on ACI and IFFI performance. The 'pass' group ( $n=10$ ) scored above cutoffs on both the ACI and IFFI, the 'fail' group ( $n=10$ ) scored below cutoffs on both measures, and the valid learning patterns group ('valid learning' group,  $n=10$ ) scored below cutoff on the ACI but above cutoff on the IFFI.

**Results:** ANOVAs demonstrated that the fail group performed significantly poorer than the pass group on all neuropsychological measures. In contrast, the valid learning group performed similarly to the pass group across all cognitive domains ( $p's > .05$ ) except for memory, where the

valid learning group performed significantly worse than the pass group on learning and recall measures of the California Verbal Learning Test II (CVLT-II) and comparably to the fail group.

**Conclusions:** The response consistency indices of the TOMM show differential patterns in Veterans with a history of TBI and PTSD; those performing below cutoff on the ACI but above on the IFFI show neuropsychological patterns more similar to those scoring above cutoff on both indices. However, memory performance was most similar between the fail and valid groups.

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**P. SINGH, A. FRIDMAN, D. PISNER & W.D. KILLGORE. Time Dependent Differences in Gray Matter Volume in Individuals Post Mild Traumatic Brain Injury: A Voxel Based Morphometric Study.**

**Objective:** Mild Traumatic brain injury (mTBI) is known to cause diffuse axonal injury, but may also affect gray matter (GM) structures in the brain. This damage is dependent on multiple factors such as site of injury and time since injury (TSI), which can vary clinical manifestations of mTBI. Due to their location, the occipital and temporal lobes have shown to be prone to the effects of mTBI. Damage to these regions may lead to disturbances in the visual pathways and object and facial recognition

**Participants and Methods:** Twenty-six right-handed mTBI individuals participated in the study. Two groups were formed on the basis of TSI: 13 acute ( $\leq 92$  days) and 13 chronic ( $>92$  days). Voxel-based morphometry (VBM8) was used to analyze T1 high-resolution structural magnetic resonance imaging (MRI) scans. Segmented GM images were analyzed to determine regions in which acute and chronic groups had significant differences in volume

**Results:** After controlling for age, gender and intra-cranial volume, the acute group had significantly ( $p<0.05$ , FDR corrected) less GM volume in the right fusiform gyrus and right inferior temporal gyrus as compared to the chronic group. The fusiform gyrus region was found to be significantly correlated ( $R^2 = 0.172$ ) with the psychomotor vigilance task (PVT) average reaction time performance as compare to chronic group ( $R^2 = 0.044$ )

**Conclusions:** Significant differences were found in GM volumes in the acute and chronic groups particularly in the regions involving ventral visual processing. This finding shows that some of the visual processes in the acute phase of mTBI might be compromised more as compared to chronic phase. Early intervention post mTBI might be helpful at this stage. Future studies will need to examine other effects of mTBI in acute and chronic stages, which can help in developing better targeted intervention strategies.

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**M. SULLAN, B. ASKEN, A.R. SNYDER, E.C. CREW, J.R. CLUGSTON & R.M. BAUER. The relationship between post-concussive sleep symptoms and recovery time in Division 1 collegiate athletes.**

**Objective:** Changes in sleep patterns are frequently reported following brain injury and have been associated with a greater likelihood of developing neuropsychiatric problems, such as depression and PTSD, complicating recovery. This study sought to determine the relationship between sleep-related symptoms and recovery time following sports related concussion.

**Participants and Methods:** The University of Florida Concussion Databank (UFCD) contains retrospective and prospective concussion-related data for consenting UF varsity athletes. Records from 74 concussed athletes (4 female, 70 male,  $20.3 \pm 1.3$  years) were analyzed. Symptoms were assessed using the Post-Concussion Scale (PCS) and were clustered into four categories: somatic, cognitive, sleep, and psychological. Days

Missed was calculated as the number of days between day of injury and clearance for return to contact.

**Results:** Using Pearson correlations, only total sleep symptom severity and somatic symptom severity were significantly related to Days Missed ( $r=.309$ ,  $p=.007$ ;  $r=.244$ ,  $p=.037$  respectively). In a single hierarchical regression model controlling for gender and history of concussion, sleep and somatic symptoms were no longer significant predictors of recovery time. However, sleep symptom severity ( $\beta=.234$ ) was a better unique predictor of Days Missed than was somatic ( $\beta=.117$ ), cognitive ( $\beta=-.026$ ) or psychological symptom severity ( $\beta=.060$ ).

**Conclusions:** Changes in sleep patterns following concussion are significantly associated with greater recovery time following injury. These data provide the impetus for a larger-scale study with an increased sample size and more heterogeneous population to determine the mechanisms by which post-concussive sleep changes impact recovery time. Correspondence: *Molly Sullan, BS, Clinical and Health Psychology, University of Florida, 230 SW 2nd Ave, Apt 403, Gainesville, FL 32601. E-mail: mollysullan@gmail.com*

**D.F. TATE, C.S. VELEZ, A. DRENNON, M. REID, J. KENNEDY, A. BOWLES & D. COOPER. Subjective Reports of Cognitive Dysfunction and Objective Neuropsychological Test Results Among Active Duty Service Members.**

**Objective:** Subjective cognitive complaints and neuropsychological findings do not always agree in type and severity leading to a number of important clinical questions and concerns. The purpose of this study was to characterize the relationship between subjective reporting of cognitive symptoms and objective neuropsychological test results in a cohort of active duty service members.

**Participants and Methods:** 176 service members (121 mild TBI/55 orthopedically injured (OI) controls) participating in this research study. Each participant was administered the Neurobehavioral Symptom Inventory (NSI) and a battery of neuropsychological tests (NPT, 9 test/15 scores). Each participant's response to the 4 cognitive items from the NSI (NSI-Cog) were used as a subjective measure of cognitive dysfunction. Partial correlations between the NSI-Cog scores and 15 NPT scores (while controlling for age/sex) were examined for the entire group (mTBI and OI combined) and separately.

**Results:** Combined, results demonstrated significant moderate relationships between NSI-Cog response scores and all but two NPT scores (after multiple comparisons correction;  $r$  absolute value range=0.229 to 0.449). The number of relationships was reduced to 5 significant NPT test scores (CVLT-II total, short delayed, long delayed, WAIS-IV processing speed index, and Trails A time;  $r$  absolute value range=0.264 to 0.315) when examining the mTBI group only. One NPT test score (CVLT-II total score;  $r$ -value=-0.469) was found to be related to NSI-Cog score in the OI group. The direction of the correlations was consistently in the expected direction with elevated NSI-Cog scores indicating poorer NPT performance.

**Conclusions:** Results suggest that as a group (with the full range of NSI-Cog variability), military research subjects showed an association between subjective complaints and objective test performance, though it is clear that additional analyses are needed to clarify the contribution of additional individual variables of interest (i.e., mood, pain, PTSD, etc). Correspondence: *David F. Tate, Ph.D., Missouri Institute of Mental Health, University of Missouri-St. Louis, 4633 World Parkway Circle, Suite 135, Berkeley, MO 63134-3115. E-mail: David.Tate@mimh.edu*

**D.P. TERRY & L. MILLER. Microstructural White Matter Changes in Non-Professional Football Players 20-45 Years After Two or More Concussions.**

**Objective:** The long-term effects of concussions are still being elucidated at the microstructural level. Previous diffusion tensor imaging (DTI) studies have shown white matter changes in former professional athletes who experienced concussions. However, research has neglected individuals at the non-elite level. This study examined middle-aged former

high school football players who experienced multiple concussions with the expectation that those with concussive histories would have lower fractional anisotropy (FA) and higher mean diffusivity (MD) than the non-concussed controls.

**Participants and Methods:** Forty right-handed males ages 40-65 were recruited from the community. All participants played high school football but did not play in college or professionally. Participants either received two or more concussions in the context of high school football ( $n=20$ ; average 3.4 concussions) or no lifetime concussions ( $n=20$ ). DTI scans with 30 optimized gradient directions were collected. Data were processed using whole-brain Tract-Based Spatial Statistics and compared across groups using 5000 null permutations and a threshold-free cluster enhancement based  $p$ -value of .05.

**Results:** The two groups were matched on age, years of education, estimated IQ, and current concussion-like symptoms. The previously concussed group exhibited lower FA ( $p < .05$ ) than the control group in parts of the right genu/body of the corpus callosum, bilateral internal capsule, bilateral superior longitudinal fasciculus, and bilateral inferior frontal longitudinal fasciculus. However, there were no statistically significant differences in MD between groups.

**Conclusions:** These data are consistent with studies that show lower FA in professional athletes with concussive histories, which suggests microstructural changes are chronic and evident in the absence of a lifetime of contact sports exposure. Future studies should use more specific DTI indices to help elucidate the specific microstructural white matter changes, as FA is a non-specific measure.

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**E. VAKIL, O. AVIV, M. MISHAEL & Y. SACHER. Title: Direct and indirect measures of context in patients with moderate-to-severe Traumatic Brain Injury (TBI): The additive contribution of eye tracking.**

**Objective:** The facilitation of memory for target stimuli due to similarity of context in the learning and testing phases is known as the "Context Effect" (CE). The paradigm used enabled measuring memory for target, direct memory for context and indirect memory for context as expressed in CE. Previous studies reported that while memory for contextual information in patients with TBI was impaired when measured directly CE was preserved. In an attempt to obtain a better understanding of the underlying cognitive processes while performing this task, eye movements were monitored for participants in both groups.

**Participants and Methods:** Twenty five patients with moderate to severe TBI (mean age 28.58) and 25 matched controls (mean age 27.84) participated in this study. We employed a local-context stimulus array, presenting participants with photographs of trial-unique male faces shown wearing distinctive, trial-unique hats (yielding specificity). Throughout the test, eye movements were recorded by the SensoMotoric Instruments (SMI) RED-M remote eye-tracker that allowed free head movements, with a sampling rate of 120 Hz and high accuracy of 0.8°.

**Results:** Behavioral results were consistent with previous results which showed that memory in patients with TBI was impaired when measured directly but preserved when measured indirectly (i.e. CE). For both groups, eye tracking showed longer dwell-time on targets during the learning phase for the stimuli correctly answered. At the test phase, dwell-time on targets was longer for the control group than for the TBI group.

**Conclusions:** The finding that eye movement patterns were similar for the two groups during learning but different during the test phase indicates that the source of the differences in memory performance between the groups is at the retrieval rather than the encoding stage of learning. This study demonstrates the potential benefits of eye tracking to enhance understanding of underlying cognitive processes.

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**R. VAN PATTEN, Z. MERZ, K. MULHAUSER & R. FUCETOLA. Predicting Return to Work at Six-Month Follow-up in Mild to Moderate Stroke Patients: The Relative Importance of Physical Disability and Neurocognitive Functioning.**

**Objective:** Stroke is the second most common neurological disorder in adults next to Alzheimer's disease. Although cerebrovascular events are often associated with high mortality rates, improvements in acute interventions have led to increased survival rates, accentuating the importance of understanding residual deficits. A number of metrics are used to quantify everyday functioning following stroke, one of which is assessing return to work (RTW). We hypothesized that acute neurocognitive data would predict RTW above and beyond select demographic and physical therapy (PT) metrics.

**Participants and Methods:** We retrospectively examined the medical charts of 120 adults with mild to moderate strokes (defined as an NIH Stroke scale score of < 17) as part of a multidisciplinary, inter-institutional collaboration across an academic medical center, an acute care hospital, and a rehabilitation center. We sought to predict stroke patients' self-reported RTW status at a six-month follow-up phone interview from demographic and acute PT and neurocognitive data using a hierarchical logistic regression model.

**Results:** Findings indicated that 75% (90/120) patients who were working previously were able to RTW six months following their strokes. Moreover, adding neurocognitive data improved predictive power above and beyond age, stroke severity and PT measures and our final regression model accurately identified 83% (100/120) of these individuals' RTW status. Beta coefficients suggested that expressive language (the Boston Naming Test) had the greatest degree of predictive power among the neurocognitive measures in the analysis.

**Conclusions:** Our data argue for the clinical utility in examining acute neurocognitive performances, especially expressive language, when predicting a patient's ability to RTW following a stroke. Together with physical disability data, this will allow clinicians to better tailor therapies to individual patients, thereby increasing efficiency in the utilization of healthcare resources and improving overall patient outcome.

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**C.S. VELEZ, M. REID, A. DRENNON, J. KENNEDY, D. COOPER, A. BOWLES & D.F. TATE. Base Rates Neuropsychological Performance in Service Members with Mild TBI, PTSD and Orthopedic Controls.**

**Objective:** Service members in the United States military returning from Operation Iraqi Freedom (OIF)

and Operation Enduring Freedom (OEF) missions are presenting with multiple symptoms stemming from various injuries including mild traumatic brain injury (mTBI) and post traumatic stress disorder (PTSD). One of the biggest challenges is establishing the clinical and cognitive profiles that can discriminate between disorders such that finding the appropriate treatment becomes more likely. The purpose of this study is to characterize the cognitive function and symptom reporting in a cohort of 182 active duty service members returning from OEF/OIF missions.

**Participants and Methods:** The sample is comprised of four groups including Orthopedic controls (OI)=44, PTSD only=19, TBI only=31, and TBI with PTSD=88. Neuropsychological test scores and symptom reporting inventories were compared using a multivariate general linear statistical procedure controlling for age and gender.

**Results:** Results demonstrated significant differences (Hotelling's Trace F-Value=11.054,  $p < .001$ ) with a dose effect relative to OI controls. The PTSD group showed significant differences in working memory and symptom reporting ( $p < .04$ ). The TBI group showed further

significant differences in processing speed and fluency ( $p < .04$ ), and TBI+PTSD group showed significant differences across the spectrum of neuropsychological tests and symptom reporting.

**Conclusions:** These findings support the burden of adversity hypothesis that posits that the combination of mTBI/PTSD puts individuals at increased risk for worse outcomes. Characterizing the unique patterns of cognitive dysfunction across these groups is not only useful in discriminating between diagnostic groups, but planning/implementing prospective treatment programs capable of addressing the unique needs of these patients. Further analyses that include additional clinical and demographic variables (i.e., mood, pain, sleep, etc.) are needed to confirm and extend these findings.

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**K.C. VYNORIUS, A. PAQUIN & D.R. SEICHEPINE. Lifetime Multiple Mild Traumatic Brain Injuries are Associated with Cognitive and Mood Symptoms in Young Healthy College Students.**

**Objective:** Mild traumatic brain injury (mTBI) has been associated with a range of acute and long-term cognitive and emotional difficulties. To date, no studies have examined the impact of a lifetime accumulation of mTBIs on cognition and mood in a sample of young adults who were not elite athletes or military personnel. The present study examined the impact of multiple mTBIs acquired over a lifetime on executive functioning and symptoms of depression in young healthy college students.

**Participants and Methods:** Twenty-nine undergraduate students without an mTBI history (female=25) and twenty-nine with 2 or more mTBIs (female=23) participated in this study. Participants completed several standardized measures of mood, behavior, and cognition, including the Cognitive Complaint Index (CCI), Behavior Rating Inventory of Executive Function, adult version (BRIEF-A), and the Beck Depression Inventory, second edition (BDI-II). A definition of mTBI consistent with the American Academy of Neurology's current guideline was used.

**Results:** Participants with an mTBI history compared to those without, endorsed significantly more cognitive complaints on the CCI ( $p < .01$ ), more problems with executive functioning on the BRIEF-A overall score ( $p < .05$ ), and more symptoms of depression on the BDI-II ( $p < .05$ ). In individuals with mTBIs, the number of injuries significantly correlated with scores on the CCI ( $\rho = .64$ ,  $p < .01$ ), BRIEF-A overall score ( $\rho = .47$ ,  $p < .01$ ), and the BDI-II ( $\rho = .53$ ,  $p < .01$ ).

**Conclusions:** Consistent with the literature in elite athletes and military personnel, mTBIs acquired over a lifetime were associated with cognitive and executive functioning complaints and symptoms of depression in young healthy college students. These mTBIs were acquired through a wide variety of activities, such as horseback riding, ice hockey, basketball and using vehicles. These findings suggest that multiple mTBIs acquired over a lifetime may be associated with subtle cognitive and emotional weaknesses even in otherwise young healthy college students. Correspondence: *Daniel R. Seichepine, Boston VA Research Institute, 150 S Huntington Ave, Building #9, Room 330, Boston, MA 02130. E-mail: daniel13@bu.edu*

**R. VENEZIA, K.A. WALKER, K. HAPPER, A. KAUR, S. BRICE, A. HIRALALL & S. SCHAFFER. Total Sedation and Delirium are Related to Memory Functioning, but Not General Cognition, in Critically Ill ICU Patients at Time of Discharge.**

**Objective:** Delirium is common in the ICU, affecting 50-90% of patients. Previous research has demonstrated that delirium in the ICU is associated with long-term cognitive impairment, but the nature of the relationship between ICU delirium and cognitive dysfunction is not well understood. The goal of the current study was to determine whether total days of delirium predicted cognitive status at ICU discharge. The association between sedation, a risk factor for delirium, and cognitive status was also examined.

**Participants and Methods:** 34 individuals without pre-existing neurological or cognitive impairment who were admitted to the ICU for greater than 72 hours and diagnosed with septic shock and/or respiratory failure were enrolled. Richmond Agitation Sedation Scale (RASS) score and delirium (i.e., orientation and attention) were assessed approximately four times daily. At the time of ICU discharge, memory (RBANS List Learning) and general cognitive functioning (MMSE) were assessed.

**Results:** After covarying for length of stay, age, and total hypoxia (serum oxygenation), cumulative level of sedation during the ICU stay predicted poorer memory functioning ( $\beta = -1.04, p < .01, R^2 \Delta = .17$ ) at ICU discharge. Total days of delirium was also predictive of poorer memory, but to a lesser degree ( $\beta = -.34, p < .10, R^2 \Delta = .09$ ). Of the covariates, length of ICU stay ( $\beta = -1.24, p < .01$ ) emerged as an independent predictor of poorer memory functioning at discharge. However, neither cumulative sedation, nor total delirium was predictive of poorer MMSE score at the time of ICU discharge.

**Conclusions:** In critically ill ICU patients, length and depth of sedation and the total days of delirium were found to be associated with poorer memory functioning at the time of ICU discharge. These findings support previous research that has linked delirium to post-ICU memory impairment. Additionally, the results suggest that the level and duration of sedation may play an even greater role in the development of early memory impairment.

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**M. KRENGEL, M.K. YEE, T. NOLAN, P.A. JANULEWICZ, K. SULLIVAN & D.R. SEICHEPINE. Multiple Self-Reported Brain Injuries are Associated with Increased Health Symptoms in a Cohort of 1990-1991 Gulf War Veterans.**

**Objective:** Traumatic brain injury (TBI) was recently associated with chronic health symptoms reported by Gulf War (GW) Veterans. Repetitive TBIs, even mild (mTBI), are linked to poor health in other cohorts, but to our knowledge have not been examined in GW Veterans. The aim of this study was to determine if GW veterans reporting multiple mTBIs also endorse higher rates of health symptoms.

**Participants and Methods:** Two hundred and twenty nine male 1990-1991 GW Veterans (mean age=55.8±8.3) from the Ft. Deven's Cohort endorsed the presence or absence of 34 health symptoms over the last 30 days. Veterans were categorized according to self-reported frequency of mTBIs defined by the American Academy of Neurology's current guidelines: no mTBIs (n=72), one mTBI (n=26), two TBIs (n=25), and three or more mTBIs (n=106). A one-way ANOVA was performed with mTBI group as the independent variable and total number of health symptoms as the dependent variable. Post-hoc analyses utilized Tukey's HSD test.

**Results:** Age was similar between mTBI groups ( $F=2.04, p=0.109$ ). A significant overall difference of total health symptoms by mTBI group was found ( $F=13.94, p<0.001$ ). Post-hoc analyses showed Veterans reporting two mTBIs or three or more mTBIs had significantly higher rates of health symptoms than Veterans reporting no mTBIs ( $p=0.007$  and  $p<0.001$ ).

**Conclusions:** GW Veterans self-reporting two or more mTBIs also indicated significantly higher rates of symptoms. This suggests GW veterans may have fully recovered from one mTBI, but sustaining two or more may be contributing to chronic health problems. These findings could be applicable to other Veteran populations (e.g. OEF/OIF).

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**M.K. YEE, D.R. SEICHEPINE, T. NOLAN, P.A. JANULEWICZ, K. SULLIVAN & M. KRENGEL. Self-Reported Exposures to Mild Traumatic Brain Injury and Neurotoxins Predict Current Total Health Symptoms in a Cohort of 1990-1991 Gulf War Veterans.**

**Objective:** Gulf War (GW) Veterans have reported chronic health symptoms since returning from war nearly 25 years ago. Environmental exposures are believed to be an etiologic factor, however, history of mild traumatic brain injury (mTBI) has recently been raised as a potential contributor. The aim of the present study was to examine the relation between environmental exposures and mTBI with current health symptoms in GW Veterans.

**Participants and Methods:** Two hundred and fifty-six (male=229) 1990-1991 GW Veterans (mean age=55.6±8.3) from the Ft. Deven's cohort endorsed the presence or absence of 34 health symptoms over the last 30 days. Veterans also self-reported frequency of mild TBIs defined by the American Academy of Neurology's current guidelines. Exposure to Agent Orange, chemical or biological warfare (e.g. scud missiles), anthrax vaccine, and pyridostigmine bromide (PB) were also self-reported. Linear regressions were performed with exposures as the predictor variables and total number of health symptoms as the dependent variable.

**Results:** The initial model was significant when all predictor variables were entered into the regression ( $p<0.001$ ). Using backward elimination Agent Orange, anthrax vaccine, and PB were removed from the model. The final model revealed exposure to chemical or biological warfare ( $\beta=0.389, p<0.001$ ) and mTBI ( $\beta=0.222, p=0.003$ ) predicted total health symptoms.

**Conclusions:** Exposure to mTBI and chemical or biological warfare predicted total number of health symptoms. This may support the multi-hit hypothesis, which suggests multiple insults to the central nervous system induce chronic neuroinflammation potentially causing chronic health problems. This data could influence future treatment targets for GW veterans.

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## Language and Speech Functions/Aphasia

**A. DANGUECAN, T.L. MCAULEY, G. GILL & L. BUCHANAN. Challenging the Phonological/Deep Dyslexia Continuum: A Case Study.**

**Objective:** Deep dyslexia (DD) is an acquired reading disorder characterized by semantic paralexias and impairments in nonword reading. One theory of DD proposes that it is an extreme variant of phonological dyslexia (Glosser & Friedman, 1990; Crisp & Lambon Ralph, 2006), and thus that phonological impairment is the core deficit in DD. This continuum hypothesis predicts that patients with mild DD (who make few semantic errors) should be relatively sensitive to phonology. However, in a series of experiments by Gooding, Danguécan, and Buchanan (2014), a patient with mild DD (GL) had more difficulty naming pictures preceded by phonemic cues than by semantic cues. This demonstrated insensitivity to phonology challenges a continuum theory of phonological/deep dyslexia. The objective of the present study is to further assess GL's sensitivity to phonology by evaluating his recognition speed of real words in the context of a task that places fewer demands on phonological output.

**Participants and Methods:** GL completed three visual lexical decision tasks in which he was required to distinguish real words from non-pronounceable nonwords, pronounceable nonwords, or pseudohomophones.

**Results:** Consistent with previous research, GL responded fastest to words in the non-pronounceable nonword condition. Unexpectedly however, GL responded faster to words in the pseudohomophone condition than in the pronounceable nonword condition.

**Conclusions:** Together with Gooding et al.'s (2014) findings, these results may suggest that GL is insensitive to phonology on certain tasks,

which is inconsistent with a continuum theory of phonological/deep dyslexia. Notably, an alternative model of DD proposed by Buchanan, McEwen, Westbury, and Libben (2003) known as the Failure of Inhibition Theory may be easily accommodated to account for the present data. Such a modification proposes that there may be qualitative (not just quantitative) differences between phonological and deep dyslexia. Correspondence: *Ashley Danguécan, Psychology, University of Windsor, 31 Hepburne Street, Toronto, ON M6H1K1, Canada. E-mail: danguec@uwindsor.ca*

#### **A. FONG, C. TUFO & P. DONOVICK. Do Bilinguals Have an Advantage in Learning a New Language?**

**Objective:** Our research was designed to address whether greater years of language instruction in a classroom setting facilitates language acquisition of a completely novel language. We examined this relationship in both bilingual and monolingual groups. We hypothesized that there would be a difference in language acquisition ability, where those who received more years of language instruction in a classroom setting would perform the task better, and that bilinguals would perform the task better.

**Participants and Methods:** 71 undergraduate participants disclosed their language history, including level of proficiency in languages and years of formal language instruction, through a self-reported survey. We chose to teach words in Tibetan, as it was a language that few students had contact with. We provided audio samples of 12 Tibetan words followed with their English translations. Short-term recall was tested through the presentation of the auditory samples for 3 trials. Participants were asked to write down the English translation following a Tibetan-only auditory cue. Long-term recall was tested with one trial of the Tibetan-only auditory cue.

**Results:** We found that there was a positive correlation between the years of formal language training and number of correct translation responses both in short term recall ( $r=.328, p=.005$ ) and long term recall of Tibetan words ( $r=.419, p < .001$ ). Greater years of language instruction in a classroom setting correlated with greater translations remembered. There was no significant difference in the number of translations recalled between the bilingual and monolingual groups.

**Conclusions:** We found that having a greater number of years of language instruction in a classroom setting results in better performance in learning a completely novel language. These results indicate that foreign education training in classrooms is beneficial for those seeking to acquire a new language later in life.

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#### **J.P. JOHNSON, K. ROSS & S. KIRAN. Evaluating Responsiveness to Treatment and Generalization in Patients with Acquired Reading and Writing Deficits.**

**Objective:** Dyslexia and dysgraphia in persons with aphasia (PWA) are responsive to treatment but the extent of recovery is variable. This study aimed to determine if a novel treatment improved PWA's single word reading or writing and generalized to an untreated modality and untreated words.

**Participants and Methods:** Five PWA (age range 44-72 years) received eight weeks of treatment for oral reading ( $n=2$ ) or writing to dictation ( $n=3$ ). Each was treated on 16 words using a 13-step protocol targeting lexical and sublexical processes. Treatment effects were monitored on treated words and orthographically or semantically related words in both modalities. Accuracy was assessed pre- and post-treatment and probed at each session. Response to treatment was analyzed via logistic regression predicting the odds of a correct response over the course of treatment and slope analysis of accuracy on each treatment step.

**Results:** Four PWA significantly improved their log odds of a correct response in the trained modality and two did so in the untrained modality (all  $ps < .01$ ). Two PWA showed signs of generalization to untreated but related words. All PWA who improved in treatment increased their

accuracy on steps involving independent reading or writing, while three improved on spelling with letter tiles, phoneme to grapheme conversion and delayed reading or writing (all  $ps < .05$ ).

**Conclusions:** Results suggest the treatment improves PWA's written language skills and promotes generalization. Key treatment steps require immediate or delayed reading or writing, scaffolded spelling and sublexical conversion. Patient factors such as locus of impairment likely contribute to variability in improvement. Future research will examine whether these factors predict patient performance and will align patient profiles with the most essential treatment steps to promote recovery.

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#### **P.T. LAI & A.R. LOPEZ. Language and Prosodic Measures in Typically Developing Children and Children with High Functioning Autism.**

**Objective:** The goal of this study is to better characterize how school-age children produce language during a dyadic naturalistic conversation focusing on prosodic measures.

**Participants and Methods:** Children (ages 7-14) were asked questions such as "What did you do over the weekend"; "Can you tell me about your siblings". Children encounter these types of questions on a daily basis, and thus, this situation reflects everyday verbal interactions. Typically Developing children (TD;  $n=22$ ) and children with High Functioning Autism (HFA;  $n=22$ ) participated. Based on the total length of the interview, the video was separated into beginning, middle, and end. Within each segment, 8 seconds of continuous speech from the child was collected. PRAAT, a linguistic program that parses out the various aspects of prosody was used to analyze mean pitch, range pitch, mean intensity, and range intensity.

**Results:** For pitch and range of pitch, no differences were observed between the two groups. Interestingly, a large amount of variance was observed for pitch in the HFA group. A follow-up analysis investigating variability between the two groups resulted in a significant difference ( $p=0.018$ ), the HFA group was more variable with regards to pitch than the TD group. This result suggests that children with HFA are producing speech with a more variable pitch pattern than TD children when conversing with an adult on everyday topics. For intensity, a significant difference was observed as the HFA group was creating more intense speech ( $p=0.026$ ) than the TD group. A trend was observed for range of intensity ( $p=0.113$ ), with the HFA group having a larger range than the TD group.

**Conclusions:** Taken together, during naturalistic speech, children with HFA are more variable in their pitch patterns and are more intense compared to their TD peers. These results can better help define the social and communicative profile of our groups, and future research can begin linking aspects of communicative behaviors to potential underlying neural mechanisms.

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#### **S. LEVÄNEN, K. THIPPANA & E. VILKMAN. Influence of Visual Speech on Audiovisual Speech Perception in Language-Impaired Children.**

**Objective:** Speech perception in children with and without developmental language impairment (LI) was investigated by presenting auditory and audiovisual speech stimuli in noise and in noise-free conditions. In addition, visual speech-reading abilities were evaluated.

**Participants and Methods:** The participants were 5-6 year-old children diagnosed with LI, and a sample of typically developing (TD) children. In addition to auditory, visual and congruent audiovisual speech stimuli, the participants were presented with an incongruent McGurk stimulus, where the consonant uttered by the voice (auditory /aPa/) differed from that articulated by the face (visual /aKa/).

**Results:** Although both LI and TD children were inaccurate while perceiving consonants in noise and gained from the visual input in congruent audiovisual stimuli, LI children were significantly worse at the task in all auditory and congruent audiovisual conditions. In addition, they were worse at visual speech-reading. Finally, while TD children were strongly influenced by the visual input in McGurk stimuli, LI children gave both /aTa/ and /aKa/ responses. There were no differences in the auditory responses (/aPa/) between LI and TD children. Auditory, visual and audiovisual speech perception did not differ between LI children who had problems predominantly either in speech production or in understanding speech.

**Conclusions:** LI children had clear deficits in speech-in-noise perception and at visual speech-reading. This was reflected in poorer performance in perceiving congruent audiovisual speech. Responses to the McGurk stimuli reflected their poorer speech-reading ability, i.e. children with LI confused visual /aKa/ with /aTa/. These results show that speech perception problems in LI occur both in auditory and visual domain.

#### A.R. LOPEZ & P.T. LAI. Sustainable Language Production in Typically Developing Children and Children with Focal Lesions.

**Objective:** The goal of this study is to better characterize how school-age children produce language in a naturalistic conversation. Language production and prosodic variables were captured to investigate how children interact in a dyadic interview with an adult.

**Participants and Methods:** Children between the ages of 7-14 years old participated and were asked questions such as “what do you and your sibling do for fun” or “what did you do on your vacation”. Based on the total length of the interview, the video was separated into beginning, middle, and end. Within each segment, 8 seconds of continuous speech were indicated as either completed or incomplete. Two separate group comparisons were examined. First, typically developing children (TD; n=24) were divided into two groups; the first group consisted of children producing sustainable language (three full segments of 8 seconds of speech; n=11), and the second group of children unable to sustain language production (did not complete all three segments of speech; n=13). Our second comparison examined language production in children with focal lesions. Participants include children with Left Hemisphere Injury, LHI; n=8 and children with Right Hemisphere Injury, RHI; n=11.

**Results:** Full scale IQ, performance IQ, mean pitch, range pitch, mean intensity, and range intensity all were not significant in these two TD groups. Verbal IQ score was able to separate the two TD groups, with higher verbal IQ scores for the TD children able to complete all three segments of speech ( $p=0.04$ ). Results indicated that the majority of the LHI was not able to complete all three segments (1/8), while over half of the RHI was able to sustain language production (6/11).

**Conclusions:** These results suggest that once TD children speak, their prosodic levels are similar in the two groups, while TD children with higher verbal IQ are more talkative. As well as suggest the LHI group is having a tough time producing sustainable language, while the RHI group is more inline with the TD group at this age.

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#### S.B. PILLAY, W.L. GROSS, C. HUMPHRIES & J.R. BINDER. Brain Regions Mediating Recovery of Word Reading in Phonological Aphasia: An Event-Related fMRI Study.

**Objective:** Damage to the perisylvian phonologic system is common in aphasia and can cause severe deficits on oral reading, yet most patients with damage to this system recover the ability to read some words. Neuroimaging studies show a variety of brain activity changes in people with chronic aphasia, but whether these changes truly support successful performance or reflect increased task difficulty is not clear. The variable success observed in people with aphasia on overt reading

tasks makes it possible to examine the neural responses associated with correct and incorrect responses.

**Participants and Methods:** Participants included 21 chronic left hemisphere ischemic stroke patients with a phonologic retrieval deficit. The fMRI task required participants to read aloud 72 concrete nouns. Correct and incorrect trials were used as regressors of interest in a deconvolution analysis. The Correct – Incorrect contrast images were then used in a second-level group analysis, thresholded at voxel-wise  $p < .01$ , and cluster corrected to  $p < .05$ . An index of each patient’s phonological impairment severity was included as a covariate in the group analysis to improve detection by accounting for between-subject variability.

**Results:** Successful word reading was associated with activation in the left angular gyrus (AG). In contrast, activation in bilateral posterior inferior frontal cortex and SMA was greater for incorrect word trials.

**Conclusions:** These data show the brain regions where neural activity is correlated specifically with successful phonological retrieval in chronic aphasia. The AG has been linked with semantic processing in healthy controls, which suggests that additional recruitment of the semantic system contributes to successful word production when the phonological retrieval mechanism is damaged. Greater activation of posterior inferior frontal cortex and SMA during incorrect trials may reflect secondary engagement of attention, working memory, and error monitoring processes when phonological retrieval is unsuccessful.

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#### M. PURDY & J. MCCULLAGH. The Impact of Dichotic Listening Training on Auditory Comprehension in Aphasia.

**Objective:** The lesions producing aphasia following a stroke often occur in the areas associated with auditory processing (AP). Auditory functioning is considered to be a significant component of aphasia and recovery of AP is important in the rehabilitation of individuals with aphasia. Several studies have identified AP deficits in individuals with aphasia and some have found correlations between dichotic listening and language tasks, particularly auditory comprehension and sentence repetition. However, little research has been conducted on the rehabilitation of dichotic listening and changes in auditory comprehension. The purpose of this pilot study was to explore the impact of using the Dichotic Interaural Intensity Difference (DIID) training on the comprehension and speed of processing of auditory commands of increasing length and complexity

**Participants and Methods:** Two individuals with chronic mild aphasia and dichotic listening deficits, documented through standardized peripheral and central audiological assessments, participated in auditory training for 60 minutes per day, 3 days per week, for 4 to 6 weeks. DIID training was completed using dichotic letters, numbers, words, and sentences. Training included both binaural integration and separation tasks with intensity bias for the weaker ear. Auditory language processing was assessed pre- and post- DIID training using the Revised Token Test (RTT).

**Results:** Although specific performance patterns varied among the participants following treatment, improvements in the performance on the Competing Sentences test and the Words in Noise test indicated improvements in the weaker ear for both participants. Gains were also documented on the RTT, demonstrated by more accurate and prompt responses. These results indicate increased volitional direction of attention and efficiency of processing.

**Conclusions:** DIID training may be a useful treatment for auditory processing deficits in aphasia.

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**J. SAVOIE, J. VILLERS & M. SHORT. Boston Naming Test Performance among French-speaking Acadians in Canada.**

**Objective:** The purpose of this study was to a) examine name agreement on the Boston Naming Test (BNT-Kaplan, Goodglass & Weintraub, 2001) in French-speaking Canadians living in New Brunswick compared to French-speakers in Quebec (Roberts & Doucet, 2011) and b) examined the effect of using different normative data when calculating scores to determine levels of impairment (i.e., above average, average, low average, borderline and impaired).

**Participants and Methods:** One hundred and nineteen participants completed the study (mean age=44.3; mean years of education=14.4). Participants completed a French-Canadian version of the Language Experience and Proficiency Questionnaire (LEAP-Q; Marian, Blumenfeld & Kaushanskaya, 2007) followed by the administration of the BNT in French for those identified as unilingual French-speakers and counterbalanced French and English versions of the BNT for bilingual French-speakers.

**Results:** Name agreement analysis was performed and revealed similar frequency of correct items for many, but not all, items. Overall, classification levels differed significantly ( $t(118)=27.45, p<.001$ ) when using the current data set versus the BNT original norms. Seventy four percent of participants were classified as impaired, compared to only 5.1%, when using the original versus current normative data. A small number of participants ( $n=7, 5.9\%$ ) retained their classification levels, while a large number ( $n=73, 61.9\%$ ) changed three levels of classification (e.g., impaired to average).

**Conclusions:** In conclusion, slight differences in name agreement across a French-Quebec sample and the current French-Acadian sample were revealed, but overall difficulty level of items were more similar across French samples (Acadian vs Quebec) than compared to English. Classification levels differed significantly across normative data sets and supports the need for separate norms for French-speakers. The study further highlights the implications of proper normative data for diagnosis and assessment of language impairments.

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**J.M. STINSON, R. MARTIN, J.E. CHANG & R. COLLINS. Logopenic Progressive Aphasia in Patient with Meningioma: Neuropsychological Evaluations Over Time.**

**Objective:** Logopenic Progressive Aphasia (LPA) is a variant of Primary Progressive Aphasia (PPA) characterized by word finding difficulties and phonemic paraphasias, as well as impaired repetition, naming, and sentence comprehension, while single word comprehension and reading remain intact. LPA may also be associated with acalculia and apraxia. This rare language disorder is poorly understood and clinicians are rarely given an opportunity for serial evaluation. Additionally, as many patients are already significantly impaired across domains at the time of initial testing, it can be difficult to evaluate the nuances of language-dominant neurodegenerative disorders. The following presents serial testing of a medically complex patient in order to illustrate the characteristics of LPA in a typical patient.

**Participants and Methods:** A case study report of an older adult male is presented with data from Neurology and Neuropsychology collected at approximately yearly intervals spanning a three-year period. This patient had a complex medical history, including a history of a right-sided frontal lobe meningioma and subsequent craniotomy, and neuroimaging reports and other important medical information will be reviewed.

**Results:** Over time, the patient evidenced initial intact memory consolidation with mild declines over three years. However, there was remarkable decline in his expressive language abilities, including naming, repetition, comprehension and spontaneous speech, while single word comprehension remained intact. He also exhibited increased executive dysfunction and frontal release signs. Full results, including neuroimaging results, will be discussed in the poster.

**Conclusions:** This case demonstrates the complexity of assessment and diagnosis of neurodegenerative disorders, particularly those related to language. In particular, this case highlights the need for serial neuropsychological evaluations and interprofessional collaboration to aid in effective treatment for patients with complex medical histories.

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**Symposium 16. Disentangling Autism Symptomology Across Pathologies: Investigations of Shared Phenotypic Traits**

**Chair: Brian Willoughby**

**1:00–2:30 p.m.**

**B. WILLOUGHBY, D. COMAN, J. PINEDA, K. DOOLEY & E. BRAATEN. Disentangling Autism Symptomology Across Pathologies: Investigations of Shared Phenotypic Traits.**

**Symposium Description:** Autism spectrum disorder (ASD) is neurodevelopmental condition characterized by social communication impairment and restricted and repetitive behaviors. Children with ASD show symptoms or “traits” commonly thought to be specific to autism, such as sensory issues (e.g., tactile sensitivity), restricted interests (e.g., preoccupation with a particular topic), and social communication deficits (e.g., poor conversational skills). However, the prevalence of these ASD traits across other childhood disorders (e.g., ADHD, Psychosis, Anxiety) remains unclear. The current symposium examines ASD traits across other child psychiatric conditions. In the first presentation, Dr. Drew Coman discusses the presence of sensory abnormalities across children with ASD, Psychosis, Mood Disorders, ADHD, and anxiety. In the second presentation, Dr. Jill Pineda will present on social deficits and restricted and repetitive behaviors in children with ASD versus other clinical disorders. Lastly, Dr. Kimberly Dooley will share her investigation of the ASD diagnosis as a potential moderator of the relationship between social difficulties and internalizing/externalizing problems in children and adolescents. Drs. Ellen Braaten and Brian Willoughby, who serve as chair and discussant, will bring their research and clinical expertise on ASD to highlight the implications of key findings. By demonstrating that the traits thought to be “hallmarks” of ASD cut across several other childhood conditions, the current symposium has implications for both clinical practice and theoretical conceptualizations of neuropsychiatric illness.

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**D. COMAN, P. VUIJK, N. DOTY, J. BLAIS, H. DITMARS, B. LEE, A. DOYLE & E. BRAATEN. Sensory Abnormalities Beyond Autism Spectrum Disorders (ASD): An Investigation of a Shared Phenotypic Trait Across Other Major Psychiatric and Neurodevelopmental Conditions.**

**Objectives:** To investigate sensory abnormalities across probands with formal diagnoses of Psychosis, ASD, Mood Disorders (MD), ADHD, and Anxiety (ANX), and demonstrate both differences and commonalities among these groups. To elucidate the relationship between sensory abnormalities and internalizing and externalizing problems across these conditions and test for moderation.

**Participants & Methods:** 675 probands aged 6 to 18 years were recruited as part of the Longitudinal Study of Genetic Influences on Cognition. Diagnoses were confirmed and data were collected via neuropsychological evaluation. Parents completed a Developmental History Form and the CBCL.

Results: Group differences in the total number of experienced sensory abnormalities were observed,  $F(4, 622) = 13.88$ ,  $p < .001$ ,  $\eta^2 = .08$ , such that the ASD group had a higher frequency relative to only three of the four other groups. Groups did differ on some, but not all sensory abnormalities, including sensitivity to noise,  $\chi^2(4, n = 675) = 5.99$ ,  $p = 0.20$ , temperature,  $\chi^2(4, n = 675) = 3.83$ ,  $p = 0.43$ , sensory seeking,  $\chi^2(4, n = 675) = 2.02$ ,  $p = 0.73$ , and others (e.g., sensitivity to pain),  $\chi^2(4, n = 675) = 4.84$ ,  $p = 0.30$ . Controlling for confounds, total frequency of sensory issues,  $R^2 = .32$ ,  $F(4, 404) = 75.13$ ,  $p < .001$ ,  $\beta = 0.16$ ,  $t(404) = 3.64$ ,  $p < .001$ , was associated with internalizing problems across sample. This relationship was not supported in Psychosis, MD, or ANX. Tests of moderation and associations with externalizing problems were not supported.

Conclusions: While certainly prevalent in ASD, sensory abnormalities are not unique to this disorder relative to other groups (i.e., Psychosis). Particular sensory problems (e.g., auditory, tactile, sensory-seeking) are equally as common across conditions as well. Higher frequencies of sensory processing issues may only be associated with higher levels of internalizing disorders in youth with ASD and ADHD. Sensory issues can be a "red herring" in assessment.

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**J. PINEDA, D. COMAN, N. DOTY, K. DOOLEY, H. DITMARS, B. LEE, A. DOYLE & E. BRAATEN. Investigation of Restricted and Repetitive Behaviors Across Clinical Populations.**

Objective: While restricted and repetitive behaviors (RRBs) are most strongly associated with an Autism Spectrum Disorder (ASD), research has found that they can also occur in a number of other central nervous system disorders (OCD, Schizophrenia), as well as typical development (Turner, 1999, Frith & Done, 1990; Tracy et al., 1996). This shared sequela over a number of other clinical disorders has important implications when assessing for symptoms associated with ASD. Furthermore, research has found that several executive processes are highly related to RRBs in ASD (Lopez, Lincoln, Ozonoff, & Lai, 2005). This study examines the frequency of RRBs across a number of clinical populations, as well as the relationship between elevated levels of RRBs and executive dysfunction.

Participants and Methods: 538 participants age 6-18 were recruited as part of an ongoing investigation of youth presenting for psychological assessment at a hospital-based clinic. Parents rated social impairment and the presence of RRBs on the Social Responsiveness Scale (SRS), and executive functioning on the Behavior Rating Inventory of Executive Function (BRIEF). Additionally, clinician determined presence of a primary diagnosis of Psychosis, ASD, Mood Disorder, Attention Deficit Hyperactivity Disorder (ADHD) and Anxiety was considered. Frequency and between-group differences were assessed for total SRS scores, as well as RRBs rated on the SRS.

Results: While ASD had significantly higher rates of overall social impairment than most clinical populations, rates of social impairment in Psychosis were not significantly different than ASD on the SRS; however, RRBs were significantly higher in ASD than all other populations. In a linear regression model, elevated levels of RRBs predicted higher rates of executive dysfunction.

Conclusions: Results suggest that RRBs may be helpful in differentiating ASD from Psychosis and treatment of RRBs may be helpful across other clinical disorders.

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**K. DOOLEY, N. DOTY, N.E. COOK, B. WILLOUGHBY, J. PINEDA, H. DITMARS, J. BLAIS, B. LEE, E. BRAATEN & A. DOYLE. Autism Spectrum Disorder Diagnosis as a Potential Moderator of the Relationship Between Social Impairment and Externalizing/Internalizing Problems.**

Objective: By definition, children and adolescents with an Autism Spectrum Disorder (ASD) have difficulties with social skills. Research has also found that up to 50% of epidemiological and community samples of patients diagnosed with ASD have a co-occurring anxiety disorder (Kerns & Kendall, 2012), and there is evidence that a higher level of anxiety is predictive of lower social skills (Chang, Quan, & Wood, 2012). Additionally, elevated externalizing symptoms are also common among children with ASD. However, social skill deficits, internalizing symptoms, and externalizing problems can occur in youth without an autism spectrum disorder. This study examines an Autism Spectrum Disorder diagnosis as a potential moderator of the relationship between social difficulties and internalizing/ externalizing problems in children and adolescents.

Participants and Methods: 57 participants aged 6-18 were recruited as part of an ongoing investigation of youth presenting for psychological assessment at a general hospital. Parents rated social impairment on the Social Responsiveness Scale (SRS), internalizing problems on the Child Behavior Checklist (CBCL), and externalizing problems on the CBCL. Additionally, clinician determined presence of an Autism Spectrum Disorder was also considered.

Results: In linear regression models, youth internalizing/ externalizing problems were not predicted by interaction between social impairment and ASD diagnosis. The association between social difficulties and internalizing/externalizing problems was not impacted by an ASD diagnosis.

Conclusions: Results suggest that the impact between social difficulties and psychopathology (specifically internalizing and externalizing symptoms) was similar for youth diagnosed with ASD and those who are not.

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**Symposium 17. Predictors and Outcomes of Pediatric Concussion: Insights from the Prospective, Multicenter 5P Project**

**Chair: Miriam H. Beauchamp**

**1:00–2:30 p.m.**

**M.H. BEAUCHAMP, M.H. BEAUCHAMP, M. KEIGHTLEY, B. BROOKS, K.O. YEATES & R. ZEMEK. Predictors and Outcomes of Pediatric Concussion: Insights from the Prospective, Multicenter 5P Project.**

**Symposium Description:** Concussion, a form of mild traumatic brain injury, is a highly prevalent public health problem, resulting in a range of somatic, motor, cognitive and socio-emotional symptoms. Functional changes in these domains can in turn lead to reduced quality of life in both the short and long term. Children and adolescents may be especially sensitive to the effects of concussion due to the instability of cognitive and social functions coming online during early development, as well as their physiological vulnerability. Despite this, few well-powered studies have examined the predictors and outcomes of pediatric concussion across a range of domains. The Predicting and Preventing Postconcussive Problems in Pediatrics project (5P) aimed to identify the key risk factors for developing post-concussive symptoms and to determine the predictors of persistent neuropsychological, neuromotor and behavioral problems. The goal of this symposium is to present an integrated view of pediatric concussion via the findings of the 5P neuropsychological sub-study (n = 311, 6-18 years) at one and three months post-injury. Dr Roger Zemek, emergency physician and 5P lead investigator, will give an overview of the main project and provide discussion

points pertaining to four individual presentations. First, developmental, clinical and cognitive predictors of neuropsychological outcome will be addressed. Second, we will explore neuromotor performance as indexed by measures of grip-strength, balance, and manual coordination. The third presentation will focus on psychological outcomes including anxiety and depression. Finally, we will consider how neuropsychological, motor, and psychological indicators are associated with patient quality of life after concussion. The symposium will provide knowledge on the pre-morbid and clinical risk factors for poor outcomes after pediatric concussion and an understanding of their association with the evolution of injury in the first three months.

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**M.H. BEAUCHAMP, M. AGLIPAY, P. ANDERSON, N. BARROWMAN, B. BROOKS, N. DESIRE, M. KEIGHTLEY, K.O. YEATES & R. ZEMEK. Predictors of Neuropsychological Outcome after Pediatric Concussion.**

**Objective:** Pediatric concussion is not known to result in long-term cognitive and motor deficits (Yeates, 2010), but acute or transient difficulties may nonetheless affect functioning. Accurate outcome prediction is useful for identifying children at risk for poor prognosis and optimizing recovery. A sub-goal of the 5P study (Zemek et al., 2013) was to identify predictors of persistent neuropsychological difficulties after concussion. **Participants and Methods:** 287 participants (6-18 years,  $M=11.6$ ,  $SD=3.1$ , 109 female) completed cognitive and fine motor tasks one month post-injury. Global outcomes were dichotomized via a Neuropsychological Impairment Rule (NPI, Beauchamp et al., 2015). Pre-morbid (sex, prior concussion, learning disability, ADHD, etc.) acute symptoms (amnesia, loss of consciousness, etc) and acute testing (Post-Concussion Symptoms Inventory, Standardized Assessment of Concussion) predictors were subjected to univariate logistic regression. Those significant at the .01 level were entered into a three step hierarchical logistic regression.

**Results:** The overall model significantly predicted NPI ( $p<0.01$ ). In the first step, pre-morbid variables contributed significantly, though no individual variable contributed uniquely. Symptom variables introduced in the second step also contributed ( $\chi^2=8.73$ ,  $df=3$ ,  $p=0.03$ ), with an independent association between the presence of amnesia and NPI (aOR=2.26, 95%CI: 1.04-4.90,  $p=.02$ ). Consideration of acute testing further contributed ( $\chi^2=8.86$ ,  $df=1$ ,  $p<0.01$ ), with the SAC independently predicting NPI (aOR=0.72, 95%CI: 0.58-0.90).

**Conclusions:** A combination of pre-morbid and acute medical and cognitive factors predict neuropsychological outcome after pediatric concussion. These results contrast with reports that only factors pre-dating injury predict cognitive outcome (ex: Babikian et al., 2013). Amnesia and acute cognitive deficits may be associated with more persistent neuropsychological difficulties and poor recovery.

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**M. KEIGHTLEY, M. AGLIPAY, P. ANDERSON, A. ARNOLD-OATLEY, N. BARROWMAN, M.H. BEAUCHAMP, B. BROOKS, N. DESIRE, K.O. YEATES & R. ZEMEK. Neuromuscular and Neuromotor Performance following Pediatric Concussion.**

**Objective:** Concussion is a common injury amongst youth. Muscle weakness, decreased strength and impaired balance is commonly associated with more serious brain injuries, but remains relatively understudied in pediatric concussion. This study describes performance on physical functioning measures in children and youth.

**Participants and Methods:** In a planned substudy, children aged 6-17 years with acute concussion were enrolled from the emergency departments of 4 Canadian pediatric hospitals as part of a larger prospective multicentre cohort (5P Study). At 4 and 12 weeks post injury,

participants completed a battery of neuropsychological and physical functioning tests including hand grip strength (a measure of neuromuscular performance), grooved pegboard (a neuromotor performance task) on both dominant and non-dominant hands and the Balance Error Scoring System (BESS). Performance was considered impaired if children scored 1.5 standard deviations ( $SD$ ) below the normative mean.

**Results:** 311 children were enrolled, of which 25.6% and 19.9% were impaired at 4 weeks on dominant and non-dominant hand grip strength, respectively. By 12 weeks post-concussion those frequencies were 37.0% and 15.5%, respectively. 13.3% and 11.2% were considered impaired on the grooved pegboard test 4 weeks post-concussion for the right and left hands, respectively. At 12 weeks post-injury these frequencies were 7.7% and 10.8%, respectively. There were no significant associations between hand grip strength and neuropsychological test scores, post-concussion symptom scores or balance scores taken pre- or post-concussion. In contrast, left hand grooved pegboard performance was significantly (albeit weakly) associated with the number of errors on the tandem stance condition of the BESS at 4 weeks post-concussion ( $r = -0.13$ ,  $p < 0.05$ ).

**Conclusions:** Neuromuscular performance was frequently impaired in children 4 and 12 weeks post-concussion which could lead to increased risk for re-injury.

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**B. BROOKS, M. AGLIPAY, P. ANDERSON, N. BARROWMAN, M.H. BEAUCHAMP, N. DESIRE, M. KEIGHTLEY, K.O. YEATES & R. ZEMEK. Psychological Functioning after Pediatric Concussion.**

**Objective:** Psychological functioning after concussion is an important area of clinical and research focus. Limited existing research suggests that problems with anxiety and mood may be present early in recovery and typically resolve over time. The objective of this observational study was to examine psychological functioning in children and adolescents who have sustained a concussion.

**Participants and Methods:** 311 youth (6-18 years,  $M=11.8$ ,  $SD=3.1$ , 35.0% female) who completed neuropsychological testing at 4 and 12 weeks post-concussion. These participants were part of a larger multicentre, cohort study (Zemek et al., 2013). Psychological measures included the anxiety/depressed and withdrawn/depressed subscales from the Child Behavior Checklist (CBCL), and the emotional distress subscale from the Strengths and Difficulties Questionnaire (SDQ).

**Results:** Mean T scores on CBCL subscales were within normal range at both 4 and 12 weeks. There were not significant differences over time in the proportion of youth who fell within the clinical ranges for anxiety (week 4, 8.0%; week 12, 4.7%;  $p=.17$ ) or depression (week 4, 4.7%; week 12, 2.6%;  $p=.25$ ). There were not significant differences between boys and girls or between age groups (5-7, 8-12, or 13-18 years). Youth with multiple prior concussions and youth who took longer than 1 week to recover from their prior concussion had significantly worse anxiety, depression, and emotional distress symptoms at 4 weeks post-injury ( $ps<.001$ ) but not 12 weeks. Youth with persistent post-concussion symptoms had significantly more psychological problems at both 4 and 12 weeks ( $ps<.05$ ).

**Conclusions:** Youth who sustained multiple previous concussions and have taken more than 1 week to recover from a prior injury have more psychological problems at 4 weeks, but not at 12 weeks post acute concussion. Youth with persistent post-concussion symptoms at both 4 and 12 weeks have elevated psychological concerns.

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**K.O. YEATES, M. AGLIPAY, P. ANDERSON, N. BARROWMAN, M.H. BEAUCHAMP, B. BROOKS, N. DESIRE, M. KEIGHTLEY & R. ZEMEK. Neuropsychological Functioning as a Predictor of Quality of Life after Pediatric Concussion.**

**Objective:** Neuropsychological functioning can be affected acutely in pediatric concussion, but its relationship to quality of life in this population is uncertain. We sought to examine neuropsychological functioning as a predictor of quality of life after childhood concussion.

**Participants and Methods:** At 4 weeks post-injury, 197 6-18 year old children from the larger multicentre 5P study completed measures of IQ, attention, executive function, memory, processing speed, and fine motor skills. Results were classified as impaired or not impaired via a published Neuropsychological Impairment Rule (NPI). Participants also rated post-concussive symptoms (PCSI) at 4 weeks post-injury and quality of life (PedsQL) at 12 weeks. Variables assessing demographics, premorbid history, and acute clinical presentation were subjected to univariate regressions predicting PedsQL scores. Significant univariate predictors were entered into hierarchical regression analyses, with 4-week symptom and NPI status added in the last two steps.

**Results:** The overall model significantly predicted the PedsQL total score and all subscale scores. Demographic and premorbid history variables collectively accounted for significant variance in the PedsQL total score and all subscales ( $R^2$  change = .15-.23), although no individual variable was an independent predictor. Acute clinical presentation did not predict PedsQL scores. Symptom status was a significant predictor of the PedsQL total score and three of four subscales ( $R^2$  change = .02-.04). NPI status did not predict PedsQL scores after controlling for all other variables.

**Conclusions:** Demographics, premorbid history, and postconcussive symptoms are significant predictors of quality of life among children with concussion. When those variables are controlled, neuropsychological functioning is not associated with quality of life. The findings have implications for the utility of neuropsychological testing after pediatric concussion.

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## Paper Session 14. Dementia 2

Moderator: Maxine Kregel

1:00–2:30 p.m.

**A.E. BLANKEN & D.A. NATION. Endophenotypes of Preclinical Alzheimer's Disease Empirically-Derived from Both Cognitive and Cerebral Spinal Fluid Biomarkers.**

**Objective:** Previous studies have established separate biomarker and cognitive signatures of preclinical Alzheimer's disease (AD). The present study aimed to use a combination of markers to identify distinct neurocognitive profiles of preclinical AD and compare their rates of progression to dementia.

**Participants and Methods:** We performed hierarchical cluster analysis (HCA) using Ward's clustering linkage on baseline cognitive scores (Boston Naming Test, AVLT, the Logical Memory, Categorical Fluency, Trails A & B) and cerebrospinal fluid (CSF) biomarker (amyloid beta 1-42 and p-tau) data from 367 normal control (NC) and 610 mild cognitive impairment (MCI) subjects from the Alzheimer's Disease Neuroimaging Initiative (ADNI 1/GO/2) in order to objectively determine subgroups characterized by cognitive performance and biomarker status. We computed ANOVAs to examine group differences in cognitive performance and biomarker status, and Cox regression was applied to investigate the effect of group membership on rate of disease progression.

**Results:** Three different subtypes resulted from the HCA: a cognitively normal (N=624) with normal biomarker status, an amnesic group (N=216) with a biomarker profile consistent with preclinical AD, and a

mixed impairment group (N=137) had advanced cognitive impairment in diverse domains and elevated biomarkers. The mixed impairment group was significantly less impaired in memory and displayed less biomarker elevation than the amnesic group. Decline towards dementia was significantly more rapid for the two cognitively impaired groups.

**Conclusions:** A complete neurocognitive profile is important for AD diagnosis and prognosis. The combination of neuropsychological test scores and CSF biomarkers were useful for identifying groups with distinct patterns of preclinical AD features. Disease characterization using these, and possibly other AD biomarkers, may reveal clinically unique subgroups of early AD.

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**J. HASSENSTAB, Y. LIM, J.C. MORRIS, A. FAGAN & R.J. BATEMAN. CSF Biomarkers and Cognitive Decline in Autosomal Dominant Alzheimer's Disease.**

**Objective:** Little is known about cerebrospinal fluid (CSF) biomarkers and cognitive decline in autosomal dominant Alzheimer's disease (ADAD). Describing this relationship is critical for defining the transition from cognitive normality to the symptomatic phase of Alzheimer's disease (AD) and for establishing the efficacy of ADAD cohorts for secondary prevention trials.

**Participants and Methods:** 167 participants from the Dominantly Inherited Alzheimer Network (DIAN) observational study completed comprehensive neuropsychological testing and CSF collection at baseline and returned for at least one additional visit. Groups were defined by mutation status and severity of symptoms using the Clinical Dementia Rating Scale (CDR) and included CDR 0 Asymptomatic Mutation Carriers (as-MC, n=56), CDR > 0 Symptomatic Mutation Carriers (s-MC, n=54), and Non-Carriers (NC, n=57). Cognitive performance on 22 tests was used to form composite scores for cognitive domains and a global composite measure. Linear mixed effects models examined whether baseline CSF biomarkers predict cognitive decline in DIAN.

**Results:** Beta amyloidosis and neurodegeneration as measured by CSF AB1-42, t-tau, and p-tau181 were strongly associated with longitudinal decline across nearly all cognitive domains. Asymptomatic mutation-carriers closer to their estimated year of symptom onset (EYO) showed elevations in t-tau and elevated t-tau/AB1-42 ratios that were strongly associated with declines in episodic memory and global cognitive performance, suggesting that cognitive decline accelerates when substantial neurodegeneration is present.

**Conclusions:** In the DIAN population, cognitive decline in symptomatic carriers and asymptomatic carriers appears to be related to tau-mediated neurodegeneration as measured by CSF biomarkers. These findings are similar to studies in sporadic AD and suggest that CSF AB42 is less sensitive than CSF t-tau and p-tau181 for the detection of cognitive decline.

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**M.A. TRIVEDI, T.P. COTHRAN, D.V. MERKITCH, V.T. DINH, G.T. STEBBINS, T.B. PARRISH, R.C. SHAH, N.T. AGGARWAL, D.A. BENNETT & D.A. EVANS. APOE genotype effects on resting state functional connectivity of the default mode network in middle-aged individuals with a parental history of Alzheimer's disease.**

**Objective:** Previous neuroimaging studies indicate that there is a long preclinical phase of AD where cognitively-healthy, middle-aged individuals with AD risk factors display alterations in brain structure/function in default mode network (DMN) regions many years prior to the onset of cognitive decline. We used resting-state functional connectivity MRI (rsfMRI) to examine the influence of the APOE e4 allele on DMN functional connectivity in the adult children of persons diagnosed with AD.

**Participants and Methods:** Seventy middle-aged (40-65 years of age) children of persons with AD underwent genetic testing, neuropsychological evaluation, and neuroimaging. There were 38 APOE  $\epsilon 4$  carriers and 32 non-carriers. We examined the relationship between APOE genotype and seed-based rsfcMRI. Time series were extracted from 5mm radius spheres in left/right hippocampus, posterior cingulate and medial prefrontal cortices. Results were considered significant at  $p=.05$ , uncorrected; cluster size  $[k]=100$ .

**Results:** The  $\epsilon 4$  allele was associated with 1) greater connectivity between left hippocampus and right anterior medial temporal lobe, but with reduced connectivity in bilateral precuneus; 2) greater connectivity between right hippocampus and left inferior/middle temporal lobe, but reduced connectivity in right posterior thalamus; 3) greater connectivity between midline posterior cingulate and bilateral occipital, inferior/middle temporal, and right parietal regions; 4) greater connectivity between medial prefrontal cortex and bilateral occipital and left inferior temporal regions, but reduced connectivity with left posterior cingulate and lateral parietal regions.

**Conclusions:** The APOE  $\epsilon 4$  allele is associated with both greater and reduced functional connectivity between DMN regions in middle-aged individuals with a parental history of AD, indicating that preclinical changes in brain connectivity can be observed prior to cognitive changes. Future studies examining the interactive effects of parental history and the APOE  $\epsilon 4$  allele are needed.

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#### A. MINOR, S. MAYERS, T. HOHMAN, A.L. JEFFERSON & K. GIFFORD. Social and cognitive factors relate to the presence of subjective cognitive decline in non-demented older adults.

**Objective:** Subjective cognitive decline (SCD) may predict cognitive decline and diagnostic progression to Alzheimer's disease (AD). Little research has examined factors that may increase or reduce SCD. The current study examined how social activity or engaging in cognitive compensatory strategies related to SCD in non-demented older adults.

**Participants and Methods:** Participants included 1120 cognitively normal (NC;  $69 \pm 8$  years, 56% female) and 250 mild cognitive impairment (MCI;  $76 \pm 10$  years, 52% female) individuals from the Vanderbilt Memory & Alzheimer's Center participant registry. All completed a Telephone Interview for Cognitive Status (TICS), 196-item SCD survey, and depression screen (CESD). SCD was defined as the total score of the SCD-survey with higher scores indicating more SCD. Diagnostic status was determined using the TICS. Modifying factors included 1) endorsement of "Do you participate in hobbies and activities as often as usual?" and 2) use of compensatory strategies as measured by the mnemonics subtest of the Memory Functioning Questionnaire. ANOVA and regression related these factors to SCD, adjusting for age, education, and depression.

**Results:** Lower cognition was related to more SCD ( $B=-6.2$ ,  $p<0.001$ ). Decreased activity participation was related to higher SCD scores in NC ( $F(1, 1086)=12.7$ ,  $p<0.001$ ) and MCI ( $F(1, 234)=5.0$ ,  $p=0.03$ ). Engaging in more compensatory strategies related to higher levels of SCD in NC ( $B=1.86$ ,  $p<0.001$ ) and MCI ( $B=1.90$ ,  $p=0.001$ ). There was no interaction between participation and strategy use ( $F(1, 1312)=0.03$ ,  $p=0.9$ ) but individuals with high strategy use and low participation showed the most SCD.

**Conclusions:** A protective factor for AD, engagement in social activities, may minimize the presence of SCD. Utilization of more compensatory strategies may increase the likelihood of an older adult reporting SCD and could signal early cognitive problems. Further research into the interplay between SCD and modifying factors is needed.

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#### N.K. NADKARNI, O.L. LOPEZ, S.A. STUDENSKI, B.E. SNITZ, S. PERERA, K.I. ERICKSON, C.A. MATHIS, M.S. REDFERN & W.E. KLUNK. The Cognition-Mobility Interface is Associated with Cerebral Amyloid Deposition in Clinically Normal Older Adults.

**Objective:** Amyloid-beta ( $A\beta$ ) is deposited in the regions that control cognition and mobility. We sought to study the association between  $A\beta$  and the cognition-mobility interface (COMBINE) in clinically normal elders.

**Participants and Methods:** Cognitively normal older adults enrolled in a longitudinal Pittsburgh Compound-B (PiB) PET study to characterize  $A\beta$  were screened for mobility impairment. Blinded to their  $A\beta$  status, we measured usual gait speed on the Gait Mat II. We assessed the COMBINE by measuring RT and accuracy on motor sequencing, response inhibition and working memory tasks and on dialing a phone while standing and while walking. We compared the COMBINE, measured by the magnitude of gait speed and cognitive performance decline while walking, in high- and low-  $A\beta$  groups ((PiB(+)) and PiB(-) respectively). Multiple linear regressions explored the association between COMBINE and global PiB retention.

**Results:** PiB(+) ( $n=16$ ) and PiB(-) ( $n=12$ ) groups were comparable in age (75yrs), general cognition and physical function, white matter hyperintensities, usual gait speed and on working memory, response inhibition and motor sequencing task performance. The PiB(+) group demonstrated greater gait speed decline than the PiB(-) group on the response inhibition and motor sequencing tasks (both  $p=0.03$ ) and while dialing a phone ( $p=0.008$ ). Greater global PiB-PET correlated with greater gait speed decline during the motor sequencing and response inhibition tasks (both  $r=0.4$ ,  $p=0.04$ ) and the phone dialing while walking tasks ( $r=0.39$ ,  $p=0.04$ ) but not with usual gait speed, standing cognitive task performance or cognitive performance decline while walking. The association between magnitude of gait speed decline while dialing a phone was statistically significant ( $p=0.03$ ) despite adjustments.

**Conclusions:** Gait speed decline on the response inhibition, motor sequencing and phone dialing tasks is associated with  $A\beta$  in older adults. Dialing a phone while walking may serve as a "stress test" to screen healthy older adults for high  $A\beta$  load.

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#### B.W. COLEMAN, Y. TRIPODIS, B. MARTIN, C. CHAISSON, E. STEINBERG, N. KOWALL, K. SCHON & R.A. STERN. Subjective Cognitive Complaints Predict Conversion to MCI and Alzheimer's Disease Dementia.

**Objective:** The clinical value of specific subjective cognitive complaints (SCC) in healthy people is unclear even though neuroimaging and biomarker studies suggest SCC are early preclinical symptoms of future objective cognitive decline. The purpose of this study was to examine whether cognitively healthy older subjects with self-reported "significant" complaints in memory, judgment, language, orientation, and attention domains have greater risk of developing Mild Cognitive Impairment (MCI) and Alzheimer's disease dementia (AD) than those without "significant" SCC.

**Participants and Methods:** This study utilized 10 years of longitudinal data from the Boston University Alzheimer's Disease Center research registry. Registry participants are examined annually based on the National Alzheimer's Coordinating Center's Uniform Dataset and receive diagnoses based on a multidisciplinary diagnostic consensus conference. Participants also receive structured interviews regarding SCC. We identified 235 participants aged 55 and older who were initially cognitively unimpaired. For each participant, we determined if objective cognitive decline occurred (resulting in MCI or AD dementia diagnosis) and whether a specific SCC domain preceded decline. Using logistic and survival models, we investigated whether each SCC domain increased the likelihood and rate of developing MCI or AD.

**Results:** A significant memory complaint but no other domain SCC greatly increased the odds of conversion to AD dementia (odds ratio =

7.898,  $p$ -value  $< .01$ ). Moreover, significant SCC in any domain other than judgment increased the odds of having future objective cognitive decline, including MCI. These findings were independent of the presence of psychiatric disorders (depression and anxiety), age, sex, and education.

**Conclusions:** SCC are an early preclinical indicator of MCI and AD dementia and should be considered a meaningful early symptom of future decline in individuals without current objective cognitive impairment. Correspondence: *Benjamin W. Coleman, Anatomy and Neurobiology, Boston University, 72 East Concord St (L 1004), Boston, MA 02118. E-mail: bcoleman@bu.edu*

**R. MARTIN-WILLET, L. SAMUELS, D. LIU, K. GIFFORD, T.J. HOHMAN, S. BELL, E.M. LANE, M. WIGGINS, K.M. WISNIEWSKI, M. BABICZ, C. DUNIFON, M. THURSBY, L. LOGAN, C. SEABOLT & A.L. JEFFERSON. Lower hematocrit and hemoglobin values relate to worse cognitive performance in older adults: The Vanderbilt Memory & Aging Project.**

**Objective:** Animal studies suggest that cerebral hematocrit declines in aging. The purpose of this study is to assess whether lower hematocrit (red blood cell volume) or hemoglobin (oxygen-transport metalloprotein in the red blood cells) is related to neuropsychological performance in older adults with normal cognition (NC) and mild cognitive impairment (MCI).

**Participants and Methods:** Participants were drawn from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging. At enrollment, NC participants ( $n=163$ ,  $72\pm 7$  years, 40% female) and MCI ( $n=165$ ,  $73\pm 8$  years, 41% female) underwent fasting blood draw and neuropsychological assessment. Multivariable regression related hematocrit or hemoglobin (separately) to all neuropsychological outcomes, adjusting for age, diagnosis, Framingham Stroke Risk Profile, creatinine clearance, body surface area, and APOE4 status.

**Results:** Lower hematocrit level was related to worse performance on Montreal Cognitive Assessment (MoCA,  $p=0.003$ ), Boston Naming Test (BNT,  $p=0.02$ ), Biber Figure Learning Test (BFLT) Discrimination Trial ( $p=0.01$ ), and Tower Test ( $p=0.01$ ). Lower hemoglobin was related to worse performance on MoCA ( $p=0.001$ ), BNT ( $p=0.02$ ), BFLT Long Delay Recall ( $p=0.03$ ), BFLT Discrimination Trial ( $p=0.003$ ), and Tower Test ( $p=0.03$ ).

**Conclusions:** Findings suggest that among adults age 60 and older both lower red blood cell volume and lower oxygen-transport metalloprotein are associated with worse global cognition, visuospatial memory, lexical naming, and planning. Future work will assess whether longitudinal changes in hematocrit or hemoglobin affect cognitive aging, structural brain changes, or cerebral blood flow.

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