
Final Program

Forty First Annual Meeting

International Neuropsychological Society

February 6-9, 2013
Waikoloa, Hawaii, USA

WEDNESDAY, FEBRUARY 6, 2013

- 9:00 AM–12:00 PM** **CE Workshop 1: Neuroimaging Studies: Methodological Issues and Clinical Implications Across the Lifespan**
Presenters: Linda Chang, Thomas Ernst, Kenichi Oishi
Kings Ballroom
1. CHANG, L CE Workshop 1: Neuroimaging Studies: Methodological Issues and Clinical Implications Across the Lifespan
- 9:00 AM–12:00 PM** **CE Workshop 2: Get to Know the NIH Toolbox: A Common Currency for Measuring Neurological and Behavioral Functioning**
Presenters: David Tulsy, Sandra Weintraub, Richard Gershon, Robert Heaton
Queens Ballroom
1. TULSKY, D CE Workshop 2: Get to Know the NIH Toolbox: A Common Currency for Measuring Neurological and Behavioral Functioning
- 1:00–4:00 PM** **CE Workshop 3: Evidence-based Interventions for Learning Disabilities: Relations with Brain Function**
Presenter: Jack Fletcher
Kings Ballroom
1. FLETCHER, J CE Workshop 3: Evidence-based Interventions for Learning Disabilities: Relations with Brain Function
- 1:00–4:00 PM** **CE Workshop 4: Genetics and Genomics for Neuropsychology**
Presenter: Robert Bilder
Queens Ballroom
1. BILDER, R CE Workshop 4: Genetics and Genomics for Neuropsychology
- 1:00–4:00 PM** **Student Lecture: Reliability Change Methods as They Relate to Outcomes Research**
Presenter: Gordon Chelune
Monarchy Ballroom
- 4:15–5:15 PM** **Presidential Address: Lifespan Neuropsychology: The New Age-ing Frontier**
INS President: Sandra Weintraub
Monarchy Ballroom
1. WEINTRAUB, S Presidential Address: Lifespan Neuropsychology: The New Age-ing Frontier
- 5:30–6:30 PM** **Invited Address: Frontal Lobe Functioning in Daily Life**
Presented by INS Lifetime Achievement Award Winner: Donald Stuss
Monarchy Ballroom
1. STUSS, DT Frontal Lobe Functioning in Daily Life
- 6:30–7:30 PM** **Wednesday Evening Welcome Reception**
Lagoon Lanai

THURSDAY, FEBRUARY 7, 2013**7:20–8:50 AM****CE Workshop 5: Ethics in Clinical Neuropsychology: How to Conduct a Culturally Competent Neuropsychological Evaluation**
Presenter: Daryl Fujii
Kohala 3 & 4

1. FUJII, D

CE Workshop 5: Ethics in Clinical Neuropsychology: How to Conduct a Culturally Competent Neuropsychological Evaluation

7:20–8:50 AM**CE Workshop 6: Use of Amyloid PET Imaging in Clinical Practice**
Presenters: Stephen Salloway, Paul Malloy
Kohala 2

1. SALLOWAY, S

CE Workshop 6: Use of Amyloid PET Imaging in Clinical Practice

9:00–10:00 AM**Paper Session 1: Childhood Cancers**
Moderator: Celiane Rey-Casserly
Monarchy Ballroom

1. BRINKMAN, TM

Cerebral White Matter Integrity and Executive Function in Adult Survivors of Childhood Medulloblastoma

2. BRINKMAN, TM

Neurocognitive Impairment Twenty Years after Treatment for Pediatric Brain Tumors: A Report from the St. Jude Lifetime Cohort (SJLIFE)

3. RIGGS, L

Dose-dependent hippocampal volume changes following cranial radiation for medulloblastoma

4. KAHALLEY, L

Utility of the General Ability Index (GAI) with Survivors of Pediatric Brain Tumors: Comparison to Full Scale IQ and Premorbid IQ Estimates

9:00–10:00 AM**Paper Session 2: Dementia/ Episodic Memory/ Cognitive/Physical Activity**
Moderator: Angela Jefferson
Kings Ballroom

1. IRISH, M

Exploring the Neural Substrates of Episodic Memory Dysfunction in Frontotemporal Dementia and Alzheimer's Disease

2. BREWSTER, PW

Synergistic Effects of Physical and Cognitive Activity Reduce Dementia Risk in Community Dwelling Older Adults: Evidence from a Prospective Cohort Study

3. MCDONALD, CR

Patterns of Hippocampal and Cortical Atrophy in MCI, AD, and TLE: Shared and Unique Contributions to Verbal Memory

4. MEIER, IB

Regional white matter hyperintensity volume and cognition predict death in a multi-ethnic, community cohort of older adults

9:00–10:00 AM**Symposium 1: Trajectories of Female Brain Aging: The influence of natural and induced menopause**
Chair: Miriam Weber
Discussant: Pauline Maki
Queens Ballroom

1. WEBER, M

Trajectories of Female Brain Aging: The influence of natural and induced menopause

2. WEBER, MT

Reproductive Aging Stage Affects Cognitive Trajectories Across the Menopausal Transition

3. ROCCA, WA

Increased Risk of Cognitive Impairment and Dementia Following Early Bilateral Oophorectomy

4. DUMAS, J

Hormone and Neurotransmitter Interactions in the Brain: Effects on Cognition and Brain Activation in Postmenopausal Women

9:00–10:00 AM**Poster Session 1: Aphasia/Forensics/Hemispheric Asymmetry/ Imaging/Medical Disorders/MS/Stroke/Visuospatial**
Kona Ballroom**Forensic Neuropsychology**

1. HANSEN, A

Relationship between Atlantic salmon consumption, nutritional status and measures of self-regulation: heart rate variability and executive function

2. SANDVIK, A

Can Psychopaths Read the Emotional Language of the Eyes? – An Emotional Paradox

3. SULLIVAN, C

Childhood Lead Ingestion and Adult Intelligence in a Forensic Sample

Hemispheric Asymmetry/Laterality/Callosal Studies

4. PANOS, A Impulsivity, Vigilance, and Attention in Agenesis of the Corpus Callosum: Results of the Continuous Performance Test
5. REHMEL, JL Comprehension of Cartoon Humor in Individuals with Agenesis of the Corpus Callosum
6. RENTERIA-VAZQUEZ, T Social Inference in Individuals with Agenesis of the Corpus Callosum: Explorations with Topic Modeling
7. PAUL, LK Autism Spectrum in Agenesis of the Corpus Callosum
8. PAUL, LK Lateralized Brain Function Without a Corpus Callosum

Imaging (Functional)

9. BAZINET, AD fMRI Correlates of Risky Decision Making in Adolescent Alcohol-Users
10. BRUCE, SE Cognitive Behavior Therapy for PTSD in Women Victimized by Interpersonal Violence: Examination of the Neural Correlates of Treatment Outcome using fMRI
11. BUGESCU, N Neurobiological Correlates of Handwriting Skill
12. BURNS, CM Elevated Fasting Serum Glucose Levels and Brain Function: An FDG PET Study of Younger Adults
13. CHOI, J Dysfunctional brain change in the anticipatory reward system in young adults with pathological gambling
14. GESS, J Building the Cognitive Connectome: A Case Study with Temporal Lobe Epilepsy
15. GILLIS, M Working Memory Contributes to the Encoding of Object Location Associations
16. HASHIMOTO, T Dissociations in body size perception between width and thickness
17. HIDAKA, T Neural Correlates of False Recognition for Face in Short-term Memory: 3T-fMRI Study
18. LEAL, S Age-related Alterations in Intrinsic Functional Connectivity Networks Measured With Resting State fMRI
19. TIGHE, S Resting State fMRI Functional Connectivity in Individuals with Mild Cognitive Impairment
20. MEDAGLIA, JD An Automated Person-Specific Approach to Region of Interest Selection in fMRI Data
21. MEUSEL, L The Neural Bases of Recollection & Familiarity in High- and Low-Performing Older Adults
22. NAESER, M Functional Connectivity (fcMRI) Increase in Language Network after Left Scalp Application of Red/Near-infrared, Light-emitting Diodes (LED) in Primary Progressive Aphasia - Potential for Treatment Research
23. PARSONS, M Abnormal Brain Activation During Inhibitory Control in Blast-Related Mild/Moderate TBI
24. PERAZA, JR Emotional Regulation and Change in Brain Response from Novel to Familiar Emotional Images
25. RENO, AJ Neural Activity and Behavioral Performance on Measures of Working Memory Among Healthy Subjects
26. SCHULTE, T The Restless Brain of Alcoholics
27. SCOTT, J Enhanced Amygdala Response to Working Memory Overload in Posttraumatic Stress Disorder
28. VAN STEENBURGH, JJ Default Mode Network Connectivity with Left DLPFC Interferes with Verbal Fluency in Schizophrenia
29. WEISSBERGER, G Language and Executive Control in the Bilingual Brain: An fMRI Study
30. WETHERILL, R Attentional Bias and Brain Response to "Unseen" Cannabis Cues
31. WILDE, EA Treatment Effects in Resting State fMRI in Veterans with Comorbid Alcohol Abuse, Post-traumatic Stress Disorder, and Mild Traumatic Brain Injury
32. FEIGON, M fMRI Activations During Performance of the Symbol Digit Modalities Test in Adults with a Parental History of Alzheimer's Disease

Stroke/Aneurysm

33. FEIGON, M Validation of the NINDS-CSN VCI Neuropsychological Protocols in African-Americans with Sickle Cell Disease
34. COPPENS, AM Outcomes of Paediatric Unilateral Arterial Ischemic Stroke on Receptive and Expressive Vocabulary: Effects of Age at Stroke
35. PIRES-BARATA, S Cognitive Profile in Acute Stroke Patients
36. PIRES-BARATA, S Cognitive Function in Stroke Patients with Arterial Stenosis
37. SAMPANIS, D Functional Recovery And Cortical Reorganization After Mirror Therapy In Chronic Stroke Patients
38. SAMPANIS, D Motor Functional Improvement and Functional MRI Evidence of Cortical Reorganization in Upper-Limb Stroke Survivors with Motor and Visual Neglect Treated With Functional Electrical Stimulation (FES)
39. STERLING, C Children Have Greater Motor Improvement but Similar Structural Brain Change Compared to Adults Following CI Therapy

Language and Speech Functions/Aphasia

40. ANSALDO, AI Pre-therapy Activation Patterns and Recovery from Anomia: Neurobiological and Neurolinguistic Issues Support the efficacy of Semantic Feature Analysis in the Elderly with Chronic Broca's Aphasia
41. GHAZI SAIDI, L Language and Control Networks in Second Language Learning: A Longitudinal Functional Connectivity Study
42. HADDAD, MM Validity of the Verbal Activity Log (VAL) for Assessment of Spontaneous Real-World Speech in Aphasia
43. HAMBERGER, MJ Neural Activation Patterns for Auditory Description and Visual Object Naming in Healthy Adults

44. ISKANDAR, S The Role of Working Memory in Metaphor Interpretation
 45. LÖFKVIST, U Word Fluency and Lexico-Semantic ability in Children with Cochlear Implants
 46. MILMAN, L Production, Treatment, and Generalization Patterns for Adjectives and Pronouns in three cases of Nonfluent Aphasia
47. MORIN, A Activation of the Left Frontal Gyrus During Self-referential Thinking
 48. NAKAGAWA, Y Grammatical difficulties faced by children with autism spectrum disorders
 49. PHATAK, VS Age Cohort Effects in Famous Faces Naming Test
 50. RAYMER, AM Word Retrieval Treatments for Aphasia: Connected Speech Outcomes
 51. TALLBERG, IM The Ability to Communicate a Decision in Alzheimer's disease
 52. WAMBAUGH, J Melodic Intonation Therapy Applied to the Production of Questions
 53. WAMBAUGH, J Word Retrieval in Aphasia: Using Treatment Performance to Predict Probe Performance
 54. YOON, J Visuospatial Representation of Hangul Syllable in Alzheimer's Disease: Does It Withstand the Impact of the Disease?
- Medical/Neurological Disorders/Other (Child)**
55. BREWSTER, R The Cognitive Phenotype of a Patient with Moyamoya Disease: An Adolescent Case Study
 56. GRIECO, J Working Memory in Children with Lyme Disease versus ADHD
 57. HELDER, EJ Trajectory of Catch-up and Areas of Continued Deficit in Children Adopted Internationally at School-age
 58. HUDEPOHL, MB Caring for Pediatric Patients during Inpatient Rehabilitation after Acquired Brain Injury: What Predicts Caregiver Confidence?
 59. IAMPINETRO, M Memory functioning in Pediatric Stroke Survivors
 60. JANOS, A Developmental Changes in Processing Speed and Executive Abilities in Children with Phenylketonuria
 61. KERNS, KA An Exploration of Intra-individual Variability in Children with FASD
 62. VERNESCU, RM Process Training for Children with FASDs
 63. KIM, S Long-term Neurocognitive Outcomes in Survivors of Acute Childhood Lymphoblastic Leukemia
 64. KOOP, J Title: Cognitive Profile in Pediatric Posterior Fossa Tumors: Feasibility of fMRI to Assess Working Memory and Inhibitory Control
 65. KRAMER, SE Comparison of Neuropsychological Test Performance between Children with Fetal Alcohol Syndrome and Fetal Alcohol Effects
 66. LEE, J Perinatal Stroke in Broca's Area: Long-term Language and Verbal Memory Outcome in Two Patients
 67. LOUGHAN, AR Executive Dysfunction in School Age Children with Congenital Heart Defects (CHD)
 68. MAXWELL, EC Visual Perception and Posterior Cortical Changes in Children with Spina Bifida Myelomeningocele
 69. OMIZZOLO, C Neonatal Brain Abnormalities and Memory and Learning Outcomes at 7 Years in Children Born Very Prematurely
 70. OMIZZOLO, C Hippocampal Volume, Memory and Learning at 7 Years in Children Born Very Prematurely
 71. SADY, MD Two Pediatric Cases of Paraneoplastic Limbic Encephalitis – Neurological and Neurocognitive Outcomes
 72. SALAMA, CH Pediatric Anti-NMDA Receptor Encephalitis: Case Series Review of Acute and Long-Term Neuropsychological Findings
 73. SCHUH, J Neuropsychological Predictors of Socioemotional Outcomes in Pediatric Brain Tumor Survivors
 74. SCHWARTZ, DD Acute Fine-Motor Dysfunction as a Marker of Neurobehavioral Vulnerability in Children with Type 1 Diabetes
 75. STERN, M Effect of Multi-Night Experimental Sleep Restriction on Attention in Healthy Adolescents
 76. TAYLOR, NM Persisting Deficits in Mirror-Normal Discrimination Among Preterm Youth
 77. VAN DER FLUIT, F Examination of the Effects of Perinatal Neurological Insult on Visual Attention
 78. WALTER, J Effects of Congenital Hydrocephalus and Prematurity on Intellectual Functioning
- Multiple Sclerosis/ALS/Demyelinating Disorders**
79. ARREOLA, C Efficacy and safety of 4-aminopyridine treatment on cognitive performance of patients with Multiple Sclerosis: A randomized, blinded, and placebo-controlled study
 80. BASSO, MR Memory Impairment in MS is Characterized by Deficits in Acquisition and Retention
 81. MILLER, A The Influence of Pain on Prospective Memory in Multiple Sclerosis
 82. BECKSTRAND, JN Alternate Formulations of the MSFC and Their Correlation with Cognition in Patients with Remitting-Relapsing Multiple Sclerosis
 83. DENNEY, DA Symbol Digit Modalities Test as a Predictor of Memory Performance in Children and Adults with Multiple Sclerosis
 84. FROST, R Lower and Slower: Comparison of the Performance of Multiple Sclerosis Patients and Controls on a Sternberg Paradigm Task
 85. GENOVA, HM Speed Accuracy Face Off: the interplay of speed and accuracy of facial processing in Multiple Sclerosis
 86. GLUSMAN, MB Speeded Eye Tracking is Associated with Performance on Cognitive Tests that Require Visual Scanning in Multiple Sclerosis
 87. HAVINS, WN The relationship of apathy, depressive symptoms, and anxiety to cognitive functioning in individuals with amyotrophic lateral sclerosis (ALS)
 88. RYAN, JJ WMS-IV Performance of Patients with Multiple Sclerosis: Preliminary Findings

89. SHUMAN, MJ The Effect of Time on Verbal Fluency Performance in Individuals with Multiple Sclerosis and Age-Matched Controls
90. SHUMAN, M Learning and Cognitive Fatigue Trajectories in Multiple Sclerosis Defined using a Burst Measurement Design
91. WALDRON, EJ Personality Ratings Detect Early Neurobehavioral Changes in ALS Before Deficits Are Evident on Cognitive Tests: A Case Study
92. WALKER, L Cognitive Correlates of Health-Related Quality of Life in MS Patients Undergoing Immunoablative Therapy and Autologous Hematopoietic Stem Cell Transplantation (IA-HSCT)
93. WALKER, L Relationship between MSNQ and objective cognition in early relapsing-remitting multiple sclerosis: Self and informant ratings
94. WIGAS, G Processing Speed and Decision Making in Multiple Sclerosis: The Digital Clock Drawing Test (dCDT)

Visuospatial Functions/Neglect/Agnosia

95. MARK, VW Touchscreen vs. Paper Cancellation Testing in Brain Injury
96. MORALES, G Visual Perception and Visuospatial Abilities among Children with Hemophilia: A Mexican Sample Who Experienced Cerebral Hemorrhage
97. SCHMIDT, L Effects Of Age And Spatial Plane On The Subjective Visual Vertical (SVV) – Results Of A Novel Testing Apparatus
98. WELFRINGER, A Constraint-Induced Movement Therapy (CIMT) in Patients Showing Chronic Neglect Symptoms – A Randomized Controlled Study
99. WULFF, M Effects of Unfamiliar Object Pairs on Recovery from Extinction

Behavioral Neurology

100. ROTBLATT, M Peer Relationships In Adolescents With Epilepsy: How Do They Compare With Their Peers With Asthma?

10:00–10:15 AM

**Thursday AM Coffee Break
Grand Promenade**

10:15–11:15 AM

**Invited Address: Can We Detect Alzheimer's Disease a Decade before Dementia (and why would we want to)?
Presenter: Reisa Sperling
Monarchy Ballroom**

1. SPERLING, R Can We Detect Alzheimer's Disease a Decade before Dementia (and why would we want to)?

11:30 AM–12:30 PM

**Invited Address: Primary Progressive Aphasia and the Language Network
Presenter: Marsel Mesulam
Monarchy Ballroom**

1. MESULAM, M Primary Progressive Aphasia and the Language Network

1:00–2:00 PM

**Poster Symposium: Brain Structure and Function in Alcoholics
Chair: George Fein
Kona Ballroom**

Drug/Toxin-Related Disorders (Including Alcoholism)

1. FEIN, G Brain Structure and Function in Alcoholics
2. PFEFFERBAUM, A Alcoholism, HIV Infection, Hepatitis C, and the Brain
3. ENDRES, MJ Emotion-word Processing Difficulties in Long-term Abstinent Alcoholics with and without Other Lifetime Externalizing Disorders
4. GREENSTEIN, DW Gait and Balance Ataxia in Abstinence Alcoholics

1:00–2:00 PM

**Poster Session 2: Autism/Behavioral Neurology/Cancer/Executive Functions
Kona Ballroom**

Autism Spectrum Disorders

1. GIDLEY LARSON, JC The Role of Self-Directed Speech in Motor Control in Children with Autism
2. BREWSTER, R Differential relationships between white matter integrity, facial emotion perception, and socialization skill in participants with ASDs and controls
3. CARSON, AM Social Anxiety and Electroencephalogram Coherence in Teens with and without Autism Spectrum Disorders

4. DE LEEUW, D Prevalence of Autism in Patients with Laurence Moon Bardet Biedl Syndrome
 5. DELBENE, VA Atypical visual habituation in children with autism: A high density electrical mapping study
 6. DUFFIELD, T Finger Tapping, Strength-of-Grip and Grooved Peg-Board Performance in Autism
 7. FUKATSU, R Basic Motor Skill and Praxis in 5-year-old Boys with Autism
 8. GREEN, R Visual-Motor Integration Deficits and Neurological Correlates in Autism Spectrum Disorder
 9. KLEINHANS, NM Association between Early Rapid Head Growth and Reduced Connectivity in Adolescents with Autism Spectrum Disorders
 10. MOTTRON, L Inspection Time Confirms that the Raven Matrices are the Optimal Measure of Autistic Intelligence
 11. NAIR, A Impaired balance correlated with repetitive behavior severity in Autism Spectrum Disorders
 12. ONO, KE Response Monitoring as a Predictor of Developmental Trajectories in Higher Functioning Adolescents Diagnosed with Autism
 13. PERSSON, BA Autism and Schizophrenia – Overlap, Differential Aspects, and Comorbidity
 14. PETERS, JB Intersensory Selective Attention and Task Switching in Autism Spectrum Disorders: A High-Density Electrophysiological Investigation
 15. RAY, P Executive Functioning In Children With Autistic Spectrum Disorder On The Behavioural Assessment Of Dysexecutive Syndrome In Children
 16. REINVAL, O Developmental and Behavioural Problems in Children and Adolescents with Autism Spectrum Disorders
 17. RICHARD, A Neural Synchrony during Direct and Averted Gaze in Autism Spectrum Disorder (ASD) Using MEG
 18. SEMRUD-CLIKEMAN, ME Hippocampal and Amygdala Volumetric Differences in Asperger Syndrome, NVLD, and Controls
 19. STEFANATOS, CA Demographic Factors Are Not Differentially Predictive of Early Onset and Regressive Autism Spectrum Disorder
 20. TRONTEL-DUFFIELD, H Volumetric Relationships of Medial Temporal Lobe Structures with Memory in Autism
 21. WODKA, EL The Relationship Between Sensory and Motor Functioning in Two Clinical Groups
 22. WODKA, EL Evidence for Specificity of Motor Impairments in Catching and Balance in Children with Autism
- Behavioral Neurology**
23. ACOSTA, L Mindfulness Based Stress Reduction and Creativity
 24. ARCARA, G Numerical Activities of Daily Living In Neurological Diseases
 25. FALCHOOK, AD Crossed Aphasia Without Apraxia In A Right-Hander
 26. KEIFER, E Motor Perseverations in Older Patients
 27. MENNEMEIER, MS Perception of Strength and Balance is Influenced by Stroke Laterality and Arousal Level
 28. YOUNG, CY Academic Achievement in Children and Adults with Agenesis of the Corpus Callosum
 29. YUND, BD Klüver–Bucy-like Symptoms in Sanfilippo syndrome
- Cancer**
30. BRINKMAN, TM Processing Speed as a Predictor of Social and Adaptive Functioning in Survivors of Childhood Acute Lymphoblastic Leukemia (ALL)
 31. EDELMANN, M Uric Acid is Associated with Neurocognitive Function in Survivors of Childhood Acute Lymphoblastic Leukemia
 32. GROSCHE, MC Executive function in breast cancer survivors
 33. HARDY, KK Computerized Cognitive Training for Newly-Diagnosed Children with Cancer: Cognitive, Medical, and Psychosocial Predictors of Feasibility
 34. HILE, S The Developmental Trajectory of IQ Deficits Following Cranial Radiation Therapy for Acute Lymphoblastic Leukemia (ALL)
 35. HOWARTH, RA Cognitive Outcomes among Long-Term Survivors of Diffuse Intrinsic Pontine Glioma Diagnosed in Childhood
 36. KIMBERG, CI Visuospatial Construction in Long-term Survivors of Childhood Acute Lymphoblastic Leukemia (ALL): Evaluation of a Developmental Scoring System
 37. MEIER, A Impact of Clinically Elevated Distress on Baseline Neurocognitive Performances
 38. MELLOTT, E Long-Term Neurocognitive Outcome of Children Treated for Standard-Risk Acute Lymphocytic Leukemia: A Case Comparison
 39. RIDDLE, T Adjuvant Score at Breast Biopsy: Relationship With Cognitive Ability and Quality of Life
 40. SCHREIBER, JE Change in Academic Skills Following Treatment for an Embryonal Tumor
- Executive Functions/Frontal Lobes**
41. ANDERSON, JW The Relationship between Time Estimation and Executive Functioning
 42. ANDERSON, JW Are People Aware That Time Flies While Having Fun?
 43. ARAUJO, G Patterns of Executive Function Deficits in Children with Distinct Brain Disorders
 44. ARESHENKOFF, CN The Benefits of Physical and Cognitive Training Programs on Executive Functions among Older Adults: A Meta-Analytical Comparison
 45. ASHFORD, JM Cognitive Performance and fMRI Findings among Healthy Volunteers with Incidental Structural Neuroimaging Findings
 46. AVERILL, L Executive functioning across the lifespan: An examination of the D-KEFS
 47. WISDOM, N Learning stories vs. word lists: The role of executive functioning
 48. BANERJEE, P Impact of Non-planning Impulsivity and Psychological Distress on Executive Functioning in a Non-Clinical Sample

49. BANERJEE, P
Organizational Strategic Processing: A Latent Variable Analysis
50. BARCELO, F
Card Sorting Revamped: Lessons from Cognitive Electrophysiology of Task Switching
51. CASSIDY, AR
Developmental Continuity and Discontinuity in Organization of Executive Functions: Evidence for an Early Adolescent Transitional Period
52. CHÁVEZ, CL
Developmental course of cognitive and executive functions in three adolescents with prefrontal injury
53. CIRINO, PT
Contributions of Executive Function to Academic Skills
54. DELISLE, RE
Refining the EMO-CPT for Measuring “Hot” and “Cool” Executive Circuit Function
55. DENNY, KG
MRS Correlates of Executive Function and Depression in ALS
56. DIRENFELD, E
Cross-cultural Validation of a Screener for Executive Functions
57. FETTERMAN, Z
An Investigation of Potential Threshold Effects in the Prediction of Cognitive Dysfunction from Body Mass Index in Healthy Adults
58. FLAHERTY-CRAIG, CV
Equivalence Between Gender Specific Profiles in Amyotrophic Lateral Sclerosis (ALS) Behavioral Impairment Frontotemporal Disease (biFTD) and Attention Deficit Hyperactivity Disorder (ADHD): A Neuroendocrine Hypothesis
59. FRANCHOW, EI
High Suppression and Poor Behavioral Control: an Executive Effect
60. FULCHER, KK
Greater Physical Activity is Independently Associated with Better Cognitive Function in Older Adults with Heart Failure
61. GOLDSTEIN, CM
Health Literacy is Associated with Performance on a Test of Frontal Systems Functioning in Phase-II Cardiac Rehabilitation
62. GRAVANO, J
Variability in Executive Control of Attention in Parkinson’s Disease
63. HANRATTY, AM
Intellectual Ability as a Predictor of Performance on the Wisconsin Card Sorting Test
64. HECHT, LK
Examining the Contribution of IQ-Executive Functioning Discrepancies to Externalizing Behaviors in Youth
65. HUBSHER, H
Associations Among Alcoholism, Impulsivity, Executive Functioning, and Frontal Cortical Volumes in Men and Women
66. KAKOS, L
Cognitive Function Following Exercise-Induced Dehydration: Role of Sports Drink Supplementation
67. KASZYNSKI, K
Executive Functioning, Self-Restraint, and Distress in Homeless Youth
68. KIBBY, MY
Inferior Frontal Lobe Volume Predicts Working Memory Abilities and ADHD Symptoms in a Mixed Sample
69. KLIPFEL, K
Investigation of the Role of Executive Dysfunction in Dating Aggression
70. LACOURSIÈRE-CIRARD, J
Evaluating brain frontal activation in clinical practice: A preliminary study with passive near-infrared imaging
71. LAFO, JA
Memory Dissociations in Essential Tremor and Parkinson Disease: A Final Common Pathway?
72. MAROLA, J
Executive Function (EF) and Depressive Symptoms in Ischemic Stroke Participants
73. MARSHALL, DF
Deficient Inhibitory Control as an Outcome of Childhood Trauma in Bipolar Disorder and Healthy Controls
74. NA, S
Fluid and Crystallized Intelligence Relationships with N-back Performance
75. NZEREM, C
Executive Dysfunction is Associated with Clinical Symptomatology in 22q11.2 Deletion Syndrome
76. PARKER, DJ
EMO-CPT: A Measure of “Hot” and “Cool” Executive Circuit Function?
77. PINARD, FA
Intergenerational Associations between Executive Functioning of Parents and their Adult Offspring
78. PLOTKIN, RM
Texting While Driving: An Investigation of Divided Attention Resources Among Deaf Drivers
79. RAU, H
Profiles of Executive Functioning in Healthy Young Adults
80. RECKESS, GZ
Decision-Making in Parkinson’s Disease: Effects of Deep Brain Stimulation of the Subthalamic Nucleus
81. ROBINSON, H
Lesion Correlates of Executive Functions: A Neuropsychological Approach Using the EXAMINER Battery
82. RODRÍGUEZ-VILLEGAS, A
Executive functions and coping in healthy adults
83. SCHMID, M
First Episode Major Depressive Disorder- Sustained Impairment in Inhibition and Semantic Fluency in a 1 year Follow up Assessment
84. SCHNEIDER, H
Factor Structure of the BRIEF-Preschool Version: How Many Executive Skills Are There, Anyway?
85. SETER, C
Do Traditional Neuropsychological Measures of Planning Measure the Same Construct?
86. SØLSNES, AE
Self-Evaluation of Executive Functions in Very-Low-Birth-Weight Preterm Born Young Adults Does Not Correspond to Results on Neuropsychological Tests Assessing Attention/Executive Functions
87. VANDERMEER, M
On the Nature of a Novel, Ecologically Valid Measure of Executive Functioning in Patients with Mild Traumatic Brain Injury: A Pilot Study
88. VERA-ESTAY, E
Precursors of Sociomoral Reasoning in Adolescence: The Contribution of Executive Functions
89. WARNER, J
Neurocognitive Late-Effects of Pediatric Oncology: Annual Screening as Standard of Care with the KP-NCLE Brief Assessment Battery
90. WEBER, R
Selective Attention in Bilingual and Monolingual Children
91. WILSON, J
Hot and Cool Executive Functioning during Middle Childhood: Development and Association with Academic and Psychological Outcomes
92. WOCHOS, C
Parent Ratings of Executive Function in Pediatric Brain Tumor Survivors May be Inadequate in Identifying Executive Function Late Effects

1:30–3:00 PM**Invited Symposium: Diagnosing Challenging Cases Using Biomarkers and the New AD Research Criteria****Chair: Stephen Salloway
Monarchy Ballroom**

1. SALLOWAY, S

Invited Symposium: Diagnosing Challenging Cases Using Biomarkers and the New AD Research Criteria

1:30–3:00 PM**Symposium 2: Social Outcomes in Pediatric Traumatic Brain Injury: Results from the SOBIK Project****Chair: Keith Yeates
Kings Ballroom**1. YEATES, K
2. YEATES, K

Social Outcomes in Pediatric Traumatic Brain Injury: Results from the SOBIK Project

Social Outcomes in Kids with Brain Injury (SOBIK): A Multi-Level Study of Social Outcomes in Pediatric Traumatic Brain Injury

3. BIGLER, E
4. DENNIS, M
5. TAYLOR, H

How to Image the Social Brain in Pediatric Traumatic Brain Injury

Modeling Theory of Mind in Pediatric Traumatic Brain Injury

Social Adjustment after Pediatric Traumatic Brain Injury

1:30–3:00 PM**Paper Session 3: Cognitive Interventions for Memory and Brain Training****Moderator: Bonnie Sachs
Queens Ballroom**1. ROWE, G
2. KRAWCZYK, DC
3. NOVAKOVIC-AGOPIAN, T
4. SMITH, J
5. MORENO, S

Memory for Implicitly Presented Information in Amnesia

Brain Training to Enhance Frontal Lobe Reasoning in Adult Traumatic Brain Injury

Training in Attention Regulation Applied to Individually Defined Goals in Veterans with Chronic TBI

Longitudinal Associations Between Physical Activity, Cognitive Decline, and Hippocampal Volume in Healthy APOE-ε4 Carriers

Cognitive Benefits of Music and Art Training in Healthy Older Adults

2:15–3:15 PM**Poster Symposium: Innovative Approaches to Examining the Long-Term Outcomes of Survivors of Childhood Brain Tumors****Chair: Tricia King
Kona Ballroom****Cancer**1. KING, TZ
2. AILION, AS
3. KING, T
4. SMITH, K
5. IVANISEVIC, M
6. JAYAKAR, R

Innovative Approaches to Examining the Long-Term Outcomes of Survivors of Childhood Brain Tumors

Childhood Brain Tumors: A Longitudinal Model of Factors Affecting Socialization Behaviors

Functional MRI Activation to Increased Working Memory Demands Among Long-Term Survivors of Childhood Brain Tumors

The Mediating Role of Processing Speed in Reading-Related White Matter Tract Integrity and Word Reading Skills of Adult Survivors of Childhood Brain Tumor

Adult Survivors of Childhood Brain Tumor and Community Living Abilities: The Mediating Role of Planning Skills

Hippocampal Volume and Verbal Memory Skills in Long-Term Survivors of Childhood Brain Tumors

2:15–3:15 PM**Poster Session 3: Aging/Assessment (Child)/Imaging
Kona Ballroom****Aging**1. AGBAYANI, K
2. ANDREWS, GL
3. BAENA, E
4. BRAMBATI, S
5. BROWN, T
6. CARR, D
7. CARR, D
8. CARR, D

Model comparisons of age-group differences in IQ after accounting for the Flynn effect

Left Frontal Lobe Damage: A Case Study in Long-Term Effects

The Effects of Age and Increasing Task Difficulty on the Neural Correlates of Semantic Knowledge and Episodic Memory: An fMRI Investigation of Functional Compensation

Reading aloud skills: their positive redefinition through aging

The Relationship Between Education and Problem Solving Ability in Older Adults in a Stereotype Threat Context

Interaction of Executive Functioning and Mood on Memory, Global Cognition and Activities of Daily Living (ADLs) in Older Adults at Follow-Up

Examining the relationship between blood pressures, triglycerides, lipids and executive functioning in cognitively healthy older adults

Additive models of dementia risk factors on cognitive dysfunction in a cognitively healthy older adult sample

9. GALIOTO, R
Cognitive reserve preserves cognitive function in obese individuals
10. HAN, SD
Neuroimaging of Temporal Discounting and Memory Networks with a Frontal Insular Cortex Seed
11. ISOMURA-MOTOKI, AJ
At-Risk Older Drivers in Japan and Their Awareness
12. KIM, B
Categorization of topic shift in autobiographical narratives of normal elderly
13. KIM, BB
Gender Differences in Estimating Performance Speed on Instrumental Activities of Daily Living
14. KIM, J
The Performance in MMSE in the Elderly of Rural versus Urban Communities
15. KIM, S
Effect of Active Communication Behaviors in Daily Living on Cognition and Language Abilities of the Elderly
16. LALONDE, FM
Gender Differences in Cortical Thinning Associated With Normal Aging and Alzheimer's Disease
17. LEE, S
Interval-based analysis of verbal fluency performance in the elderly
18. LEMONDA, B
The Association between High Neuroticism/Low Extraversion and Dual Task Performance in Healthy Older Adults
19. MAHONEY, JR
Visual-Somatosensory Integration in Aging: Does Space Really Matter?
20. LI, C
The Effects of Attention Resources and Dual-Task Strategies on Gait Performance in Aging: a Comparison of Two Walking While Talking Paradigms
21. MCLAUGHLIN, P
Cognitive Variability in Visual Search Performance: Auditory Cues Reduce Variance in Young, Middle-aged, and Older adults
22. METHQAL, I
Process-Dependant Neurofunctional Reorganization in Aging for the Semantic Processing of Words
23. NORMAN, AL
Changes in Verbal Learning Across Trial and Time: Predicting Cognitive Decline in Older Adults Over Five Years
24. PHILLIPS, D
Relationships Between Sleep Quality, Perceived Cognition, and Quality Of Life in Older Adults
25. REED, B
Effects of General and Cardiovascular Illness Burden on Memory and Executive Function in Aging
26. ROGERS, SA
Does Cognitive Status Influence Older Adults' Spiritual Importance?
27. SAKAMOTO, M
Cardiovascular Risk Predicts Differential Patterns of Impairment on the Philadelphia Verbal Learning Test – Japanese version
28. SALAMI, A
The Effect of Aging on Successful Conflict Resolution: Evidence for Functional Reorganization of Cortical Networks
29. SELIGMAN, SC
Coding of Everyday Action Inefficiencies in Older Adults
30. SMART, CM
Mindfulness Training Increases Error Processing in Older Adults With and Without Subjective Cognitive Impairment
31. SUGARMAN, MA
Rapid Forgetting in the Prediction of Future Cognitive Decline in Healthy Older Adults
32. TARDIF, S
Associative Memory Processes in Healthy Aging and in Mild Cognitive Impairment
33. TSUI, HS
Cognitive Decline in Older Adults: A Decade Follow-up
34. VALLESI, A
Spatial Stroop and Cognitive Reserve in Normal Aging
35. WENDELL, CR
Aerobic Fitness, Body Mass Index, and Brain Atrophy
36. WOHLTMANN, JJ
Facebook for Seniors: A Pilot Study of the Effects of Online Social Networking on Cognitive Function in Healthy Older Adults
37. YOSHIZAKI, K
Effects of aging on the location-based conflict adaptation for visual selectivity
38. YOU, SC
Factor Analysis of the Geriatric Depression Scale
39. ZIMMER, HD
Shortage of Processing Relational Information during Encoding Contributes to the Age-related Association Deficit in Episodic Memory
- Assessment/Psychometrics/Methods (Child)**
40. ANDERSON, S
Inter-related Visual Reception and Receptive Language Scales of the Mullen Scales of Early Learning
41. BAUM, KT
Sleep Restriction Impacts Adolescents' Behaviors and Learning in a Simulated Classroom
42. DONDERS, J
An 8-Subtest form of the WISC-IV for Use after Pediatric Traumatic Brain Injury
43. GEURTEN, M
Children's Knowledge About Memory: Adaptation and French Validation of a Scale to Assess it
44. KERNS, KA
The Tower of Monkeys: Investigation of Psychometric Properties of a Preschool Tower Task
45. KHURSHID, A
When Family and Physician Lack of Cooperation Interferes with Development
46. LALONDE, G
The Influence of Age on Sociomoral Reasoning Maturity in Adolescents
47. LI, ST
Objective and Subjective Measures of Executive Functioning in a Kindergarten Sample
48. WALSH, KS
Evaluating the Validity of a Computer-Based Neuropsychological Battery in Children with Medical Conditions at Risk for Neurodevelopmental Disruptions
49. WARSCHAUSKY, SA
ERPs as Alternative Cognitive Test Access for Children with CP
50. WILKINSON-SMITH, A
Parent Report Compared to Direct Assessment of Symptoms of Autism Spectrum Disorders in Children with Primary Anxiety
51. YOUNG, C
The Virtual Reality Classroom Stroop Task as a Measure of Executive Dysfunction
- Imaging (Structural)**
52. ANSADO, J
Validation of a New Template to Study Callosal Growth During Childhood and Adolescence
53. BARGHI, A
Structural Brain Integrity Is Associated with Spontaneous Real-World Arm Use in Chronic Hemiparetic Multiple Sclerosis
54. BENITEZ, A
A Survey of Expert Neuropsychologist-Neuroimagers' Recommendations for Neuroimaging Training for Neuropsychologists
55. DOVE, D
White Matter Integrity in Young School-age Children Positively Correlates with Reading, Language, and Executive Function
56. EASTMAN, JA
3D Mapping of Semantic Fluency in Clinical and Pre-Clinical Alzheimer's Disease

57. FANI, N White Matter Integrity and Fear-potentiated Startle Response During Acquisition and Extinction of Conditioned Fear in Individuals With and Without PTSD
58. GARON, M A new template establishes a relationship between callosal volume and performance IQ
59. GICAS, K Neurocognitive Profiles and Structural Brain Differences in a Marginalized Population
60. GIRARD, HM Beginning to See Clearly: Application of Prospective Motion Correction (PROMO) MRI to Pediatric Epilepsy
61. GONENC, A Uncinate Fasciculus is Associated with Cognitive Function and Impulsivity in Bipolar Disorder: An Enhanced Tractography Analysis
62. GRABOWSKA, A Grey matter volume differences in cognitive subtypes of developmental dyslexia
63. HAMPTON, L The Relation of Anomalous Heschl's Gyrus and Dichotic Listening in Spina Bifida
64. JEFFERSON, AL Gray-White Matter Contrast Ratio Relates to Progression in Mild Cognitive Impairment
65. KIBBY, MY Are Teachers Better Raters Than Parents? Teacher-rated Hyperactivity and Attention Problems Predict Right Orbitofrontal Cortex Volume in Children
66. KIBBY, MY An Investigation of the Precentral Gyrus as a Neural Structure Underlying Rapid Automatized Naming in a Mixed Childhood Sample
67. LEE, AK Imaging Markers of Myelin in Alzheimer's Disease: Diffusion-Tensor Imaging and mcDESPOT
68. RAO, J Myelin Integrity, ApoE Genotype, and Cognitive Function in MCI and AD
69. MARQUEZ DE LA PLATA, CD DTI Correlates with Acute Injury Severity and Chronic Outcomes after TAI
70. MARQUEZ DE LA PLATA, CD Evolution of White Matter Damage after TAI
71. MATSUI, M Developmental Trajectories of the Fronto-Temporal Lobes from Infancy to Early Adulthood
72. PARK, H Distribution Analysis of Cerebral Microbleeds in Cognitive Impairment and Stroke with Susceptibility Weighted Imaging
73. REID, MW Impact of Social Engagement on Brain Volumetrics Among the Elderly
74. RHOADS, K Relationships between volumetric MRI and neuropsychological assessment results in MCI and Alzheimer's disease
75. RICKARDS, T White Matter Hyperintensity Load In Adults With Chronic Stroke Relates To Initial Motor Function, Not Response To CI Therapy
76. RYMAN, S Subcortical Volumes Relate to Intelligence Measures
77. SQUEGLIA, LM Does Cortical Thickness During Adolescence Predict Neuropsychological Functioning?
78. STARK, C Medial temporal lobe cortical thickness measurement using diffeomorphic registration in aging and mild cognitive impairment
79. TATE, DF Relationship between quantitative frontal white matter neuroimaging measures and global cognitive function in high altitude pilots
80. TREMBLAY, S Long-term impact of sport concussion on primary motor cortex thickness and metabolism in asymptomatic athletes
81. WIENER, JR Grey Matter Changes Following Attention Training
82. WILLIAMS, VJ Examination of Frontal and Parietal Tectocortical Attention Pathways in Spina Bifida Meningomyelocele Using Probabilistic Diffusion Tractography
83. WU, TC Diffusion Tensor Imaging Findings in Mild Traumatic Brain Injury and Orthopedic Injury

Dementia (Subcortical, Specific Disorders, MCI, etc.)

84. PARK, K Randomized, Double-Blind, Placebo-Controlled Clinical Trial of Korean Ginseng as a Functional Food in Healthy Volunteers with Mild Cogni

Dementia (Alzheimers)

85. MITSUTO, R Evaluation of the patients with Alzheimer's disease and mild cognitive impairment -Utility of discriminant-analysis in the subtests of Rivermead Behavioral Memory Test-

Electrophysiology/EEG/ERP

86. STEFANIDOU, C Neural Time-Course of Mechanisms for the Processing of Human Action Sounds in Toddlers

ADHD/Attentional Functions

87. SHAPERO, D Working Memory Deficits in ADHD and ODD: Shared or Unique?

3:00–3:15 PM

**Thursday PM Coffee Break
Grand Promenade**

3:15–4:45 PM

**Invited Symposium: Progression of Non-Amnesic Dementias:
Measurement and Intervention
Chair: Emily Rogalski
Monarchy Ballroom**

1. ROGALSKI, E Invited Symposium: Progression of Non-Amnesic Dementias: Measurement and Intervention
2. CHOW, TW Update on Concepts of Progression and Caregiver Interventions
3. DICKERSON, B Monitoring Progression of PPA and bvFTD: Toward Measures Useful for Clinical Trials

3:15–4:45 PM**Symposium 3: The Reserve Construct: How Homogeneous is it?****Chair: Eli Vakil****Discussant: Yaakov Stern****Kings Ballroom**

1. VAKIL, E
The Reserve Construct: How Homogeneous is it?
2. STERN, Y
Imaging Cognitive Reserve
3. BIGLER, ED
Brain and Cognitive Reserve in Traumatic brain injury
4. VAKIL, E
Predicting Long-term Outcome Following Traumatic Brain Injury (TBI): Three-factor Cognitive Reserve Structure
5. RASSOVSKY, Y
Emotional Reserve in Traumatic Brain Injury: Evaluating Construct Validity of Emotional Reserve and its Relationship to Functional Outcome

3:15–4:45 PM**Symposium 4: The Pediatric Imaging, Neurocognition and Genetics (PING) Study: Focus on Assessment Core Phenotypes****Chair: Terry Jernigan****Queens Ballroom**

1. JERNIGAN, TL
The Pediatric Imaging, Neurocognition and Genetics (PING) Study: Focus on Assessment Core Phenotypes
2. AKSHOOMOFF, N
The NIH Toolbox Cognition Battery: Results from a Large Normative Developmental Sample (PING)
3. CHANG, L
Prenatal Tobacco Smoke Exposure on Brain Morphometry and Diffusivity
4. NEWMAN, E
Age-Dependent Relationship between Childhood Anxiety and Regionalization of the Ventromedial Prefrontal Cortex
5. DOUET, V
Relationship of a Functional Variant in the Neuregulin 1 Gene to White Matter Microstructure in Children of the Pediatric Imaging Neurocognitive Genetic (PING) Study

3:30–4:30 PM**Poster Symposium: Depression after TBI: Empirically-based Interventions****Chair: George Fein****Kona Ballroom****TBI (Adult)**

1. ASHMAN, T
Depression after TBI: Empirically-based Interventions
2. TSAOUSIDES, T
Depression After TBI
3. ASHMAN, T
Randomized Clinical Trial for Treatment of Depression After TBI
4. D'ANTONIO, E
Session by Session Data for a RCT Treating Depression After TBI

3:30–4:30 PM**Poster Session 4: Aging/Assessment (Adult)/TBI****Kona Ballroom****Aging**

1. AKERSTEDT, AM
Nightly Awakenings In Persons With Alzheimer 's Disease And Its Implications For Family Caregiver Daily Emotional Functioning
2. BELLEVILLE, S
Working Memory and Control of Attention in mild cognitive impairment: relation to white-matter hyperintensities and disease progression
3. BURNS, C
Importance of Personal Wellness: How Exercise and Leisure Activities Relate to Memory
4. CHI, S
Differentiation of Prospective and Retrospective Components of Prospective Memory Performance in Older Adults using a Computerized Event-Based Task
5. RABIN, L
The Test of Practical Judgment (TOP-J): Updated Normative Data and Validation in a Demographically Diverse Group of Older Adults
6. CONNELL, S
Presence of Alzheimer's Disease and Changes in Normal Ageing Are Reflected in the Patterns of Early and Late ERP Components
7. CURIEL, AR
Hormone Replacement Therapy and Language Functioning
8. ENGLAND, S
Subjective Perception and Objective Assessment of Turns While Walking
9. FOX, SJ
A Look at the Effects of Marital Status on Global Cognitive Functioning in a Non-Clinical Sample of Elderly Adults
10. GEFEN, T
Neuropsychological Performance of Cognitive SuperAgers: Preliminary Findings from a Longitudinal Study of Extraordinary Seniors
11. HAMILTON, JL
Depressive Symptoms Effect Different Domains Of Cognition In Older, Non-Demented African Americans
12. KANDAH, CC
Recent and Remote Recognition: Brand Names, Famous Names and Television Shows
13. KAUFMAN, DA
Apathy, Anxiety, and Executive Functioning in Healthy Aging
14. KRASEAN, L
Does Occupational Complexity Impact Knowledge of Personal Health and Safety and Money Management?

15. KRASEAN, L Word Reading Ability, Occupational Complexity, and Neuropsychological Functioning in a Clinical Older Adult Population
16. LAZOR, B Does Depression Affect Attention and Processing Speed in Older Adults? Bethany T.S. Lazor and Steven A. Rogers
17. MACDONALD, SW Gait and Interletter Variability Under Cognitive Load Are Associated With 25-Year Cognitive Decline
18. MARTYR, A Executive Function And Activities Of Daily Living In Older Adults
19. MCCULLOCH, K Sensitivity and Specificity of the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) in Screening for Mild and Severe Cognitive Impairment Related to Dementia
20. MCCULLOCH, K How to Select Between the Mini-Mental State Examination (MMSE) or Montreal Cognitive Assessment (MoCA) When Accounting for the Base Rate of the Sample and the Level of Severity Being Screened For
21. MCCULLOCH, K Predicting Caregiver Burden from Patient Functional Ability and Mood
22. MEDINA, LD Prospective Memory Relates to Everyday Functioning in Older Adults but not in Younger Adults
23. MULLIGAN, BP Utility of Neural and Behavioral Markers of Intra-Individual Variability in the Discrimination of Healthy Older Adults from Those with Subjective Cognitive Impairment
24. PATERSON, TS Depressive Symptoms Predict Practical, Not Social, Everyday Problem Solving Ability in Older Adults
25. PAUL, R Relationship between white matter hyperintensities and subcortical fiber lengths among healthy older adults
26. PAULSON, D Prediction of IADL disability using executive functioning in older African-Americans
27. PERSSON, N Change and Variability in Body Mass Index & Cognitive Performance in the Adult Life Span
28. RHODES, E Exploratory Analysis of Graph Theory in Neuroimaging as a Marker of Cognitive Reserve in Aging and Late-Life Depression
29. RODRIGUEZ-ARANDA, C Addressing the Link Between Age-related Cognitive Decline and Fine Motor Dexterity in Healthy Elderly Adults
30. SCHARAGA, EA Psychometric Properties of the BRIEF: An Efficient Assessment of Instrumental Activities of Daily Living Performance
31. SHERMAN, E Neuropsychology in the Primary Care Setting: Overview and Experiences from a Brain Health Program
32. STRATTON, J Super-Memory-Agers or Super-Cognitive-Agers: Are they one and the same?
33. THOMAS, K Cerebrospinal Fluid and Plasma apolipoprotein A-1 Predicts Performance on Verbal Episodic Memory Measures
34. WONG, AL Triglyceride Levels as a Predictor of Cognitive Performance in Healthy Aging Adults
35. TOMASZEWSKI FARIAS, S Relationships between everyday cognition, neuropsychological function and structural brain imaging vary by diagnosis
36. TRIVEDI, MA The neural correlates of symbol digit modalities test (SDMT) performance across the lifespan
37. WOOD, SA Neurocognitive Risk Factors for Elder Financial Exploitation
38. WORTHY, DA Older Adults Show a Heightened Behavioral Response to Negative Prediction Errors During Decision-Making: A Proposed Effect of Dopaminergic Decline
39. FANNING, M Verbal Fluency Output over Time: Relation to Executive Dysfunction and Vascular Risk Factors
- Assessment/Psychometrics/Methods (Adult)**
40. OTTEMILLER, D Creativity and Everyday Action
41. BOETTCHER, A Association Between Experimental Measures of Working Memory Ability and Concussion Vital Signs Domains
42. BOLZENIUS, J Construct Validity of the N-Back Task as an Attention and Working Memory Paradigm in Individuals with Traumatic Brain Injury
43. BOXLEY, L Does MOCA Performance Vary By IQ?
44. BURTON, CZ Cognition and Functional Capacity Assessment in English Speakers and Monlingual Spanish Speakers with Schizophrenia
45. BUSSE, M Reliability of the PAI in a Neuropsychological Population
46. CHELUNE, GJ Assessing Reliable Cognitive Decline in Older Adults: Part I — Efficacy of Multivariable Regression Equations Derived from Summary Data
47. CHELUNE, GJ Assessing Reliable Cognitive Decline in Older Adults: Part II — Base Rates of Decline in a Clinical Sample at Two Levels of Impairment
48. EDMUNDSON, MS Methodological considerations for research in mild traumatic brain injury (mTBI) and posttraumatic stress disorder (PTSD) in combat veterans: Information from a preliminary study
49. FORD, AI Construct Validity and Reliability of Repeated Telephone-based Cognitive Screening Measures for Dementia
50. FUNES, CM The Impact of Education within the U.S. on List Learning in Ethnically Diverse Groups
51. GOPIN, C The Neuropsychological Assessment Battery-Naming Subtest: Convergent Validity in a Clinical Sample
52. GROSCHE, MC A new measure of processing speed in cancer survivors
53. KESSELS, RP Perception of Morphed Facial Expressions: Norms for the Emotion Recognition Task (ERT) for Ages 8-75
54. MACDONALD, G Clinical Utility of the Montreal Cognitive Assessment (MoCA) in an Acute Care Setting: Association of MoCA Total and Subtest Scores with Standardized Neuropsychological Test Performance

55. MACKALA, SA Test-retest Reliability of Global Rating Measures of Metacognition in Healthy Volunteers
56. MACKALA, SA Understanding the Underlying Relationship Between Traditional Cognition and Functional Abilities in Hospitalized Patients with Severe Mental Illness
57. MCCLINTOCK, SM Test-Retest Psychometrics of Translational Neurocognitive Measures Specific for Electroconvulsive Therapy
58. ODLAND, A Rates of Elevated Scores on the MMPI-2-RF in the Normal Population
59. OKAHASHI, S Development of a Virtual Shopping Test (VST) for Assessment of Cognitive Function: Parallel form Reliability and Effect of Age
60. PARISH, RV Initial Premorbid Army CT Scores Are Strongly Related to Subsequent WTAR-Demographics Predicted WAIS-III FSIQ Scores in Patients Presenting for Neurocognitive Testing in a Military Medical Setting
61. PARKER, J Convergent Validity Of Bethesda Eye & Attention Measure (BEAM) Saccadic Inhibition Errors With Measures Of Executive Functioning: A Preliminary Study
62. PIERCY, JC Papillary Tumor of the Pineal Region: A Twin Case Study
63. RANSOM, DM Detection of Symptom Exaggeration using the Personality Assessment Inventory (PAI) and the Structured Inventory of Malingered Symptomatology (SIMS)
64. READY, R Training in Psychological Assessment: Current Practices of Clinical Psychology Programs
65. RYAN, JJ Base Rates of Temporal Disorientation in Alzheimer's Disease and Parkinson's Disease
66. STERN, S Psychometric Properties of the Saint Louis Mental Status Exam (SLUMS) for the Identification of Mild Cognitive Impairment (MCI) in a Veteran Sample
67. SUN, L The Underlying Structure of the Ekman 60 Faces Test and Adaptive Testing
68. WALD, D Preliminary Psychometric Data for the Wechsler Memory Scale-Fourth Edition Designs and Spatial Addition Subtests in a Sample of Older Adults
69. WONG, AL Evaluating Alternate Form Use in Neurocognitive Research
70. YAMAMOTO, A Development and Evaluation of New RBANS Story and Figure Recognition Memory Items
71. YOSHIMURA, T Working memory and digit span in dementia
- TBI (Adult)**
72. BALLANTYNE, E The Role of Obsessive-compulsive Traits in Chronic Cognitive Complaints: A Comparison Between Individuals With Mild Traumatic Brain Injury and Somatization Disorders
73. BOWN, S The Prevalence Of Traumatic Brain Injury In Adult Female Victims Of Interpersonal Violence: A Meta-Analysis
74. ESOPENKO, C The Interaction between Traumatic Brain Injury and Aging: Evidence from NHL Alumni
75. FARRER, TJ Prevalence of Traumatic Brain Injury in the General Population: A Meta-Analysis
76. GARDIZI, E Does Medical Comorbidity Predict Depression 1-year After Traumatic Brain Injury?
77. GRIECO, J Comparison Study of Predictors of Aggression in Individuals with Mild Traumatic Brain Injury and Individuals with Somatization Disorder
78. HALLER, CS Validation of the Langer Mindfulness Scale among severe TBI patients, and their significant others in German
79. HUANG, W Impact of Pre-injury Factors on Neuropsychological Outcome in Adults with Severe Traumatic Brain Injury: A Cognitive Reserve Perspective
80. KRISHNA M.D., R Diffusion Tensor Imaging in the care of a Moderate Traumatic Brain Injury Patient
81. LEE, M Discriminant variables of cognitive-pragmatic language abilities in traumatic brain injury
82. MILLER, D Spatially Variable White Matter Disruptions in Blast-Induced Mild Traumatic Brain Injury
83. NAESER, M Improved Executive Function in Chronic, mild TBI after Treatment with Scalp Application of Red/Near-infrared, Light-emitting Diodes (LEDs): Open-Protocol Study
84. NEILS-STRUNJAS, J Telehealth Intervention Results in Treatment Adherence and Improved Performance
85. O'DELL, KM Anger and Guilt in US Veterans with Traumatic Brain Injury: Who is Vulnerable and what are the Relationships with Subjective Psychological Functioning and General Well Being?
86. RAMANATHAN, DM Factors Associated with Resiliency Following TBI in a Military Population
87. ROMERO, E Cognitive Reserve Enhances Functional Recovery from Traumatic Brain Injury
88. SILVERBERG, ND Illness Perceptions in the Prediction of Outcome from Mild Traumatic Brain Injury: A Cross-Validation
89. SZABO, AJ Perceived Risk for Concussions in College Football Players
90. UZZAMAN, S On the Nature of Prospecction and its Relationship to Instrumental Activities of Daily Living in Patients with Mild Traumatic Brain Injury
91. WILLIAMS, MW Life Satisfaction, Community Integration, and Emotional Distress after Traumatic Brain Injury

5:00–6:00 PM

Award Ceremony
Monarchy Ballroom

FRIDAY, FEBRUARY 8, 2013**7:20–8:50 AM****CE Workshop 7: Decision-Making in Neuropsychological Syndromes and Implications for Neuropsychiatric Disorders****Presenter: Antoine Bechara**
Kohala 2

1. BECHARA, A

CE Workshop 7: Decision-Making in Neuropsychological Syndromes and Implications for Neuropsychiatric Disorders

7:20–8:50 AM**CE Workshop 8: Correcting IQ and Neuropsychological Scores in High Stakes Decision-making: An Ethical Issue?****Presenter: Jack Fletcher**
Kohala 3

1. FLETCHER, J

CE Workshop 8: Correcting IQ and Neuropsychological Scores in High Stakes Decision-making: An Ethical Issue?

7:20–8:50 AM**Student Lecture: Building a Career in Clinical Research****Presenter: Reisa Sperling**
Queens Ballroom**9:00–10:00 AM****Symposium 5: Interventions for Enhancing Behavioral and Neural Plasticity in Older Adults****Chair: Ruchika Prakash**
Monarchy Ballroom

1. PRAKASH, RS
2. STERN, Y
3. LIU-AMBROSE, T
4. PRAKASH, RS

Interventions for Enhancing Behavioral and Neural Plasticity in Older Adults
 Space Fortress Game Training and Executive Control in Older Adults
 Resistance Training to Promote Cognitive Function in Older Women
 Mindfulness Training and Neural Indices of Emotional and Cognitive Control

9:00–10:00 AM**Paper Session 4: ADHD/LD****Moderator: Janet Sherman**
Kings Ballroom

1. BRAGER, S
2. HALE, JB
3. GRUBER, S
4. BIGLER, ED

Teachers' Perceptions of the Implementability of Assessment Recommendations Given in the Treatment of Attention-Deficit/Hyperactivity Disorder
 Operationalizing a Neuropsychological Process Approach for Specific Learning Disabilities Identification
 Gone to Pot? Early marijuana use and impulsivity predict neurocognitive impairment and alterations in brain structure
 Voxel-Based Morphometry of Gray and White Matter Correlates of WASI IQ and WISC-III Processing Speed Index in Pediatric Traumatic Brain Injury and Orthopedic Injury

9:00–10:00 AM**Paper Session 5: Aging in Alcoholism/ AD Signature****Moderator: Emily Trittschuh**
Queens Ballroom

1. RUIZ, SM
2. STRICKER, NH
3. LARSON, MJ
4. JAK, AJ

Premature Aging in Alcoholism: Influences of Gender and Recovery
 Decreased AD-signature Cortical Thickness and White Matter Integrity in Neuropsychologically-defined Mild Cognitive Impairment
 Cognitive Control and Conflict Adaptation in Healthy Older Adults: An Electrophysiology Study
 Hippocampal Atrophy Varies by Neuropsychological Definition of Mild Cognitive Impairment in Men in Their 50s

9:00–10:00 AM**Poster Session 5: Assessment (Adult)/Cognitive Intervention/Cognitive Neuroscience/Memory****Kona Ballroom****Assessment/Psychometrics/Methods (Adult)**

1. BEESON, PM
2. BOXLEY, L

The Arizona Semantic Test: A Picture-Based Test of Conceptual Knowledge
 Assessing Delirium and Cognitive Impairment among Veterans through Behavioral Observations

3. BOXLEY, L An Investigation of MMSE Items Associated with Insufficient Task Engagement
 4. BOXLEY, L Discerning Insufficient Task Engagement From Mild to Moderate Delirium Among Inpatient Veterans
 5. FEIGON, M Use of the NINDS-CSN VCI Neuropsychological Protocols in a Sample of African-American Normal Healthy Controls
 6. HAHN-KETTER, A Analysis of Performance on Effort Testing in a Dementia Population
 7. HAMMERS, DB Converting Montreal Cognitive Assessment to Mini-Mental Status Examination Scores and Vice Versa in a Clinical Sample
 8. HARP, JP Symptom Validity Effects in Neuropsychological Evaluation of Veterans
 9. HARRELL, KM Comparing Clinical Video Telehealth and Face-to-Face Administrations of Neuropsychological Measures in a Patient with Multiple Sclerosis: A Case Study
 10. HENRY, M Discriminant and construct validation of a new impulsivity measure: the Virtual Reality Stroop Task
 11. HILL, B Much Ado About Norming: A Comparison of the Heaton Demographically Adjusted Norms and Mitrushina Meta-Norms
 12. KANE, R Reliability of Selected Tests From The Automated Neuropsychological Assessment Metrics (ANAM) Test System For Pharmaceutical Research
 13. KNEZEVIC, B A Multidimensional Model of Impulsivity: Can Impulsivity be Modeled as a Macroconstruct?
 14. KULAS, J Exploration of the Association between Premorbid Learning Difficulties and Verbal Fluency Measures in a Veteran Clinical Population
 15. LOGUE, E The Everyday Cognition (ECog) Scale: Further Evidence for Construct Validity
 16. LOGUE, E Further Validation of the ECog Using a Diverse Clinical Sample
 17. LOWE, DA Improving Predictive Validity of the Clinical Dementia Rating Scale for Functional Outcomes
 18. MADATHIL, R Diagnosis Threat Affects Executive Functioning in an Adult ADHD Population
 19. MADATHIL, R Diagnosing Adult ADHD: Self-Report vs. Objective Measures
 20. NIKI, C Chronological changes of cognitive function in glioma patients from pre- and postoperative stages
 21. PARANAWITHANA, CE The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS): Preliminary Clinical Validity of Individuals Diagnosed with Schizophrenia
 22. PARANAWITHANA, CE The Sinhala version of the Repeatable Battery for the Assessment of Neuropsychological Status and its association with to patients' functional outcome
 23. RAYMOND, N Development of a Naming Test for Older Adults with Visual Impairment
 24. RECKESS, GZ Calibrating Performance for Age, Sex, Race, Education and Estimated Premorbid Ability Can Increase the Diagnostic Precision of Cognitive Testing
 25. SAFFER, BY Identifying Invalid Computerized Cognitive Test Performance in Older Adults
 26. SAFFER, BY Examining the Construct Validity of Computerized Cognitive Testing in Older Adults
 27. SAFFER, BY Identifying Invalid Computerized Cognitive Test Performance in Patients with Depression
 28. YOUNG, J Using Rey Effort Tests to Distinguish Amnesic Impairment
 29. UTTL, B WMS-IV Verbal Paired Associates: Can It Assess Memory?
- Memory Functions**
30. UTTL, B Prospective Memory, Personality, and Individual Differences
 31. AXELRAD, ME Verbal Memory in Costello Syndrome
 32. CORRELL, D Prospective Memory in Schizophrenia: Relationship to Medication Adherence, Neurocognition and Symptoms
 33. ESOPENKO, C Episodic and Semantic Autobiographical Memory and Traumatic Brain Injury
 34. GONZALEZ, L Changes in everyday memory in children and young people with temporal lobe epilepsy: A follow up study
 35. HAMMAR, A Verbal memory functioning in recurrent depression during partial remission and remission
 36. IRISH, M Deconstructing Episodic Future Thinking in the Dementias
 37. KAY, CD Fine Motor Variability, APOE-ε4, and Longitudinal Memory Outcome in Healthy Elders
 38. KAY, CD Discriminability of Transient and Enduring Remote Famous Names in Alzheimer's Disease
 39. LA CORTE, V Selective and chronic confabulation in personal temporality: a longitudinal case study
 40. LACKOVIC, S Auditory/Verbal Attention and Memory in Focal Brain Lesion Patients
 41. LOEHAUGEN, GC Relationship between hippocampal volume and memory functions in VLBW young adults
 42. MEAGER, MR Do Patients with Frontal Lobe Memory Disorders Benefit More from Cueing than Patients with Temporal Lobe Memory Disorders?
 43. NAKHUTINA, L The Relationship between Memory Complaints, Diabetes Knowledge, and Treatment Adherence in Predominantly Ethnic Minority Adults with Type-2 Diabetes Mellitus
 44. PYYKKONEN, B The Efficacy of Memory Training Programs Among Non-Demented Elderly Adults: a Meta-Analysis of Prospective, Longitudinal Studies
 45. SALVADOR CRUZ, J Neuropsychological Development of Attention and Semantic Memory in Elementary School Children
 46. TOLEDO, A Modularity vs. Non-modularity of Working Memory for Musical Stimuli: A Systematic Review
 47. TSUTSUI, M Development of a modified version of the visual memory test, using Rey-Osterrith Complex Figures
 48. WISDOM, N Normal aging and verbal memory: A comparison of tests
 49. YU, A Verbal and visuospatial measures of working memory most associated with cognitive impairment in older adults
 50. ZAMROZIEWICZ, M Effects of Drinking Patterns on Prospective Memory Performance in College Students

Cognitive Intervention/Rehabilitation

51. BIDELMAN, G
52. LEE, Y
53. BURTON, CZ
54. CASTRO, M
55. CHERRIER, M
56. JOHNSON, WT
57. OJEDA, N
58. PRITCHETT, A
59. RASKIN, S
60. ROSEMA, S
61. SETER, C
62. SHIBASAKI, M
63. SMITH, J
64. STUBBERUD, J
65. STUBBERUD, J
66. TRITTSCHUH, EH
67. TSAOUSIDES, T
68. TWAMLEY, EW
69. ZWICK, S
70. DUNNAM, M
- Enhanced Pre-attentive Auditory Processing Following Short-term Musical Training in Older Adults
Music and Language Short-term Training Reveal Brain Plasticity in Early Childhood
Neurocognitive Insight, Cognition, and Treatment Utilization in Individuals with Schizophrenia
Procedural and Declarative Memory Differences in Mild Cognitive Impairment
Effectiveness of a Group-Based Intervention of Cognitive Rehabilitation in Cancer Survivors
The Relationship of Neurocognitive Functioning to Driving Status Following Holistic Neurorehabilitation
First Episode Psychosis and Chronic Schizophrenia show a similar pattern of improvement after cognitive rehabilitation with REHACOP
Computerized Working Memory Training in Stimulant Exposed Children
Cognitive Remediation of Prospective Memory Deficits after Traumatic Brain Injury
Preliminary efficacy of an attention and memory intervention post childhood brain injury – case series
Does Planning Improve Performance on Everyday Tasks?
Cognitive Rehabilitation of Response Inhibition Deficit in a Chronic Stroke Patient: A Near-Infrared Spectroscopy Study
Effects of an Exercise Intervention on Semantic Memory fMRI Activation in Mild Cognitive Impairment
Enhanced Attentional Performance Following Goal Management Training in Individuals With Spina Bifida
Self-reported Executive Functioning in Daily Life Following Goal Management Training in Patients With Spina Bifida
Outpatient Memory Skills Training for Older Adult Veterans with PTSD and Cognitive Concerns
Online Group Treatment for Individuals with Traumatic Brain Injury: Preliminary Feasibility Study
Compensatory Cognitive Training for People with Severe Mental Illness: Effects on Cognition, Functional Capacity, and Psychiatric Symptoms
“Don’t you know what we need?” Social Burden and Quality of Life in patients after acquired brain injury and their partners
Cybercycling for Cognitive Health: Interactive versus Simultaneous Physical and Mental Exercise

Cognitive Neuroscience

71. DUNNAM, M
72. ANDREWS, GL
73. CAMCHONG, J
74. CLAWSON, A
75. CLAYSON, P
76. FERRÉ, P
77. FERRÉ, P
78. HAINSELIN, M
79. HERNANDEZ, GR
80. KIRWAN, B
81. KLEIDER, H
82. LØVSTAD, M
83. MCCOURT, ME
84. MEINZER, M
85. NGUYEN, TT
86. PAPEO, L
87. RAAB, HA
88. RAKSIT, MP
89. SCHIFF, R
90. SEMENZA, C
91. SENI, AG
92. SILVA, LM
93. STOESZ, BM
94. VARVARIS, M
95. WATANABE, Y
- Cycling for Cognitive Health: Virtual versus Real Outdoor Rides
Changes in Physiological and Behavioral Measures Following Four Weeks of Meditation
Resting State Synchrony in Short-Term and Long-Term Abstinent Alcoholics
Dopaminergic Influences on Performance Monitoring Across the Menstrual Cycle
The Effects of Dopamine on Reinforcement Learning Across the Menstrual Cycle: An ERP Investigation
Communication Profiles And Executive Impairments Following Right-Hemisphere Stroke: A Crosscultural Perspective
White Matter Tracts And Cognitive-Linguistic Impairments Following A Right-Hemisphere Stroke: A MRI-DTI Multiple Case Study
Just Do It! Performing an Action Enhances Remembering in Transient Global Amnesia
Gender Variations in Perception of Children and Adolescents in Distress: A Stroop Interference Study
Prospective Memory is Not Impaired in Pregnancy
Vivid Imagining of False Events Leads to False Memories: Comparisons of Neural Activity Show Differences in Rejection and Acceptance of Imagined Events
Neuropsychological and electrophysiological findings in two patients with lesions to dorsomedial prefrontal cortex
Cue Potency Modulates Task Switching Costs: The Role of Perceptual Processes in Cognitive Control
Impact of tDCS on Task-Related Brain Activity and Resting-State Functional Connectivity in Older Adults
Goal-directed Regulation of Force in Children with Heavy Prenatal Alcohol Exposure
Lexical and Gestural Symbols in Left-damaged Patients
Effects of DAT1 and APOE Polymorphisms on Structural Connectivity and Cognitive Performance
Perception of Causality Predicts Spirituality and Lifetime Change in Religious Belief
The Development of Skill Learning as Demonstrated by the Tower of Hanoi Task
Intra-operative Mapping of the Parietal Lobe: Addition and Multiplication
Cognitive and Emotional Predictors of Sociomoral Decision-Making in Adolescence
Between-Sex Differences in the Relationship Between Thalamic Volumes and Aspects of Creative Achievement
Sex Differences in Interference between Identity and Expression Processing with Static but not Dynamic Faces
Compensatory Neural Structures of High-Performing Adults with Schizophrenia
Information transformation of thalamic mediodorsal neurons during spatial working memory performance

10:00–10:15 AM

**Friday AM Coffee Break
Grand Promenade**

10:15–11:15 AM

**Invited Address: Do Children Really Recover Better? Neurobehavioral
Plasticity after Early Brain Insult
Presenter: Vicki Anderson
Monarchy Ballroom**

1. ANDERSON, V

Do Children Really Recover Better? Neurobehavioral Plasticity after Early Brain Insult

11:30 AM–12:30 PM

**Birch Lecture: Clinical and Pathological Studies in the Oldest Old: The
90+ Study
Presenter: Claudia Kawas
Monarchy Ballroom**

1. KAWAS, C

Birch Lecture: Clinical and Pathological Studies in the Oldest Old: The 90+ Study

1:00–2:00 PM

**Poster Symposium: Promoting Health and Well-being in Individuals with
Mild Cognitive Impairment and Dementia: The Roles of Cognition,
Emotion and Reminiscence.
Chair: Nicole Caza
Kona Ballroom****Cognitive Intervention/Rehabilitation**

1. CAZA, N

Promoting Health and Well-being in Individuals with Mild Cognitive Impairment and Dementia: The Roles of Cognition, Emotion and Reminiscence

2. BELLEVILLE, S

The role of cognitive training to improve cognition in persons with mild cognitive impairment: efficacy, transfer effects and generalization to activities of daily living

3. CIQUIER, GC

The Beneficial Effects of Reminiscence on Mental Health and Quality of Life in Institutionalized Dementia Patients: Preliminary Results

4. ERGIS, A

The Role of Emotion as a Facilitator in Memory Rehabilitation in Persons with Mild Alzheimer's Disease

1:00–2:00 PM

**Poster Session 6: Cross Cultural/Emotional
Processes/Malingering/Psychopathology
Kona Ballroom****Cross Cultural**

1. BENNETT, J

Acculturation and Phonemic Fluency in Hispanic Bilinguals

2. CASAS, R

Differences in Visual Memory Span Performance in Latino and Caucasian Adults in a Healthy Community Sample

3. CELESTIAL, JE

Subjective Self-Rating of English Language Skills in Filipinos and Filipino Americans

4. FERNANDEZ, V

Neural Correlates of a Novel Spanish Word Recognition fMRI Memory Task

5. GONZÁLEZ, HM

Cultural and socioeconomic correlates of neurocognitive function among middle-aged and older Hispanics/Latinos: Results from the Hispanic Community Health Study/Study of Latinos

6. KAMAT, R

Correlates of apathy in a Brazilian cohort of HIV-infected individuals

7. PARIKH, M

A Cross-Cultural Investigation of the Texas Card Sorting Test

8. PLUCK, G

Cognitive Function of a Sample of 'Street Children' in Quito, Ecuador

9. SAYEGH, P

Cross-cultural Differences in the Role of Language-based Neuropsychological Tests in Dementia Diagnosis among Hispanic and Non-Hispanic White Outpatients

10. SUAREZ, PA

Bilingual Advantages on Test Performance Persist after Controlling for Education Among Spanish Speakers Tested in their Native Language

Emotional Processes

11. ABEARE, C

Physiological Reactivity During the Emotion Word Fluency Test in Comparison to Phonemic and Semantic Fluency Measures

12. FREUND, S

Physiological, Affective, and Cognitive Aspects of Alexithymia

13. ALTERESCU, K

Facial Emotional Expressivity Following Voice Treatments in Individuals with Parkinson's Disease (PD)

14. BAKER, FC

Cognitive Interference from Emotional Faces in Severe Premenstrual Syndrome

15. BOROD, JC

Behavioral and Personality Judgments of Patients with Parkinson's Disease: A Focus on Observers

16. CARTER, A

Alexithymia and Facial Affect Recognition in Healthy Controls

17. DIETZ, J

Parkinson's Disease, Apathy, and the ERP to Emotional Pictures

18. LA BUISSONNIÈRE ARIZA, V Neural Fear Circuitry Function and Harsh Parenting in High and Low Anxious Healthy Youths: Preliminary Results
 19. MELTZER, EP Bodily Expression of Emotion: Factors Affecting the Accuracy of Emotion Identification
 20. OATLEY, AE Using Eye-Tracking to Develop an Emotion Perception Treatment and Tackle the Challenge of Community Integration After Traumatic Brain Injury (TBI)
 21. PARK, G Individual differences in cardiac vagal tone are associated with differential neural responses to facial expressions at different spatial frequencies: An ERP and sLORETA study
 22. ROSENQVIST, JE Preschoolers' Recognition of Emotional Expressions: Relationships With Other Neurocognitive Capacities
 23. RYMARCZYK, K The relation between emotion empathy and facial muscle activity
 24. SAVAGE, KR Age Differences in the Perception of Discrete Emotions
 25. STINSON, JM Exploring the Impact of Anxiety on Learning in the California Verbal Learning Test-2nd Edition
 26. SUN, L Impairment in Emotion Recognition in Brain Injury Patients
 27. TWAITE, JT A New Measure to Assess Subjective Emotional Experience and Application to Parkinson's Disease (PD)
 28. WINGO, J Examining Post-Traumatic Stress Disorder in Electrically Injured Individuals Using Optimal Data Analysis
 29. WORTHY, EL Affective Priming Following Unilateral Temporal Lobectomy: The Role of the Amygdala
- Malingering/Effort Testing**
30. ADAMS, KM Cross-validation of the Grooved Pegboard test as an embedded performance validity measure
 31. SPENCER, RJ Grooved Pegboard is an acceptable embedded performance validity measure among medicolegal evaluatees
 32. BIRATH, J Standard Neuropsychological Measures as Embedded Indicators of Effort in a Clinical Sample
 33. DENBOER, J Validation of the Memory for Complex Pictures (MCP) test in a Post-Acute TBI Sample
 34. SCHALK, S Memory for Complex Pictures: Validation with Patients with HIV-related Memory Deficits
 35. SCHALK, S Memory for Complex Pictures (MCP) and TOMM: Validation in a TBI Sample
 36. GOLDSTEIN, DS Cross-Validation of Failure Rates, Sensitivity and Specificity and Predictive Power Findings on the REY-15, TOMM, VSVT, WMT, and CVLT-II Among Criminal Defendants Using a Compensation-Seeking Sample
 37. MATTHEWS, MA Sensitivity and Specificity of Response Latencies from the Victoria Symptom Validity Test and WAIS-III Digit Symbol Incidental Recall as Embedded Measures of Effort Among Criminal Defendants
 38. MATTHEWS, MA The Relationship between Intelligence and Effort in Test Profiles of Criminal Defendants
 39. MITCHELL, EH Increasing the Positive Predictive Power of the Rey Fifteen Item Test in Criminal Defendants Through the Use of Alternative Scoring Methods and Sample-Relevant Cutoff Scores
 40. GROTE, C "Go/No Go" Decisions for Neuropsychologists: Utilizing Estimated-Achieved IQ Discrepancy Scores to Help Determine Whether to Continue Testing in Clients Displaying Poor Effort
 41. HARRISON, A Do research pool subjects fake Dyslexia in the same way as real world students who meet the Slick et al. criteria for malingering?
 42. KAY, DB Performance On The Medical Symptom Validity Test (MSVT) Related To Insomnia Complaint: A Preliminary Report
 43. ROECKEMAN, S Comparative Data On The Medical Symptom Validity Test (MSVT) Among Veterans With An Insomnia Complaint: A Preliminary Analysis
 44. LAPIS, Y Breadth of Effort: Relation of Two RBANS Effort Measures to Performance on Multiple Neuropsychological Tests in a Polytrauma Clinic
 45. PADUA, M RBANS Forced-Choice List: Initial Evaluation of a New Effort Measure in a Polytrauma Clinic
 46. LAWLEY, S Does the Internet Represent a Threat to the Security of Symptom Validity Tests?
 47. LYNCH, A Effort and attention in motor vehicle accident victims
 48. MACRYS, S Development of Self-report Index of Feigning ADHD
 49. MILLER, JB The Reliable Digit Span: Standard Criterion of Seven Yields Excessive False-Positives in a Healthy Bilingual Latino Sample
 50. MILLIKIN, C Motivated Forgetting: Factitious Disorder and Malingering in Older Adults Presenting for Dementia Assessment
 51. NOVITSKI, JI Sensitivity and Specificity of Commonly Available Embedded Effort Measures in a Sample of Adult Criminal Defendants
 52. ODLAND, AP The Effect of Using Multiple Effort Measures on Diagnostic Specificity
 53. RAMBO, PL Finger Oscillation as a Symptom Validity Test in Children
 54. RANSOM, DM Psychometric Properties of the Minnesota Multiphasic Personality Inventory-2-Restructured Form, FBS-r, Fs, and RBS Scales in a Neuropsychological Setting
 55. RIORDAN, P Evaluation of the Predictive Value of Inconsistent Errors on the Test of Memory Malingering (TOMM) in a Veteran TBI Sample
 56. SHANEYFELT, K Comparing the Classification Accuracy of Symptom Validity Measures in a Simulated Malingering Design
 57. SHARKEY, L Preliminary Validation of a Force Choice Measure of Performance Validity Embedded Within the ANAM-IV
 58. SIDERS, C Detection of Suboptimal Effort in a Clinical Sample on the California Verbal Learning Test Second Edition (CVLT-II)

59. THORGUSEN, SR Exploring the Relationship Between Low IQ and Invalid Effort Testing
60. VARGAS, GA Changes in Observation-Based Motivation Ratings Between Baseline and Post-Concussion Testing
61. VICTOR, TL Cross Validation of the b Test in a Large Known Groups Sample
62. VICTOR, TL Cross-validation of The Rey Word Recognition Symptom Validity Test
63. VICTOR, TL Cross-validation of the Lu et al., (2003) Rey-Osterrieth Complex Figure Test Effort Equation in a Large Known Groups Sample
64. VICTOR, TL A Re-examination of the Meyers and Volbrecht (2003) Motor Equation for the Identification of Neurocognitive Symptom Invalidity
65. WARDIN, LA Delayed Recall Trials of the California Verbal Learning Test II as Embedded Measures of Effort
66. YOUNG, JC Word Memory Test Performance and VA Disability Rating: A Dose-Response Relationship
67. ESTEVIS, E Judgment of Line Orientation as an Embedded Measure of Performance Effort
- Psychopathology/Neuropsychiatry (Other)**
68. ESTEVIS, E Executive Function and Verbal Learning in Inpatient Depressives
69. LAU, L Functional Outcomes and Neuropsychological Impairment in Unipolar Depression
70. ÅRDAL, G Depression and the association between cognitive inhibition and health related quality of life - a study of patients in remission
71. BOTT, NT Relationship Between Executive Function and Verbal Performance in Youth with a History of Interpersonal Violence
72. BRICENO, EM Elder Men and Women with Major Depressive Disorder Exhibit Opposite Disruption in Emotion Processing Circuitry
73. DAWSON, EL Prediction of Antidepressant Treatment Response from Baseline Cognition in Depressed Adults
74. DOUET, V Relationship Of A Functional Variant In the Neuregulin 1 Gene to White Matter Microstructure In Children Of The Pediatric Imaging Neurocognitive Genetic (PING) Study
75. ELLIS, A Cognitive Style Moderates Negative Working Memory Bias in Healthy, But Not Depressed, Individuals
76. FLODEN, D Change in Depressive Symptoms after Deep Brain Stimulation in Patients with Parkinson's Disease
77. GREGORY, AM Neuropsychological Performance Predicts PTSD Treatment Outcome
78. HANSSON, P Cognitive functioning and cortisol suppression in first episode major depression
79. HUNT, I Cognitive Control and Performance Monitoring in Adult Major Depressive Disorder: A Meta-Analysis
80. IP, RY Agitation and Decision Making Impairments in Neuropsychiatric Inpatients
81. KAY, R Effects of Psychotropic Medications upon Depression-Related Cognitive Decrements
82. KIMPTON HEALD, CA Neuropsychological Characteristics of Children and Adolescents with Nonverbal Learning Disability
83. LARSON, MJ Emotion-Related Conflict Adaptation in Generalized Anxiety Disorder
84. LEWIN, AB Executive and Memory Impairment in Youth with Obsessive Compulsive Disorder (OCD)
85. LLAMAS, V Image-Based Affective Parity Task: Examining Psychopathic Traits and Attention
86. MCKENNA, BS Working Memory Component Processing Deficits in Euthymic Bipolar Patients
87. PANOS, S Cognitive Reserve May Buffer against the Expression of Psychiatric Symptomatology
88. REINLIEB, M The Patterns of Cognitive and Functional Impairment in Amnesic and Non-Amnesic Mild Cognitive Impairment in Geriatric Depression
89. VERDEJO-GARCÍA, AJ Sex differences in working memory and decision-making among cocaine users with comorbid personality disorders
90. WAAGE, L Heart rate variability, attachment style, and psychopathy
91. WALKER, S Error Monitoring in Mood Disorders: The Effect of Depression and Bipolar Disorder on Post-Error Slowing
92. WEISSER, V Prospective Memory in Post-Traumatic Stress Disorder and its Relationship to Executive Functioning

1:30–3:00 PM**Invited Symposium: Advances in Cultural Neuropsychology****Chairs: Desiree Byrd and Jennifer Manly****Monarchy Ballroom**

1. MANLY, J Invited Symposium: Advances in Cultural Neuropsychology
2. THAMES, AD The impact of non-cognitive factors on neuropsychological test performance: A closer look into stereotype threat and perceived discrimination
3. COLLAN, T Bilingualism in Aging & Dementia: Evidence for Language-Specific Control Mechanisms
4. BYRD, DA Cultural neuropsychology: recent developments and applications

1:30–3:00 PM**Symposium 6: Trans-Disciplinary Approaches to the Assessment of Driving Safety: From Teens to the Oldest Old****Chair: Margaret O'Connor****Discussant: Linas Bieliauskas****Kings Ballroom**

1. O'CONNOR, M Trans-Disciplinary Approaches to the Assessment of Driving Safety: From Teens to the Oldest Old
2. CLASSEN, S Clinical Indicators of Driving Performance in Adolescents with Autism Spectrum Disorder (ASD) vs. Controls
3. BIELIAUSKAS, LB The Role of the Neuropsychologist as a Member of a Trans-disciplinary Assessment Team
4. OTT, BR Office Assessment of the Cognitively Impaired Older Driver

5. UC, EY Driving in Parkinson's Disease
6. KAPUST, L DriveWise: An Inter-disciplinary Hospital Based Driving Assessment Program

1:30–3:00 PM**Symposium 7: New Frontiers in Executive Functioning: The NIH EXAMINER****Chair: Joel Kramer****Discussant: Gerry Taylor****Queens Ballroom**

1. KRAMER, J New Frontiers in Executive Functioning: The NIH EXAMINER
2. KATHERINE, P The EXAMINER Executive Composite Predicts Real-World Executive Behavior and Frontal Volumes
3. RANKIN, KP Individual Differences in Intrinsic Functional Connectivity Predict Sensitivity to Social Norms
4. BETTCHER, BM NIH EXAMINER Battery and Brain Structure: Is White Matter Integrity the Keystone to Executive Functioning?
5. SCHREIBER, JE Executive Function in Children with Attention Deficit/Hyperactivity Disorder

2:15–3:15 PM**Poster Session 7: ADHD/Learning Disabilities/TBI Kona Ballroom****ADHD/Attentional Functions**

1. ANDRESEN, E College Students With ADHD Do Not Perform Significantly Differently Than Controls On Continuous Performance Tests
2. ANTONINI, TN Effects of ADHD and Marijuana Use on Iowa Gambling Task Performance in Young Adults
3. BEAN, J Anticipatory Fixations as a Marker of Visual Attention: Eye-tracking Evidence for Children with Typical Development, Autism Spectrum Disorders, and ADHD
4. BEDARD, A The Neural Correlates Of Visual-Spatial Working Memory In Youth With And Without ADHD: An fMRI Study Of Brain Activation
5. BOXER, O Effects of Methylphenidate and Cognitive Training on ADHD Symptoms: A Meta-Analysis
6. COLEMAN, B Does Cogmed Working Memory Intervention Improve Virtual Classroom Attention?
7. FEDOR, A Does ADHD Increase Risk of Concussion in Student-Athletes
8. GEIST, M Sluggish Cognitive Tempo: Associations with Processing Speed, Age, and Emotional Symptomatology
9. GEURTEN, M Perceptual and Motor Inhibition in ADHD: Evidence for a specific impairment?
10. HARRISON, A Screening young adults for possible ADHD: Think horses not zebras
11. HINKLE, CD Comparison of Neuropsychological Profiles of Children with Attention-Deficit/Hyperactivity Disorder (ADHD), Reading Disorder (RD), and Comorbid ADHD and RD
12. KUBAS, HA Differentiating Frontal-Subcortical Circuit Executive Dysfunction in ADHD Medication Response
13. LOMAN, M Neuropsychological Functioning and Brain Activity of Post-Institutionalized, Internationally Adopted Adolescents with ADHD
14. MACRYS, S Discrimination of ADHD from Heterogeneous Sample on Self-Report Measure
15. MEADOWCROFT, T ADHD Symptoms Contribute to Unhealthy Coping Independent of Depression and Executive Dysfunction
16. MURPHY-BOWMAN, SC Sluggish Cognitive Tempo: Is it Attention, Mood, or Something Else?
17. NEEDHAM, V A Case Study of an Eleven-Year-Old with an Atypical Cluster of Symptoms: ADHD, LD, Autism-Spectrum Disorder, Sensory Integration Disorder, Social Deficits or Other?
18. O'BRIEN, KM Performance on the Paced Auditory Serial Addition Test (PASAT) Among Young Adults With ADHD and a History of Marijuana Use
19. PLOETZ, D Relationship Between Parent-Reported Inattentive Behaviors and Child Performance on Attentional Tests in a Pediatric Clinical Sample
20. RENNIE, B Cognitive Abilities in High Achieving ADHD: What Sets them Apart?
21. RENNIE, B Working Memory Across Development in an ADHD Population
22. ROSCH, KS Increased Delay Discounting for Real and Hypothetical Rewards in Children with ADHD
23. ROSCH, KS Differential Effects of Reward on Response Inhibition and Variability in Children with ADHD
24. RYAN, M Rapid Automatized Naming in Children with ADHD: An ex-Gaussian Analysis
25. SEGALA, L Differential Effects of ADHD on Neurocognitive Impulsivity in Opiate and Stimulant Users
26. WADSWORTH, H Self-Identification with the Diagnosis of ADHD and its Relationship to Performance on Self-Report and Objective Measures

Learning Disabilities/Academic Skills

27. AUNE, E Memory Updating Deficits Predict Future Learning Impairments in Children: A Longitudinal Study
28. BACKENSON, EM Specific Psychosocial Deficits Associated with Learning Disability Subtypes
29. BENAVIDES-VARELA, S How do Daily Activities Influence Children's Performance in Number-Related Tasks?
30. CADAVID-RUIZ, N Cognitive Profile Differences of Colombian Children with Non-specific Reading Disabilities
31. CADAVID-RUIZ, N Differential Outcomes of Implicit and Explicit Learning Strategies for Overcoming Non-specific Reading Difficulties
32. CIRINO, PT Numerosity and Cognitive Predictors of Math Skills in Middle School

33. FRITZ, C Rates of Dyslexia and Specific Comprehension Deficits Pre and Post Treatment in Elementary and Middle School Students
34. GREEN, R Working Memory Training: Does it Improve Math Performance?
35. HODGE, M Multidisciplinary Assessment of Reading Difficulties in Children
36. JANKE, KM Concurrent Relations between Early Neuropsychological and Academic Skills in Young Children with NF1 and Typically Developing Peers
37. KAYSER, K The Relationship Between Neurocognitive Functioning and Spelling Phonology
38. LOUGHAN, AR Significant Math Strengths: In Children without Autism Spectrum Disorder?
39. MANSOUR, A MEG Coherence Imaging in Dyslexia: Activation of Working Memory Pathways
40. MCCOY, TE Patterns of Neuropsychological Function in Subgroups of Children with Nonverbal Learning Disability
41. MORRIS, J The Effect of Language Deficits on Basic Arithmetic Understanding & Performance
42. RAGHUBAR, K Neurocognitive Correlates of Mathematical Processing in School-Aged Children with Spina Bifida and Their Typically Developing Peers
43. SIQUARA, C Relationship between Working Memory and Academic Performance
44. TANAKA, H Neurobiological Signatures of IQ-Reading Discrepancy in Average Readers
45. WAGNER, R A Causal Indicator Model Approach to Identifying Causes of Reading Problems
46. WILLIAMS, BL Differentiating Attention Deficit Hyperactivity Disorder and Reading Disability Using the Verbal Selective Reminding Test
- TBI (Child)**
47. ANDREWS, B Differences in Symptom Recovery after Concussion based on Mood Disorder History
48. SADY, MD Standardized Assessment of Cognitive Exertion in mTBI and Non-Injured Children
49. AVCI, C Selective Learning and Memory Span after Early Brain Injury in Relation to DTI
50. BEAUCHAMP, MH Predicting Outcome After Childhood Traumatic Brain Injury: The Role of Susceptibility Weighted Imaging
51. BLAHA, RZ Factors Influencing Attrition in a Multi-Site Randomized Clinical Trial Following TBI in Adolescence
52. CASE, RJ The Relationship Between Mild Traumatic Brain Injury and Post-Injury Developmental Functioning in Children: 12-month Outcomes from the COBIC Study
53. CASTILLO, CL Post-Concussion Syndrome and Psychiatric Emergence: A Female Factor in Pediatric Concussion Recovery?
54. COOPER, J Neural Substrates of Autobiographical Memory in Adolescents after Traumatic Brain Injury
55. GLANG, A Student Transition re-Entry Program: Connecting Hospitals and Schools following Pediatric Brain Injury
56. GORMAN, S Working Memory Development Following Pediatric Traumatic Brain Injury: A Longitudinal Analysis
57. HARIK, L Written Expression Following Pediatric Traumatic Brain Injury In School-Aged Children
58. JOHNSON, CP Exploring the Effect of Age at Injury on White Matter Integrity in Pediatric TBI: A TBSS Diffusion Tensor Imaging Study
59. KARVER, CL Hot and cold executive functions following pediatric traumatic brain injury (TBI)
60. LEVAN, A Hippocampal Volume, Cognitive Proficiency Index and the CVLT-C: Predictors for Social Reintegration After Pediatric Traumatic Brain Injury
61. MAXWELL, EC Math Performance and White Matter Microstructure in Children with Traumatic Brain Injury
62. MCGILL, C Symptom Profiles of Children and Adolescents With mTBI and ADHD
63. MERKLEY, TL Social Communication and Frontotemporal Brain Indices Following Early Pediatric Traumatic Brain Injury
64. NEWSOME, MR How Functional Connectivity between Emotion Regulation Structures Can Be Disrupted: Preliminary Evidence from Youth with Chronic Moderate to Severe Traumatic Brain Injury
65. OCKEN-HELMEN, M Affective Variables Associated With Attention Performance Following Traumatic Brain Injury
66. ROSEMA, S Long-term social and psychological outcomes following childhood traumatic brain injury
67. ROSENBERG, J Neuropsychological Functioning and Symptom Report after TBI Based on Injury Severity in Children who Require Brief Hospitalization
68. SNYDER, AR A Normative Study of the Sports Concussion Assessment Tool (SCAT-2) in Children and Adolescents
69. STERN, M Effortful Control Following Early Childhood TBI
70. TLUSTOS, S Relationship between Social Competence and Functional Outcomes after TBI in Adolescence
71. VAUGHAN, C School Problems Following Sports Concussion. Which Children Are At Greatest Risk?
72. VAUGHAN, C Return to Play Following Pediatric Concussion
73. WADE, SL Interventions for Pediatric TBI: Timing, Targets, and Developmental Considerations
- TBI (Adult)**
74. CHIOU, KS Voxel Based Morphometry Examination of Gray Matter Volume and Depression in Moderate and Severe Traumatic Brain Injury
75. DIDEHBANI, N The Role of Concussions in Depressive Symptom Endorsement for Aging Retired NFL Players
76. HANNA, S Pre-Injury Income and Return to Work after Mild Traumatic Brain Injury
77. KLAS, P The Predictive Utility of Neuropsychological Testing in Patients with Mild Traumatic Brain Injury with and without Disabling Cognitive Impairment
78. ZANJANI, A The Utility of a Novel Virtual Environment Test of Attentional Abilities in Mild Traumatic Brain Injury: A Pilot Study

79. HILL, B Positive Linear Relationship Between Traumatic Brain Injury Severity and Intra-Individual Variability Across a Neuropsychological Battery
80. MAESTAS, K Predictors of Anxiety in Persons with Traumatic Brain Injury
81. MANNINO, CM Cognitive Effects of Hypertension and Concussion in Retired National Football League Players
82. NORSETH, C The Influence of Language and Mental Flexibility on Cerebral Metabolism Following Mild Traumatic Brain Injury
83. NORSETH, C The Influence of Neuropsychological Performance on Cerebral Metabolism Following Mild Traumatic Brain Injury
84. OBERMEIT, LC Memory for Performed and Observed Activities Following Traumatic Brain Injury
85. O'NEIL, ME Consequences of Mild TBI in Veteran/Military Populations: A Systematic Review
86. O'NEIL, ME Neuropsychological Test Performance of Blast-Exposed OEF/OIF Veterans
87. PEDERSEN, AD Relationship between Cognitive Complaints, PTSD symptoms and Neuropsychological Test Performance in Danish Veterans with mTBI
88. PUTNAM, SH The MMPI-2 in the Assessment of Pain and Sleep Disturbance in Persistent Head Injury Complainants
89. ROBERTSON, KK Examination of Attentional Deficits Following Traumatic Brain Injury
90. ROSKOS, P Structural MRI Abnormalities are Associated with Reduced Cognitive Performance in Individuals with Post-Acute Traumatic Brain Injury
91. SESTITO, N Detection of Symptom Exaggeration on the Neurobehavioral Symptom Inventory
92. SULLAN, M Satisfaction with Cognitive Rehabilitation Delivered Via the Internet in Persons with Acquired Brain Injury
93. WONG, CG Emotional Expression and Well-Being in Traumatic Brain Injury

3:00–3:15 PM

**Friday PM Coffee Break
Grand Promenade**

3:15–4:45 PM

Symposium 8: Episodic Memory and Aging: Contributions from Brain Imaging Studies
Chair: Michael Yassa
Monarchy Ballroom

1. YASSA, MA Episodic Memory and Aging: Contributions from Brain Imaging Studies
2. STARK, C Pattern separation, episodic memory, and aging
3. STERN, Y Examining Age-Related Changes in Episodic Memory Using Reference Ability Neural Networks
4. KENSINGER, EA Effects of Age on the Encoding and Retrieval of Emotional Memories
5. JAGUST, W Amyloid Imaging, Memory, and Aging

3:15–4:45 PM

Symposium 9: Cognitive Impairment and Disability in Mood Disorders Across the Lifespan
Chair: Sara Weisenbach
Discussant: Meryl Butters
Kings Ballroom

1. WEISENBACH, S Cognitive Impairment and Disability in Mood Disorders Across the Lifespan
2. LANGENECKER, SA Strong Reliability for Intermediate Phenotypes in the Multifaceted Investigation of the Neurobiology of Depression Subtypes (MINDS) Study
3. MCCLINTOCK, SM Association between Major Depressive Disorder Characteristics and Neurocognitive Function in Adults and Elderly Adults
4. BRICENO, EM Emotion Processing Dysfunction in Depression: Overview, Psychometric Properties, and Key Considerations
5. WEISENBACH, SL Frontostriatal and Hippocampal Network Dysfunction Among Older Adults with Major Depressive Disorder
6. RYAN, K Emotion Perception and Executive Functioning Predict Work Status in Euthymic Bipolar Disorder

3:15–4:45 PM

Paper Session 6: Pediatrics/Autism/LD/Memory Training and Executive Functions
Moderator: Michael Larson
Queens Ballroom

1. WODKA, EL Predictors of Speech in Severely Language-Delayed Children with Autism Spectrum Disorder
2. ØSTGÅRD, HF Neuropsychological profile in young adults born small-for-gestational-age at term
3. HALE, JB Operationalizing a Neuropsychological Process Approach for Specific Learning Disabilities Identification
4. HERMANSEN GRUNEWALDT, K Positive Long Term Effect after Computerized Working Memory Training in Very Low Birth Weight Children at Preschool Age

5. KARR, JE Modeling Longitudinal Invariance of Executive Functions in Children

3:30–4:30 PM**Poster Symposium: Naturalistic Assessment of Everyday Abilities in Healthy Older Adults and Individuals with Mild Cognitive Impairment and Dementia**

**Chair: Maureen Schmitter-Edgecombe
Kona Ballroom**

Dementia (Subcortical, Specific Disorders, MCI, etc.)

1. SCHMITTER-EDGEcombe, M Naturalistic Assessment of Everyday Abilities in Healthy Older Adults and Individuals with Mild Cognitive Impairment and Dementia
2. SCHMITTER-EDGEcombe, M Functional Impairment and Cognitive Correlates in Aging and Mild Cognitive Impairment
3. MARSON, D Towards Naturalistic Assessment of Function in Cognitively Impaired Older Adults: Lessons from Laboratory Studies of Financial Capacity
4. SEELYE, AM Technology Based Prompting for Instrumental Activities of Daily Living (IADLs) in Healthy Aging, Mild Cognitive Impairment (MCI), and Dementia
5. GIOVANNETTI, T Everyday Action Impairment in Dementia: Person-specific Error Profiles

3:30–4:30 PM**Poster Session 8: Alzheimers/Medical Disorders/TBI
Kona Ballroom****Dementia (Alzheimers)**

1. BAERRESEN, KM Neuropsychological Instruments Predicting Conversion to Mild Cognitive Impairment and Probable Alzheimer's Disease
2. BEN-AMI, J The Roles of Semantic and Serial Clustering in Everyday Functioning in Mild Cognitive Impairment
3. IZAGUIRE, B The Cognitive Foundations of Memory Strategy Use in Mild Cognitive Impairment
4. EPPIG, J Alzheimer's disease with Vascular Co-Morbid Features I: An Empirically-Driven Cluster Analysis Approach
5. EPPIG, J Alzheimer's disease with Vascular Co-Morbid Features II: Further Neuropsychological Comparison of Cluster-Derived Subgroups
6. FIGUEROA, CM Predictive Ability of Intraindividual Variability in Healthy Elders at Risk for Alzheimer's Disease
7. FORD, AI Predictive Validity of Yearly Cognitive Screening to Autopsy-confirmed Cases of Alzheimer's Disease
8. GANDINI, D On The Relation Between Face Perception And Cerebral Anatomy In Alzheimer Disease
9. GRABYAN, JM A Simple Method for Enhancing Prediction of Longitudinal Decline in Instrumental Activities of Daily Living in Alzheimer's Patients
10. HASSENSTAB, J Using Biomarkers and Neuroimaging to Detect Early Cognitive Decline in Preclinical AD: the SuperNorms Study
11. HAUGRUD, N Individuals Diagnosed With Preclinical and Early Stage Alzheimer's Disease Produce Fewer Low Frequency Words on a Semantic Verbal Fluency Task
12. HAZLETT, KE Longitudinal Change in Parahippocampal Cortical Thickness as a Function of Cognitive Decline and Genetic Risk for Alzheimer's Disease
13. HORNING, S Insight in Alzheimer's Disease and its Relation to Psychiatric and Behavioral Disturbances
14. KAISER, NC Proverb Test Performance and Neuroanatomical Correlates in Frontotemporal Dementia and Early-onset Alzheimer's disease
15. KESSELS, RP Controlled Evaluation of a Non-Pharmacological Intervention for Patients with Mild Cognitive Impairment and Their Significant Others
16. KIEWEL, NA Predictive Utility of an ADAS-cog Pre-Preprogression Rate in Patients with Probable Alzheimer's Disease
17. LACY, M The Effects of Depression on Executive Functioning in a Geriatric Dementia Population
18. MAHENDRA, N Recall Of Short Stories Versus Routes By Persons With Dementia
19. MAHENDRA, N Making Music: Quantifying Communicative and Affective Outcomes of a Music-based Intervention for Dementia Residents
20. MAK, E Anosognosia in a Singaporean cohort of persons with cognitive impairments
21. MARTYR, A Executive Function And Activities Of Daily Living In Alzheimer's Disease: A Correlational Meta-Analysis
22. MELROSE, RJ Hypometabolism in Attention Networks in Alzheimer's Disease: an FDG-PET Study of the Stroop
23. MOGRABI, DC Implicit reactivity to failure in tasks in Alzheimer's disease
24. NATION, DA Cortical and Subcortical Cerebrovascular Resistance in Alzheimers Disease and MCI
25. NIELSON, KA Episodic Memory, Hippocampal Activation During Encoding, and Eventual Cognitive Decline in Elders: the Importance of Correct Rejections
26. OLESON, S Genetically at risk ApoE $\epsilon 4/4$ and ApoE $\epsilon 3/4$ individuals with possible AD and odor identification task performance
27. OWASHI, T Association between MMSE subscale and hippocampal volume in elderly people
28. SESTITO, J Individuals with Dementia Make More Errors Toward the End of Everyday Tasks: Evidence for the "Titanic Effect."

29. SHERMAN, J Do Language Changes Differentiate Prodromal Alzheimer's disease (AD) from Healthy Aging?
 30. SONG, W General and Specific Semantic Knowledge for Person Identity in Alzheimer's Disease
 31. SUMIDA, C Odor Identification in Normal Older Adults: the Influence of Statin Use
 32. TREMONT, G Adult-Child and Spouse Dementia Caregivers Differ in Basic ADL Assistance and Perceived Burden
 33. TREMONT, G Prediction of Conversion from Mild Cognitive Impairment to Dementia with the Telephone-Administered Minnesota Cognitive Acuity Screen (MCAS)
 34. WEINTRAUB, S Visual Target Cancellation In Primary Progressive Aphasia With Alzheimer Or Frontotemporal Neuropathology
 35. WOODARD, JL Use of Automated Hippocampal Subfield Segmentation for Predicting Probability of Cognitive Decline in Healthy Older Adults
 36. ZHU, JY Digit Symbol Substitution as a Marker of Asymptomatic Alzheimer's Disease
- Medical/Neurological Disorders/Other (Adult)**
37. ALOSCO, M Obesity Interacts with Cerebral Hypoperfusion to Exacerbate Cognitive Impairment in Older Adults with Heart Failure
 38. ALOSCO, M Left Atrial Size Is Independently Associated With Cognitive Function
 39. ALTMANN, LJ The Contribution of Multi-Tasking Ability to Activities of Daily Living in Parkinson's Disease
 40. BOXLEY, L The Effect of Psychiatric Comorbidity on Sleep Quality in a Veteran Population
 41. BRENNAN, L Effects of Dopaminergic Therapy on Everyday Functional Tasks in Parkinson's Disease
 42. DEAN, PM Frontotemporal Brain Sagging Syndrome: A Case Presentation
 43. EDMONDS, EC Delirium with Catatonia in a Patient with Bilateral Idiopathic Basal Ganglia Calcification: Neuropsychological Aspects
 44. EDWARDS-HAMPTON, SA Age-Related Cognitive Functioning in Liver Transplant Candidates
 45. ERICKSON, RL WAIS-III Index Scores in Individuals with Agenesis of the Corpus Callosum
 46. FEDOR, A Patient Reports of Cognitive Problems are not Associated with Neuropsychological Test Performance in Bariatric Surgery Candidates
 47. FESTA, J Tests of processing speed are associated with quality of life in carotid occlusion: Analysis from the RECON trial
 48. GARCIA, S METs Independently Associated with Cognitive Performance in Heart Failure Patients Enrolled in Cardiac Rehabilitation
 49. GARCIA, S Greater Dairy Intake Associated with Poorer Executive Function in Heart Failure
 50. GREMILLION, A Residual Sequelae from Pituitary Craniopharyngioma Removal: A 15 Year Saga
 51. JONES, J Differential Effects of Hypertension and Hypotension on Executive and Memory Status in Non-Demented Parkinson's Disease Patients
 52. KAMPER, JE Health, Cognitive, and Psychosocial Predictors of Neuropsychological Status in Cardiac Patients
 53. KOZORA, E PASAT Performance and White Matter Abnormalities in Systemic Lupus Erythematosus (SLE)
 54. LABELLE, M Effects of Sleep Deprivation on Inhibitory Processes in Adult Sleepwalkers
 55. LUBOMSKI-HALFACRE, MM The Effect of the Lee Silverman Voice Treatment (LSVT) on Facial Mobility, Social Engagement, and Emotional Experience in Parkinson's Disease
 56. MELIKYAN, Z Verbal and Visual Memory in Mild and Moderate TBI Patients 1, 3 and 6 Months After the Injury
 57. MILLER, LA Executive Function/Attention Predicts Memory Performance in Older Adults with Heart Failure
 58. MÖLLER, MC Fatigue and Cognitive Functions in Newly Diagnosed Graves' Disease
 59. MOORE, C Processing Speed in Diabetic Men With and Without Erectile Dysfunction
 60. RAGHUBAR, K Parent- and Self-Ratings of Self-Management Skills in Young Adults with Spina Bifida
 61. SCHWARZ, L The Relationship between Cognitive Status and Psychosocial Assessment in Hepatic Transplant Candidates
 62. SEIDEL, GA Characterizing Cognition in Older Adults with Cardiac Disease
 63. SZATKOWSKA, I Altered Cortical Thickness in Parkinson's Disease
 64. TART-ZELVIN, A A Process Approach to Verbal Fluency Performance in Parkinson's Disease – Evidence for Derailed Temporal Gradients
 65. WERTHEIMER, JC Speech Characteristics in Individuals with Parkinson's Disease with and without Deep Brain Stimulation: Implications for Neuropsychologists
 66. VALMAS, MM Alexithymia and Apathy in PD: Neurocognitive Correlates
 67. ZANINOTTO, AC Cognitive function and mood disorder in patients with and without hepatitis C virus infection in the waiting list for liver transplantation
- TBI (Adult)**
68. ZANINOTTO, AC Performance on Verbal Fluency tasks in Traumatic Diffuse Axonal Injured patients
 69. BOGDANOVA, Y Sleep Quality and its Relation to Cognitive Function in Veterans with Self-reported Blast-induced mTBI
 70. CLARK, AN Relationship Of Post-Concussive Symptoms To Participation Outcomes At 3 Months Following Mild Traumatic Brain Injury
 71. GULLETT, JM Predictors of Pre-deployment Intellectual Ability in OEF/OIF Veterans with Mild Traumatic Brain Injury and Post-Traumatic Stress Disorder
 72. HARRIS, M Quantitative Sensory Testing in Sports-Related Concussion: A Pilot Study
 73. HIGH, WM Long-Term Effect of Growth Hormone Replacement Therapy on Cognition after Traumatic Brain Injury

74. IKANGA, JN CT Findings, Somatic Complaints and Anxiety Predict Performance on Visual Attention as Measured by Trail Making Tests
75. JIVANI, S Do APACHE-II Scores, an Index of ICU Illness Severity, Predict Cognitive Outcomes Following Severe TBI?
76. KOSMIDIS, M Self-awareness and Neuropsychological Status After Traumatic Brain Injury
77. KUHN, T Self Report Measures of Psychological Distress as Predictors of Cognitive Performance in Mild Traumatic Brain Injury
78. MARSON, D Neurocognitive Predictors of Financial Capacity In Traumatic Brain Injury
79. MATEVOSYAN, A Neuropsychological Predictors of Quality of Life in Veterans with Mild to Moderate Traumatic Brain Injury
80. MONTI, JM History of Mild Traumatic Brain Injury is Associated with Reduced Neural Integrity and Memory Impairment Later in Life
81. PAGULAYAN, K Predictors of FrSBe Scores Among Veterans with Repeated Blast-Related mTBI
82. PRATSON, L An In-Vivo Biomechanical Study of Collegiate Football Players: The Inter-Instrument Reliability of the X2Impact Mouthpiece and the Head Impact Telemetry System
83. RABINOWITZ, A Sensory Symptoms and Neuropsychological Test Performance in Sports-Related Concussion
84. RIDLEY, K Cognitive Factors Underlying Verbal Learning and Memory Impairments After Traumatic Brain Injury
85. ROSSETTI, M The Relationship Between Thalamic Metabolites, Attention, and Pain in Mild TBI
86. SCHIEHSER, DM History of TBI Exacerbates Cognitive Decline in Parkinson's Disease
87. SESTITO, N The Impact of Time Since Acquired Brain Injury on Functional Outcome Following Post-Acute Brain Injury Rehabilitation Treatment
88. SIDERS, C Characterization of Verbal Memory Following Repeated Concussion in Retired Professional Football Players
89. SILVERBERG, ND The Good-Old-Days Bias after Mild Traumatic Brain Injury and Orthopedic Injury
90. SORG, S Processing Speed and Memory Deficits in Veterans with Mild to Moderate TBI: Associations with Anterior White Matter Integrity
91. TATE, DF Functional relevance of cortical thickness abnormalities in U.S. service members following blast related mild traumatic brain injury: A pilot study
92. TROYANSKAYA, M Factors Contributing to Perceived Changes in Resiliency in OEF/OIF Service Members and Veterans

5:00–5:30 PM

**INS Business Meeting
Monarchy Ballroom**

5:30–6:15 PM

**Friday Evening Reception
Lagoon Lanai****SATURDAY, FEBRUARY 9, 2013**

7:20–8:50 AM

CE Workshop 9: Adult Neuropsychological Outcomes of Childhood Disorders
Presenter: Celiane Rey-Casserly
Kohala 2

1. REY-CASSERLY, C

CE Workshop 9: Adult Neuropsychological Outcomes of Childhood Disorders

7:20–8:50 AM

CE Workshop 10: Simple Tools for the Evidence-Based Practitioner and How to Use Them in Daily Practice
Presenter: Gordon Chelune
Kohala 3

1. CHELUNE, G

CE Workshop 10: Simple Tools for the Evidence-Based Practitioner and How to Use Them in Daily Practice

9:00–10:00 AM

Symposium 10: Neuroinformatics: The Design of Neuropsychology for the 21st Century
Chair: Vinoth Jagaroo
Monarchy Ballroom

1. JAGAROO, V
2. JAGAROO, V
3. BILDER, RM

Neuroinformatics: The Design of Neuropsychology for the 21st Century

The Current Status of Neuroinformatics in Neuropsychology, Critical Goals and Crucial Decisions

Revising the Taxonomy of Mental Disorders: Neuroinformatics and Neural Circuit Description Frameworks

4. BOSL, W Neuroinformatics, EEG Advances, and the Emerging National Health IT Infrastructure

9:00–10:00 AM

Symposium 11: New Directions in Using Neuro-imaging to Understand Neuropsychological Late Effects across the Lifespan in Pediatric Cancer
Chair: Donald Mabbott
Discussant: Maureen Dennis
Kings Ballroom

1. MABBOTT, D New directions in using neuro-imaging to understand neuropsychological late effects across the lifespan in pediatric cancer
 2. CONKLIN, HM The Relationship between Working Memory Abilities and White Matter Integrity in Childhood Brain Tumor Survivors
 3. MABBOTT, D Neural correlates of delayed visual-motor performance in children treated for brain tumours
 4. KRULL, KR Regional Brain FDG PET in Adult Survivors of Childhood Cancer Treated with Cranial Radiation

9:00–10:00 AM

Paper Session 7: TBI-Pediatrics and Adults
Moderator: Mary Newsome
Queens Ballroom

1. SHERER, M Factors that Predict Self-reported PTA Duration in Persons with Medically Documented TBI
 2. DORSEY, ZR Disruption of White Matter Pathways Involved in Emotional Processing After Pediatric Traumatic Brain Injury: A Diffusion Tensor Imaging Study
 3. CHAMARD, E Sports-related concussions in female athletes: Neurometabolic and microstructural alterations
 4. PRASAD, MR Long-Term School Outcome in Children with Moderate and Severe Traumatic Brain Injury

9:00–10:00 AM

Poster Symposium: Comprehensive Neurorehabilitation for TBI
Chair: Teresa Ashman
Kona Ballroom

Cognitive Intervention/Rehabilitation

1. ASHMAN, T Comprehensive Neurorehabilitation for TBI
 2. TSAOUSIDES, T Comprehensive Neurorehabilitation: Theoretical Foundations
 3. CANTOR, J Comprehensive Neurorehabilitation: Current Clinical Evidence Based Practice

9:00–10:00 AM

Poster Session 9: Dementia/Epilepsy/TBI
Kona Ballroom

Dementia (Subcortical, Specific Disorders, MCI, etc.)

1. ANDRADE CALDERÓN, PA Positive impact of speech therapy in nonfluent primary progressive aphasia. A single case study
 2. ASHIZUKA, A Semantic memory of environmental sounds in a case with right-dominant semantic dementia
 3. AVILA, JF The Utility Of The CVLT-II And A Performance-Based Task In Differentiating MCI Patients From Controls
 4. BANGEN, KJ APOE Genotype Modifies the Relationship Between Midlife Vascular Risk Factors and Later Cognitive Decline
 5. BANKS, SJ Neuropsychiatric symptom profile differs based on pathology in patients with clinically diagnosed frontotemporal dementia
 6. BARRERA, KD Methodological Issues in Assessing Anosognosia: Are Informants More Accurate?
 7. BOCTI, C Impact of Orthostatic Hypotension on Cognitive Performance in MCI
 8. BOLCEKOVA, E FTLD-TDP and Progressive Supranuclear Palsy in Comorbidity: Study of a Rare Case
 9. BURKE, MM Visual Cognition In Parkinson's Disease Patients With And Without Visual Hallucinations
 10. CALLAHAN, BL Memory Bias for Emotional Pictures in Amnesic Mild Cognitive Impairment and Late-Life Depression
 11. CALVO, D Serum IGF-1 is Positively Associated with Cognitive Performance in Mild Cognitive Impairment
 12. CLARK, LR Medial Temporal and Posterior Cingulate Cerebrovascular Resistance Predicts Cognitive Decline and Diagnostic Instability in Non-Demented Older Adults
 13. DYE, RV Role of Mood Symptoms in Predicting Cognitive Decline in Aging Adults
 14. ERCOLI, LM Plaque and Tangle Imaging and Cognitive Decline in Non-Amnesic Mild Cognitive Impairment
 15. FLOWERS, AT Performance of Patients with Frontotemporal Dementia and Alzheimer's Disease on an Activities of Daily Living Task
 16. GIFFORD, K Cognitive Complaints are related to memory performance in older adults with mild cognitive impairment
 17. KOSMIDIS, M Assessing Memory Decline in Illiterate Elderly Adults
 18. LIGHT, S Diagnosing Mild Cognitive Impairment in the Cognitively Gifted
 19. MANGAL, P Many Faces of Mild Cognitive Impairment in Parkinson Diseases: Classification Approaches Matter

20. MOELTER, ST Neuropsychological Factors Associated with the Decision to Enroll in an Early-Phase Parkinson's Disease Research Study
21. NORDLUND, A Neuropsychology Predicts Dementia more Accurately than CSF Biomarkers and MRI Volumetry
22. PARSEY, CM Direct Observation of Instrumental Activities of Daily Living in Normal Aging, Mild Cognitive Impairment, and Dementia
23. PINEAULT, J Neural Substrates Of Residual Semantic Processing In Semantic Dementia: A Case Study in MEC
24. SCOTT, TM Performance Differences on a Measure of Information Processing Speed between Alzheimer's, Mild Cognitive Impairment, and Healthy Control Participants
25. SHAUGHNESSY, L Diagnostic Accuracy of UDS-Plus Neuropsychological Measures for the Lewy Body Spectrum Disorders
26. SOUTHWICK, J Personality Change in "Frontotemporal Sagging Brain Syndrome" and Frontotemporal Dementia
27. SPRINGATE, B Conversion from Mild Cognitive Impairment to Dementia is Associated with Repetitive Behaviors
28. SULLIVAN, C The Clinical Features of Neuropathology-Confirmed Hippocampal Sclerosis Dementia
29. TAN, J Category Fluency is Superior to Letter Fluency in Identifying Spanish-speakers with MCI/AD
30. TIMPANO SPORTIELLO, MR Stability/instability in Mild Cognitive Impairment progression
31. WEAKLEY, AM Analysis of Verbal Fluency in Mild Cognitive Impairment
32. WEISSBERGER, G Error Profiles on the California Verbal Learning Test Across Four Empirically Derived MCI Subgroups
33. WU, TC Frontostriatal Changes Detected by DTI Tractography in Parkinson's Disease Dementia
34. YOSHIZAWA, H Neuropsychological Differentiation of Autopsy-confirmed Lewy Body Disease in Early Stage
- Epilepsy/Seizures**
35. BARRETT, LE Patterns of Attention and Hyperactivity in Children with Epilepsy compared to those with ADHD
36. LAURA, B Academic Difficulties in Children with Epilepsy
37. BOYER, K Predictors of Risk for Behavior and Learning Problems in Children with Benign Rolandic Epilepsy
38. BUSCH, RM Dual Pathology is Associated with Better Language and Memory Outcome Following Left Anterior Temporal Lobectomy for the Treatment of Epilepsy
39. BUSCH, RM Differences in Postoperative Mood and Psychological Outcome Between Adults with Frontal and Temporal Lobe Epilepsy
40. CHIN, E Lateralization and Plasticity of Communication and Socialization Among Hemispherectomy Patients
41. WILSON, RT Verbal and Nonverbal Memory in Hemispherectomy: Lateralization Effects
42. COHN, M Sarcasm Comprehension and the Temporal Lobes: Evidence from Temporal Epilepsy and Excision
43. DORFMAN, A Frontal Lobectomy for Treatment of Intractable Epilepsy in Children: Cognitive Outcome as a Function of Side of Surgery
44. DULAY, MF White and gray matter integrity and cognitive impairments in patients with epilepsy with and without major depression
45. GERSTLE, M Relative Sensitivity of IQ Scores to Parental Education and Seizure-Related Variables
46. GOTTLIEB, L Application of a GAI-CPI Analytic Framework to Wechsler Intelligence Scales in Pediatric Epilepsy
47. HEIDEMAN, E Depressive Symptoms Decrease in Pediatric Epilepsy Patients Post-Surgery
48. HILL, SW A Case of Amnesia Following Subtemporal Selective Amygdalohippocampectomy: Implications for Practice
49. JACOLA, LM Executive Function and Maladaptive Behavior Before and After Surgical Intervention in Children with Epilepsy
50. JANECEK, J Naming Outcome after Left or Right Temporal Lobectomy in Patients with Bilateral Language Representation by Wada Testing
51. LENTZ, ME Differences In Personality Assessment Inventory (PAI) Profiles For Individuals With Focal Versus Non-Epileptic Seizures
52. LENTZ, ME Gender Differences on the Personality Assessment Inventory (PAI) In Patients with Non-Epileptic Seizures (NES)
53. MARTIN, RB Memory and Executive Functions in Children Following Frontal and Temporal Lobectomies
54. MARTIN, RB Verbal and Nonverbal Memory Following Surgical Intervention for Intractable Epilepsy in Children
55. CARLSON, H The Effectiveness of Cognitive Rehabilitation in Epilepsy Surgery Patients: Systematic Review
56. CARLSON, H Employment of Symptom Validity Measures in Longitudinal Neuropsychological Evaluation of Epilepsy Surgery Patients: Systematic Review
57. PACKWOOD, S Wechsler Adult Intelligence Scale-Fourth Edition Performance in Temporal Lobe Epilepsy
58. PEARSON, CM Material Specific Memory Impairment Across Multiple Age Cohorts in a Temporal Lobe Epilepsy Sample
59. SCHAFFER, S Ability of the ACS Faces Subtest to Lateralize Patients with Right Seizure Focus
60. SEPETA, L Hippocampal Activation during Preoperative Functional MRI Across the Life Span in Epilepsy
61. STAIKOVA, E Selective Mutism Status-Post Left Temporal Resection in Children with Treatment-Resistant Epilepsy: a Report on Two Cases
62. STEFANATOS, AK Psychosocial Outcomes of Children With Intractable Epilepsy: A Comparison of Pre- and Post-Surgical Functioning
63. UMFLEET, LG Sensitivity of Memory and Naming Tests for Identifying Left Temporal Lobe Epilepsy
64. WISDOM, N Use of the Health History Checklist (HHC) to detect patients experiencing psychogenic non-epileptic events (PNEE) on a long-term monitoring unit

TBI (Adult)

65. ADAMSON, N Vocational rehabilitation services related to successful employment outcomes of persons with traumatic brain injury
66. ARNETT, P Poor Baseline Neuropsychological Test Performance is Associated with Low Examiner-Rated Motivation in Collegiate Athletes
67. AVERILL, L Sex Differences in Veterans with Mild Traumatic Brain Injuries
68. CAMPBELL, JS Source of Injury Differentiates Concussed from Non-Concussed Marines Returning from Combat Deployments
69. CHEEMERLA, S Examining Changes in Fractional Anisotropy (FA) of White Matter Tracts in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans with Tract-Based Spatial Statistics (TBSS)
70. FABER, J Diffusion Tensor Imaging of the Fornix and Perforant Pathway in Relation to Memory in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans
71. FABER, J Diffusion Tensor Imaging of the Ventral Striatum in Relation to Executive Function in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans
72. KAMATH, RS Case Studies in Patients with Severe Traumatic Brain Injury Patients Utilizing Tract-Based Spatial Statistics: Commonalities and Differences in Injury Patterns
73. DELANO-WOOD, L Fornix Integrity is Related to Cognition but not Postconcussive Symptoms in Chronic Military Traumatic Brain Injury: A Quantitative Tractography Study
74. FAIR, JE The Roles of Positive and Negative Affect on Cognitive Rehabilitation after Moderate-to-Severe Traumatic Brain Injury
75. FORD-JOHNSON, LM The Impact of Cognitive and Emotional Functioning on Medication Adherence in TBI
76. GREENE, HA Coping Style and Subjective and Functional Well-Being in Persons with Traumatic Brain Injury
77. HANSON, KL Cognitive Discrepancy-Based Analysis of Traumatic Brain Injury in Veterans Suggests Mild Executive Dysfunction
78. HERGES, AM The Relationship Between Neuropsychological Functioning and Productivity Outcomes in Adults with Brain Injury
79. JURICK, SM Cognitive Profiles of Mild to Moderate Traumatic Brain Injury Iraq and Afghanistan Veterans
80. KENNEDY, JE Psychological Profiles of Active-Duty Military Service Members following mild TBI with and without High Levels of Combat Stress
81. KRCH, D Cognitive Reserve Protects Against Memory Dysfunction in TBI
82. LENGENFELDER, J Emotion Perception Deficits and Executive Functions in TBI
83. LUC, NK Iowa Gambling Task Impairment is Associated with Executive Dysfunction in Veterans with Chronic Mild-to-Moderate Traumatic Brain Injury
84. MAESTAS, K Quantifying Social Participation with the Mayo-Portland Participation Index (M2PI) in Returning Veterans with Mild Traumatic Brain Injury
85. ORFF, HJ Association of Sleep Disturbance With Neuropsychological and Psychiatric Functioning in Veterans with Mild to Moderate Traumatic Brain Injury
86. REAGAN, TA Neurorehabilitation: Treatment Gains Beyond Two Years Post Brain Injury?
87. SOZDA, CN The effect of traumatic brain injury on attentional networks: An event-related potential investigation
88. TSAO, JW Decrements in Post-Deployment Automated Neurocognitive Testing Performance in Marines
89. UKUEBERUWA, D Structural Integrity and Working Memory Performance in TBI

Imaging (Functional)

90. POTVIN, D Reliability Study: Visual Readings of fMRI of Language Lateralization

10:00–10:30 AM**Saturday AM Coffee Break
Grand Promenade****10:15–11:15 AM****Poster Session 10: Drugs/Alcoholism/EEG/Genetics/
HIV/AIDS/Psychopathology
Kona Ballroom****Drug/Toxin-Related Disorders (Including Alcoholism)**

1. ARIAS, F Neurocognitive Characteristics of Opioid-Dependent Adults Seeking Buprenorphine Treatment
2. COULEHAN, K Neurocognitive Effects of Buprenorphine and Methadone: A Systematic Review
3. CRANE, NA Sex Differences in Associations between Amount of Cannabis Use and Neuropsychological Performance
4. ELLIS, C Everyday problems related to executive dysfunction and impulsivity in adults recovering from methamphetamine addiction
5. SHIBANO, RL Comorbid Internalizing Disorders in Abstinent Alcoholics
6. HOFFMAN, R Verbal Learning Deficits With Daily Use of Khat
7. MARCOTTE, T Methamphetamine dependence and risky driving behaviors
8. RASALAN, RC Association Between Increasing Length of Exposure to Manganese in Welding Fumes and Motor Function in Welders

9. SAWYER, KS Associations of Anterior Cingulate Metabolite Levels with Neuropsychological Measures in Alcoholism
10. SCHRETLEN, DJ Does Childhood Lead Ingestion Predict Self-reported Depression and Antisocial Behavior in Adults?
11. SCHUSTER, RM Interactions between Cannabis and Tobacco on Episodic Memory among Young Adult Cannabis Users
12. SULLIVAN, K Qualitative Neuropsychological Errors and MRI Correlates in Military Pesticide Applicators from Gulf War I
13. VALMAS, MM Construct and Criterion Validity of Social Cognition Measures in Alcoholism
- Electrophysiology/EEG/ERP**
14. CRUZ, G Neural correlate of prospective memory: Is preparatory attention required for successful identification of Prospective Memory cues?
15. D'ALBERTO, N Subthalamic Nucleus Deep Brain Stimulation Reduces Cortical Oscillatory Power
16. FAUSTO, B Aerobic Capacity and Attention Network Efficiency in Young Adulthood
17. FOX, A Different Developmental Trajectories of Response Inhibition and Interference Suppression: An Electrophysiological Perspective
18. GILMORE, CS Event-Related Theta Synchronization as a Biomarker for Alcoholism's Morbid Effect on Brain Function in Treatment-Naïve Actively Drinking Alcoholics
19. GRAVES, L The effects of age and the Apolipoprotein E $\epsilon 4$ allele on OERP scalp topography in odor recognition memory
20. HARDY, DJ Older Adults Maintain Visual-Spatial Filtering Ability: RT and Event-Related Brain Potential Evidence
21. LOGAN, DM Cognitive Control and Performance Monitoring in Pregnant/Post-Partum Women
22. MOES, P "Happy Together:" Interhemispheric ERP Synchrony for Happy and Angry Emotion Perception
23. KARR, JE Electrophysiological and Behavioral Investigation of Dopamine-Related Error Processing in Individuals Who Stutter: A Foundation for Future Treatments
24. SIMON, C Abnormal Semantic Processing and Episodic Memory in Females with Fragile X-associated Tremor/Ataxia Syndrome (FXTAS)
25. SPOKES, T Age-Related Changes to Neural Processing of an Automatic and Controlled Task of Cognitive Inhibition
26. STEFANATOS, GA Attentional Effects on Steady State Auditory Evoked Responses to FM
- Genetics/Genetic Disorders**
27. BARBER, B Neuropsychological Profile of 7q11.23 Duplication: A Family Case Study
28. BENDER, HA The neuropsychological and adaptive functioning of children with Cobalamin C (cblC) disease
29. BLACKWELL, M Psychosocial Protective Factors Within Families of Children With Shwachman Diamond Syndrome
30. BROWN, AL Neuropsychological profile of children with glutaric aciduria type 1 detected by newborn screening – 5 year follow up
31. BUSCH, RM Cognitive Characteristics Associated with Cowden Syndrome (CS), Bannayan-Riley-Ruvalcaba Syndrome (BRRS), and Other Syndromes Involving PTEN Mutations
32. CHANG, JS Elevated Plasma Lactate/Pyruvate Ratio as a Marker for Deficits in Adaptive and Neurocognitive Abilities in Children with Mitochondrial Disease
33. CLARKE, SB Psychosocial Functioning in Mucopolysaccharidosis I: Disease Severity, Treatment Type, and Age
34. DUVALL, SW Executive Function in Individuals with Mucopolysaccharidosis, Type I (MPSI)
35. GERNER, G Episodic Memory in Autism and Lesch-Nyhan Disease
36. GERNER, G Cortical Thickness Abnormalities in Lesch-Nyhan Disease
37. GOLD, AB Duchenne Muscular Dystrophy: Academic Achievement and Cognitive Correlates
38. NEUGNOT CERIOLI, M Cognitive profiles of children affected by a de novo truncating SYNGAP1 Mutation
39. SALMINEN, L Impact of the Serotonin Receptor Transporter Polymorphism on Cognitive Aging
40. VAN DER WEES, M Neuropsychological profiles of Marinesco-Sjögren syndrome: A unique sibling study
41. WONG, LM Oculomotor Performance Indicates Adult Male Fragile X Premutation Carriers Asymptomatic for FXTAS Exhibit Impaired Cognitive Control
42. YUND, BD Brain Abnormalities and Neuropsychological Function in Children with Attenuated Mucopolysaccharidosis type II
43. ZINK, T Trauma Exposure Decreases the Heritability of Verbal Learning
- HIV/AIDS/Infectious Disease**
44. ARBID, N Implicit Learning Among Patients With HIV/AIDS: The Role of Cognitive Reserve
45. ARCE RENTERIA, M The Role of Neurocognitive Dispersion in HIV+ Adults with a History of Substance Use Disorders
46. ARENTOFT, A Decision Making among HIV+ adults: The influence of neurocognition, sensation seeking, and personality
47. ARENTSEN, TJ Probabilistic learning and basal ganglia integrity among HIV+, older adults: A diffusion tensor imaging study
48. BABAKHANYAN, I Long Term Cognitive Impact of Perinatally Infected HIV Positive Youth
49. BAKER, LM Impact of age on cognitive changes following the initiation of combined antiretroviral therapy (cART) in HIV+ patients
50. BICKHAM, R HAART Treatment Status AND Neurocognitive Development in Pre-school Age HIV Positive Ugandan Children

51. GARDNER, A HAART Treatment Status and Neurocognitive Outcomes Among HIV Positive Ugandan Children
 52. BOLDEN, KA Assessing Callosal Fiber Tracts in Methamphetamine Dependence and HIV Infection
 53. BRAGA, D Driving Performance Among Individuals With “Asymptomatic” HIV-Associated Neurocognitive Disorders
54. DEVLIN, KN The Relation of Cardiovascular Risk Factors and HIV to Neuropsychological Functioning
 55. DUFOUR, CA Strenuous Exercise is Associated with Less Neurocognitive Impairment In HIV-Infected Adults
 56. EIKELAND, R Neuropsychological Profile In Persons Who Did Not Recover From Lyme Neuroborreliosis 30 Months After Treatment
57. ERICH, B The effectiveness of the Color Figure Mazes Test in the detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish speaking individuals infected with HIV
 58. FAMA, R Verbal and Nonverbal Fluency in HIV Infection and Alcoholism Comorbidity: Contribution of Motor and Memory Processes
59. FAZELI, PL Factors Related to Medication Management Abilities in Older Adults with HIV: A Pilot Study
 60. FUENTES, A Neurocognition Influences Health Locus of Control in a Sample of HIV-Seropositive Adults
 61. GIESBRECHT, CJ Sub-Domains of Executive Dysfunction in Poly-Substance Users: Associations with Viral Exposure
 62. GRULLON, E The relationship between neurocognitive functioning and employment in HIV seropositive women in India
63. HOLT, JL Altered Age-Dependent Brain Activation During Working Memory in HIV-Infected Individuals
 64. LE BERRE, A Decision Making in Alcoholism, HIV Infection, and Their Comorbidity: Differential Contributions of Cognitive Functions
65. LEVINE, A Establishing a Link Between Host Genotype and HIV-Related Neuropathology – A Novel Approach to Understanding Neuropathogenesis
 66. LOPEZ, E The Effectiveness of the Computerized Picture Memory Interference Test in the Detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish Speaking Individuals Infected with HIV
67. MCINTOSH, RC A Moderated Mediation Model of Cognitive Depression in HIV
 68. MIRANDA, C Relative Utility of Three English Language Dominance Measures in Predicting the Neuropsychological Test Performance of HIV+ Bilingual Latino Adults
 69. MOORE, DJ Time-based Prospective Memory Deficits are Associated with Psychotropic and ART Medication Non-Adherence among HIV+ Individuals with Bipolar Disorder
70. MÜLLER-OEHRING, EM Striatal Intrinsic Functional Connectivity in HIV and Parkinson Disease
 71. PATEL, SM HIV-associated neurocognitive decline predicts declines in instrumental activities of daily living: A longitudinal study
72. POSADA, C Emotional Attention Processing among HIV-infected Persons with Bipolar Disorder
 73. ROMERO, RA Neurocognitive Effects of HIV on Preschool-aged Children in Uganda
 74. SAKAMOTO, M Neuropsychological Test Combinations As a Screening Measure for Detection of HIV-associated Neurocognitive Impairment in India
75. SHAPIRO, ME Apathy Correlates with Cognitive Performance, Functional Disability, and RNA Plasma Levels in HIV Positive Individuals
 76. SHAPIRO, ME Cognitive Reserve Protects Against Apathy in HIV Positive Patients
 77. SHAPIRO, ME Disease Severity Moderates the Effect of Age on Neuropsychological Performance in HIV-Positive Patients
78. YAMAKAWA, C The Effectiveness of the HIV Dementia Scale (HDS) in the Detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish Speaking Individuals Infected with HIV
 79. ZANINOTTO, A Cognitive function, depression symptoms and health-related quality of life before and during interferon therapy of chronic hepatitis C
- Psychopathology/Neuropsychiatry (Schizophrenia)**
80. OJEDA, N Cognitive impairment in first-episode bipolar I disorder: the processing speed hypothesis
 81. OJEDA, N Clinical Symptoms Moderate the Association Between Nicotine Dependence and Cognition
 82. POMMY, J The Relationship of General Cognitive Ability and Gray Matter Volumes Mediated by Total Number of Rare Deletions in Individuals with Schizophrenia
83. SIMON, JJ Assessing the relation between symptoms and neural reward processing in healthy subjects and patients with schizophrenia – an fMRI study
 84. SOLIS-VIVANCO, R Reduced P3a amplitudes in antipsychotic naïve first-episode psychosis patients and individuals at clinical high-risk for psychosis
85. SUNG, K Persons with Schizophrenia Show Aberrant Clustering on Category Word Fluency Compared to Healthy Adults with Equivalent Productivity
 86. YEO, RA The Impact of Parent Socioeconomic Status on Executive Functioning and Cortical Morphology in Individuals with Schizophrenia and Healthy Controls
 87. ZANJANI, A Component Analysis of Memory Function in Schizophrenia: A Quantitative Review
- Aging**
88. MAINLAND, BJ Multiple Clock Drawing Scoring Systems: Do They Matter?

10:30 AM–12:00 PM

Symposium 12: Rehabilitation of Mild to Moderate TBI Symptoms in Service Members and Veterans

Chair: Elizabeth Twamley

Discussant: Keith Cicerone

Monarchy Ballroom

1. TWAMLEY, EW
2. BELANGER, H
3. COOPER, DB
4. BOGDANOVA, Y
5. TWAMLEY, EW

- Rehabilitation of Mild to Moderate TBI Symptoms in Service Members and Veterans
 Psychoeducational Interventions for Postconcussive Symptoms – Computer and Web-based Administration
 A Randomized Controlled Trial of Cognitive Rehabilitation for Service Members with mild Traumatic Brain Injury (mTBI): Insights from the SCORE Trial
 Multimodal Approach to Cognitive Rehabilitation of Blast-Induced TBI
 Compensatory Cognitive Training for Veterans with Mild to Moderate TBI

10:30 AM–12:00 PM

Symposium 13: Cognitive Intervention in Aging Populations with Mild to Severe Memory Disorders: How Basic Science Influences Practical Application.

Chair: Kelly Murphy

Kings Ballroom

1. MURPHY, K
2. ANDERSON, ND
3. TROYER, AK
4. MURPHY, KJ
5. ROWE, G

- Cognitive Intervention in Aging Populations with Mild to Severe Memory Disorders: How Basic Science Influences Practical Application
 Episodic Memory Processes in Healthy Older Adults and Older Adults with Amnesic Mild Cognitive Impairment
 Evidence Supporting Memory Intervention for Healthy Older Adults
 Approaches to Cognitive Intervention for Mild Cognitive Impairment
 Memory Intervention Techniques for Individuals with Moderate to Severe Amnesia

10:30 AM–12:00 PM

Symposium 14: Impaired Socio-emotional Functioning Following Severe TBI: An examination of behavioural, cognitive and neural mechanisms.

Chair: Skye McDonald

Queens Ballroom

1. MCDONALD, S
2. PONSFORD, J
3. MCDONALD, S
4. RUSHBY, J
5. HONAN, CA
6. COOPER, JM

- Impaired socio-emotional functioning following severe TBI: An examination of behavioural, cognitive and neural mechanisms
 Sexual changes following traumatic brain injury
 Emotional empathy: sensitivity to body and facial feedback following severe traumatic brain injury
 Neurophysiological Correlates of Empathy after Severe Traumatic Brain Injury
 Deficits in comprehension of speech acts after TBI: The role of Theory of Mind and Executive Function
 Neural Substrates of Moral Reasoning after Traumatic Brain Injury

Abstracts Presented at the Forty First Annual Meeting International Neuropsychological Society

February 6-9, 2013
Waikoloa, Hawaii, USA

WEDNESDAY MORNING, FEBRUARY 6, 2013

**CE Workshop 1:
Neuroimaging Studies: Methodological Issues and
Clinical Implications Across the Lifespan**

Presenters: Linda Chang, Thomas Ernst, Kenichi Oishi

9:00 a.m.–12:00 p.m.

L. CHANG. CE Workshop 1: Neuroimaging Studies: Methodological Issues and Clinical Implications Across the Lifespan.

Modern neuroimaging techniques provide a unique window into changes in brain structures, physiology, function, and chemistry across the age span. The organizers of this course will first review the principles and technical issues involved in several neuroimaging techniques that are used to study these alterations in vivo. We will then provide an overview of the changes that have been observed on various neuroimaging measures, spanning the entire age range from the neonatal to the elderly aging periods. Lastly, we will provide examples of the relationship between neuroimaging phenotypes and cognitive status, as well as how particular genes may modify brain development or the aging brain, in both health and neurological disorders. Learning Objectives:

- 1) Describe the basic principles of the neuroimaging techniques used in the clinical and the research settings, as well as some technical limitations in the use of these techniques to study brain development and aging
- 2) Discuss typical changes in neuroimaging measures across the age span
- 3) Incorporate cognitive studies and genetic information in the assessments of various neuroimaging measures (i.e., as endophenotypes).

Correspondence: *Linda Chang, Medicine, University of Hawaii, 1356 Lusitana St 7th fl, Honolulu, HI 96813. E-mail: lchang@hawaii.edu*

**CE Workshop 2:
Get to Know the NIH Toolbox: A Common Currency
for Measuring Neurological and Behavioral
Functioning**

Presenters: David Tulskey, Sandra Weintraub, Richard Gershon, Robert Heaton

9:00 a.m.–12:00 p.m.

D. TULSKY. CE Workshop 2: Get to Know the NIH Toolbox: A Common Currency for Measuring Neurological and Behavioral Functioning.

The NIH Toolbox for Neurological and Behavioral Functioning was developed as part of the NIH blueprint for Neuroscience Research. This

new measurement system provides short assessments covering a wide range of functioning in 4 larger domain areas (Cognition, Emotion, Motor, and Sensory Functioning). Each domain area includes a range of subtests, each providing a standardized score. The Toolbox includes a large normative sample representative of the U.S. population across a wide age range of 3 – 85. Finally, the NIH Toolbox has been translated and adapted into Spanish and also has been extensively tested as part of the standardization study. The focus of this workshop is to provide the audience with an overview of the NIH Toolbox, with demonstrations of the actual test components across 4 domain areas (cognitive, sensory, motor, and emotional measures). The session will focus heavily on the cognitive health domain, including background to the development and demonstrations of the administration of the tests, and the validation and standardization results. A central goal of the Toolbox is to provide measures that are easily administered to researchers that are outside the traditional domain area so that baseline data can be collected across a wide spectrum of functioning. Toward that goal, the workshop will also describe the tests in the other key domain areas, including some demonstrations. Some domain areas have been developed using state-of-the-art measurement techniques that include item response theory (IRT) and computer adaptive testing (CAT). The workshop will demonstrate how CAT is used to greatly reduce administration times and still provide reliable estimates of functioning along the continuum of each trait. Finally, the workshop will discuss the relevance of the NIH Toolbox to the neuropsychologist and discuss the implications for research and clinical practice.

Learning Objectives:

- 1) have basic knowledge of the NIH Toolbox and understand its implications for research and practice
- 2) be able to list the NIH Toolbox domains and measures and discuss how they are administered
- 3) be able to review the standardization and validation efforts to develop the cognition tasks
- 4) have a basic knowledge of how computerized adaptive testing can reduce assessment time while yielding extremely reliable scores.

Correspondence: *David Tulskey, Department of Physical Medicine and Rehabilitation, University of Michigan, 325 E. Eisenhower Parkway, Ann Arbor, MI 48108. E-mail: dtulskey@med.umich.edu*

WEDNESDAY AFTERNOON, FEBRUARY 6, 2013

**CE Workshop 3:
Evidence-based Interventions for Learning
Disabilities: Relations with Brain Function**

Presenter: Jack Fletcher

1:00–4:00 p.m.

J. FLETCHER. CE Workshop 3: Evidence-based Interventions for Learning Disabilities: Relations with Brain Function.

In this course, a framework emanating from an instructional conceptualization of the core construct of LD, unexpected underachievement, is presented. This framework integrates identification using a triangle model (low achievement, inadequate instructional response, exclusion of other conditions that cause low achievement). The framework integrates academic and cognitive skill development with neurobiological and environmental sources of variability that underlie different types of LD. Six academic types of LD are presented with guidelines for identification and a summary of evidence-based interventions, along with cognitive and neurobiological correlates.

Learning Objectives:

- 1) identify six major forms of LD
- 2) list their causes and correlates
- 3) connect this knowledge and information obtained from neuropsychological evaluations with evidence-based interventions

Correspondence: *Jack Fletcher, Department of Psychology, University of Houston Texas Medical Center, 2151 W Holcombe Blvd, Suite 222, Houston, TX 77204-5355. E-mail: jackfletcher@uh.edu*

**CE Workshop 4:
Genetics and Genomics for Neuropsychology**

Presenter: Robert Bilder

1:00–4:00 p.m.

R. BILDER. CE Workshop 4: Genetics and Genomics for Neuropsychology.

This workshop provides an introduction to genome-wide genetic research methods with a focus on neuropsychological phenotypes. We will review the central dogma of molecular biology to provide perspective on relations of structural genetic variation to higher-level cellular and neural system phenotypes, and consider endophenotype and intermediate phenotype concepts. Next we will focus on research designs and statistical genetic analyses used to quantify heritability and identify genetic associations. The workshop will then survey the current status of research on genetic bases of key neuropsychological phenotypes including conventional diagnostic phenotypes, and phenotypes assessed using structural MRI, functional MRI, diffusion imaging, and cognitive assessments. We will close with a review of new directions including genome-wide sequencing, epigenome-wide association studies, and novel analytic and informatics strategies including meta- and mega-analyses, whole genome covariance analyses and the application of functional genomic (gene expression) results to constrain genetic analyses.

Learning Objectives:

- (1) provide examples of DNA variation causing variation in proteins and cellular function
- (2) describe the current status of association studies for major neuroimaging-based and cognitive phenotypes including intellectual ability, memory, and executive functions
- (3) discuss current strategies for analyzing genome-wide genotype data.

Correspondence: *Robert Bilder, David Geffen School of Medicine at UCLA, 760 Westwood Plaza, Room CS-849, Los Angeles, CA 90024. E-mail: rbilder@mednet.ucla.edu*

**Presidential Address:
Lifespan Neuropsychology: The New Age-ing
Frontier**

INS President: Sandra Weintraub

4:15–5:15 p.m.

S. WEINTRAUB. Presidential Address: Lifespan Neuropsychology: The New Age-ing Frontier.

The “New Age” of the science of Neuropsychology has been forged by evolving concepts of the functional organization of the brain according to principles of large-scale neuroanatomical network connectivity and by an ontogenetic perspective on brain and cognitive health from infancy to advanced old age. In the past 30 years, the study of cognitive aging and dementia has taken on a growing urgency. The American Academy of Neurology dubbed the 1990’s the “Decade of the Brain” and the American Psychological Association called the first ten years of this century, the “Decade of Behavior”. These monikers attest to the fact that the brain has achieved its due status as a target of intense research investigation and of frequent coverage in the popular press. Most importantly, brain health has captured the attention of public policy makers as a critical priority and our field has played a significant role in that development. At the inception of the INS in 1967, when Karl Pribram, noted psychologist and neurosurgeon was president, the early foundations of the field of brain and behavior rested on experimental studies in human and non-human primates and on the study of patients with cognitive and behavioral deficits due to neurological lesions. Now, with the advent of novel technologies combined with increasingly sophisticated experimental behavioral paradigms, we are able to probe the structure and function of the human brain in real time. These advances have heralded a new age of neuropsychology. This year’s INS program for the 41st annual North American conference applauds these advances in the study of cognitive aging and dementia and in the linkage between early developmental events and their long term impact on brain aging outcomes. The future holds unprecedented promise for the field. This meeting may well mark a new beginning, a time when our knowledge will lead to restorative techniques that can prevent and treat neurological disorders of cognition and behavior and when techniques for maintaining brain health can catch up with the extended longevity promoted by medical advances of the past century.

Learning Objectives:

- (1) list key developments that have marked the progress of neuropsychology since the inception of INS
- (2) describe how these key developments have influenced concepts of cognitive change in neuropsychology throughout the lifespan.

Correspondence: *Sandra Weintraub, Cognitive Neurology and Alzheimer’s Disease Center, Northwestern Feinberg School of Medicine, 320 E. Superior, Searle 11-467, Chicago, IL 60611 . E-mail: sweintraub@northwestern.edu*

**Invited Address:
Frontal Lobe Functioning in Daily Life**

Presenter: Donald Stuss

5:30–6:30 p.m.

D.T. STUSS. Frontal Lobe Functioning in Daily Life.

In neuropsychology, the functions of the frontal lobes have been studied primarily in individuals who have some type of frontal lobe dysfunction. The study of the range of “normal” frontal lobe functioning, or the applications of the lessons learned about brain organization from impaired functioning to how individuals in the “normal” population function in everyday life, is seldom addressed.

A series of vignettes will be presented that indicates there is considerable variability in “normal” frontal lobe functioning than might have been suggested if looking solely through the lens of our knowledge about impaired functioning. The types of functions associated with the frontal lobes will be briefly reviewed. This work identifies a model of four categories of frontal lobe functioning that work together in a synergistic, domain general, manner. These four categories have been labelled Energization (activation, drive); Executive (task setting, and monitoring); Behavioral and emotional self-regulation; and Meta-cognition/integration.

We will then examine how this framework might be applied to understand and perhaps even improve daily functioning. Two examples re-

late to personal experiences. The first application of this framework focuses on education. Can knowledge of frontal lobe functioning help organize how a teacher works in a classroom? Should the student’s context (e.g., age, beginning of year to end of year) be considered in using the framework? The second addresses the frontal lobes and management. Higher level managers are called “executives”. The head executive is often called the Chief Executive Officer. How might a CEO use knowledge of frontal lobe functioning to maximize performance, individual satisfaction and happiness, as well as profit or impact?

Correspondence: *Donald T. Stuss, Ph.D., Ontario Brain Institute, 655 Bay Street, Suite 600, Toronto, ON M5G 2K4, Canada. E-mail: dstuss@braininstitute.ca*

THURSDAY MORNING, FEBRUARY 7, 2013

CE Workshop 5: Ethics in Clinical Neuropsychology: How to Conduct a Culturally Competent Neuropsychological Evaluation

Presenter: Daryl Fujii

7:20–8:50 a.m.

D. FUJII. CE Workshop 5: Ethics in Clinical Neuropsychology: How to Conduct a Culturally Competent Neuropsychological Evaluation.

Cultural competency in performing neuropsychological assessments is so vital to our profession that this issue is addressed in several sections of the Ethical Principles of the American Psychological Association (APA), and also included in APA’s Forensic and Multicultural Guidelines, and the American Academy of Clinical Neuropsychology (AACN) Practice Guidelines. Despite the clinical and ethical importance, there is surprisingly little specific guidance on how to conduct a culturally competent neuropsychological assessment. This course will introduce a literature-based systematic approach for performing culturally competent neuropsychological assessments that follows practice guidelines. The focus is on performing assessment on ethnic minorities where there is no/little normative data. This approach will cover the following aspects of the evaluation: preparation, interview, assessment, interpretation of data, and write-up.

Learning Objectives:

- 1) list cultural resources for assisting in neuropsychological assessment
- 2) develop a conceptual framework for estimating premorbid functioning and interpreting test data
- 3) develop strategies for neuropsychological assessment for ethnic minorities where there is no/little normative data; (4) be explicit in describing the strengths and limitations of the neuropsychological evaluation

Correspondence: *Daryl Fujii, Pacific Island Health Care Services, Veterans Affairs, 459 Patterson Road, Honolulu, HI 96819. E-mail: dfujii07@gmail.com*

CE Workshop 6: Use of Amyloid PET Imaging in Clinical Practice

Presenters: Stephen Salloway, Paul Malloy

7:20–8:50 a.m.

S. SALLOWAY. CE Workshop 6: Use of Amyloid PET Imaging in Clinical Practice.

Amyloid PET imaging was approved by the FDA for clinical use in April 2012 and it offers a major advance in the diagnosis of cognitive decline

in the elderly. This workshop will introduce participants to image interpretation and the application of this technique in clinical practice. We will present information on image acquisition, interpretation, and application of Amyloid PET imaging. Furthermore, cases likely to benefit from the test will be presented. Finally, we will discuss how to integrate this information with other diagnostic tools.

Learning Objectives:

- 1) describe the basis for amyloid PET imaging and its correlation with post-mortem data
- 2) apply the knowledge to basic interpretation of amyloid PET images
- 3) learn to integrate amyloid PET with other diagnostic tools in the evaluation of MCI and dementia cases

Correspondence: *Stephen Salloway, Alpert Medical School, Brown University, x, Providence, RI. E-mail: ssalloway@butler.org*

Paper Session 1: Childhood Cancers

Moderator: Celiane Rey-Casserly

9:00–10:00 a.m.

T.M. BRINKMAN, W.E. REDDICK, J. LUXTON, J.O. GLASS, N.D. SABIN, K. SRIVASTAVA, L.L. ROBISON, M.M. HUDSON & K.R. KRULL. Cerebral White Matter Integrity and Executive Function in Adult Survivors of Childhood Medulloblastoma.

Objective: Loss of white matter volume and integrity has been associated with reduced intelligence in pediatric medulloblastoma survivors. Associations between specific neurocognitive processes and white matter integrity have not been examined in long-term adult survivors.

Participants and Methods: Twenty adult survivors of medulloblastoma were randomly recruited from a larger institutional cohort of adult survivors of childhood cancer. Survivors underwent comprehensive neurocognitive evaluations and magnetic resonance imaging (MRI). Brain volume, cortical thickness and diffusion tensor imaging (DTI) were acquired, including measures of fractional anisotropy (FA), apparent diffusion coefficient (ADC), and axial (AX) and radial diffusivity (RAD). Observed neurocognitive scores were compared to population norms and correlated to MRI indices.

Results: Survivors were, on average, 29 years of age and 18 years from diagnosis. Mean full scale IQ was nearly 1SD below the normative mean (86.3 vs. 100, $p=0.004$). Seventy-five percent of survivors were impaired on at least one measure of executive function. Eighty

percent showed evidence of leukoencephalopathy. All survivors evidenced multifocal hemosiderin deposits on MRI. RAD in the frontal lobe of both hemispheres was correlated with shifting attention (left: $r_s = -0.67$, $p = 0.001$; right: $r_s = -0.64$, $p = 0.002$) and cognitive flexibility (left: $r_s = -0.56$, $p = 0.01$; right: $r_s = -0.54$, $p = 0.01$). Shifting attention was also negatively correlated with RAD in both hemispheres of the temporal (left: $r_s = -0.69$, $p = 0.001$; right: $r_s = -0.63$, $p = 0.003$) and parietal lobes (left: $r_s = -0.63$, $p = 0.003$; right: $r_s = -0.55$, $p = 0.01$). Volume and cortical thickness were not correlated with neurocognitive function.

Conclusions: Neurocognitive impairment was common and involved many domains. Reduced white matter integrity in multiple brain regions correlated with poorer performance on tasks of executive function.

Correspondence: *Tara M. Brinkman, PhD, Epidemiology and Cancer Control, St. Jude Children's Research Hospital, 262 Danny Thomas Place, MS 735, Memphis, TN 38105. E-mail: tara.brinkman@stjude.org*

T.M. BRINKMAN, W. LIU, G.T. ARMSTRONG, A. GAJJAR, T.E. MERCHANT, C. KIMBERG, L. KUN, K. SRIVASTAVA, L.L. ROBISON, J.G. GURNEY, M.M. HUDSON & K.R. KRULL. Neurocognitive Impairment Twenty Years after Treatment for Pediatric Brain Tumors: A Report from the St. Jude Lifetime Cohort (SJLIFE).

Objective: Pediatric brain tumor survivors are at risk for neurocognitive impairment, which appears progressive over time and is associated with treatment exposures. Little is known about neurocognitive function in long-term adult survivors.

Participants and Methods: Neurocognitive functions were evaluated in 130 adult survivors of pediatric brain tumors (mean [SD] current age = 27.4 years [5.2], age at diagnosis = 8.6 years [4.6], and time since diagnosis = 18.8 years [4.8]) participating in the SJLIFE long-term follow-up protocol. Age-adjusted standard scores for measures of intelligence, academic achievement, attention, memory, processing speed, and executive functioning were calculated, with clinical impairment defined as scores <10th percentile. Multivariable general linear regression models were used to examine associations between neurocognitive functions and treatment variables.

Results: Survivors performed below average across multiple domains, with 34% demonstrating impaired IQ (mean=88.1; SD=18.2). Rate of impairment was greater than expected for executive function (54%), long-term recall (49%), short-term recall (35%), and processing speed (41%) [all p 's < 0.001]. Cranial radiation was associated with lower performance on short-term recall ($\beta = -0.55$, SE=0.22, $p = 0.02$) and processing speed ($\beta = -0.54$, SE=0.19, $p = 0.005$). History of hydrocephalus with shunt placement was associated with lower performance on verbal learning ($\beta = -0.60$, SE=0.22, $p = 0.008$), verbal fluency ($\beta = -0.63$, SE=0.25, $p = 0.01$), focused attention ($\beta = -1.12$, SE=0.36, $p = 0.002$), math ($\beta = -0.51$, SE=0.25, $p = 0.04$) and reading ($\beta = -0.54$, SE=0.19, $p = 0.006$).

Conclusions: Twenty years following initial diagnosis and treatment, adult survivors of pediatric brain tumors demonstrate considerable neurocognitive impairment. Observed impairment suggests pervasive impact on cognition and lack of normalization to age-expected performance. Future studies will examine factors including functional outcomes and radiation dose/volume.

Correspondence: *Tara M. Brinkman, PhD, Epidemiology and Cancer Control, St. Jude Children's Research Hospital, 262 Danny Thomas Place, MS 735, Memphis, TN 38105. E-mail: tara.brinkman@stjude.org*

L. RIGGS, N.J. SCHOENHOFF, F. LIU, F. WANG, C. DOCKSTADER, E. BOUFFET & D.J. MABBOTT. Dose-dependent hippocampal volume changes following cranial radiation for medulloblastoma.

Objective: Cranial radiation treatment for medulloblastoma has been shown to inhibit hippocampal neurogenesis in animal models and in-

duce hippocampal atrophy in human patients. Declines in memory have also been documented. Depending on the tumour risk stratification, either standard- (~3600cGy) or reduced- (~2400cGy) dose radiation protocols are used. In this study, we examined dose-dependent hippocampal volume changes in children treated with cranial radiation.

Participants and Methods: 10 patients treated with standard-dose radiation (SDR; age = 12.45 ± 3.54), 10 patients treated with reduced-dose radiation (RDR; age = 12.49 ± 2.97), and 13 health age-matched controls (HC; age = 12.53 ± 2.63) were included. All participants were scanned using a GE 1.5T MRI. T1 images were processed using Analyze 9.0; each brain was segmented into grey and white matter in order to exclude CSF, and hippocampal regions were traced blind to participant status. Total brain and hippocampal volumes, as well as hippocampal to whole brain ratios, were calculated for each participant, and compared across the three groups.

Results: One-way ANOVAs revealed a significant between group difference in hippocampal volume ($F(2,32) = 4.31$, $p < 0.05$); hippocampal volume of the SDR group was significantly reduced as compared to the HC group ($t(21) = 3.21$, $p < 0.01$). Hippocampal volume of the RDR group fell between the SDR and HC group, but did not differ significantly from either group ($p > 0.1$). No significant differences were found for measures of whole brain volume or hippocampal to whole-brain ratio ($p > 0.1$).

Conclusions: The current results suggest that hippocampal volume changes following radiation treatment for medulloblastoma is dose-dependent. Specifically, whereas standard-dose radiation resulted in significant hippocampal volume atrophy, this was not observed among children treated with reduced-dose cranial radiation. Future work will examine dose-dependent cognitive changes among the same cohort, especially on measures of learning and memory.

Correspondence: *Lily Riggs, PhD, Psychology, The Hospital for Sick Children, 555 University Ave, Toronto, ON M5G 1X8, Canada. E-mail: lily.riggs@sickkids.ca*

L. KAHALLEY, A. WINTER, H.H. STANCEL, T. PIPKINS & M. RIS. Utility of the General Ability Index (GAI) with Survivors of Pediatric Brain Tumors: Comparison to Full Scale IQ and Premorbid IQ Estimates.

Objective: Pediatric brain tumor (BT) survivors are at risk for working memory and processing speed impairment as a consequence of disease and treatment. The General Ability Index (GAI) provides an estimate of intellectual functioning that is less influenced by working memory and processing speed than a Full Scale IQ (FSIQ). Study objectives are: 1) to examine discrepancies between GAI and FSIQ scores, and 2) to explore the clinical utility of the GAI to represent general reasoning ability in a sample of pediatric BT survivors.

Participants and Methods: Data on 43 BT survivors (ages 6-16) were examined. GAI and FSIQ scores were derived from the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV). Premorbid IQ scores were estimated from ethnicity and parental education.

Results: GAI scores (M=96.2) were significantly higher than FSIQ (M=89.4, $t(42)=8.9$, $p < 0.001$). Processing Speed Index (M=77.8, $t(42)=8.1$, $p < 0.001$), and Working Memory Index scores (M=91.5, $t(42)=2.2$, $p < 0.05$). A binomial test revealed the rate of significant intra-individual GAI-FSIQ differences in our sample (44.2%) was significantly greater than the rate observed in the WISC-IV standardization sample (7.9%), $p < 0.001$. Estimated premorbid IQ scores (M=101.9) were significantly higher than GAI, $t(34)=2.5$, $p < 0.05$, and FSIQ scores, $t(34)=5.2$, $p < 0.001$.

Conclusions: Many pediatric BT survivors exhibit weaker functioning in working memory and processing speed than expected for their age. After minimizing the influence of those domains, GAI scores suggest that general reasoning ability appears largely intact and closer to estimates of premorbid IQ than traditional FSIQ scores in this population. Clinicians may find the GAI to be a useful tool to quantify the intellectual potential of a BT survivor when appropriate accommodations are in place to compensate for relative cognitive proficiency weaknesses. It remains an empirical question whether the FSIQ or the GAI better predicts academic functioning or services needed in the school setting for this population.

Correspondence: *Lisa Kahalley, Ph.D., Texas Children's Hospital, 1102 Bates Ave., Ste. 730, Houston, TX 77030. E-mail: lskahall@texaschildrens.org*

Paper Session 2: Dementia/ Episodic Memory/ Cognitive/Physical Activity

Moderator: Angela Jefferson

9:00–10:00 a.m.

M. IRISH, M. HORNBERGER, J.R. HODGES & O. PIGUET. Exploring the Neural Substrates of Episodic Memory Dysfunction in Frontotemporal Dementia and Alzheimer's Disease.

Objective: The integrity of episodic memory in the behavioural variant of frontotemporal dementia (bvFTD) represents a contentious issue in neuropsychology. Recent evidence suggests that episodic memory in progressive cases of bvFTD is compromised to the same extent as in Alzheimer's disease (AD), posing a significant challenge for the differential diagnosis of these dementia syndromes. Here, we sought to elucidate the neural substrates of episodic memory performance on those tasks typically used in the clinical assessment of bvFTD and AD patients.

Participants and Methods: We assessed episodic memory, across visual and verbal domains, in 19 bvFTD, 18 AD patients, and 19 age- and education-matched controls. Immediate and delayed recall test performance was indistinguishable between patient groups, irrespective of task modality.

Results: Whole-brain voxel-based morphometry analyses revealed considerable overlap in the neural regions implicated in episodic memory dysfunction for both patient groups, namely the right temporal pole, right frontal lobe, left paracingulate gyrus, and right anterior hippocampus. Importantly, our analyses revealed divergent neural networks specifically underlying episodic memory impairments in each group. Whereas a widespread network including posterior regions such as the posterior cingulate cortex, parietal and occipital cortices was exclusively implicated in AD, the frontal and anterior temporal lobes underpinned episodic memory dysfunction in bvFTD.

Conclusions: Our results underscore the inherent difficulty in distinguishing cases of bvFTD from AD. Crucially, our results highlight distinctive neural changes underlying episodic memory decline specific to each dementia syndrome. We propose that novel tasks of episodic memory which specifically stress the anterior or the posterior neural circuits that are differentially disrupted in bvFTD and AD, respectively, will be needed to assist in the dissociation of these dementia syndromes in the clinical setting.

Correspondence: *Muireann Irish, Neuroscience Research Australia, Barker Street, Randwick, Sydney, NSW 2031, Australia. E-mail: m.irish@neura.edu.au*

P.W. BREWSTER, S.W. MACDONALD, E.J. LAUKKA & L. BÄCKMAN. Synergistic Effects of Physical and Cognitive Activity Reduce Dementia Risk in Community Dwelling Older Adults: Evidence from a Prospective Cohort Study.

Objective: In adult mice, a combination of physical exercise (PE) and cognitive activity (CA) increases hippocampal neurogenesis by 30% relative to isolated exposure to either CA or PE for the same duration. The synergistic effects of PE and CA for promoting hippocampal neurogenesis have been attributed to their different mechanisms of action: PE induces precursor cell proliferation, whereas CA exerts a survival-promoting effect on newborn cells. In a human sample, we examined whether combined regimens of CA and PE were superior to CA or PE alone for decreasing dementia risk.

Participants and Methods: A cox proportional hazards model was applied to data from the Kungsholmen project, a longitudinal prospective dementia study. Participants were residents of the Kungsholmen district of Stockholm, Sweden who were age 75 or older. In the present study, eligible participants were nondemented at baseline, completed at least one follow-up assessment, underwent APOE genotyping, and provided information about their engagement in PE and CA. Information regarding PE and CA was obtained from a structured interview carried out at the first assessment. These values were standardized and examined in relation to subsequent dementia risk. We also included a PA-by-CA interaction term to determine the presence of a synergistic association between PA and CA.

Results: Of 397 eligible participants who were followed for a mean of 5.1 years, 341 progressed to dementia. Adjusting for age, sex, education, health status and APOE genotype, CA and a PE-by-CA interaction significantly reduced dementia risk. The independent effects of PE approached significance. The stability of model parameters was supported by 1,000 bootstrap iterations.

Conclusions: We observed an interactive effect of PE and CA for reducing dementia risk in a cohort of community dwelling nondemented older adults. The synergy of PE and CA for promoting adult hippocampal neurogenesis, as observed in mice, may also operate to protect against dementia in human populations.

Correspondence: *Paul W. Brewster, M.Sc., Psychology and Centre on Aging, Univ of Victoria, 450 Dallas Rd, Apt 704, Victoria, BC V8V 1B1, Canada. E-mail: pbrew@uwic.ca*

C.R. MCDONALD, H.M. GIRARD, E. KUCUKBOYACI, N. KEMMOTSU, B.P. HERMANN & A.M. DALE. Patterns of Hippocampal and Cortical Atrophy in MCI, AD, and TLE: Shared and Unique Contributions to Verbal Memory.

Objective: Alzheimer's disease (AD) and its preclinical state, mild cognitive impairment (MCI), are considered clinically distinct from the syndrome of temporal lobe epilepsy (TLE). However, there are striking similarities in the memory impairments and medial temporal atrophy seen across groups. Furthermore, there has been a recent surge in animal models describing the common pathogenesis of AD and TLE, as well as increased appreciation of their co-morbidity. We compare patterns of cortical atrophy in patients with MCI, AD, and TLE, and examine how regional atrophy contributes to verbal memory impairment (VMI) in each group.

Participants and Methods: Volumetric MRIs were evaluated for 352 patients with MCI, 165 with AD, 37 with chronic TLE, and 188 controls (age-matched to each group). Cortical thickness (CT) estimates and hippocampal volumes (HCVs) were obtained using Freesurfer software. CT maps comparing regional atrophy in each group relative to age-matched controls were created. Verbal memory was evaluated using Logical Memory II.

Results: All patient groups showed HCV loss, as well as cortical thinning in lateral temporal, prefrontal, and precuneus regions. Patients with MCI/AD showed greater thinning in medial temporal cortex, whereas patients with TLE showed greater thinning in pre- and postcentral gyri—regions spared in MCI/AD. Stepwise regression revealed that left HCV loss and entorhinal thinning explained VMI in TLE, whereas bilateral HCVs and entorhinal thinning explained VMI in MCI. Bilateral HCVs and posterior cingulate thinning explained VMI in AD. Patients with TLE and multiple-domain MCI showed the strongest concordance in their cognitive and cortical profiles.

Conclusions: These data suggest considerable overlap in cortical atrophy patterns in TLE and MCI, but also demonstrate unique regions of atrophy that differentially contribute to VMI. The unique pathology evident in TLE vs MCI/AD may, in part, reflect the different neurodevelopmental vs neurodegenerative features of these disorders.

Correspondence: *Carrie R. McDonald, Ph.D., Psychiatry, University of California, San Diego, 8950 Villa La Jolla Drive, Suite C101, La Jolla, CA 92037. E-mail: camcdonald@ucsd.edu*

I.B. MEIER, A.F. WIEGMAN, F.A. PROVENZANO, J.J. MANLY, N. SCHUPF & A.M. BRICKMAN. Regional white matter hyperintensity volume and cognition predict death in a multi-ethnic, community cohort of older adults.

Objective: White matter hyperintensities (WMH) have emerged as among the strongest radiological correlates of suboptimal cognitive aging and dementia. We previously demonstrated that increased WMH distribution in posterior brain regions, particularly the parietal lobes, predicted incident Alzheimer's disease (AD) in a community cohort of older adults. Here, we examined whether regional WMH volumes and cognitive functioning predict mortality.

Participants and Methods: Between 2004 and 2007, magnetic resonance imaging (MRI) was acquired on 769 older adult participants in a multi-ethnic community based study of cognitive aging and dementia in upper Manhattan. Participants were also evaluated with a comprehensive neuropsychological battery and a summary cognitive measure was derived by averaging cognitive domain scores. Participants were followed longitudinally and death was ascertained and confirmed by study personnel. We used Cox regression analysis to determine whether age, cognition, and regional (frontal, temporal, parietal, and occipital) WMH volumes increased risk of death.

Results: A total of 189 participants died in the longitudinal follow-up period (5.11 +/- 1.46 years). Age (HR=1.07, $p < 0.001$), cognitive functioning (HR=0.76, $p = 0.028$), and frontal lobe WMH volume (HR=1.09, $p = 0.002$) increased the risk of death. White matter hyperintensities in other regions were not reliably predictive of death.

Conclusions: The findings suggest that frontal lobe WMH volume, cognition, and age independently increase the risk of death among older adults. White matter hyperintensities are associated with suboptimal cognitive outcomes and with all-cause mortality, but their regional distribution may be mechanistically important.

Correspondence: *Adam M. Brickman, Ph.D., Taub Institute for Research on Alzheimer, Columbia University, 630 West 168th Street, P & S Box 16, New York, NY 10032. E-mail: amb2139@columbia.edu*

Symposium 1: Trajectories of Female Brain Aging: The influence of natural and induced menopause

Chair: Miriam Weber

Discussant: Pauline Maki

9:00–10:00 a.m.

M. WEBER, M.T. WEBER, W. ROCCA, J. DUMAS & P. MAKI. Trajectories of Female Brain Aging: The influence of natural and induced menopause.

Symposium Description: Age-related effects on cognition include declines in verbal memory, attention, verbal fluency and processing speed, cognitive functions that are modulated by gonadal hormones, in particular estrogen. In women, it is important to know whether trajectories of cognitive decline with age are steady and gradual, or altered by the hormonal changes that occur in menopause. Of critical interest is whether the menopausal transition is a turning point characterized by decline in certain cognitive domains, whether the declines are transitory, and whether the effects are dependent on the age at which estrogen losses occur. One of the challenges of differentiating between age effects and hormonal effects in women is the lack of a proper control group, given that all women will transition through the menopause if they live to be middle aged. Thus, other models of induced menopause may be particularly informative. By examining proximal and distal effects of gradual versus abrupt declines in estrogens, we may elucidate the mechanisms of hormone-related cognitive declines in women as distinct from

age-related declines. This symposium highlights ongoing research focusing on the relationship between menopause and cognition. The speakers will present findings on cognitive trajectories across the natural menopausal transition (M. Weber) and in women who have undergone surgical menopause (W. Rocca), and the effects of estrogen manipulations in postmenopausal women (J. Dumas). Our discussant, Pauline Maki, will place this work in the context of hormonal effects on cognition through the lifespan, risk of cognitive decline and dementia in postmenopausal women, and role of hormone therapy.

Correspondence: *Miriam Weber, Ph.D., Department of Neurology, University of Rochester Medical Center, 601 Elmwood Avenue, Box 673, Rochester, NY 14642. E-mail: Miriam_Weber@urmc.rochester.edu*

M.T. WEBER. Reproductive Aging Stage Affects Cognitive Trajectories Across the Menopausal Transition.

Our understanding of the impact of reproductive aging stage on cognition has been significantly advanced in recent years due to findings from large-scale studies of the menopausal transition (MT). The Kinmen Women's Health Investigation and the Study of Women's Health Across the Nation have demonstrated decreases in verbal fluency, processing speed and verbal memory in perimenopause that may be time-limited. It is postulated that fluctuations in endogenous estrogen levels and symptoms associated with the MT, such as depression, sleep disturbance and hot flashes, may independently or additively underlie these changes. The Rochester Investigation of Cognition Across Menopause builds upon these findings in several ways to understand cognitive function across the natural MT. We use a comprehensive test battery assessing six cognitive domains, use a finer differentiation of transition stage, include women at earlier stages of transition, and examine cognitive change in the context of endogenous sex steroid levels and other menopausal symptoms. Through this longitudinal investigation, we are able to determine if cognitive function differs across stages of reproductive aging, evaluate whether hormones or menopausal symptoms predict cognitive function in perimenopause, and determine the trajectory of cognitive function across the natural MT. We find that women in the first year of postmenopause perform significantly worse than women in earlier stages on measures of attention/working, verbal learning, verbal memory and motor function, and that the trajectory of change over time differs as a function of baseline group status. We conclude that cognitive domains supported by the hippocampus and the prefrontal cortex, brain regions that are a putative target for the effects of estrogen, are particularly vulnerable during perimenopause and in the first year following the final menstrual period.

Correspondence: *Miriam T. Weber, 601 Elmwood Avenue, Rochester, NY 14642. E-mail: Miriam_Weber@urmc.rochester.edu*

W.A. ROCCA. Increased Risk of Cognitive Impairment and Dementia Following Early Bilateral Oophorectomy.

In the Mayo Clinic Cohort Study of Oophorectomy and Aging, women who had both ovaries removed prior to reaching natural menopause experienced a long-term increased risk of cognitive impairment or dementia. The risk was higher with younger age at oophorectomy, and was offset by estrogen therapy following the surgery. Because these associations were observed in a cohort study, we cannot exclude that they may have resulted from the confounding effect of genetic variants or of other risk factors. However, the evidence for a confounding effect is limited. Therefore, we also suggest three possible causal mechanisms for the associations: 1) the associations may be mediated by an abrupt reduction in levels of circulating estrogen; 2) the associations may be mediated by an abrupt reduction in levels of circulating progesterone or testosterone; and 3) the associations may be mediated by the increased release of gonadotropins by the pituitary gland in response to the loss of circulating ovarian hormones. These three proposed causal mechanisms are probably not mutually exclusive, and may play a different role in different women (heterogeneity of effects at the population level). Thus, we hypothesize that in each woman who undergoes bilateral oophorectomy

at young age, the abrupt cessation of ovarian function triggers one or several chains of biological events leading to lesions in specific regions of the brain. The topography of the lesions may vary to some degree across women. It remains unclear whether the lesions triggered by oophorectomy are of degenerative type, vascular type, or a combination of both. In addition, genetic variants (e.g., variants in the APOE or ESR1 genes) or non-genetic risk factors (e.g., smoking, obesity) may modify the hormonal effects of bilateral oophorectomy through simple or complex interactions.

Correspondence: *Walter A. Rocca, 200 First Street SW, Rochester, MN 55905. E-mail: rocca@mayo.edu*

J. DUMAS. Hormone and Neurotransmitter Interactions in the Brain: Effects on Cognition and Brain Activation in Postmenopausal Women.

Advances in both preclinical and clinical research have substantially altered our view of the roles that gonadal steroids play in maintaining brain function and the impact of their loss and/or replacement on brain aging. In an effort to bridge the gap in findings from animal work and those in human clinical trials, we have attempted to translate animal models to examine the effects that neurotransmitter manipulations have on estrogen effects on cognition in postmenopausal women. We propose that age-related changes in cognition are specific to changes in the cholinergic system that are modifiable by estrogen. Our results showed that estrogen reversed the anticholinergic impairment seen on attention and speed tasks in older postmenopausal women and on episodic memory in younger postmenopausal women. Additionally, we have shown that estrogen interacted with the cholinergic system to decrease frontal lobe activation that is often seen in normal aging. We will contextualize these data with a new look at the cholinergic hypothesis of geriatric memory dysfunction first described by Bartus in 1982. Our data provide link between the cognitive and brain circuitry effects of this hormone-neurotransmitter interaction that serve as a model the neurobiological changes in cognition after menopause. This model will potentially aid research and treatment strategies regarding menopause- and age-related cognitive dysfunction.

Correspondence: *Julie Dumas, 1 South Prospect St, UHC Arnold 6, Burlington, VT 05401. E-mail: julie.dumas@uvm.edu*

Poster Session 1: Aphasia/Forensics/Hemispheric Asymmetry/ Imaging/Medical Disorders/MS/Stroke/Visuospatial

9:00–10:00 a.m.

Forensic Neuropsychology

A. HANSEN, D. LISBETH, G. OLSON, D. THORNTON, I. GRAFF, L. FRØYLAND, G. ROSENLUND & J. THAYER. Relationship between Atlantic salmon consumption, nutritional status and measures of self-regulation: heart rate variability and executive function.

Objective: This study aimed to investigate the effects of fatty fish (Atlantic salmon) consumption on erythrocyte EPA+DHA, vitamin D status, heart rate variability (HRV), and executive functioning.

Participants and Methods: Eighty-three male forensic patients, randomly assigned into a Fish group or a Control group, participated in this study. The Fish group received Atlantic salmon (>8% fat) for dinner 3 times per week for a period of six months (July-January). Erythrocyte fatty acid composition, serum 25-hydroxyvitamin D, HRV (high frequency power; HF), heart rate (HR), Low frequency/HF; LF/HF-ratio, and executive function (Tower of Hanoi) were assessed before (pre-test) and after (post-test) the fish intervention.

Results: Erythrocyte EPA + DHA, was significantly increased from pre- to post-test among participants in the Fish group, whilst no such changes

was recorded in the Control group. The vitamin D status decreased in both groups during the winter season. However, at post-test the Fish group was closer to a vitamin D status regarded as optimal compared to the Control group. Moreover, the Fish group showed increased HRV-HF and reductions in HR and LF/HF-ratio. The Fish group also showed significantly improved performance on the Tower of Hanoi task. At baseline vitamin D status correlated significantly with HRV measures.

Conclusions: The findings suggest that fatty fish consumption may have important implications for improvement of executive functioning and self-regulation.

Correspondence: *Anita Lill Hansen, Dept. Psychosocial Science, University of Bergen, Christiesgate 12, Bergen 5015, Norway. E-mail: anita.hansen@psyssp.uib.no*

A. SANDVIK, A. HANSEN, B. JOHNSEN & J. LABERG. Can Psychopaths Read the Emotional Language of the Eyes? – An Emotional Paradox.

Objective: Psychopathy is often characterized as an empathic dysfunction. Whether this also affects the identification of other's facial expression of emotions (cognitive empathy) remains a controversy, and the existing literature reports contradictory findings.

Participants and Methods: Seventy-five male inmates at Bergen prison participated in this study. Psychopathy was assessed through the use of Hares Psychopathy Check-List Revised (PCL-R) and the Self-Report Psychopathy (SRP-III). The "Reading the Mind in the Eyes" Test – revised (Adult Eyes Test; Baron-Cohen et al., 2001) was used to assess mentalizing (Theory of Mind) capabilities. The stimulus used was also categorized into three separate emotional valence categories (positive, neutral, and negative).

Results: Correlational analysis for the PCL-R revealed significant positive relation between primary psychopathy (e.g. callousness and grandiosity) and the ability to read "natural" eyes ($r=.292, p=.011$). There was significant negative relation between secondary psychopathy (impulsive and antisocial) and the reading of natural ($r=-.272, p=.018$) and negative eyes ($r=-.247, p=.033$). For the self-report there was an overall negative relation. Subsequent analysis using ANOVA revealed significant group differences between low, medium, and high scoring on PCL-R ($p<.05$). Both the low and high scoring group on primary psychopathy performed significantly better than the medium scoring group. No such significant group difference was found for secondary psychopathy (PCL-R) or for the self-report.

Conclusions: Individuals scoring high on primary psychopathy show no impairment in reading of others emotions. This ability may be "advantageous" in their manipulative behavior. Previous contradictory findings can maybe be accounted for by the use of different assessment method and/or the treatment of psychopathy as a homogenous construct. Correspondence: *Asle Makoto Sandvik, Cand.Psychol, Department of Psychosocial Sciences, University of Bergen, P.O.Box 7507, Bergen N-5020, Norway. E-mail: asle.sandvik@psyssp.uib.no*

C. SULLIVAN, L. EMERY, S. BARR, T. VANNORSDALL, C. MUNRO & D. SCHRETLEN. Childhood Lead Ingestion and Adult Intelligence in a Forensic Sample.

Objective: Studies of childhood lead ingestion and IQ have correlated blood lead levels (BLLs) with IQ testing administered concurrently or a few years later. To clarify whether lead ingestion in childhood shows a similar dose relationship with adult IQ and academic functioning, we analyzed socioeconomic and cognitive data obtained from adult plaintiffs referred for a neuropsychological examination by defense counsel in the context of litigation.

Participants and Methods: The sample included all plaintiffs (62 men, 64 women) referred to the Johns Hopkins Medical Psychology Clinic for assessment between 2005 and 2012. The sample was exclusively African Americans with a mean age of 20.4 (SD=1.8) years and a mean education of 10.5 (SD=2.0) years. We recorded each person's lowest (M=7.7; SD=4.4 µg/dL), highest (M=19.5; SD=8.2 µg/dL), and mean (M=13.3; SD=5.1 µg/dL) BLLs for correlation with educational attainment, IQ, academic achievement, and symptom validity testing (SVT).

Results: No BLL (lowest, highest or mean) correlated significantly with educational attainment, Full Scale IQ, academic achievement scores, or SVT performance. Nor did BLL show a significant association with employment status or history of special education, psychiatric illness or substance abuse. However, FSIQ scores correlated with maternal educational attainment ($\rho = .28$; $p < .003$) and arrest history ($\rho = -.25$; $p < .02$). We then regressed FSIQ scores on each person's three BLLs, maternal education, and TOMM Trial 2 scores. This yielded a significant ($F(5,83) = 7.9$; $p < .001$) model with a Multiple R of .40. Notably, only the beta weights for maternal education and TOMM Trial 2 were statistically significant.

Conclusions: In this sample, individual differences in childhood blood lead levels showed no significant association with adult educational attainment, IQ, or academic achievement test scores. However, maternal educational attainment and SVT performance accounted for approximately 16% of the variance in adult FSIQ scores.

Correspondence: *Campbell Sullivan, Psy.D., Johns Hopkins University, 600 N. Wolfe Street, Meyer 218, Baltimore, MD 21287. E-mail: asulli15@jhmi.edu*

Hemispheric Asymmetry/Laterality/Callosal Studies

A. PANOS, L.K. PAUL & W.S. BROWN. Impulsivity, Vigilance, and Attention in Agenesis of the Corpus Callosum: Results of the Continuous Performance Test.

Objective: A previous study suggested that children (ages 6-11) with agenesis of the corpus callosum (ACC) were viewed by parents as having difficulty with attention (Badaruddin et al, 2007). The current study directly assessed impulsivity, vigilance, and inattention in ACC using the Connor's Continuous Performance Test II (CCPT II), a test of temporally sustained visual attention.

Participants and Methods: Individuals with complete or partial ACC ($n=26$) were administered the CCPT II (ages 16-52, $M = 27.9 \pm 10.9$; 12 females; 6 partial). Each participant's scores on reaction time, errors of commission and omission, response style (β), and signal detectability (d') were converted to T-scores using age-specific norms. Single-sample t-tests were used to compare the ACC group with a standard T-score distribution (mean = 50).

Results: Although none of the mean T-scores differed significantly from 50, there were trends for elevated scores for errors of commission ($p = .06$) and detectability ($p = .09$). These trends were supported by individual data: 27% of ACC participants exceeded the clinical cut-off score on errors of commission and 23% on detectability, higher than the expected rate of 15.9% in a normal distribution.

Conclusions: These data suggest a very moderate level of inattentiveness in adults with ACC. Given the consistent parent observation of attention difficulties in their children with ACC, these results indicate either that problems with sustained attention become less marked in adulthood, or that this form of attention was not the primary source of these parent observations. Other studies suggest that problems in memory encoding may appear as inattention in ACC.

Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 180 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

J.L. REHMEL, L.K. PAUL & W.S. BROWN. Comprehension of Cartoon Humor in Individuals with Agenesis of the Corpus Callosum.

Objective: Persons with agenesis of the corpus callosum (ACC) may have normal measured intelligence, yet exhibit deficiencies in understanding the non-literal, second-order meanings of language. Previous research indicated that persons with ACC were also deficient in humor comprehension when asked to choose the most humorous ending to narrative jokes. In that study, appreciation of cartoon humor was not deficient, although there were very few cartoon items.

Participants and Methods: This research used the Watson Humor Task to evaluate comprehension of cartoon humor in 15 adults with complete or partial ACC (FSIQ > 80, $X = 98.47 \pm 13.64$) compared to an age- and IQ-matched control group ($n=14$). Participants rated the humor-ousness of 100 cartoons, involving both humorous and non-humorous items, and language and non-language dependent humor. Literal and nonliteral language comprehension scores from the Familiar and Novel Language Comprehension test, and the proverbs subtest of the Delis-Kaplan Executive Function System were used as covariates in secondary analyses.

Results: Two 2x2 repeated-measures ANOVAs (group by humorous/non-humorous, and group by language/non-language) revealed no significant differences between groups in ratings of humor-ousness, and no interaction effects. Covarying performance on tests of literal language, nonliteral language, or proverb comprehension did not result in group differences.

Conclusions: These results continue to support the differentiation between narrative jokes and cartoon humor with respect to deficiencies in humor comprehension in ACC. We theorize that single-picture cartoons (with or without verbal labels) do not reach a sufficient level of cognitive complexity (compared to narrative humor) for processing deficiencies to emerge in individuals with ACC.

Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 180 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

T. RENTERIA-VAZQUEZ, A. BECHUM, C. KANG, A. LIN, L.K. PAUL & W.S. BROWN. Social Inference in Individuals with Agenesis of the Corpus Callosum: Explorations with Topic Modeling.

Objective: Individuals with agenesis of the corpus callosum (ACC) and normal intelligence have deficits in social comprehension and inference, but it is difficult to objectively describe the nature of the deficiency. This research explored Topic Modeling (like cluster analysis in identifying clusters of words with semantic similarities; Steyvers & Griffiths, 2006) to analyze differences in semantic content of free-response descriptions of 4 animations involving 2 triangles (orange and blue) interacting. Normally these animations elicit inferences of mind and emotion (Castelli et al, 2002).

Participants and Methods: Sixteen adults (age 20-51) with complete ACC, all with FSIQ > 80, were compared with 15 age- and FSIQ-matched controls. Participants described what they saw in each animation. For each animation, topic modeling identified 10 topics from the corpus of all participant responses. Between-subject differences in topic scores, reflecting use of the topic in an individual's response, were analyzed in group-by-topic MANOVAs.

Results: There were trends for group difference for animations 1 (mocking) and 2 (coaxing). Topic 10 of animation 2 (involving "blue", "stop", "turns", "finally", "catch", and "accost") was more heavily loaded in the responses of controls than persons with ACC ($p < .03$). This topic reflected actions and intentions of the antagonist (blue triangle). Responses of controls also tended to include more of topic 8 in animation 1 ($p = .07$). This topic involved "bigger", "want", "home", "leaving", "push", and "saw", again reflecting inference of intentionality.

Conclusions: In both animations, persons with ACC tended to use less content from topics that reflected social inference. These results suggest the potential value of Topic Modeling of free spoken responses in the study of social inference in individuals with brain disorder.

Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 180 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

L.K. PAUL, C. CORSELLO, D.P. KENNEDY & R. ADOLPHS. Autism Spectrum in Agenesis of the Corpus Callosum.

Objective: The corpus callosum (CC) is one of several structures thought to feature abnormal long-range connectivity in autism, as borne out by decreased CC volume and decreased functional coupling between ho-

motopic cortical regions in autism. Agenesis of the corpus callosum (AgCC) is a congenital condition in which the ~190 million callosal fibers that normally connect the cerebral hemispheres fail to develop. This study characterizes the frequency of autism spectrum diagnoses (ASD) and nature of ASD symptoms in a large sample of adolescents and adults with isolated AgCC.

Participants and Methods: ADOS Module 4 was administered to 26 individuals with AgCC (age range = 16 - 54, mean = 28.77, sd = 11.25; FSIQ range = 78 - 129, mean = 94.17, sd = 14.56). Five participants had partial AgCC, 10 were female and 5 were fully right-handed. Parents of 14 participants completed ADI-R and 8 more completed SCQ.

Results: 18 out of 26 participants (69.23%) met diagnostic criteria for ASD (or autism) on the ADOS and/or parent report (ADI-R or SCQ). Diagnostic criteria were met in the following manner: both ADOS & parent report (n=4), ADOS but not parent report (n=2), ADOS only (n=1; no parent report available), and parent report only (n=11). Of the remaining 7 participants, 4 met ASD criteria on either the communication or social interaction domains of the ADOS.

On the ADOS, 3 met autism and 5 met ASD criteria (30.77% of total group). All 8 had complete AgCC. FSIQ of participants who met ASD criteria (range 77-113; mean=89.25) was lower than those who did not (range = 78-129; mean=96.80), but the ranges clearly overlapped and group difference was not significant ($p > .5$).

Conclusions: Our findings indicate that over 2 out of 3 individuals with Primary AgCC is likely to exhibit an ASD at some point in their lives and 30% will meet stringent diagnostic criteria for ASD in adulthood. Discussion will explore clinical implications of these findings and their support for the connectivity hypothesis of social deficits in autism.

Correspondence: Lynn K. Paul, Ph.D., Caltech, Caltech MC 228-77, Pasadena, CA 91125. E-mail: lkpaul@hss.caltech.edu

R. NAIR, J. TYSZKA, R. ADOLPHS & L.K. PAUL. Lateralized Brain Function Without a Corpus Callosum.

Objective: Language and motor systems are typically strongly lateralized in the brain. We tested whether direct callosal interaction between the hemispheres during development is required to establish lateralized function.

Participants and Methods: Eight adults with isolated complete AgCC and nine healthy controls performed unimanual motor and language tasks that are typically strongly lateralized. BOLD activation was quantified in anatomically defined regions of interest (ROIs). We calculated a laterality index (LI) for activation relative to rest within these ROIs, followed by an ANOVA (motor: group (2) by ROI (4) by hand (2); language: group (2) by ROI (6)).

Results: LI in the motor task differed significantly by hand and ROI, but not group. However, group interacted with ROI ($p < .001$, $np2 < .1$) and hand ($p < .0001$, $np2 < .01$). In both groups, LI for left and right hand tasks were as expected in M1, SMA and cerebellar ROIs. In basal ganglia, controls had right lateralization for both hands whereas AgCC had minimal LI for either hand, resulting in a significant group difference ($p < .005$, $np2 = .24$).

On the language task, controls showed greater left lateralization overall than AgCC ($p < .0001$, $np2 = .15$). Controls were left lateralized for all ROIs, but right lateralized in AgCC for all ROIs except the temporal pole.

Conclusions: Despite the lack of callosal connections, people with AgCC develop typical lateralization for simple motor tasks in core motor processing regions, but diminished lateralization in basal ganglia. By contrast, language generation in AgCC showed considerably less left lateralization. These findings suggest that basic sensorimotor functioning may be lateralized without direct callosal developmental interaction between the hemispheres, whereas language lateralization requires such interaction.

Correspondence: Lynn K. Paul, Ph.D., Caltech, Caltech MC 228-77, Pasadena, CA 91125. E-mail: lkpaul@hss.caltech.edu

Imaging (Functional)

A.D. BAZINET, J.L. WINWARD, N.M. BEKMAN, C. PULIDO, S.F. TAPERT & S.A. BROWN. fMRI Correlates of Risky Decision Making in Adolescent Alcohol-Users.

Objective: Risk-taking behavior often emerges and peaks in adolescence, and is thought to have a neurobiological basis, as the brain undergoes rapid changes during this time. Alcohol use is itself a risk-taking behavior, and initiation of drinking in adolescence may contribute to neural functioning changes, which may lead to impaired decision-making in risky situations.

Participants and Methods: Functional neuroimaging (fMRI) assessed brain response during a risky decision-making task in adolescents aged 16-18 with histories of recent heavy alcohol use (n=27) and non-users (n=17). In a Balloon Analog Risk Task (BART), participants inflated balloons by entering a number of pumps, earning 1 cent per pump unless the balloon popped; a higher value indicated a riskier choice. Participants also completed memory and executive functioning tasks, and self-report questionnaires on personality and substance use behavior. Neuroanatomical regions of interest were identified, and independent samples t-tests compared brain response (to anticipation and feedback conditions) between groups. Bivariate correlations examined the relations of brain response, cognitive performance, and personality/behavior.

Results: Performance on the BART did not differ between groups. Compared to non-users, heavy-drinking adolescents showed greater response in the ventromedial prefrontal cortex (VMPFC) when receiving feedback that balloons had popped (cluster = 459 μ l; $p < .01$). Greater VMPFC response correlated ($p < .05$) with more rule-breaking behavior ($r = .40$) and impulsivity ($r = .49$), less approach motivation ($r = -.32$), and poorer long-delay free recall memory performance ($r = -.30$).

Conclusions: Adolescent alcohol-users had greater brain response to negative feedback during a risky decision-making task than did non-users. The VMPFC has previously been linked to affective processing and reward prediction, and abnormalities in this region may contribute to a higher propensity for risk-taking.

Research support: F31 AA018054 (Bazinet) & R21 AA017321 (Brown)
Correspondence: Alissa D. Bazinet, M.S., SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 6363 Alvarado Ct., Suite 103, San Diego, CA 92120. E-mail: abazinet@projects.sdsu.edu

S.E. BRUCE, K. BUCHHOLZ, W. BROWN, L. YAN, A. DURBIN & Y.I. SHELINE. Cognitive Behavior Therapy for PTSD in Women Victimized by Interpersonal Violence: Examination of the Neural Correlates of Treatment Outcome using fMRI.

Objective: The goal of the current study is to examine brain activity differences after cognitive behavioral therapy during a cognitive task with emotional activation. Significant fMRI changes as a result of successful treatment may have profound implications for the development and refinement of psychological treatments for PTSD.

Participants and Methods: 20 female participants meeting criteria for PTSD (mean age 27) received 12 weeks of cognitive processing therapy (CPT) at the Center for Trauma Recovery. All participants underwent MRI scanning in a 3T Siemens TRIO system. Functional images were collected in runs using an asymmetric spin-echo sequence BOLD contrast T2* weighted. These images were acquired while participants performed an "emotional conflict" task in which emotionally laden images from the Ekman series were distracters in a matching task. Each participant completed two MRI scans: one at baseline and one at the conclusion of the 12-week psychotherapy.

Results: Comparing Time 1 and Time 2 differences (pre-post therapy), several significant differences were found in the prefrontal cortex (PFC). Specifically, participants had higher right and left dorsal later PFC activation at Time 2 compared to Time 1 in the "attend fear" condition as well as significantly higher ventral medial PFC activation at Time 2. Significant activation differences were also found in the right hippocampus and right amygdala following treatment

Conclusions: Our results indicate significant alterations in DLPFC activation after successful psychotherapy for participants with PTSD, which may be predictive of overall treatment response. Further analyses examining the specific PTSD symptom clusters and their relationship with brain regions will be discussed regarding the development and maintenance of PTSD

Correspondence: *Steven E. Bruce, Ph.D., Psychology, University of Missouri-St. Louis, One University Blvd, Weinnmann Bldg, 1st Floor, St. Louis, MO 63121. E-mail: brucese@umsl.edu*

N. BUGESCU, P. GIMENEZ, J.M. BLACK, H. TANAKA, B. CASTO, T. SORIANO, E. KUTNER, M. TUMBER, R. MARTINEZ, A. THURSTON & F. HOEFT. Neurobiological Correlates of Handwriting Skill.

Objective: Although advances in neuroimaging techniques have elucidated the neural underpinnings of reading acquisition, comparatively little is known about the neurobiological correlates of handwriting. This study aims to investigate the neural architecture of handwriting in beginning writers and aims to provide a framework for the neural basis of impaired handwriting.

Participants and Methods: Handwriting skills of 51 children (mean age 5.59 years) were ranked from worst (=1) to best (=51) by two blinded investigators who were trained to score based on legibility irrespective of spelling errors. Ranked scores were correlated with functional MRI (fMRI) brain activation during a meta-phonological task, in which children judged whether a pair of pictures of common objects or animals started with the same sound. Meta-phonological processing has been identified as an important precursor to reading, handwriting, and spelling acquisition. Analyses focused on regions of interest (e.g., Broca's area, fusiform gyrus) identified by extant work as significant neural correlates of handwriting.

Results: Poorer handwriting was positively associated with greater activation during phonological processing in the right inferior frontal gyrus (IFG; worse handwriting = greater right IFG activation) within Broca's Area/Brodman Area 45/pars triangularis (TAL: X=44, Y=24, Z=15; peak T=3.74; p=0.033 corrected; mean cluster $r(40) = -0.43$). The positive correlation remained significant even after regressing out variables that significantly correlated with handwriting skills, such as age ($r(41) = 0.305$, $p = .053$) and gender ($t(41) = 2.542$, $p = 0.016$ [girls = better handwriting]).

Conclusions: While the causal mechanism is unclear, we propose that poorer handwriting during early development stems from (or is strongly associated with) inefficient brain systems subserving phonological processing, which is reflected by the increased activation in a brain region involved in phonological manipulation and planning as well as subvocalization.

Correspondence: *Nicolle Bugescu, MS, University of California, San Francisco, 401 Parnassus Ave., San Francisco, CA 94143. E-mail: nicolle.bugescu@gmail.com*

C.M. BURNS, A.W. KASZNIAK, K. CHEN, W. LEE & E.M. REIMAN. Elevated Fasting Serum Glucose Levels and Brain Function: An FDG PET Study of Younger Adults.

Objective: Elevated indicators of poor glucose control have been associated with lower scores on tests of cognitive functioning and decreased measurements of brain function and structure in older adults. For example, studies have shown that elevated fasting serum glucose (FSG) has been associated with reduced regional cerebral metabolic rate for glucose (rCMRgl) in Alzheimer's disease (AD) related areas in cognitively healthy older adults without diabetes. Furthermore, higher levels of insulin resistance have been associated with lower scores of language functioning and less gray matter volume in older adults. In order to investigate whether these associations occur earlier on in the lifespan, we investigated the association between elevated FSG and rCMRgl in a sample of young adults.

Participants and Methods: This is a cross sectional study of 31 cognitively normal non-diabetic participants 31.2 ±5.4 years of age with an average FSG level of 81.4 mg/dl (±8.2) which ranged from 69-100 mg/dl. General linear model based voxel-wise analyses were performed to examine the overall negative correlation between fasting serum glucose and rCMRgl.

Results: Higher FSG levels were associated with reduced rCMRgl in AD-related right parietotemporal areas as well as left and right inferior frontal areas which corresponded with Broca's area ($p < .005$, uncorrected for multiple comparisons).

Conclusions: Elevated FSG may have an impact on cerebral metabolism in earlier adulthood. These results underscore the importance of lifestyle or psychosocial interventions that address glucose control and brain health across the lifespan.

Correspondence: *Christine M. Burns, M.A., Department of Psychology, University of Arizona, PO Box 210068, Tucson, AZ 85721. E-mail: cmburns@email.arizona.edu*

J. CHOI. Dysfunctional brain change in the anticipatory reward system in young adults with pathological gambling.

Objective: The reward system is involved in the pathophysiology of pathological gambling (PG). To elucidate the neural activities specific to the anticipation phase of reward in PG, we performed event-related functional magnetic resonance imaging (fMRI) in young adults with PG and compared them with healthy controls.

Participants and Methods: Fifteen male patients with PG and 15 healthy controls, group-matched for age, gender, and IQ, participated in a monetary incentive delay task during fMRI scanning. We included only male subjects based on the findings showing predominant male prevalence in PG and sex differences in the neural response to reward stimuli. Furthermore, we included young adult patients with PG who had an illness duration of <5 years to elicit earlier brain changes in the PG reward system.

Results: Neural activities in the ventromedial caudate nucleus and the thalamus during gain anticipation decreased in PG relative to those in healthy controls. During loss anticipation, anterior insular activation in PG showed significantly positive correlation with South Oaks Gambling Screen score.

Conclusions: Decreased neural activity in the ventromedial caudate nucleus and the thalamus during anticipation may be a specific neurobiological feature for the pathophysiology of PG. Correlation of anterior insular activity during loss anticipation with PG symptoms suggests that patients with PG show enhanced sensitivity to negative reward as PG symptoms deteriorate. Our findings have identified neural correlates related to the anticipation of reward in young adult patients with PG who were in the early stages of illness.

Correspondence: *Jung-Seok Choi, MD, PhD, Department of Psychiatry, SMG-SNU Boramae Medical Center, 425 Shindaebang-dong, Dongjak-gu, Seoul 156-707, Republic of Korea. E-mail: choijs@neuroimage.snu.ac.kr*

J. GESS, J.K. FAUSETT & G. JAMES. Building the Cognitive Connectome: A Case Study with Temporal Lobe Epilepsy.

Objective: Neuropsychology plays a critical role in assessing functional status prior to neurosurgery, but its ability to inform is hampered by patient variability. Thus functional neuroimaging has great potential to add to the understanding of brain function to thereby guide surgical decision making. The barrier to functional neuroimaging's clinical use is the lack of large normative samples. We address this limitation by building the Cognitive Connectome (CC) – an exploration of normative variability in cognition and brain function which, like the Human Genome Project, will integrate functional neuroimaging into individualized patient-oriented care as demonstrated in the present case.

Participants and Methods: Patient is a 51-year old right handed male with refractory left TLE seen for neuropsychological testing and fMRI tasks as part of a presurgical evaluation. His results are compared to CC healthy control participants (n=10) who underwent comprehensive Neuropsychological evaluations in addition to a wide range of fMRI tasks. Using these controls we have established a preliminary continuum relating brain function and cognition for numerous tasks

Results: The patient had average abilities for most cognitive domains except moderately impaired phonemic verbal fluency. When his performance and functional activation on two tasks (COWAT and JLOT) are compared to controls, his results are comparable to controls on spatial perception, but are well off the continuum for the COWAT (lower performance and higher parahippocampal activation).

Conclusions: This case provides an example of how fMRI may be integrated into clinical evaluation through the use of the Cognitive Connectome. Integrating neuroimaging into patient care will provide additional, unique inference into patient state, thereby directly impacting clinical decision making. The CC will be used to develop neural phenotypes to better understand the individual impact of a condition or injury and will be broadly applicable across neurologic and psychiatric illnesses.

Correspondence: *Jennifer Gess, Ph.D., University of Arkansas for Medical Sciences, 4301 W. Markham St., #568, Little Rock, AR 72205. E-mail: gessjenniferl@uams.edu*

M. GILLIS & B.M. HAMPSTEAD. Working Memory Contributes to the Encoding of Object Location Associations.

Objective: A recent model posits that the encoding of object location associations (OLAs) requires the coordination of several distinct cognitive processes that rely on ventral (object perception) and dorsal (spatial perception) visual pathways as well as the hippocampus (integration; Postma et al., 2008, *Neurosci. and Behav. Rev.*, 32). Within the model, prefrontal recruitment is believed to contribute to both the spatial processing and working memory demands of the task. The current study investigated the extent to which working memory contributes to OLA encoding using functional magnetic resonance imaging (fMRI).

Participants and Methods: Twelve right-handed males (mean age = 25 yrs) encoded OLAs and performed standard n-back tasks (0 and 2-back) during fMRI scanning. Activation maps were created to assess the brain regions mediating each task independently (OLA: novel stimuli > repeated stimuli; n-back: 2-back > 0-back). We overlaid these maps to identify brain regions that were uniquely recruited by each task and then performed a conjunction analysis to identify shared regions.

Results: Participants demonstrated bilateral activation within regions of the ventral and dorsal visual streams, hippocampus, and ventrolateral prefrontal cortex during successful OLA encoding. The 2-back > 0-back contrast revealed a standard working memory network involving the ventrolateral and dorsolateral prefrontal cortex, superior parietal lobule and intraparietal sulcus. Conjunction analysis demonstrated several regions of common activations bilaterally within the ventrolateral and medial superior prefrontal cortex, superior parietal lobule, and intraparietal sulci. Activation within the dorsolateral prefrontal cortex was unique to the working memory tasks.

Conclusions: Working memory appears to play a limited role in OLA encoding, potentially mediating the mental holding rather than the manipulation of new information.

Correspondence: *Meredith Gillis, Ph.D., Rehabilitation Medicine, Emory University, 1441 Clifton Road NE, Atlanta, GA 30322. E-mail: mmgilli@emory.edu*

T. HASHIMOTO. Dissociations in body size perception between width and thickness.

Objective: Body size can vary throughout one's lifetime, influenced by one's lifestyle. Changes in horizontal width accompany those in dorsal-to-ventral thickness. To examine differences in the perception of different body axes, neural correlates of own-body size perception in horizontal and dorsoventral directions were compared using fMRI

Participants and Methods: Eleven healthy right-handed female subjects aged 19–27 years participated in this study. Mean body mass index was 19.5. Written informed consent was obtained from each participant, and the experiment was conducted in accordance with the Declaration of Helsinki and was approved by the Ethical Committee of Keio University, Japan.

Original and distorted (-30%, -10%, +10%, and +30%) images of the neck-down region of participants' own bodies were presented, and they were then asked whether the images were their own or not based explicitly on body size.

Results: Participants perceived body images distorted by -10% as their own, whereas those distorted by +30% as belonging to others. Horizontal width images yielded slightly more subjective own-body perceptions than did dorsoventral thickness images. Subjective perception of own-body size was associated with bilateral inferior parietal activity. In contrast, others' judgment showed pre-supplementary motor and superior parietal activity. Expansion in the dorsoventral direction was associated with the left fusiform gyrus and the right inferior parietal lobule, whereas horizontal expansions were associated with activity in the bilateral somatosensory area.

Conclusions: The results suggest that unfamiliar dorsoventral images of thickness may require visual processing, whereas bodily sensations are involved in horizontal body size perception. Somatosensory rather than visual process could be critical for one's frontal body appearance. Correspondence: *Teruo Hashimoto, Symbolic Cognitive Development, RIKEN, 2-1 Hirosawa, Wako 351-0198, Japan. E-mail: t-hashimoto@brain.riken.jp*

T. IIDAKA & T. HARADA. Neural Correlates of False Recognition for Face in Short-term Memory: 3T-fMRI Study.

Objective: False memory is a well-known phenomenon in which semantically or perceptually related lure items are wrongly remembered as old items and has been known to involve long-term memory. A recent study showed that false memory for word occurred in a short-term memory range (e.g., less than 5 s) and that the prefrontal cortex (PFC) mediated an interference effect of semantically related items. In this study, we investigated whether face stimuli could induce false memory in a short-term memory range and the brain regions involved in such false memory by using functional magnetic resonance imaging (fMRI).

Participants and Methods: Sixteen normal subjects participated in the study. We created face stimuli similar to each other by using a morphing technique. In each trial, the subjects were first shown 3 different faces (study faces) simultaneously for 3500 ms. After a 500-ms fixation period, a probe face was presented, and the subjects were asked to judge whether this face was one of the study faces. There were 3 conditions: OLD, the probe face was one of the study faces; LURE, the probe face was similar to but different from the study face; and NEW, the probe face was not a study face. We conducted 60 trials for each condition. Brain activity was measured using a 3T MRI scanner. Image data were analyzed by SPM8 and random effects model (threshold was set at $p = 0.005$).

Results: The subjects judged the probe face as a study face more frequently in the LURE than in the NEW condition ($p < 0.01$), indicating an occurrence of false memory. fMRI showed that the regions in the right PFC and anterior cingulate cortex (ACC) were more active in the LURE than in the OLD condition.

Conclusions: Our results showed that false memory for face involves neural activation in the PFC and ACC. Previous neuroimaging studies have reported that these regions play a role in attention and error processing. Together, these results suggest that perceptual interference increases neural activity in these frontal regions.

Correspondence: *Tetsuya Iidaka, M.D., Department of Psychiatry, Nagoya University, Graduate School of Medicine, 65 Tsurumai, Showa-ku, Nagoya 466-8550, Japan. E-mail: iidaka@med.nagoya-u.ac.jp*

S. LEAL, S. TIGHE, S.M. STARK, C.E. STARK & M.A. YASSA. Age-related Alterations in Intrinsic Functional Connectivity Networks Measured With Resting State FMRI.

Objective: Aging is associated with changes in intrinsic connectivity networks (ICNs). The goal of this study was to evaluate group differences in ICN functional correlations in healthy young and older adults using resting state fMRI.

Participants and Methods: We evaluated resting state fMRI data from 14 young adults (mean age 25.6 + 4.9) and 17 older adults (mean age 68.4 + 3.7). 3mm whole brain EPI data was collected on a Philips 3T scanner. Functional connectivity analyses were conducted within the CONN Toolbox for SPM8. Briefly, scans were slice-timing corrected, motion-corrected, registered to a central EPI template, and smoothed with a 6mm Gaussian kernel. The resulting time series was then subjected to a voxel-by-voxel correlational analysis while excluding the effect of motion regressors. Second-level group analyses proceeded using a graph theoretical approach with seeds placed bilaterally in the posterior cingulate/precuneus network, medial temporal lobe regions, and the medial prefrontal cortex.

Results: We found that compared with young adults, older adults had reductions in the number of regions functionally connected with each seed region, but the remaining regions were more strongly functionally connected with each other, suggesting that there is a shift from distributed to more local processing. This pattern was apparent across all three networks tested (medial temporal, posterior cingulate/precuneus, and medial prefrontal).

Conclusions: Aging is associated with re-organization of intrinsic connectivity networks during rest. Network processing shifts from a more distributed pattern in young adults to a less distributed (fewer nodes, with greater within-region connectivity) in older adults. This may reflect an age-related shift in processing or a shift in cognitive bias. Rest is often an active process. Older adults may engage in different cognitive activities during rest than young adults, and this may also explain some of the group differences observed.

Correspondence: *Michael A. Yassa, Ph.D., Psychological and Brain Sciences, Johns Hopkins University, 3400 N. Charles St., Ames 216A, Baltimore, MD 21287. E-mail: yassa@jhu.edu*

S. TIGHE, S. LEAL, S.M. STARK, C.E. STARK & M.A. YASSA. Resting State fMRI Functional Connectivity in Individuals with Mild Cognitive Impairment.

Objective: Alzheimer's disease is associated with changes in intrinsic connectivity networks (ICNs). The goal of this study was to evaluate group differences in ICN functional correlations in healthy older adults and MCI patients using resting state fMRI.

Participants and Methods: Resting fMRI data from 17 healthy older adults (mean age 68.4 + 3.7) and 7 older adults with MCI (mean age 74.9 + 9.7) were compared. Functional connectivity analyses were conducted within the CONN Toolbox for SPM8. Scans were slice timing and motion corrected, registered to a central EPI template, and smoothed using a 6mm Gaussian kernel. The resulting time series was then subjected to a voxel-by-voxel correlational analysis while excluding the effect of motion regressors. Second-level group analyses proceeded using a graph theoretical approach with seeds placed bilaterally in the posterior cingulate/precuneus network, medial temporal lobe regions, and the medial prefrontal cortex.

Results: Overall, we found a breakdown in ICN correlations across all networks examined in MCI where fewer nodes per network were correlated and the degree of correlation was reduced. We found an increase in anti-correlation (negative functional connectivity) between the medial temporal lobe (MTL) and the frontal lobe in MCI patients that we did not find in controls. Furthermore, we found that performance on the Rey Auditory Verbal Learning Test (RAVLT) delayed recall measure was mediated by medial temporal to frontal connectivity in the MCI group only.

Conclusions: Our results suggest that there are global reductions in network communication in MCI. The anti-correlation found in MCI patients between the medial temporal and frontal networks suggests that there is a shift in network-network communication where perhaps network synchrony is phase-shifted compared to controls. The correlation in MCI patients between RAVLT delay recall and MTL-frontal connectivity suggests that communication between those two networks is important for performance of this task.

Correspondence: *Michael A. Yassa, Ph.D., Psychological and Brain Sciences, Johns Hopkins University, 3400 N. Charles St., Ames 216A, Baltimore, MD 21287. E-mail: yassa@jhu.edu*

J.D. MEDAGLIA, C. DANCY, T. BOCHNAKOVA, N. DEPINTO & F. HILLARY. An Automated Person-Specific Approach to Region of Interest Selection in fMRI Data.

Objective: Region of interest (ROI) definition is a critical step in most fMRI data analyses but procedures bias the data through data "normalization" and aggregation of the fMRI signal for ROI localization. These procedures result in the loss of person-specific features that may hold unique importance in the interpretation of fMRI data, which is critical when heterogeneity is high. We demonstrate substantial inter-subject variability in the functional neuroanatomy involved in a well-established working memory task. In order to leverage this heterogeneity for group analysis, a novel data reduction procedure is described to derive ROIs using both anatomical and person-specific functional information.

Participants and Methods: fMRI data acquired during WM task performance from 12 individuals with moderate to severe traumatic brain injury were preprocessed according to conventional parameters in SPM8. Timecourses of areas commonly involved in WM (e.g., Brodmann's Area 46) were extracted and submitted to exploratory Independent Component Analysis (ICA). Then, data were preprocessed without normalization and spatial smoothing. Person-specific reverse-normalized anatomical ROIs were used to sample Brodmann's area data. Data was then submitted to ICA for comparison with the conventionally defined ROIs.

Results: Component structures demonstrated considerable heterogeneity across individuals in normalized data. Additionally, analysis of the person-specific anatomically and functionally defined ROIs yielded a significant increase in recovered components.

Conclusions: The results demonstrate that substantial variance exists within examined regions of the brain in the clinical sample that is masked by conventional ROI selection approaches. This variance may hold as yet unknown implications for heterogeneity in cognitive functioning. In order to leverage this variance for later analyses, an analytic framework and toolbox is described with implications for 2nd-level analyses of fMRI timeseries in healthy and clinical contexts.

Correspondence: *John D. Medaglia, M.S., Psychology, Pennsylvania State University, 347 Moore Building, University Park, State College, PA 16802. E-mail: jdm454@psu.edu*

L. MEUSEL, R. CABEZA, J. JENNINGS, C. GRADY, P. EBERT, S. GRAHAM & N. ANDERSON. The Neural Bases of Recollection & Familiarity in High- and Low-Performing Older Adults.

Objective: Familiarity-based memory is immune to healthy aging, whereas context-dependent recollection declines. To explore individual differences in the neural bases of these effects, we collected fMRI during a source recognition task sensitive to recollection and familiarity.

Participants and Methods: Older adults were divided into two groups based on standardized memory test performance (25 Lo, 16 Hi). 160 words were presented, half visually/half auditorily, with each word repeated in the same or different modality after a lag of 3 or 16 intervening words. The task was to respond "yes" to same repeats (accurate responses are mediated by recollection, familiarity, or both) and "no" to new words and to different repeats (accurate responses are contingent on recollection of the original modality).

Results: As predicted, recollection was reduced in the Lo group at both lags, $F(1,78) = 9.89$, $p = .002$, but familiarity did not differ between groups. Neuroimaging data (AFNI) revealed three significant Group x Task interactions. At lag 16, the Hi group showed stronger activation to repeated words than new words in the left precuneus and left parahippocampal gyrus, whereas the Lo group showed no differences in acti-

variation across conditions. Group x Same/Different interactions at both lags showed greater activity for different than same repeats in the Hi group, and the opposite pattern in the Lo group. These interactions involved the left lateral temporal lobe and right insula/inferior frontal gyrus (lag 3), and the posterior cingulate (lag 16).

Conclusions: In the Lo group relative to the Hi group, decreased activation to repeated words in the precuneus and parahippocampal gyrus suggests the neural bases of lower memory performance. Across groups, differential activation to same and different repeats suggests that brain regions involved in recollection in the Hi group are activated more by familiarity in the Lo group, possibly reflecting over-reliance on automatic, familiarity-based memory in the face of decreased recollection. Correspondence: *Liesel-Ann Meusel, PhD, Rotman Research Institute, Baycrest Centre for Geriatric Care, 3560 Bathurst St, Rm. 722, Rotman Research Institute, Toronto, ON M6A2E1, Canada. E-mail: lmeusel@research.baycrest.org*

M. NAESER, M. HOLLENBECK, M. HO, P.I. MARTIN, E. TREGLIA, M.H. KRENGEL, M.R. HAMBLIN & B. DICKERSON. Functional Connectivity (fcMRI) Increase in Language Network after Left Scalp Application of Red/Near-infrared, Light-emitting Diodes (LED) in Primary Progressive Aphasia - Potential for Treatment Research.

Objective: Primary progressive aphasia is a devastating neurodegenerative syndrome without current treatment. Application of red/near-infrared (NIR) wavelengths of light to hypoxic/compromised cells using light-emitting diodes (LED) has beneficial effects including 1) improved mitochondrial function with increased production of ATP, improving cellular function; 2) increased rCBF (vasodilation) triggered by release of nitric oxide from hypoxic/compromised cells. This study examined resting state functional connectivity (rs-fcMRI) after scalp application of Sham or Real LED to L perisylvian language network.

Participants and Methods: One PPA case (71YrF, 3-Yr Hx. PPA) was studied with rs-fcMRI immediately before and immediately after scalp application of red/NIR LED to L perisylvian areas, at different energy density dosages (0, 2 and 13 Joules/cm²). LED is non-invasive, painless, non-thermal (500mW LED, MedX Health, Toronto), FDA-cleared, non-significant risk. Each LED cluster head had a 2" diameter. A mean whole-brain rs-fcMRI correlation map was generated from a spherical ROI (radius=6mm) located in L IFG, in order to establish an optimized representation of this network. Spherical ROIs centered at the coordinates of maximum correlation strength were then located within MFG and MTG. These ROIs subserved language processing, and demonstrate robust rs-fc in healthy individuals. Pair-wise correlation measures were calculated for each ROI-pair at all 3 dosages, before and after the LED therapy, separately. A summary measure of language network functional connectivity strength before and after LED was computed by averaging the correlation strengths of the 3 ROI-pairs.

Results: Neither Sham, nor 2 J/cm² LED dosages modulated this language network connectivity summary measure. The 13 J/cm² dosage robustly increased connectivity within the network.

Conclusions: These preliminary data demonstrate: 1) LED therapy affects the language network; 2) rs-fcMRI may be useful for demonstrating that a treatment can modulate the language network.

Correspondence: *Margaret Naeser, PhD, Harold Goodglass BU Aphasia Research Center, VA Boston Healthcare System, JP, VA Boston Healthcare System, JP Campus, 150 So. Huntington Ave., Boston, MA 02130. E-mail: mnaeser@bu.edu*

M. PARSONS, S. DURGERIAN, C. REECE, L. MOURANY, A. BURA, M. LOWE, E. BEALL, K. KOENIG, R. SCHEIBEL, M. NEWSOME, M. TROYANSKAYA, H. LEVIN & S. RAO. Abnormal Brain Activation During Inhibitory Control in Blast-Related Mild/Moderate TBI.

Objective: Blast induced mild to moderate traumatic brain injury (MTBI) has become the signature injury of military personnel involved in Operations Enduring Freedom and Iraqi Freedom (OEF/OIF). This study used functional MRI (fMRI) during an inhibitory control task to determine if blast-related MTBI has a differential effect on brain function in comparison to civilian MTBI caused primarily by mechanical forces.

Participants and Methods: Four subject groups participated: (1) military TBI (milTBI; n=21; age=28.3 yrs, ed=12.7 yrs) sustained one or more blast induced MTBI between 1 and 6 years prior to enrollment; (2) military controls (milCON; n=22, age=29.7, ed=14.1); (3) civilian TBI (civTBI, n=21, age=26.2, ed=15.1) sustained a non-blast MTBI 1-6 years prior to enrollment; and (4) civilian controls (civCON; n=23, age=27.3, ed=15.5). Subjects completed the Stop Signal (SS) task, a measure of inhibitory control, while undergoing fMRI; 2 [mil, civ] X 2 [tbi, con] ANOVAs were used to evaluate fMRI data and task performance corrected for multiple comparisons.

Results: SS behavioral performance was comparable across the 4 groups with slightly poorer performance in military than civilian subjects. During correct inhibition trials, fMRI activation was lower in the TBI than CON subjects in regions commonly associated with the default mode network. In contrast, during incorrect inhibition trials, significant interactions were observed indicating differences between blast and non-blast (mechanical) TBIs in the inferior temporal lobe, caudate, and cerebellum, with significantly greater activation in the milTBI than civTBI groups.

Conclusions: MTBI is associated with abnormal brain activation in response to an inhibitory control task. Whereas correct inhibitions are associated with a generalized TBI effect (less activation in MTBI than controls), the brain response to incorrect inhibitions suggests a unique pattern of brain activation in persons exposed to blast injury. Supported by DOD W81XWH-08-2-0124, Rao & Levin, PI's.

Correspondence: *Michael Parsons, Ph.D., Cleveland Clinic, 9500 Euclid Ave, Cleveland, OH 44195. E-mail: parsonm2@ccf.org*

J.R. PERAZA, J.L. GESS, J.S. FAUSETT, A.J. RENO, T. KEARNEY-RAMOS & C. JAMES. Emotional Regulation and Change in Brain Response from Novel to Familiar Emotional Images.

Objective: Exposure to emotionally valent visual images is related to increased limbic activity and is greater for novel versus familiar stimuli. Limbic activity also decreases when instructed to reappraise emotionally valent images. The current study examined the relationship between emotion regulation (i.e., reappraisal and suppression) and change in brain response from novel to familiar emotionally valent images. These data were collected through the Cognitive Connectome project, which seeks to translate functional neuroimaging into personalized medicine by comprehensively mapping normative variability in cognition and brain function.

Participants and Methods: Using fMRI, 14 participants performed an event-related recognition paradigm in which they identified 45 previously viewed emotionally valent images (15 positive, 15 negative, and 15 neutral) from 45 novel distracters. The change in these regions' activity across conditions (novel and familiar) was correlated with suppression (inhibition of emotional responses) and reappraisal (rethinking of emotional responses) from the Emotion Regulation Questionnaire.

Results: Tendency to suppress emotions was negatively correlated with right temporal pole (TP) activity for novel negative and positive images and negatively correlated with right amygdala for novel positive images. Change in brain response with familiarity revealed significant negative correlations between tendency to suppress and left TP for negative images, and negative correlation between emotional reappraisal and anterior cingulate cortex (ACC) for positive images.

Conclusions: The current study suggests different relationships between emotional regulation using reappraisal and suppression and brain response to novel and familiar emotionally valent images within the TP, ACC, and amygdala. Although amygdala response was greater for novel than familiar negative images, change did not correlate with emotion regulation. Future research should seek to better understand the role of the TP in emotion regulation.

Correspondence: *Jennifer R. Peraza, M.A., Central Arkansas Veterans Healthcare System, 2200 Fort Roots Drive, North Little Rock, AR 72114. E-mail: pera3470@pacificu.edu*

A.J. RENO, J.S. FAUSETT, J.L. GESS, J.R. PERAZA, T. KEARNEY-RAMOS & G. JAMES. Neural Activity and Behavioral Performance on Measures of Working Memory Among Healthy Subjects.

Objective: The n-back task is a commonly used measure of working memory in neuroimaging research; however, little is known about the relationship between neural activity on the n-back task and behavioral performance on commonly used neuropsychological measures. The purpose of the current investigation was to examine the relationship between neural activity on the n-back task and two commonly used neuropsychological measures of working memory (Digit Span and Spatial Span), as well as DKEFS Trails 4, which has also been hypothesized to involve working memory. These data were collected through the Cognitive Connectome project, which seeks to translate functional neuroimaging into personalized medicine by comprehensively mapping normative variability in cognition and brain function.

Participants and Methods: Participants (N = 17) underwent fMRI scanning while performing an n-back task with alternating blocks of 2-back and 0-back trials. A general linear model determined 10 brain regions as more active during 2-back than 0-back conditions, most prominent in the bilateral posterior parietal and bilateral superior frontal cortices. The change in these brain regions' activity across conditions was correlated with neuropsychological tests.

Results: Performances on Trails 4 and Spatial Span (Total) were highly correlated. In contrast, performance on Digit Span (Forward, Backward, Sequencing and Total) was not correlated with performances on either Spatial Span or Trails 4. Performance on Trails 4 and Spatial Span correlated only with activation in the left parietal region on the n-back task, while Digit Span did not correlate with any neural regions activated by the n-back task.

Conclusions: These results suggest parietal involvement in working memory tasks with spatial demand, but found no relationship between frontal cortex and the most established measure of working memory (Digit Span). Future research will examine the relationship of the n-back task to other neuropsychological measures to further clarify the nature of the task.

Correspondence: *Ashley J. Reno, Psy.M., School of Professional Psychology, Wright State University, 16401 Chenal Valley Drive, Little Rock, AR 72223. E-mail: reno.9@wright.edu*

E.M. MÜLLER-OEHRING, E.V. SULLIVAN, Y. JUNG, W. HAWKES, A. PFEFFERBAUM & T. SCHULTE. The Restless Brain of Alcoholics.

Objective: Chronic alcohol consumption affects multiple cognitive processes supported by far-reaching neural networks. With functional MR imaging, intrinsic functional networks are reflected in patterns of coherent synchronous activity between brain regions possibly disrupted by alcoholism.

Participants and Methods: We investigated the impact of chronic alcoholism on 9 intrinsic functional networks: the default mode network (DMN), executive control (EC), attention (AT), reward (RW), salience (SA), emotion (EM), visual (VI), auditory (AU), and sensorimotor (SM). Participants were 27 sober alcoholics and 26 age-matched controls who underwent functional connectivity MRI. Subjects were instructed to lie relaxed with eyes open during a 5 min fMRI scan. Functional connectivity analysis comprised time series over 135 brain volumes per subject.

Results: Alcoholics and controls demonstrated similar regional connectivity within all 9 intrinsic functional connectivity networks. Despite similar patterns, seeded network connectivity analyses identified more regions in alcoholics than controls outside of regions common to both groups in the DMN, EC, AT, RW, SA, VI, SM, but not in EM or AU.

Conclusions: This pattern of extended synchrony outside the main networks suggests an alcohol-related dedifferentiation of intrinsic connectivity or an expansion to compensate for potential impairment in regional or network recruitment. Based on previous evidence for better task performance heralded by greater functional DMN synchrony, the currently observed alcohol-related intrinsic connectivity differences in multiple networks may reflect altered functional organization, which is needed to prepare for switching between network functions and for ex-

erting executive control when needed. This constellation of altered intrinsic networking may also contribute to clinical markers of alcoholism, including impaired executive control, cognitive switching, reward evaluation, and visuospatial processing. Support: AA018022, AA012388, AA017168, AA010723, AA017923

Correspondence: *Tilman Schulte, PhD, Neuroscience Program, SRI International, 333 Ravenswood BN154, Menlo Park, CA 94025. E-mail: til@stanford.edu*

J. SCOTT, K.M. WROCKLAGE, J. JORDAN, A. CHRISTENSEN, V. WEISSER, M. TREJO, S.M. SOUTHWICK, J.H. KRYSAL & B.C. SCHWEINSBURG. Enhanced Amygdala Response to Working Memory Overload in Posttraumatic Stress Disorder.

Objective: Posttraumatic stress disorder (PTSD) is associated with attention/working memory deficits, although the mechanisms of these deficits are not well understood. This study examined the impact of increasing cognitive load—including at the limits of working memory capacity—on brain function in PTSD.

Participants and Methods: 15 veterans with PTSD and 10 demographically similar veterans with combat exposure but without PTSD (controls) underwent functional magnetic resonance imaging while performing a parametric (0- to 4-back) spatial working memory task.

Results: On 2-back, individuals with PTSD showed increased BOLD response in parahippocampal and lingual gyri, while controls showed significantly increased activation in superior frontal and anterior cingulate gyri. On 3-back, individuals with PTSD displayed increased activation in the amygdala, lingual gyrus, and superior parietal lobule, while controls showed increased activation in middle and superior frontal gyri. On 4-back, individuals with PTSD showed significantly increased activation in right amygdala and decreased activation in the medial frontal gyrus, precuneus, and anterior cingulate compared to controls. In addition, mean right amygdala activation during 4-back was significantly associated with reduced task performance ($\rho = -.44$) and PTSD symptom severity ($\rho = .59$).

Conclusions: Individuals with PTSD experienced reduced activation in circuitry essential for spatial working memory as cognitive load increased. Moreover, individuals with PTSD also showed increased activation in right amygdala in combination with decreased activation in medial prefrontal regions that may be partially responsible for controlling amygdala responses, perhaps indicating an enhanced emotional response to failure during working memory overload. Importantly, right amygdala response was also associated with PTSD symptom expression and task performance, providing support for the role of amygdala modulation in attention/working memory difficulties in PTSD.

Correspondence: *J. Cobb Scott, Ph.D., Psychiatry, Yale University, 300 George Street, Suite 901, New Haven, CT 06511. E-mail: cobb.scott@yale.edu*

J.J. VAN STEENBURGH, M. VARVARIS, K. SMITH, J. HERNANDEZ, P. CHAMBERS, B. GORDON & D.J. SCHRETLEN. Default Mode Network Connectivity with Left DLPFC Interferes with Verbal Fluency in Schizophrenia.

Objective: Synchronous BOLD activity on fMRI reveals functional connectivity (FC) in a default mode network (DMN) that is most active at rest, during undirected thinking, and then deactivates during goal-directed thinking as task-positive networks become active. In schizophrenia (SZ), the DMN is diffuse and fails to deactivate normally during goal-directed thinking. SZ is characterized by dysfunction in many domains of cognition, especially verbal fluency (VF). We hypothesized that VF performance would correlate with FC within the left dorsolateral prefrontal cortex (DLPFC) and Broca's area (BA44/45). We further predicted that FC between the DMN and left DLPFC or Broca's area would interfere with VF.

Participants and Methods: Letter-cued (S, P) and category-cued (animals, supermarket items) VF tests were administered to 101 adults with SZ and 61 healthy controls (NC). Both groups also underwent a 5-min resting-state BOLD fMRI scan.

Results: NCs produced more words (87, SD=15) than persons with SZ (65, SD=18; $t=-8.2$, $p<.001$) on VF testing. As hypothesized, FC within left DLPFC predicted VF, but more so in the SZ than NC group (peak p -FDR $<.01$). FC between left DLPFC and areas in the DMN (posterior cingulate, medial PFC) correlated inversely with VF output (cluster p -FDRs $<.01$) in SZ. FC within Broca's area also predicted VF in both groups, but more so in the SZ than NC group (BA44: peak p -FDR $<.05$; BA45: peak p -FDR $<.02$). FC between Broca's area and the DMN did not significantly correlate with VF. Finally, in SZ contrasted with NC, FC within left DLPFC and BA44/45 predicted switching on category VF (peak p -FDR $<.01$), but not clustering.

Conclusions: Poor local FC within the left DLPFC and Broca's area interferes with VF in SZ. FC between left DLPFC and the DMN also interferes with VF in SZ compared to NC, but FC between Broca's area and DMN did not predict VF in either group. Local FC in left frontal regions predicts switching but not automatic aspects of category fluency. Correspondence: *Joseph J. van Steenburgh, Ph.D., Psychiatry, Johns Hopkins School of Medicine, 130 South Patterson Park Avenue, Baltimore, MD 21231. E-mail: jvanste1@jhmi.edu*

G. WEISSBERGER, T.H. COLLAN, M.W. BONDI & C.E. WIERENGA. Language and Executive Control in the Bilingual Brain: An fMRI Study.

Objective: Bilinguals have been shown to have advantages on tasks of executive control. One hypothesis for this advantage is that shared cognitive mechanisms underlie task and language switching. We aimed to test this hypothesis by comparing neural correlates underlying task-switching and language-switching paradigms in young bilinguals.

Participants and Methods: Nineteen Spanish-English bilinguals (M age = 21; SD = 1.7) were tested on task-switching and language-switching paradigms while undergoing a functional Magnetic Resonance Imaging (fMRI) hybrid (event-related and blocked) design. Participants were asked to covertly name numbers 1-9 in English or Spanish (language-switching) based on a cue or to name the color or shape of a figure (task-switching) based on a cue. Participants were cued to switch on 25% of trials in both tasks.

Results: We modeled language-switching costs (difference in activation during trials in which participants switched between languages vs. trials in which they did not) and task-switching costs (difference in activation during trials in which participants switched between color and shape vs. trials in which they did not) and compared between groups using a within-subject voxel-wise t -test to determine regions of overlap between task- and language-switching. Significant clusters were found in several regions including the left inferior frontal gyrus, right medial frontal gyrus, right precentral gyrus, right posterior cingulate gyrus, left insula, right superior temporal gyrus, and left parahippocampal gyrus. For all regions, percent signal change was greater for Language than for Task (all $ps \leq .001$).

Conclusions: Language switching involved regions that were not involved in task switching. Thus, the findings suggest that language control does not exclusively rely on general mechanisms of executive control, and that there may be some specialized mechanisms for language switching.

Correspondence: *Gali Weissberger, Clinical Psychology, SDSU/UCSD Joint Doctoral Program, 811 West Nutmeg St., Apt. 401, San Diego, CA 92103. E-mail: gweissbe@gmail.com*

R. WETHERILL, Y. LI, J. BENDER, K. JAGANNATHAN, C.P. O'BRIEN, A. CHILDRESS & T. FRANKLIN. Attentional Bias and Brain Response to "Unseen" Cannabis Cues.

Objective: Substance-dependent individuals automatically and involuntarily orient attention towards drug-related cues. This attentional bias is clinically significant, as drug abuse theories propose that attentional bias to drug cues maintains and contributes to substance use and relapse. Further, neuroimaging research indicates that attentional bias for drug cues is associated with brain activation in incentive motivation and

reward regions. Our previous findings indicate that even when drug cues are presented entirely outside of conscious awareness (i.e., "unseen"), they can have profound effects on reward-related neural activity. It remains unknown, however, whether attentional bias for drug cues is associated with brain responses to "unseen" drug-related stimuli. Thus, the current study examined attentional bias for cannabis cues (CCs) and whether this attentional bias was associated with brain reactivity to "unseen" CCs among cannabis-dependent individuals.

Participants and Methods: Nine (9) treatment-seeking cannabis-dependent individuals completed an off-magnet visual dot-probe attention task to assess attentional bias for CCs and a "fast" event-related design backward masking task during fMRI to examine brain response to "unseen" CCs of 33 ms duration.

Results: Analyses revealed that cannabis-dependent individuals show a positive attentional bias to CCs (40.53 ms) and increased brain activity to "unseen" CCs in reward-related regions ($p<.001$). Correlation analyses indicated that attentional bias to CCs correlated with increased brain response to CCs in the ventral striatal/pallidal region ($r=.68$, $p=.02$).

Conclusions: We demonstrate, for the first time, associations between attentional bias to CCs and reward-related brain activation to "unseen" CCs among cannabis-dependent individuals. These findings provide additional support for the idea that attentional bias and brain response to reward cues outside of conscious awareness may represent potential vulnerabilities for addictive behaviors.

Correspondence: *Reagan R. Wetherill, Ph.D., Psychiatry, University of Pennsylvania, 3900 Chestnut Street, Philadelphia, PA 19104. E-mail: rweth@mail.med.upenn.edu*

E.A. WILDE, J. ANDERSON, J.K. TRAN, D.S. MENEFFEE, E.D. BIGLER, R. SANYAL, J.M. HICKEY, W.S. LEOPOULOS, J.L. WANNER, R. AGARWAL & S.R. MCCAULEY. Treatment Effects in Resting State fMRI in Veterans with Comorbid Alcohol Abuse, Post-traumatic Stress Disorder, and Mild Traumatic Brain Injury.

Objective: Combat-related comorbidities, namely post-traumatic stress disorder (PTSD), mild traumatic brain injury (mTBI), and alcohol (ETOH) abuse significantly complicate diagnosis and treatment of post-deployed veterans. Using resting state fMRI (rsfMRI), we examined the impact of these comorbidities on brain connectivity in OEF/OIF veterans and explored treatment effects after 4 weeks of a novel inpatient treatment.

Participants and Methods: RsfMRI data was collected from OEF/OIF veterans with 1) ETOH abuse+PTSD+mTBI ($n=11$), 2) ETOH abuse+PTSD only ($n=11$), and 3) no history of any of these disorders (control). Scanning was performed on a 3T Siemens scanner at admission to and discharge from treatment. RsfMRI analysis was performed using SPM8.

Results: Mean correlation between all pairs of voxels within the default mode network (DMN) differed between the ETOH+PTSD+mTBI versus control group ($p=0.037$), and between the ETOH+PTSD+mTBI vs. ETOH+PTSD groups ($p=0.025$). Internal orbitofrontal connectivity also differed between the ETOH+PTSD+mTBI vs. control group ($p=0.006$), and a trend was noted between the ETOH+PTSD+mTBI vs. ETOH+PTSD group ($p=0.085$). Examination of between-network connectivity revealed decreased connectivity between the DMN and the salience networks (ETOH+PTSD+mTBI vs. control, $p=0.018$; ETOH+PTSD+mTBI vs. ETOH+PTSD, $p=0.05$) and increased connectivity between the DMN and orbitofrontal networks (ETOH+PTSD+mTBI vs. control, $p=0.05$; ETOH+PTSD+mTBI vs. ETOH+PTSD, $p=0.013$) in the patients with mTBI. Finally, a treatment effect (admission vs. discharge scan) was found in all participants undergoing treatment ($p=0.036$), where DMN connectivity was significantly decreased at discharge from treatment. However, there was no treatment effect on the inter-network connectivity between the DMN vs. orbitofrontal or the DMN vs. salience networks.

Conclusions: The data provide preliminary evidence for chronic mTBI-related changes in functional brain connectivity, some of which may be amenable to treatment, and others which may not.

Correspondence: *Elisabeth A. Wilde, Ph.D., Physical Medicine and Rehabilitation, Neurology and Radiology, Baylor College of Medicine, 1709 Dryden Rd., Ste 1200, Houston, TX 77025. E-mail: ewilde@bcm.edu*

M. FEIGON, V. DINH, G.T. STEBBINS, R.C. SHAH, B.R. RYPMA, T.B. PARRISH, D.A. EVANS, D.A. BENNETT & M.A. TRIVEDI. fMRI Activations During Performance of the Symbol Digit Modalities Test in Adults with a Parental History of Alzheimer's Disease.

Objective: Middle-aged individuals with dementia risk factors experience faster than normal declines in brain processing speed/cognitive efficiency, and exhibit abnormalities of brain structure and function. Previous studies suggest that the Symbol Digit Modalities Test (SDMT) is sensitive to the cognitive changes that occur during the early stages of Alzheimer's Disease (AD). The presence of the apolipoprotein E4 (APOE-e4) allele significantly increases the risk of developing AD. We examined the influence of the APOE-e4 allele on fMRI activation during SDMT performance.

Participants and Methods: The present study employed an fMRI modified version of the SDMT to investigate brain activation in healthy adults with the APOE-e4 allele ($n = 16$) matched against cognitively normal controls without the APOE-e4 allele ($n = 13$). All participants were between the ages of 40-65 ($m = 55.31$) and had a parental history of AD. There were no differences between groups on age, gender, ethnicity, reaction time, or accuracy on the task. During the SDMT, participants decided whether a target symbol-digit pair matched a symbol-digit pair in a corresponding table. All data processing and statistical analyses were conducted using SPM8.

Results: We found that the APOE-e4 positive group displayed significantly greater fMRI activation ($p = 0.05$, uncorrected, $k = 50$) than the APOE-e4 negative group bilaterally in the inferior/middle temporal lobes, left insular cortex, left parietal cortex, and the right medial temporal lobe. There were no brain regions where the APOE-e4 negative group displayed greater activation than the APOE-e4 positive group.

Conclusions: The results suggest that, relative to the APOE-e4 negative group, the APOE-e4 positive group recruited medial temporal regions important for episodic memory functions during SDMT performance. These differential changes in fMRI activation are novel findings in studies of aging and cognition and hold promise for use of activation analyses as a potential biomarker for abnormal cognitive decline.

Correspondence: *Maia Feigon, M.A., Illinois Institute of Technology, 1922 W. Bradley Pl., Chicago, IL 60613. E-mail: mfeigon@iit.edu*

Stroke/Aneurysm

M. FEIGON, M.A. VERNALE, L.E. PIPER, A.M. POPA, J.N. WEIR, R.E. MOLOKIE, M. GOWHARI, J. HASSAN, L. HSU, K. KOZMA & D.L. NYENHUIS. Validation of the NINDS-CSN VCI Neuropsychological Protocols in African-Americans with Sickle Cell Disease.

Objective: Brief sensitive cognitive tests are needed to examine patients at risk for vascular cognitive impairment (VCI). Patients with sickle cell disease (SCD) may experience ischemic attacks at an early age and resultant VCI. It is therefore critical to develop brief, cognitive screens that are able to detect differences between impaired and unimpaired groups. We compared the sensitivity and specificity of the 60 Minute, 30 Minute, and 5 Minute VCI Neuropsychological Protocols in a sample of patients with SCD against matched, normal controls (Hachinski et al., 2006).

Participants and Methods: All subjects completed the 60, 30, and 5 Minute Protocols as well as the MMSE and the Montreal Cognitive Assessment. A Barona IQ score was generated for each individual ($m = 99.22$ for the SCD group and $m = 96.50$ for the control group, ($p < .01$)). There were no differences on age, education, or gender between the two groups. ANCOVA was used to compare the two groups because of the difference in Barona score. Eta2 scores were generated to examine the robustness of each effect. Participants ($n = 24$) were African-American

community dwelling adults, ages 19 to 61 ($m = 37.04$, $SD = 12.05$), with evidence of SCD matched against similar, African-American normal controls. Participants had an average of 13 years of education. Approximately one third to one half of the participants had experienced one or more strokes at the time of study participation.

Results: The results showed that all three protocols differentiated between the SCD and control groups ($p < .01$). The 60 Minute Protocol had the largest effect size. The 30 Minute and the 5 Minute Protocols also demonstrated significant effect sizes.

Conclusions: Although all three protocols distinguished between groups, the 60 Minute VCI Neuropsychological Protocol showed the most robust differences between the Sickle Cell and normal control groups. Further studies will be completed to examine potential causes for this difference. Correspondence: *Maia Feigon, M.A., Illinois Institute of Technology, 1922 W. Bradley Pl., Chicago, IL 60613. E-mail: mfeigon@iit.edu*

A.M. COPPENS, A.N. DANGUECAN, G. DEVEBER & R. WESTMAY-COTT. Outcomes of Paediatric Unilateral Arterial Ischemic Stroke on Receptive and Expressive Vocabulary: Effects of Age at Stroke.

Objective: The aim of this study was to explore the impact of age at stroke and lesion location on receptive and expressive vocabulary in children with unilateral arterial ischemic stroke (AIS). We hypothesized that earlier age at stroke is associated with poorer performance on basic language tests than later injury and that the relationship between age at injury and outcome varies based on lesion location.

Participants and Methods: Forty participants with unilateral AIS from the Children's Stroke Outcome Study at the Hospital for Sick Children were administered the Peabody Picture Vocabulary Test (PPVT-IV), measuring receptive vocabulary, and the Expressive Vocabulary Test (EVT-2), measuring word retrieval. Age at stroke was classified as: neonatal (within 28 days of life) and non-neonatal (after 28 days of life). Using MRI reports, lesion location was categorized as: cortical (cortex only); subcortical (basal ganglia and/or thalamus); and combined (cortex plus basal ganglia and/or thalamus).

Results: The following results were covaried for age at testing since preliminary analyses demonstrated decreases in EVT scores with increasing age at testing [$r = -.383$, $p = .015$] and a similar trend for PPVT [$r = -.252$, ns]. For EVT, children with neonatal strokes performed more poorly than those with non-neonatal strokes [$F(1, 39) = 5.81$, $p = .022$]. Similarly, for PPVT, children with neonatal strokes performed more poorly [$F(1, 39) = 6.54$, $p = 0.015$]. There was no main effect of lesion location and no significant interaction.

Conclusions: Earlier age at stroke leads to worse outcomes on both expressive and receptive vocabulary tests regardless of age at testing. However, deficits become more pronounced as children get older, suggesting that their vocabularies may not develop at the expected rate. Lesion location may not be particularly important for determining outcome of basic language; the effect may only occur for more sophisticated cognitive functions (e.g., higher-order language).

Correspondence: *Andrea M. Coppens, MA, University of Windsor, 173-2 Chrysler Hall South 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada. E-mail: coppens@uwindsor.ca*

S. PIRES-BARATA, R. GARCÍA-GARCIA, S. GALO, S. CLARO, C. CORZO, S. LOURENÇO, M. TEIXEIRA-SILVA & L. REBOCHO. Cognitive Profile in Acute Stroke Patients.

Objective: Studies assumed a wide variation of cognitive impairment associated to stroke. These results may be due to sample characteristics, time of evolution and to the classification of the impairment. However, characterization of the cognitive profile in acute stroke patients is not well established. The aim of the present study is to characterize the cognitive profile of acute stroke patients.

Participants and Methods: During 18 months, 374 patients were admitted to our stroke unit, from those 128 patients were evaluated by a neuropsychologist or a trained psychologist, using the inpatient neuropsychological protocol (O-LOG/C-LOG, clock drawing test and house drawing copy test).

Results: Considering the socio-demographic data: 39% were women, the mean age 67.2 ± 12 and 44% had between 0 and 4 years of education. 16% of the patients were disorientated. 70% of the patients showed impairment in at least one cognitive domain. Executive function was impaired in 67% and late recall in 69%. When considering humor, 26% showed depressive symptoms and 23% anxiety. 22% of the cognitive impairment was verified among patients with depressive symptoms.

Conclusions: Cognitive impairment was present in more than half of the patients. Executive domains were the most impaired in acute phase. The cognitive profile in an acute phase includes impairment in executive function and recall domains, and included depressive and anxiety symptoms. More research is needed to define this profile.

Correspondence: Sara Pires-Barata, Hospital do Espírito Santo EPE, Lrg. Senhor da Pobreza, Évora 7000-811, Portugal. E-mail: spiresbarata@gmail.com

S. PIRES-BARATA, R. GARCÍA-GARCIA, S. GALO, V. LADERA-FERNANDEZ, M. PEREA-BARTOLOME, S. CLARO, C. CORZO, S. LOURENÇO, S. MATEUS, V. PÓS-MINA, I. MENDES, M. TEIXEIRA-SILVA & L. REBOCHO. Cognitive Function in Stroke Patients with Arterial Stenosis.

Objective: The association between stroke and cognitive impairment is well documented. The role of arterial stenosis in cognitive impairment among stroke patients has been questioned. The purpose of the present study is to characterize the cognitive function in stroke patients with arterial stenosis, considering the perfusion MRI study.

Participants and Methods: During a 12 months period, 11 subjects fulfilling our criteria were selected: 5 with stroke and internal carotid stenosis, 6 with stroke and intracranial stenosis and 10 healthy controls. All subjects were submitted to clinical, neuropsychological examination and to MRI study (perfusion, diffusion and angio-MRI).

Results: From the stroke patients with internal carotid stenosis ($n=5$; mean age=70), 3 had a left hemispheric stroke, 3 had right stenosis and 2 had functional compensatory mechanisms. From the stroke patients with intracranial stenosis ($n=6$; mean age=68,3), 4 had a right hemispheric stroke and 4 had a PCA stenosis. Sustained attention, memory and executive function were impaired in stroke patients. Stroke patients with internal carotid stenosis showed impairment in executive domains. Stroke patients with intracranial stenosis showed impairment in sustained attention, executive domains and in processing speed. Asymmetries in the cerebral blood flow and time to peak were observed.

Conclusions: The presence of intracranial or extracranial stenosis among stroke patients were associated to specific cognitive impairment, probably due to a hypoperfusion mechanism, when compensatory mechanisms and luxurious perfusion fail. The arterial stenosis are a risk factor for vascular cognitive impairment and may create the need to include in clinical check-ups, a standard neuropsychological evaluation. More research is needed to define a cognitive profile for arterial stenosis and to better understand the mechanisms that might lead to this process.

Correspondence: Sara Pires-Barata, Hospital do Espírito Santo EPE, Lrg. Senhor da Pobreza, Évora 7000-811, Portugal. E-mail: spiresbarata@gmail.com

D. SAMPANIS. Functional Recovery And Cortical Reorganization After Mirror Therapy In Chronic Stroke Patients.

Objective: The purpose of this pilot study was to test Mirror Therapy for chronic upper-limb stroke hemiparesis and to investigate the neural correlates of recovery with fMRI

Participants and Methods: The intervention consisted of 40 minute sessions on a daily basis for over a period of 6 weeks.

Six chronic stroke patients and several measures of motor and cognitive performance were taken: (a,b) tapping performance in and out of the scanner, (c) the Action Research Arm test (ARAT), (d) fMRI sessions before and after the end of the intervention period.

Results: Tapping performance for the paretic upper limb was assessed using a repeated measure ANOVA with five factors: the time of the meas-

urement, session (pre-post intervention), eyes (opened vs closed), task (bimanual vs unilateral) and hand (contralesional vs ipsilesional). All main effects were significant: time of test ($F(3, 18) = 7.580$; $p=0.002$), session ($F(1, 6) = 13.045$; $p=0.011$), eyes ($F(1, 6) = 7.069$; $p=0.038$), task ($F(1, 6) = 29.304$; $p=0.002$) and hand ($F(1, 6) = 20.351$; $p=0.004$). There were significant interactions between session and task ($F(1, 6) = 7.546$; $p=0.033$), between time, session and hand ($F(3, 18) = 2.754$; $p=0.039$) and between session, task and hand ($F(1, 6) = 8.685$; $p=0.026$). No other interactions were significant (all p 's $> .05$).

Contralesional's hand ANOVA returned $F(1, 6) = 21.180$; $p=0.004$. Ipsilesional's hand ANOVA returned $F(1, 6) = 120.5$; $p<0.001$.

fMRI results confirmed a shift in activation balance within the primary motor cortex and the premotor cortex toward the affected hemisphere in the mirror group only (weighted laterality index difference 0.42 ± 0.35 , $P < .05$).

There was significant improvement across the patients in the ARAT ($t(5) = -12.254$, $p<0.01$).

Conclusions: Results may indicate that MT can be beneficial for chronic stroke patients, although more studies need to be conducted in the future. Kinesthetic benefits have been noticed from the application of MT. Cortical reorganization seems to be promoted by Mirror Therapy

Correspondence: Dimitrios Sampanis, MSc in Neurorehabilitation, School of Psychology; University of Birmingham, 35 Apt, St.Jame's Place, 34 George Rd, Birmingham B15 1PQ, United Kingdom. E-mail: dxs875@bham.ac.uk

D. SAMPANIS. Motor Functional Improvement and Functional MRI Evidence of Cortical Reorganization in Upper-Limb Stroke Survivors with Motor and Visual Neglect Treated With Functional Electrical Stimulation (FES).

Objective: The purpose of this pilot study was to assess the possible effect of FES in chronic stroke patients with neglect and to investigate the neural correlates of recovery with functional magnetic resonance imaging (MRI).

Participants and Methods: Five chronic stroke (12-36 months post-stroke) participants underwent a 4 weeks FES course in the upper limb. Electrodes attached to the skin in a way that their activation together with participants' voluntary movement will promote functional movement of grasping.

In order to assess the benefit of FES a number of outcome measures was used including grip force in and out of the scanner, apple cancellation test to assess changes in the visual neglect, taping device, fMRI experiment and the Action Research Arm Test (ARAT).

Results: Grip force was found to be significant improved in ($t(5) = -11.452$, $p<0.01$) and out ($t(6) = -13.627$, $p<0.01$) of the scanner. Neglect cancellation test on average returned better performance at the end of the intervention period. After training, participants showed more activity bordering the lesion, more bilateral activation in the association motor cortices, and more ipsilateral activation in the primary motor cortex. The ARAT test returned significant improvement of ($t(5) = 8.452$, $p<0.01$).

Conclusions: In their pilot study Functional Electrical Stimulation produced significant functional improvement, decreased level of neglect and resulted in plasticity as demonstrated by functional MRI.

Correspondence: Dimitrios Sampanis, MSc in Neurorehabilitation, School of Psychology; University of Birmingham, 35 Apt, St.Jame's Place, 34 George Rd, Birmingham B15 1PQ, United Kingdom. E-mail: dxs875@bham.ac.uk

C. STERLING, E. TAUB, D. DAVIS, T. RICKARDS, G. USWATTE, L.V. GAUTHIER, A. GRIFFIN, A. BARCHI, M. HADDAD & V.W. MARK. Children Have Greater Motor Improvement but Similar Structural Brain Change Compared to Adults Following CI Therapy.

Objective: Previous research from this laboratory has shown that CI therapy produces significant motor improvement along with increases in grey matter volume in both adults and children. This study evaluated how the motor benefits and structural changes seen in children following CI therapy compare to those demonstrated by adults.

Participants and Methods: 10 children with hemiparetic cerebral palsy (aged 38.7 ± 18.9 months) and 16 adults with chronic stroke (aged

63.3±12.0 years) received MRI scans immediately before and after CI therapy. Motor improvement in children was measured using the Pediatric Motor Activity Log (PMAL) while a close analogue, the Motor Activity Log (MAL), was used in adults. Both the PMAL and MAL are scripted, structured interviews administered by the same protocol to children's caregivers or adult patients, designed to determine the amount and quality of spontaneous real-world use of the more-impaired arm. Longitudinal voxel-based morphometry was performed on MRI scans in both groups to assess grey matter change.

Results: A mixed-model repeated-measures ANOVA on MAL/PMAL scores with Group (children, adults) as a between-groups factor demonstrated that children showed significantly greater improvement in spontaneous use of the more-affected arm in the life situation than adults ($F(1,26)=4.48$, $p<0.05$) following CI therapy. However, while the pattern of structural change was different between groups, the magnitude of grey matter change was similar.

Conclusions: These findings suggest that, while CI therapy produces significant motor improvement at any age, children receive greater benefit from the treatment. The similar grey matter change in the brain, along with previous research showing significantly higher increases in active range of motion following CI therapy in children compared to adults, raises the possibility that the increased clinical improvement in children is the result of greater plasticity of peripheral structures, including muscles, tendons and ligaments, in children than in adults.

Correspondence: *Chelsey Sterling, M.A., Psychology, UAB, 2830 10th Cir. S., Apt 2B, Birmingham, AL 35205. E-mail: csterli1@uab.edu*

Language and Speech Functions/Aphasia

A.I. ANSALDO & K. MARCOTTE. Pre-therapy Activation Patterns and Recovery from Anomia: Neurobiological and Neurolinguistic Issues Support the efficacy of Semantic Feature Analysis in the Elderly with Chronic Broca's Aphasia.

Objective: The last decade has brought increasing interest in the neural mechanisms underlying therapy effects on aphasia recovery. fMRI studies and more recently functional connectivity studies¹ have increased our knowledge of the links between

Participants and Methods: Nine participants with moderate to severe chronic aphasia performed a naming task within a pre-/post-therapy er-fMRI study. SFA was provided for a maximum of six weeks, or until participants were able to name 80% of the trained items.

Results: SFA resulted in significant improvement in all patients, thus showing the long term potential for plasticity of the aging damaged brain. Correlational analyses showed that SFA outcome was negatively correlated with damage to Broca's area. A significant correlation between improvement and activation in the left precentral gyrus was found both before and after therapy. As well, there was a significant activation of the inferior areal lobule (IPL).

Conclusions: Recent DTI data shows that the left precentral gyrus holds the rostral part of the superior longitudinal fasciculus, connecting to Wernicke's and Broca's area. Moreover, the IPL represents a parallel route between these two areas and is considered a key area to language processing. Given its nature, the IPL sustains multimodal associations of spoken words. The activation and correlation patterns observed suggest that SFA capitalizes on these anatomical links, providing an alternative pathway. Future studies will provide more insights on the interactions between brain connectivity and therapy procedures allowing for the recovery from aphasia.

Correspondence: *Ana I. Ansaldo, Ph.D., Centre de recherche - Institut universitaire de gériatrie de Montréal, 4565 Queen Mary road, Montréal, QC H3W1W5, Canada. E-mail: ana.ines.ansaldo@umontreal.ca*

L. GHAZI SAIDI, V. PERLBARG, G. MARRELEC, M. PÉLÉGRINI-ISSAC, H. BENALI & A. ANSALDO. Language and Control Networks in Second Language Learning: A Longitudinal Functional Connectivity Study.

Objective: It is generally accepted that language processing and cognitive control demands vary depending upon second language (L2) pro-

ficiency (Altarriba and Heredia, 2008; Abutalebi & Green, 2007). In particular, the early phases of L2 vocabulary learning are sustained both by language processing and control circuits (Raboyeau et al. 2010). Cross-sectional studies report that increased L2 proficiency is associated with reduced functional connectivity (FC) within the language processing circuit (Prat, et al., 2007; Veroude, et al., 2010; Dodel, et al., 2005; Coynel, et al., 2009), and the working memory circuit (Majerus, et al., 2008).

Participants and Methods: Twelve healthy adults were enrolled in an intensive and computerized vocabulary-learning program in L2. They were tested on a picture-naming task during fMRI-scanning, at the early (T1) and consolidation (T2) phases of L2 vocabulary learning. The language processing and control networks were identified on the basis of previous literature, (Price, 2010; Abutalebi & Green, 2007), and their integrative state was described with NetBrainWork (Perlberg et al., 2009). Thus, measures of functional integration (FI) (Marrelec, et al., 2008), at the total, within, and between-network levels were obtained at T1 and T2, both for L1 and L2.

Results: With L2, FI decreased overtime, both at the within and between network levels, whereas no significant changes with L1 were observed.

Conclusions: Previous functional connectivity cross-sectional studies report reduced FI within the language and working memory networks with increased L2 proficiency (Majerus, et al., 2008; Prat, et al., 2007; Veroude, et al., 2010; Dodel, et al., 2005; Coynel, et al., 2009). The results of the present study provide for first time, a longitudinal and integrative network perspective of L2 vocabulary learning. Specifically the evidence shows that consolidation of L2 vocabulary is reflected by decreased information flow both within, and between the language and control networks.

Correspondence: *Ladan Ghazi Saidi, Ph.D. candidate, CRIUGM, 8085, St.Laurent, Apt.204, Brossard, QC, QC J4X 1Z7, Canada. E-mail: ladan.ghazi.saidi@umontreal.ca*

M.M. HADDAD, E. TAUB, G. USWATTE, V.W. MARK, M.L. JOHNSON, J. WADE, L. HARPER, E. WESSON, L. WANG & A. BARGHI. Validity of the Verbal Activity Log (VAL) for Assessment of Spontaneous Real-World Speech in Aphasia.

Objective: Improvement in spontaneous speech in the life situation is the most important outcome for rehabilitation of individuals with aphasia. Constraint-Induced Aphasia Therapy II (CIAT II), a new treatment that transfers therapeutic improvement to the life situation, requires measurement of real-world speech. While several measures of functional communication have been developed, the amount of functional speech, per se, in the life situation has never been measured. The Verbal Activity Log (VAL) is a structured interview designed for aphasic patients and their caregivers to assess the amount (AOS) and quality (QOS) of speech during activities of daily living. This study quantified the validity of the VAL for measurement of real-world speech in individuals with aphasia.

Participants and Methods: Nine stroke patients with aphasia (2 male; 59.6 ± 14.5 years) completed the VAL and the Communicative Effectiveness Index (CETI) in the laboratory. Participants then wore a digital voice recorder for a minimum of 8 hours outside of the laboratory. Percentage of speech time during the total recorded sample was calculated as an objective measure of real-world speech.

Results: Correlation with the CETI was significant for both VAL scales ($r = 0.740$, $p = 0.023$ AOS; $r = 0.816$, $p = 0.007$ QOS). Likewise, correlation with recorded real-world speech was significant for both VAL scales ($r = 0.816$, $p = 0.007$ AOS; $r = 0.726$, $p = 0.027$ QOS.)

Conclusions: These results present initial evidence for the validity of the VAL for objectively measuring the amount of real-world speech in persons with post-stroke aphasia. These data further suggest that the VAL may be a useful index of treatment outcome for rehabilitation patients undergoing therapies such as CIAT II, which targets real-world speech. The results warrant further research.

Correspondence: *Michelle M. Haddad, B.A., Psychology, University of Alabama at Birmingham, CPM 714, University of Alabama Birmingham, 1530 3rd Avenue South, Birmingham, AL 35294-0018. E-mail: mhaddad@uab.edu*

M.J. HAMBERGER, C.G. HABECK, S.P. PANTAZATOS, A.C. WILLIAMS & J. HIRSCH. Neural Activation Patterns for Auditory Description and Visual Object Naming in Healthy Adults.

Objective: Historically, visual object naming measures have been used to study naming, and with these measures, lesion-type studies have implicated the left posterior, temporo-parietal region as a critical component of naming circuitry. However, recent results from behavioral and cortical stimulation studies using auditory description naming as well as visual object naming in left temporal lobe epilepsy patients suggest that discrete sites in anterior temporal cortex are critical for description naming, whereas posterior temporal regions mediate both visual object naming and description naming. We sought to determine whether this task specificity also reflects normal cerebral organization and processing.

Participants and Methods: Thirteen healthy adults performed auditory description naming and visual object naming during functional neuroimaging. In addition to standard univariate analysis, multivariate, ordinal trend analysis examined the network character of the regions involved in task-specific naming.

Results: Univariate analysis indicated posterior temporal activation for both visual naming and auditory description naming; however, further analysis revealed task related differences in the way the two tasks utilized this common region. Additionally, multivariate analysis revealed unique, task-specific, covarying activation patterns that were strikingly consistent in all 13 subjects for visual naming and 12/13 subjects for description naming.

Conclusions: Results suggest a common neural substrate, yet different neural processes underlying visual naming and description naming in neurologically intact individuals. These findings support the use of both types of tasks for clinical assessment, and may have application in the treatment of neurologically based naming deficits.

Correspondence: *Marla J. Hamberger, Ph.D., Neurology, Columbia University, 710 West 168th Street, New York, NY 10032. E-mail: mh61@columbia.edu*

S. ISKANDAR & A.D. BAIRD. The Role of Working Memory in Metaphor Interpretation.

Objective: Although several types of figurative language exist, neuropsychological tests of non-literal language have focused on proverbs. Metaphors in the form X is (a) Y place a lower demand on language skills and are more easily manipulated for novelty. One is more likely to encounter new metaphors (e.g., company X is the next Enron) in daily life than novel proverbs. In the present study, we created a task of metaphor interpretation and examined associations with working memory and divided attention tasks.

Participants and Methods: Forty undergraduate participants (30 females, 10 males, M age = 22.66) completed the Metaphor Interpretation Test developed by the authors. The task includes 20 items chosen from a list of metaphors that were rated on several scales (e.g. imagery, aptness) in a study by Katz & Paivio (1988). Participants rated the familiarity and provided an explanation of each metaphor. A scoring system was developed to categorize answers into: abstract complete (AC), abstract partial (AP), concrete (CT), and other/unrelated (OT) types. Participants also completed the Digit Span, Sentence Repetition, and Auditory Consonant Trigrams tests.

Results: Overall, participants produced 56% AC, 25.38% AP, 7.88% CT, and 10.88% OT responses. The strongest associations were between: Longest Digits Backward and AC responses ($r = .44$), Sentence Repetition Total and AC responses ($r = .60$), and Sentence Repetition Total and AP responses ($r = -.45$). Familiarity ratings and performance on the Auditory Consonant Trigram test were not associated with the Metaphor Interpretation Test.

Conclusions: It was found that even in a non-clinical sample, diversity in types of responses to this task exists. It appears that working memory plays a substantial role in providing abstract responses to explain metaphors. Results suggest that when one is faced with a novel metaphor, one must hold the information in working memory long enough to mentally search for similar cognitive networks and make a link between them.

Correspondence: *Sam Iskandar, M.A., Psychology, University of Windsor, 309-3355 Sandwich St., Windsor, ON N9C1B2, Canada. E-mail: iskandas@uwindsor.ca*

U. LÖFKVIST, O. ALMKVIST, B. LYXELL & I. TALLBERG. Word Fluency and Lexico-Semantic ability in Children with Cochlear Implants.

Objective: The objective was to examine word fluency and lexico-semantic ability in children with CI and in comparison to children with Normal Hearing (NH) and in relation to other clinical groups; children with Language Impairment (LI) and children with Autism Spectrum Disorder (ASD).

Participants and Methods: 34 children with CI, 6-9 years, 39 age-matched children with NH and two other clinical groups; LI (n=12) and ASD (n=12). All children were tested with two different word fluency tasks and different tests of lexico-semantic ability. A semantic response analysis of the erroneous responses children made in the picture naming test was also performed.

Results: There was a significant interaction between age and groups on word fluency ability. Children with NH in the ages 8-9 years had significant higher scores on the FAS letter fluency task compared to children with CI in. There were no significant differences between groups regarding the younger children (6-7 years) on the FAS letter fluency task. There were significant differences between groups which remained when we controlled for age and non-verbal cognitive ability. Children with NH had significantly better result on the receptive vocabulary test compared to all groups. Children with CI had significantly better results on naming and receptive vocabulary compared to children with LI and ASD. They also gave semantic relevant responses in the same way as children with NH, but to a higher degree, when they could not name pictures. The group of children with ASD had significantly more semantic irrelevant responses than the other groups and children with LI had the highest number of omitted responses.

Conclusions: Children with CI, 6-7 years, performed equally well as children with NH on assessment of word fluency ability. Children with NH retrieved significantly more words in the phonemically based task (FAS). Children with CI demonstrated a naming ability comparable with children with NH and showed relevant semantic knowledge of words which they could not name.

Correspondence: *Ulrika Löfkvist, PhD-student, CLINTEC, Karolinska Institutet, Paradisgränd 7, Södertälje 15136, Sweden. E-mail: ulrika.lofkvist@karolinska.se*

L. MILMAN, D. CLENDENEN & M. VEGA-MENDOZA. Production, Treatment, and Generalization Patterns for Adjectives and Pronouns in three cases of Nonfluent Aphasia.

Objective: One characteristic of agrammatism is the disproportionate use of nouns relative to other parts of speech. While considerable research has centered on verb production and associated verb treatments, comparatively little research has focused on production or treatment of other word classes. As with verbs, pronouns and adjectives have been linked to a variety of priming effects. Based on this literature, we hypothesized that pronoun and adjective training would result in facilitation and generalization patterns analogous to those associated with verb training.

Participants and Methods: This study investigated: 1) adjective and pronoun production in three individuals with nonfluent aphasia across a battery of standardized and experiment-specific language production measures, 2) efficacy of an integrated approach to adjective and pronoun training (targeting word, sentence, and discourse levels of interaction), and 3) treatment generalization patterns.

Results: Consistent with diagnostic classifications, all three participants showed significant impairments in adjective and pronoun production relative to neurologically healthy controls. Two of the three participants acquired trained adjective and pronoun structures and maintained these treatment effects at one month post-treatment follow up testing.

Both of these participants also showed significant gains on the Western Aphasia Battery and a variety of discourse measures. Generalization to untrained adjectives was greater for adjectives that shared particular semantic features with trained targets. Interestingly, no generalization was observed from trained to untrained pronouns, although cross-context generalization was observed for trained items.

Conclusions: Results suggest that adjectives, but not pronouns, show treatment generalization effects similar to those previously reported for verbs.

Correspondence: *Lisa Milman, Ph.D., Communicative Disorders & Deaf Education, Utah State University, 1000 Old Main Hill, Logan, UT 84322. E-mail: lisa.milman@usu.edu*

A. MORIN & B. HAMPER. Activation of the Left Frontal Gyrus During Self-referential Thinking.

Objective: The first objective of the present meta-analysis was to determine if LIFG activation is observed in a significant number of brain-imaging studies of self-reflection. A second aim was to compare LIFG activation in perceptual (agency and self-recognition) and conceptual (e.g., autobiography, traits) self-domains, where inner speech use is hypothesized to be more important in the latter.

Participants and Methods: Inner speech involvement in self-reflection was examined by reviewing 130 studies assessing brain activation during self-referential processing in key self-domains: agency, self-recognition, emotions, personality traits, autobiographical memory, and miscellaneous (e.g., prospection, judgments).

Results: The left inferior frontal gyrus (LIFG) has been shown to be reliably recruited during inner speech production. The percentage of studies reporting LIFG activity for each self-dimension was calculated. Fifty five percent of all studies reviewed indicated LIFG (and presumably inner speech) activity during selfreflection tasks; on average LIFG activation is observed 16% of the time during completion of non-self tasks (e.g., attention, perception). The highest LIFG activation rate was observed during retrieval of autobiographical information. The LIFG was significantly more recruited during conceptual tasks (e.g., prospection, traits) than during perceptual tasks (agency and self-recognition).

Conclusions: These results provide additional evidence that inner speech is involved in self-related thinking.

Correspondence: *Alain Morin, Psychology, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, AB T3E 6K6, Canada. E-mail: alain1morin@gmail.com*

Y. NAKAGAWA & T. KOYAMA. Grammatical difficulties faced by children with autism spectrum disorders.

Objective: This study investigated the grammatical ability of children with autism spectrum disorders (ASDs) to specify their comprehension difficulties in Japanese grammar compared with non-autistic native Japanese.

Participants and Methods: The participants were four children between eight and eleven years old with ASDs. They were individually assessed using a Japanese grammatical test (J.COSS: Japanese Test for Comprehension of Syntax and Semantics). The J.COSS is multiple-choice text consisting of 20 blocks of 4 items each. Each item has a choice of four pictures. The participants were required to select one picture that corresponded to a grammatical construction in orally presented Japanese; no verbal communication was required.

Results: Whenever a participant correctly answered the four questions in each grammatical block, we assumed that they could understand that block. One participant showed normal language ability, while the three others consistently obtained lower scores than the non-autistic children. Although these three could understand three elements on the sentence combination block, their grammatical abilities were evaluated as being below those of six-year-olds. According to the error patterns on the passive block, all children with ASDs tended to incorrectly choose passive sentences over active ones, though children could guess the subject of the sentences from their meaning. These difficulties were resembled to the results of previous studies on children with hearing loss and patients with aphasia.

Conclusions: The study investigated the development of Japanese grammar in children with ASDs. Except for one child, participants with ASDs showed an overall delay of grammatical competence compared with non-autistic counterparts. Although the children with ASDs showed difficulties in comprehending reversible passives, these delays might not be specific to those with ASDs, but might also be a common grammatical deficit for those with language difficulties.

Correspondence: *Yoshiko Nakagawa, PhD, Child Psychology, Tokyo Future University, 34-12, SenjuAkebono-cho, Adachi-ku, Tokyo 120-0023, Japan. E-mail: SNC59S10@nifty.com*

V.S. PHATAK, J. OJEMANN, D. LORING, K. MEADOR, J. MILLER, A. SAINDANE & D. DRANE. Age Cohort Effects in Famous Faces Naming Test.

Objective: RATIONALE: Forgetting people's names is a common complaint in normal aging but can also be indicative of dysnomia in Mild Cognitive Impairment (MCI) and Alzheimer's dementia. Iowa Famous Faces Test has shown to be a sensitive measure of proper noun naming deficits due to temporal lobe dysfunction. But it is unknown if the test can be used in a standardized manner with any age groups.

Participants and Methods: METHODS: 24 subjects met the eligibility criteria of (1) no history of neurological disease and normal MRI (2) no history of psychiatric disease, (3) no history of learning disability, (4) WAIS-III FSIQ in the normal range. All subjects were administered the Iowa Famous Faces as part of a larger battery of neuropsychological tests. In the Iowa Famous Faces test, subjects were shown 155 photographs and asked to identify the name of the person in the photograph. The subject's response was considered accurate if they produced both first and last name of the individual.

Results: RESULTS: Subjects had an accuracy rate ranging from 21.9%-99.4%. The mean accuracy was 63.63%. Response time ranged from .69 seconds to 64.53 seconds with mean response time at 4.33 sec. There was a borderline significant correlation between response time and accuracy rate ($r = -.4$, $p = .048$), which suggests faster response times in individuals with better naming performance. Age was positively correlated with accuracy rate ($r = .591$, $p < .01$).

Conclusions: CONCLUSION: The present results suggests the same stimuli set of famous people cannot be used across all age groups. Cohort specific stimuli development would be advisable.

Correspondence: *Vaishali S. Phatak, Ph.D., University of Washington, Box 359745, 325 Ninth Ave, Seattle, WA 98104. E-mail: vphatak@u.washington.edu*

A.M. RAYMER, J. KENAGY & S. SIMONE. Word Retrieval Treatments for Aphasia: Connected Speech Outcomes.

Objective: We examined changes in connected speech patterns following two phases of word retrieval treatment in aphasia, errorless naming treatment (ENT) and gestural facilitation of naming (GES).

Participants and Methods: Six participants with chronic stroke-induced aphasia took part in training. Standardized aphasia testing indicated that 5/6 had nonfluent aphasia and all had pronounced word retrieval impairments. The study incorporated a single-participant crossover design in which participants received ENT and GES in counterbalanced order. Participants were seen for up to 20 treatment sessions per phase. In addition to a daily probe picture naming task (Raymer et al., 2012), participants completed standardized aphasia testing and two connected speech tasks during baseline and after each training phase. One speech task required responses to four open-ended questions, and the other required telling a picture story for four Rockwell pictures. Transcribed speech samples were coded by two trained examiners who noted the number of Correct Information Units (CIUs), substantive nouns, and vague nouns.

Results: Although post-training changes showed increased use of CIUs and substantive nouns, and decreased use of vague nouns, these changes were not significant, and no differences were evident between treatments. Greater use of CIUs and substantive nouns were evident for the

questions task over the picture description task. Finally, correlations demonstrated significant relationships between poor comprehension abilities at baseline and increased use of vague nouns, and higher aphasia quotients and substantive noun use. Positive training effect sizes in picture naming were associated with increased use of CIUs and substantive nouns.

Conclusions: Limited positive changes in connected speech were evident following picture naming training. Open-ended questions tended to be more effective than picture description for documenting speech changes associated with treatment.

Correspondence: *Anastasia M. Raymer, Ph.D., Dept of Communication Disorders & Special Education, Old Dominion University, 110 Child Study Center, Norfolk, VA 23529-0136. E-mail: sraymer@odu.edu*

I.M. TALLBERG, S. STORMOEN, O. ALMKVIST, M. ERIKSDOTTER & E. SUNDSTRÖM. The Ability to Communicate a Decision in Alzheimer's disease.

Objective: A debated issue in dementia research is the ethical dilemma of obtaining informed consent from patients with impaired cognitive function. Previous research has pointed out different cognitive predictors of competence in medical decision-making, such as episodic memory, executive function and verbal fluency. In this study, the focus is changed to how subjects communicate reasoning about decision regarding participation in hypothetical clinical trials. Consequently, the purpose was to design and validate a Linguistic Instrument for assessment of reasoning in Medical Decision-making (LIMD) and relate performance of LIMD to cognitive and language functioning assessed with a comprehensive test battery.

Participants and Methods: Three comparable groups (matched for age, gender and level of education) participated in the study; patients with Alzheimer's disease (n=20), patients with Mild Cognitive Impairment (n=22) and a group of healthy controls (n=37). LIMD is a so called vignette method and three aspects of competence were scored (comprehension, evaluation of risks and benefits and intelligibility of decision).

Results: The reliability of LIMD was very good and so was the overall validity. Groups differed significantly on LIMD and in all cognitive and language tests also after exclusion of possible confounders by demographics (age, gender and education). A step-wise linear regression analysis showed that almost 80% of the variance of LIMD was explained by tests of high-level language (text reading capacity, ability of make inferences, ability to repeat long sentences) and to verbal episodic memory, but no other cognitive test.

Conclusions: The LIMD-method revealed that the ability to comprehend, evaluate risks and benefits and to express a decision in an intelligible way is typically impaired in AD and MCI as part of an impairment of high-level language.

Correspondence: *Inga M. Tallberg, Ass Prof, Speech Pathology, Karolinska Institutet, (CLINTEC), Karolinska Universitetssjukhuset, B69, Stockholm S14186, Sweden. E-mail: ing-mari.tallberg@ki.se*

J. WAMBAUGH, C. NESSLER, S. MAUSZYCKI & R. CAMERON. Melodic Intonation Therapy Applied to the Production of Questions.

Objective: Melodic Intonation Therapy (MIT) is a behavioral treatment for nonfluent aphasia that employs melodic intoning, hand-tapping, modeling, and repeated practice to facilitate productive verbal language. Treatment typically has been focused on functional, but linguistically uncontrolled utterances. The purpose of this investigation was to examine the effects of MIT applied in the treatment of wh-questions.

Participants and Methods: Two participants with chronic, Broca's aphasia received MIT applied sequentially to wh-questions in the context of multiple baseline designs across behaviors. The dependent measure was accuracy of question production (trained and untrained exemplars) elicited in a story completion format in probes. Treatment entailed MIT combined with training of wh-morpheme selection and movement.

Results: Participant 1 demonstrated no changes in accuracy for three of the four question types during probes despite large improvements in

treatment. Participant 2 achieved increased accuracy for two of the trained question types; improvements extended to untrained exemplars. For both participants, changes coincided with application of treatment following stable baseline performance. Calculated effect sizes were small for Participant 1 and small to large for Participant 2.

Conclusions: Treatment resulted in limited improvements with stronger effects for Participant 2. Incorrect wh-morpheme use accounted for the majority of errors and appeared to be linked to overgeneralized use of question type(s) that received treatment first. Although treatment included training to facilitate stimulus discrimination among wh-morphemes, accurate wh-morpheme selection did not carry over from treatment to the probe task. MIT appears to be amenable to the incorporation of linguistically-motivated treatment stimuli selection. Additional treatment components may be necessary to promote correct wh-morpheme production. This research was supported by VA Rehab. R&D.

Correspondence: *Julie Wambaugh, VA Salt Lake City & University of Utah, 151A, 500 Foothill Blvd, Salt Lake City, UT 84121. E-mail: julie.wambaugh@health.utah.edu*

J. WAMBAUGH, S. MAUSZYCKI & K. EATCHEL. Word Retrieval in Aphasia: Using Treatment Performance to Predict Probe Performance.

Objective: A desired outcome of treatment for aphasia is for behavioral changes to be evident when treatment is not occurring. Examination of efficacy of aphasia treatment typically entails frequent measurement of performance during probes in which no treatment (including feedback) is provided. Repeated probing is not practical for clinical practice. This study was conducted to examine the correspondence of accuracy of naming in treatment to probe performance.

Participants and Methods: Four participants with chronic aphasia received a semantic treatment for naming of actions applied in the context of multiple baseline designs across behaviors. The dependent measure was accuracy of naming of trained and untrained verbs elicited in response to picture stimuli. Probes of naming performance were conducted repeatedly throughout the investigation. Accuracy of naming during treatment was compared to accuracy of naming in probes using correlational analyses.

Results: Probe performance was highly correlated with naming accuracy during treatment for three participants who demonstrated improved performance during probes. The remaining participant (P4) did not demonstrate increases in naming accuracy in probes and correlations varied across lists of treated items; significant positive correlations were obtained for one treated list and negligible correlations were obtained for a second list.

Conclusions: For three participants, treatment performance was highly predictive of probe performance; these were the participants who achieved positive changes in probes. P4 demonstrated minimal improvements in naming during therapy for one treated list, which was reflected in poor probe performance. However, for a second treated list P4 achieved high levels of accuracy during therapy, with no corresponding changes in probes. These findings suggest that clinicians should consider verifying positive changes in naming through administration of probes. Research supported by VA Rehab. R&D.

Correspondence: *Julie Wambaugh, VA Salt Lake City & University of Utah, 151A, 500 Foothill Blvd, Salt Lake City, UT 84121. E-mail: julie.wambaugh@health.utah.edu*

J. YOON, D. NA & H. KIM. Visuospatial Representation of Hangul Syllable in Alzheimer's Disease: Does It Withstand the Impact of the Disease?

Objective: Korean writing system, Hangul, has its own nonlinguistic characteristics. Specifically, each grapheme of Hangul must be placed by dimensional and spatial rules within a square space to form a syllable. Alzheimer's disease (AD) is a disease that can result in both visuo-constructional and language dysfunction during the course of the disease, due to bilateral involvement of the temporoparietal-frontal hemispheric areas. At the later stages of disease, the patients show the loss of ability to write. However, the visuospatial representation of Hangul syllable might withstand the impact of the disease because the syllabic shape of Hangul might be sufficiently robust.

Participants and Methods: Seventy-five AD patients were included in this study. In order to identify the relationship between writing performance and Hangul representation (i.e., the knowledge of a letter shape), we instructed the patients to write from dictation 60 monosyllabic stimuli. Furthermore, we administered Hangul representation task of writing syllables which were not included in the Korean syllable inventory.

Results: The patients at early stage of AD showed correct responses above 75% in both writing to dictation and the Hangul representation tasks. Although the patients at later stage of the disease showed correct responses below 10% in Hangul writing to dictation task, they manifested 41.5% of accuracy in the Hangul representation tasks.

Conclusions: The patients at the later stage could not read aloud or understand a context well. It can be concluded based on the results that Hangul representations at the later stage of Korean AD patients might be partially preserved even though they could not read and write. This finding supports the hypothesis that visuospatial representation of graphemic position within Hangul syllable may withstand the impact of AD.

Correspondence: *Ji Hye Yoon, Hallym University, Hanlym Daehak-Gil 1, Yulgok-gwan, #7616, Chuncheon 200-702, Republic of Korea. E-mail: tracie86@hanmail.net*

Medical/Neurological Disorders/Other (Child)

R. BREWSTER & K. O'TOOLE. The Cognitive Phenotype of a Patient with Moyamoya Disease: An Adolescent Case Study.

Objective: Moyamoya disease is a rare cerebrovascular disorder characterized by progressive narrowing of the bilateral internal carotid arteries and the development of an abnormal vascular network contributing to stroke. Further research is necessary to establish a neuropsychological profile for moyamoya disease, especially in adolescents. We present the cognitive phenotype of a female, 15-year-old, right-handed adolescent through the lens of a model proposed by Dennis (2001).

Participants and Methods: The patient was diagnosed with moyamoya disease at 8 years of age. Upon diagnosis, she underwent a left hemisphere microvascular anastomosis with negative outcomes. The following year, a right hemisphere microvascular anastomosis was completed with positive outcomes. An MRI of the brain was completed at 9 years of age. A cerebral angiogram was completed at 10 years of age. Comprehensive neuropsychological evaluations were conducted at 10 and 14 years of age.

Results: Imaging revealed better right than left hemisphere cerebral recovery. A neuropsychological evaluation at 10 years of age revealed average intellectual functioning, mild weaknesses in executive functioning, strengths in verbal memory, and weaknesses in nonverbal memory. A second evaluation at 14 years of age revealed low average intellectual functioning, significant weaknesses in executive functioning, and weaknesses in verbal and nonverbal memory.

Conclusions: Current findings support results from past pediatric and adult outcome studies. Specifically, overall lower performance on measures during the later evaluation supports the suggested cognitive decline related to moyamoya disease. Executive functioning weaknesses during the later evaluation also support previous findings. Dennis's model highlights additional key factors related to individual outcome.

Correspondence: *Ryan Brewster, Georgia State University, 1114 Westshire Place NW, Atlanta, GA 30318. E-mail: rbrewst@gmail.com*

J. GRIECO & M. RISSEBERG. Working Memory in Children with Lyme Disease versus ADHD.

Objective: The current study examines working memory in children with Lyme disease (LyD), in comparison with those with ADHD. Concentration difficulty is a common complaint in LyD, and some studies have demonstrated impairment in executive processes in individuals with LyD (McAuliffe et al., 2008; Tager et al., 2001). It is hypothesized that children with LyD will demonstrate working memory deficits similar to those in children with ADHD.

Participants and Methods: Participants in the LyD group (n=38) met diagnostic criteria as set out by the Centers for Disease Control (2011), and those in the ADHD group (n=56) met DSM-IV-TR criteria for attention deficit/hyperactivity disorder (Inattentive n=18; Hyperactive/Impulsive n=3; Combined n=35). Tests administered were Digit Span, Letter-Number Sequencing, and Arithmetic from the WISC, and Finger Windows, and Picture Locations from the WRAML.

Results: Between group comparisons using independent sample t-tests revealed significantly lower scores in the ADHD group on Finger Windows [$p=0.00$] and Arithmetic [$p=0.02$]. However, no difference was found in the performance of children with LyD and children with ADHD on four of six measures: Digit Span Forward [$p=0.43$], Digit Span Backward [$p=0.79$], Number- Letter Sequencing [$p=0.20$], and Picture Locations [$p=0.55$], despite significantly higher general cognitive functioning (Verbal IQ $p=0.00$) in children with LyD.

Conclusions: Children with LyD perform similarly to children with ADHD on a variety of measures of working memory, suggesting that LyD can interfere with executive functions to a degree seen in this clinical population. As a result, children with LyD are at risk for academic difficulties that are similar to those observed in children with ADHD, and that require educational accommodations and support.

Correspondence: *Julie Grieco, M.A., The University of Wisconsin Madison & The Adler School of Professional Psychology, 2970 N. Sheridan Rd., Apt. 827, Chicago, IL 60657. E-mail: jgrieco@my.adler.edu*

E.J. HELDER, B. ELZINGA & T. LARSEN. Trajectory of Catch-up and Areas of Continued Deficit in Children Adopted Internationally at School-age.

Objective: Research in internationally adopted samples has documented a significant degree of catch-up for cognitive skills, such as intelligence and language, in the majority of children adopted from orphanage settings (Glennen, 2009; Beckett, 2006). However, most of this research has focused on children adopted as infants or toddlers. Increasingly, children are being adopted internationally at older ages and little is known about what can be expected regarding their cognitive development.

Participants and Methods: Utilizing a cross-sequential design, the current study has examined 25 children adopted internationally at the age of 4 years or older across three yearly time points (11 males, mean age at adoption=86.6+35.7 months, mean length of time in adoptive home at time 1 = 16.9+11.8 months) using a comprehensive battery of neuropsychological tests and parent-ratings of emotional and behavioral adjustment.

Results: Results indicate that the trajectory of catch-up differs by domain, with group means catching up to the average range on visual reasoning, processing speed, math, and motor skills at one year post-adoption, verbal and visual memory at two years post-adoption, reading, spelling, and attention at three years post-adoption, and verbal reasoning and language by four years post-adoption. As has been reported in a number of studies, a substantial degree of variability between participants was observed in outcomes. Statistically significant improvement was observed across almost all neuropsychological domains by time point three of the study, in contrast to the general lack of improvement that was previously reported from time one to time two (Helder, 2012).

Conclusions: Results have important implications for practitioners who provide assessment and/or intervention in this population, as they represent some of the first information about trajectory of catch-up in school-age international adoptees.

Correspondence: *Emily J. Helder, PhD, Psychology, Calvin College, 3201 Burton St SE, Grand Rapids, MI 49546. E-mail: emily.helder@calvin.edu*

M.B. HUDEPOHL, D. ILARDI & G. CHRISTOPHER. Caring for Pediatric Patients during Inpatient Rehabilitation after Acquired Brain Injury: What Predicts Caregiver Confidence?

Objective: Research has demonstrated that caregiver emotional functioning is negatively impacted after a child's acquired brain injury (ABI;

e.g. Youngblut & Brooten, 2006). Although studies have linked family functioning and burden to post-ABI outcomes (e.g. Taylor et al., 2001), there is much less research about implications of caregiver emotional functioning, particularly in acute settings after ABI. Caregiver confidence in caring for their hospitalized child is a novel construct that may be important in caregiver/child outcomes post-ABI. The purpose of this study was to explore emotional functioning as predictors of caregiver confidence in caring for their child during inpatient rehabilitation.

Participants and Methods: Data were gathered from caregivers of 26 pediatric patients (M age=8.9 years; SD=3.0) with new-onset ABI during inpatient rehab. Caregivers completed the Parental Beliefs Scale (PBS; caregiver confidence), Brief Symptom Inventory (BSI; current psychological functioning), and Parenting Stress Index, 3rd Ed. (PSI; stress level).

Results: Given the small sample in this preliminary study, three simple regression analyses were conducted to explore predictors of caregiver confidence. Caregiver anxiety ($R^2=.29$, $F(1, 25)=9.18$, $p<.01$) and depression symptoms ($R^2=.40$, $F(1, 25)=15.30$, $p<.01$), and stress ($R^2=.19$, $F(1, 25)=5.65$, $p<.05$) all significantly predicted caregiver confidence. All β -values were negative ($p<.05$), indicating that caregiver confidence decreased as anxiety, depression, and stress each increased.

Conclusions: Findings suggest a relationship between caregiver emotional functioning and confidence in their ability to care for their hospitalized child post-ABI. Further investigation of these preliminary results is warranted with a larger sample to explore these and other possible predictors of caregiver confidence. Results from this and future studies could facilitate design and implementation of family interventions that address both child and caregiver needs in acute rehabilitation settings. Correspondence: Margaret B. Hudepohl, M.A., Department of Psychology, Georgia State University, 171 Monitor Ave., Cincinnati, OH 45233. E-mail: margaretsbanks@gmail.com

M. IAMPIETRO, L. KRIVITZKY & D. BRINCKMAN. Memory functioning in Pediatric Stroke Survivors.

Objective: Children with a history of overt stroke or cerebrovascular disease often experience neurocognitive deficits across multiple domains, yet episodic memory performance remains largely understudied in this population. We examined verbal episodic memory to better understand specific learning and memory processes and their relation to lesion location. **Participants and Methods:** Participant variables, IQ data, and memory data from the California Verbal Learning Test (CVLT) were collected in a retrospective study from 27 children (M age=12.81 SD=3.45, 48% female). Inclusion criteria were: IQ >70, age at testing 6-18 yrs, and history of a cerebrovascular condition including overt stroke or symptomatic vascular malformation/disease. MRI reports were reviewed to determine lesion location, and IQ and CVLT data were extracted from clinical reports.

Results: Learning Trials 1-5 (M=48.59 SD=8.8), Short Delay FR (M=-.26 SD=1.1), Long Delay FR (M=-.17 SD=1.0), and Recognition Discriminability (M=.02 SD=1.0) performance was in the average range for the overall sample. Children with left hemisphere injury (n=12) compared to right (n=12) performed significantly worse across all four memory variables: (Learning Trials 1-5: $t(22) = -2.82$, $p = .01$), (Short Delay FR: $t(22) = -2.55$, $p = .02$), (Long Delay FR: $t(21) = -3.0$, $p = .01$), (Recognition Discriminability: $t(20) = -2.30$, $p = .03$). Children with bilateral injury (n=3) performed worse on all memory variables when compared to children with lateralized injury.

Conclusions: Overall CVLT performance was within the broad range of average for the group. However, in contrast to prior studies, children with a history of left hemisphere injury performed significantly worse on CVLT variables (.5 to 1 SD lower) than those with right hemisphere injury. Future research examining episodic memory performance in children with a history of cerebrovascular conditions is crucial for informing successful rehabilitation strategies to facilitate learning and academic success.

Correspondence: Lauren Krivitzky, PhD, Neuropsychology Program, Children's Hospital of Philadelphia, 43 Trent Road, Wynnewood, PA 19096. E-mail: cheeriodog@aol.com

A. JANOS, D.K. GRANGE, R.D. STEINER & D.A. WHITE. Developmental Changes in Processing Speed and Executive Abilities in Children with Phenylketonuria.

Objective: Children with Phenylketonuria (PKU) have been shown to exhibit slower and more variable information processing speed as well as deficits in executive abilities in cross-sectional studies. The aim of this study was to investigate the developmental relationships between age, processing speed and variability, and executive abilities in children with early-treated PKU.

Participants and Methods: The PKU group comprised 24 children (13 girls, 11 boys) aged 7-18 years (M = 12.0, SD = 3.3) at initial assessment. The control group comprised 44 typically-developing children (24 girls, 20 boys) aged 7-18 years (M = 11.7, SD = 2.9) at initial assessment. Children were assessed over three time points spanning an average of 2.7 years. No child had a major medical disorder, neurologic compromise, or learning disorder unrelated to PKU. Children completed 3 computerized reaction time (RT) tasks and 7 executive tasks examining working memory, inhibitory control, and strategic processing.

Results: To determine whether there was a differential effect of time on group, we conducted 9 omnibus repeated measures ANOVAs (composite RT mean and SD, 7 executive tasks), comprising group as the between-subjects factor and age as a covariate. Of particular interest were the interactions involving group and time, none of which reached significance ($p > .05$). Separate hierarchical linear regressions were conducted for all 9 variables at initial assessment, with independent variables entered in the following order: age, group, and the interaction between age and group. Performance improved with age for both groups in terms of RT mean and SD and 6 executive tasks ($p < .01$). There was a significant group effect for 4 executive tasks and a near-significant age by group interaction for the n-back task ($p = .053$).

Conclusions: Over a three-year period, there was no differential effect of time on RT and executive abilities in children with PKU compared with typically-developing children.

Correspondence: Alicia Janos, M.A., Washington University in St. Louis, 4400 Lindell Blvd, 15L, St. Louis, MO 63108. E-mail: alicia.janos@gmail.com

K.A. KERN, B.P. MULLIGAN, H. CARMICHAEL-OSLON & S. ASTLEY. An Exploration of Intra-individual Variability in Children with FASD.

Most research comparing children with FASD to typically developing children or other clinical groups focuses on mean differences in performance, though it is commonly noted that there is significantly more variation within groups of children with FASD. In spite of these common reports of increased variability in the performance of children with FASD, there is a lack of research examining intra-individual variability and fluctuations within task performance of these children. Measures of intra-individual variability (IIV) reflect transient, within-person changes in behavioral performance. In neuropsychological studies, IIV has been related to aging- behavioral changes associated with neurodegenerative and other brain-related disorders such as traumatic brain injury and schizophrenia. Indeed, persons with higher IIV show less efficient frontal responses during cognitive processing and that variability increases in tasks reliant on frontal cortices.

IIV can be quantified as fluctuations in performance of a single measure across trials within a task. We present data revealing significant differences in IIV in children with FASD in comparison to a group of typically developing children, which increases as a function of the complexity of the task. These differences in IIV were found in children across the spectrum of FAS/pFAS, ARND and children with prenatal alcohol exposure but only mild to moderate cognitive or behavioral dysfunction. Additionally we present data examining IIV in a group of children who received a cognitive intervention (computerized training) documenting a decrease in IIV following the intervention. Relationships between this decrease and changes in cognitive performance will be discussed.

A better understanding of IIV in children with FASD is essential as exclusive emphasis on mean levels of performance may oversimplify patterns of behavior and IIV provides unique information about cognitive processing over and above mean performance.

Correspondence: *Kimberly A. Kerns, Department of Psychology, University of Victoria, Victoria, BC BC, Canada. E-mail: kkerns@uwic.ca*

R.M. VERNESCU. Process Training for Children with FASDs.

Attention and executive functioning deficits are among the most commonly observed behaviours in children with FASDs, from difficulty with basic sustained attention to planning and organization, impulse control and inhibition, and set shifting or cognitive flexibility. Multimodal supports including environmental and compensatory strategies, positive behavioural support strategies, and cognitive-based intervention strategies (e.g., direct training of attention and executive functioning) are often recommended as effective approaches. However, while it is widely supported that intervention research can provide answers for treating specific cognitive challenges, the utility of these approaches for children with FASDs has, until recently, remained uncertain. This presentation will discuss promising and evidence-informed approaches for children/youth on the spectrum, highlighting the results of cognitive based process-specific approaches to train subcomponents of attention and executive functioning. Positive effects of cognitive process training, from basic sustained attention to more complex working memory, were observed for 6-12 year-old children with FASDs under direct one-on-one and computerized training paradigms. More specifically, basic sustained-attention training was associated with significant improvements on several untrained measures of auditory and visual sustained attention, selective attention and distractibility, as well as higher-order divided and attentional control or alternating attention measures. Working memory training contributed to improved scores on sentence repetition, narrative memory, and comprehension of instruction. In addition, training effects were found to generalize to a higher order measure of non-verbal reasoning. These findings suggest that this type of training may be beneficial for children with FASDs.

Correspondence: *Roxana M. Vernescu, Nipissing University, 125 Wellington St., Bracebridge, ON P1L-1E2, Canada. E-mail: rvernescu@nipissingu.ca*

S. KIM, J. HAN, J. BIN & I. LEE. Long-term Neurocognitive Outcomes in Survivors of Acute Childhood Lymphoblastic Leukemia.

Objective: The neurocognitive function in long-term survivors of childhood acute lymphoblastic leukemia (ALL) has been evaluated by comparison, but results have been inconclusive. This study is designed to examine long-term cognitive outcome in children with ALL in remission. **Participants and Methods:** Forty-two children, age 6.6–15.5 years in long-term remission from ALL, 4.6–8.3 years post diagnosis, without relapse and no prediagnosis history of neurodevelopmental disorder were compared with 42 controls matched for gender and age, on measures of intellectual functioning with Korean Educational Development Institute-Wechsler Intelligence Scale (KEDI-WISC), Children's Color Trails Test™, Stroop Color and Word Test: Children's Version, Beery test of Visual Motor Integration and Attention Deficit Hyperactivity Disorder Diagnostic System (ADS). Eighteen ALL survivors who's treatment protocol include intracranial irradiation were also compared with 24 ALL survivors treated without intracranial irradiation.

Results: No significant differences were found in KEDI-WISC total intelligence quotient (IQ), verbal IQ and performance IQ between ALL survivors and control. However, ALL survivors treated with intracranial irradiation showed statistically significant lower total IQ (102.2 ± 8.1 vs 111.0 ± 13.6 , $p=0.019$) and performance IQ (101.4 ± 13.2 vs 110.1 ± 14.0 , $p=0.049$) than treated without intracranial irradiation. ALL survivors attained significantly lower scores in some KEDI-WISC subtest (information, picture completion and picture arrangement) and higher in coding subtest. ALL survivors obtained higher T-score in omission, variability and lower T-score in response time of ADS test.

Conclusions: Survivors of childhood ALL suffer from neurocognitive impairment, especially when treatment includes cranial irradiation. Survivors of childhood ALL are also impaired in attention and concentration.

Correspondence: *Seong Joon Kim, Department of Pediatrics, Seoul St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, Seoul, South Korea, 93 Jeedong, Paldalgu, Suwon, Kyong-gido, Republic of Korea, Suwon 442-723, Republic of Korea. E-mail: sjhocht@naver.com*

J. KOOP, D. SABSEVITZ, A. HEFFELFINGER & S. JOGAL. Title: Cognitive Profile in Pediatric Posterior Fossa Tumors: Feasibility of fMRI to Assess Working Memory and Inhibitory Control.

Objective: Children with posterior fossa (PF) brain tumors are surviving with secondary cognitive impairments, especially executive dysfunction (EF). The mechanism for executive dysfunction is unclear but may include radiation white matter necrosis, chemotherapy toxicity, or diaschisis due to surgical resection. fMRI could inform us of the underlying mechanisms. One problem with using fMRI in pediatric brain tumor is the variability in cognitive status and age-related developmental differences, which affect fMRI task performance. This study aimed to investigate the feasibility of adapting measures of EF for the scanner that both can be equated on performance while remaining sensitive to individual differences.

Participants and Methods: Computerized Go-No Go and Sternberg Working Memory tasks were developed to titrate difficulty and calibrate for uniform success rate by adjusting inter-stimulus interval and working memory load during in vivo task performance. 18 children with PF tumors and 8 healthy controls between the ages of 6 and 16 were recruited to complete EF scanner tasks, a paper-and-pencil neuropsychological (NP) battery, and fMRI.

Results: Group performances on the EF fMRI tasks were comparable and indicated equivalent task performance by both groups. The PF group performed significantly poorer than controls, however, on NP measures, including FSIQ ($t=-2.17$; $p<.05$); PRI ($t=-2.61$; $p<.05$); and set shifting ($t=-2.16$; $p<.05$), demonstrating actual group differences on EF ability level. Correlations between NP tasks with fMRI tasks revealed group differences: There were significant relationships observed between Go-No Go performance and inattentiveness and processing speed in the tumor group.

Conclusions: Although sample sizes were small, these results suggest that despite variability in PF tumor group performance, scanner tasks can be adjusted for the individual to a level of behavioral equivalence. This will allow fMRI to assess underlying functional activation without the potential confound of task performance.

Correspondence: *Amy Heffelfinger, Medical College of Wisconsin, 9200 W. Wisconsin, Milwaukee, WI, WI 53212. E-mail: aheffelfinger@mcw.edu*

T.G. BOWERS, S.E. KRAMER, C. TOWSEY & M.A. TAYLOR. Comparison of Neuropsychological Test Performance between Children with Fetal Alcohol Syndrome and Fetal Alcohol Effects.

Objective: Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Effect (FAE) are caused by prenatal alcohol exposure (Chasnoff et al., 2010; Conry, 1990; Mattson et al., 1998; Odishaw & Snart, 2005), and come with pronounced cognitive deficits. We compared performance on neuropsychological assessments on measures of intelligence, executive function, attention and memory for children with FAS, FAE, and other neuropsychological compromises.

Participants and Methods: Data was collected for individuals between ages 6- and 16-years old ($n=168$). MANOVAs were conducted on the scores transformed into z scores, and simple regression analyses were also conducted with prenatal alcohol exposure as a predictor.

Results: The results indicated that: 1. significant differences were found on intellectual measures on the verbal comprehension scores between FAE children and the neuropsychological comparison condition but not for the FAS children. The FAS children were significantly weaker on intellectual scores for the perceptual reasoning scores, while the FAE group did not differ significantly from the comparison condition. On Comprehension of Instruction scores, all three conditions varied significantly in the expected direction. 2. Executive functioning measures in-

icated FAS groups trended to scores more poorly than the FAE comparison. FAS children were significantly weaker than the other conditions on executive functions. 3. No significant differences emerged on attention findings between the three conditions. 4. Memory measures indicated significantly poorer scores on working memory for the FAE group relative to the neuropsychological comparison condition. FAS children were found to be significantly weaker than the comparison condition on intermediate verbal learning. Prenatal alcohol exposure was found to be a significant predictor on intelligence and executive function, but not memory and attention measures.

Conclusions: The data indicated that FAS and FAE children demonstrate distinct patterns of neuropsychological test performance.

Correspondence: *Thomas G. Bowers, Ph.D., Psychology; Penn State Harrisburg, 777 W. Harrisburg Pike, Oltsted W311, Middletown, PA 17057. E-mail: dvo@psu.edu*

J. LEE, R. GREEN, A. HAMILTON & J. WISNOWSKI. Perinatal Stroke in Broca's Area: Long-term Language and Verbal Memory Outcome in Two Patients.

Objective: In contrast to adult-onset damage to the left inferior frontal gyrus (IFG) in adults, perinatal injuries to Broca's area have not typically been associated with long-term language deficits (Van Hout, 1997), although subtle impairments in morphology, syntax, or comprehension have been identified (Thal, et al, 1991; Reilly, Bates, & Marchman, 1998; Wulfeck, Bates, Krupa-Kwiatkowski, & Saltman, 2004). Moreover, the general consensus has been that language deficits often improve to normal levels by school age (MacWhinney, Feldman, Sacco, & Valdes-Perez, 2000; Stiles, Reilly, Paul, & Moses, 2005). We examined language and basic neuropsychological functions in two school-aged boys with perinatal infarcts almost exclusively restricted to the left IFG.

Participants and Methods: As part of their participation in our Patient Registry, Patients A and B (ages 9 and 16 years) underwent comprehensive neuropsychological assessments, which included tests of language, memory, visuoperceptual, executive and emotional functions.

Results: Patient A presented with broadly fluent speech, whereas Patient B had difficulties in fluency. Both had deficits in aspects of language, including sentence repetition (CELF-4 Recalling Sentences, Patient A: 5th %ile; Patient B: 2nd %ile) and grammar/word usage (CELF-4 Formulating Sentences: 2nd %ile and <1st %ile respectively). Also, both failed to use language-based strategies to organize information during a rote memory task (CVLT-C, Semantic Clustering: $Z = -1.5$ and -2.5 , respectively), although rote verbal memory was otherwise intact. Impairments in working memory and speeded information processing were also noted. Language impairments in both cases were severe enough as to interfere with school, and for Patient B, social functioning.

Conclusions: These findings indicate that perinatal lesions involving left IFG may result in persistent language deficits similar to a Broca's aphasia and raise questions about the limitations of brain plasticity in this population.

Correspondence: *Justin Lee, M.A., Children's Hospital Los Angeles, 6721 Valmont St., Tujunga, CA 91042. E-mail: jblee@chla.usc.edu*

A.R. LOUGHAN, M. BERL, M. PINON & J. SANZ. Executive Dysfunction in School Age Children with Congenital Heart Defects (CHD).

Objective: Survival rates of children with CHD have increased due to medical advancement; however, susceptibility to oxygen deprivation and neurological defects place this population at risk for brain dysfunction; specifically within the frontal cortex. There is concern regarding their cognitive outcome, particularly as they progress through school age. Given the strong link between executive function (EF) and academic success, the current study investigates the EF profile of children with CHD and examines differences associated with clinical variables.

Participants and Methods: Children with CHD ($n = 170$) were age and gender matched to neurotypical controls ($N = 340$; 62% = male; mean age = 8.72 yrs; age range = 5-18 yrs). Caregivers completed the Behavior Rating Inventory of Executive Function (BRIEF) and a demographic/medical questionnaire.

Results: Results revealed that children with CHD had higher scores (more impairment) across all subscales of the BRIEF ($p < .005$). There were no differences between cyanotic and acyanotic groups on any subscale. Approximately one-third of CHD children had clinically elevated subscale scores. Chi-square analyses revealed a higher percentage of elevated BRIEF scores in children with CHD when compared to matched controls, but no difference between children with cyanotic and acyanotic disease.

Conclusions: Overall, children with CHD demonstrated a greater frequency and symptom severity for EF difficulties on the BRIEF. Degree of oxygen deprivation was not associated with greater EF impairment, suggesting that EF is at risk regardless of the type of CHD. Proper identification and delineation of executive dysfunction will result in better monitoring, earlier intervention, and provision of optimal academic support for children with CHD.

Correspondence: *Ashlee R. Loughan, Ph.D., Walton Rehabilitation Hospital, 1355 Independence Dr, Augusta, GA 30901. E-mail: aspicerSS@yahoo.com*

E.C. MAXWELL, P.T. CIRINO, J. JURANEK, J.M. FLETCHER & M. DENNIS. Visual Perception and Posterior Cortical Changes in Children with Spina Bifida Myelomeningocele.

Objective: The present study investigated visual perception in children with spina bifida myelomeningocele (SBM) using the framework proposed by Dennis et al. (2006), which suggests strengths and weaknesses within, rather than only across cognitive domains. Group differences were expected to be largest on the coordinate relative to categorical task.

Participants and Methods: Participants consisted of 81 children with SBM and 28 controls, who were administered a categorical/coordinate visual perception task (Hellige & Michimata, 1989). A subset of participants had structural MRI data available, and behavioral performance was related to indices of cortical thickness and gray and white matter volumes in four regions of interest: inferior parietal cortex (IPC), superior parietal cortex (SPC), middle temporal gyrus (MTG), and superior temporal gyrus (STG). ANOVA and correlations/regression were used for analyses.

Results: Children with SBM had poorer categorical and coordinate accuracy relative to controls, $p < .001$, though both groups were more accurate on the categorical than the coordinate task, $p < .0001$. Children of both groups responded more slowly on the coordinate than the categorical task, $p < .0001$; however, a response time interaction was also noted, $p < .001$, though controls were slower on the coordinate task when compared to children with SBM. Across regions of interest, children with SBM had significantly reduced cortical thickness, gray matter volume, and white matter volume relative to controls. For categorical accuracy there was a consistent pattern with positive correlations with gray and white matter of the right STG and negative correlations with gray and white matter of the left STG.

Conclusions: Both task and group effects were noted, though few interactions were evident, providing partial support for the Dennis et al. (2006) model in this context. Findings also provided insight as to the brain regions impacting visual perception performance for children with SBM.

Correspondence: *Emily C. Maxwell, University of Houston, 4921 Crawford Street, Apt #1S, Houston, TX 77004. E-mail: emaxwell@gmail.com*

C. OMIZZOLO, R. STARGATT, S. SCRATCH, L. DOYLE, T. INDER & P. ANDERSON. Neonatal Brain Abnormalities and Memory and Learning Outcomes at 7 Years in Children Born Very Prematurely.

Objective: Preliminary evidence suggests very preterm children (VPT; birth prior to 32 completed weeks of gestational age) show later memory and learning difficulties. Qualitative scoring systems using MRI show VPT infants to be at high risk of brain pathology. Understanding the

association between early pathology with later memory and learning difficulties is important for early diagnosis and intervention. This study aims to characterise verbal and visual memory and learning deficits in 7 year VPT children compared to term controls, and evaluate the predictive value of early pathology for later memory and learning impairments in VPT children at 7 years.

Participants and Methods: Participants were prospectively recruited into the Victorian Infant Brain Studies cohort between July 2001 and December 2003 at Melbourne's Royal Women's Hospital, Australia. MRI brain scans were collected at term equivalent age. There were 198 VPT and 70 term children at 7 years. Measures investigated memory and learning in both verbal and visual domains. Neonatal MRI scans were qualitatively assessed for global, white-matter, cortical grey-matter, deep grey-matter, and cerebellar abnormalities in the VPT cohort.

Results: Regression models were used to examine differences between birth groups (VPT and controls) on outcome measures, and whether neonatal brain abnormality was predictive of performance in VPT children. VPT children performed significantly poorer on measures of verbal and visual working memory, long-term memory, and learning compared to controls. Neonatal brain injury significantly predicted memory and learning performance at 7 years, especially global, white-matter, grey-matter and cerebellar abnormality.

Conclusions: Children born VPT show reduced memory and learning in both verbal and visual domains at 7 years. Brain abnormalities evident on MRI at term equivalent age are predictive of performance at 7 years in VPT children.

Correspondence: *Cristina Omizzolo, Murdoch Childrens Research Institute, 53 Willow Grove, East Kew, Melbourne, VIC 3102, Australia. E-mail: cgomizzolo@students.latrobe.edu.au*

C. OMIZZOLO, D. THOMPSON, R. STARGATT, T. INDER, L. DOYLE & P. ANDERSON. Hippocampal Volume, Memory and Learning at 7 Years in Children Born Very Prematurely.

Objective: The hippocampal formation has long been associated with memory and learning, and is particularly vulnerable to complications associated with very preterm birth (VPT; birth prior to 32 completed weeks of gestational age). VPT children also show an increased prevalence of memory and learning difficulties, which has implications for intellectual development. This study aims to compare hippocampal formation volume between VPT and full-term (FT) controls, and evaluate the association between hippocampal volume and later memory and learning impairments in VPT children at 7 years.

Participants and Methods: 227 VPT and 46 FT participants were prospectively recruited into the Victorian Infant Brain Studies cohort between July 2001 and December 2003 at the Royal Women's Hospital, Australia. Participants were followed to 7-years of age, at which point they had a brain MRI scan and detailed neuropsychological assessment. In total, 145 VPT and 34 FT control T1-weighted MRI images were suitable for left and right hippocampal segmentation in the coronal view. Hippocampal segmentation was generated using ITK-SNAP. Neuropsychological assessment included measures of working memory, and memory and learning in both verbal and visual domains. Regression models examined group differences between left and right hippocampal volume, and whether hippocampal volume was associated with memory and learning in the VPT cohort.

Results: Left hippocampal volume in the VPT group was significantly reduced compared to FT controls at 7 years, and the group difference in right hippocampal volume almost reached significance ($p=.056$). Left hippocampal volume was significantly associated with verbal working memory ($p=.025$).

Conclusions: VPT children show reduced hippocampi volumes at 7 years. Hippocampal volume does not appear to be strongly associated with long-term memory and learning in this population at 7 years, but may play a role in working memory.

Correspondence: *Cristina Omizzolo, Murdoch Childrens Research Institute, 53 Willow Grove, East Kew, Melbourne, VIC 3102, Australia. E-mail: cgomizzolo@students.latrobe.edu.au*

M.D. SADY, K.S. WALSH, H.P. GOODKIN & E.M. WELLS. Two Pediatric Cases of Paraneoplastic Limbic Encephalitis – Neurological and Neurocognitive Outcomes.

Objective: Paraneoplastic limbic encephalitis (PNLE) is characterized by cognitive and mood changes, memory problems, and seizures, correlating with temporal lobe abnormalities. Pediatric PNLE is rare, and long-term prognosis is unclear. Several case series noted poor outcomes but have not described social or neurocognitive evaluation and intervention.

Participants and Methods: This series presents two children (7yo female, 11yo male) with PNLE and elevated anti-Hu antibodies with onset by age five. Longitudinal antibody levels, brain MRI, EEG and neuropsychological assessment data were examined qualitatively to characterize the medical and cognitive course.

Results: In both cases, clinical presentation included disabling emotional lability and behavioral dysregulation. Seizures were characterized by stomach discomfort and oral automatisms; EEG focus correlated with MRI temporal lobe hyperintensity. Both were treated with immunotherapy including cyclophosphamide, rituximab and IVIG, as well as antiepileptics. Antibody titers have normalized, but both children have poorly controlled epilepsy. Serial testing with the male indicated IQ falling to the range of intellectual disability, while the female's was in the average range at last assessment. Both have significant memory impairment, executive dysfunction, and ongoing behavioral dysregulation. The patients are in different educational placements; the female is in a highly modified environment with school-based psychiatry and psychology, while the male is struggling in a combination inclusion/exclusion setting.

Conclusions: Pediatric PNLE requires multidisciplinary care for immunotherapy, neurologic treatment, and behavioral/neurocognitive rehabilitation. Medical-neurological improvement is not necessarily accompanied by improvement in neurocognitive status. Wrap-around services are needed, with frequent follow-up to monitor status and provide intervention. Long-term follow-up will determine improvement, stabilization or diminishing cognitive function from memory deficits.

Correspondence: *Maegan D. Sady, Ph.D., Pediatric Neuropsychology, Children's National Medical Center, 15245 Shady Grove Road, Suite 350, Rockville, MD 20850. E-mail: maegan.sady@gmail.com*

C.H. SALAMA & D. ILARDI. Pediatric Anti-NMDA Receptor Encephalitis: Case Series Review of Acute and Long-Term Neuropsychological Findings.

Objective: Anti-NMDA receptor encephalitis is an autoimmune disease in which antibodies react against the subunits of NMDA receptors in the brain. Overactivity of NMDA receptors has been associated with seizures, dementia, and stroke; low activity has been associated with psychotic symptoms. Previously documented acute impairments include psychiatric symptoms, memory problems, seizures, unresponsiveness, dyskinesia, and autonomic instability (Dalmau et al., 2008). Limited information is available about the neuropsychological profile in pediatric populations. The purpose of this case series is to highlight the acute and long term neuropsychological findings.

Participants and Methods: Participants included six children (ages 4-18 years; 4 females) seen during inpatient rehabilitation. Course of acute cognitive, psychiatric, and neurological symptoms are described. Neuroimaging (e.g., normal; volume loss; scattered hyperintensities) and EEG (e.g., diffuse slowing, bifrontal; lateralized) findings reviewed. Two females seen at 9 months (13 yr) and 16 months (16 yr) post for outpatient neuropsychological evaluation. Medical records and parent report data available for 3 participants between 1-2 years post diagnosis.

Results: Anti-NMDA receptor encephalitis during acute phase is associated with severe neurological (e.g., seizures, dysphagia, chorea, dystonia), cognitive (e.g., amnesia, mutism), and psychiatric symptoms (e.g., hallucinations, hypersexuality, compulsive behaviors). Slope of progress and recovery appears poor for younger onset age. Long-term follow-up indicates variable outcomes, from complete recovery to diffuse deficits in motor, language, learning/memory, attention/executive functioning, and social-emotional functioning. Regression in academic and adaptive skills was also found.

Conclusions: The results suggest that pediatric anti-NMDA receptor encephalitis is associated with diffuse deficits, particularly for younger onset age.

Correspondence: *Christina H. Salama, M.A., Georgia State University, 140 Decatur St., 11th Floor, Atlanta, GA 30303. E-mail: csalama1@student.gsu.edu*

J. SCHUH, E.M. SCHWEHR, J. KOOP & A. HEFFELFINGER. Neuropsychological Predictors of Socioemotional Outcomes in Pediatric Brain Tumor Survivors.

Objective: Children with mood disorders often have neuropsychological weaknesses, which are related to poorer socioemotional outcomes. Many pediatric brain tumor survivors experience socioemotional difficulties (Holmquist & Scott, 2002), yet relatively little is known regarding the contributing neuropsychological factors. This study aims to identify neuropsychological predictors for depression and social difficulty. Because pediatric brain tumor survivors are at a heightened risk for weaknesses in processing speed, memory, and motor skills, we predict they will have particularly strong associations with socioemotional functioning.

Participants and Methods: Thirty-one children and adolescents with brain tumors (ages 5-18, $M=11.54$; $FSIQ \geq 70$) were assessed with a comprehensive neuropsychological battery. Caregivers completed the Child Behavior Checklist (CBCL), and two subscales of interest were explored: Withdrawn/Depressed and Social Problems. Linear regression analyses explored the relationships between cognitive and socioemotional domains.

Results: No significant differences in CBCL ratings were found for age, gender, tumor classification, or treatment type, all $p's > .27$. Twenty-six percent of participants were in the subclinical range or higher for depression and 10% for social difficulties. Slower processing speeds were related to greater social difficulty after controlling for verbal IQ, $p=.01$, but not to depression, $p=.70$. After accounting for verbal IQ, poorer verbal memory was not associated with social difficulty, $p=.11$, but accounted for significant variance in depression, $p=.04$. Motor weaknesses accounted for social difficulty, $p=.01$, and marginally for depressive symptoms, $p=.07$.

Conclusions: Neuropsychological weaknesses commonly associated with brain tumors and subsequent treatments may contribute to greater risk for depression and social difficulties in pediatric brain tumor survivors. Findings highlight the importance of continued neuropsychological and therapeutic treatments for pediatric brain tumor patients.

Correspondence: *Jillian Schuh, Department of Neurology - FWC, Medical College of Wisconsin, 9200 W Wisconsin Ave, Milwaukee, WI 53226. E-mail: jschuh@mcw.edu*

D.D. SCHWARTZ, M.E. AXELRAD, I. CALLAS & B.J. ANDERSON. Acute Fine-Motor Dysfunction as a Marker of Neurobehavioral Vulnerability in Children with Type 1 Diabetes.

Objective: Type 1 diabetes (T1D) is a common chronic illness that is most often diagnosed when children have dangerously high blood glucose (BG) levels that may affect the CNS. Controlling BG requires adherence to a complex daily regimen that places high demands on cognitive and executive abilities. Prior research has shown that neuropsychological deficits at T1D diagnosis are associated with adherence problems in the first year post-diagnosis. In this study, we examined the impact of neuropsychological functioning at T1D diagnosis on diabetes control over the next 3-5 years. We hypothesized that cognitive dysfunction at diagnosis would be associated with poorer long-term BG control.

Participants and Methods: We completed neuropsychological screens on 178 children within 3 days of T1D diagnosis (M age = 9.7 ± 3.6 yrs). BG control was assessed by HbA1c, a measure of BG over the prior 3 months. We determined by chart review the averaged mean HbA1c and average variability in HbA1c in the 3-5 years following diagnosis (M diabetes duration = 4.1 ± 0.7 yrs). The data were analyzed by linear regression.

Results: Fine-motor speed/dexterity predicted mean BG ($\beta = -.170$, $p = .033$) and BG variability ($\beta = -.214$, $p = .025$) in the 3-5 years following T1D diagnosis, even after accounting for correlated demographic factors (race, insurance, parent marital status). Other correlated neuropsychological variables (VMI, Digit Span) did not add any significant predictive power.

Conclusions: Fine-motor deficits at T1D diagnosis predict long-term BG control and variability. Measures of fine-motor speed and dexterity are known to be sensitive to cognitive slowing associated with chronic illness and CNS insult. Acute fine-motor dysfunction at T1D diagnosis may therefore be a marker for more general CNS vulnerability to the hyperglycemia and other metabolic fluctuations that characterize the period leading up to diagnosis (Ryan, 2008). These findings have important implications for long-term diabetes control.

Correspondence: *David D. Schwartz, PhD, Pediatrics, Baylor College of Medicine, 6701 Fannin St, Ste 1630, Houston, TX 77030. E-mail: ddschwar@bcm.edu*

M. STERN, K. BAUM, J. FIELD, L. MILLER & D. BEEBE. Effect of Multi-Night Experimental Sleep Restriction on Attention in Healthy Adolescents.

Objective: Sleep restriction adversely affects attention in healthy children and those with clinical conditions (e.g., ADHD). Chronic sleep restriction is common among adolescents, yet the effects have not been well investigated in this age group. Based on the previous literature, we hypothesized that experimental sleep restriction would adversely affect attention in adolescents.

Participants and Methods: 42 healthy 14-17 year-olds successfully completed an experimental protocol including a baseline week followed by counterbalanced 5-night periods of restricted sleep (6.5 hours in bed Monday-Friday nights) and extended sleep (10 hours in bed Monday-Friday nights), with a two-night "washout" before each experimental condition. Parent and self-report ratings of attention (Vanderbilt Assessment Scales), as well as the Psychomotor Vigilance Test (PVT) were administered on the Saturday morning following each experimental sleep condition. General linear models compared attention ratings and PVT reaction times across conditions and also probed for order by condition interactions.

Results: Significantly worse attention was reported by parents ($p < .001$) and teens ($p < .05$) during sleep restriction compared to extended sleep, without condition-by-order interactions. The effect of sleep condition on the PVT was moderated by a condition-by-order interaction ($p < .01$) in which the effect was clearly evident only when the extended sleep schedule was experienced first (and short sleep second). This may have been because the PVT became less novel (more boring) across sessions, increasing sensitivity to sleep restriction.

Conclusions: Chronic sleep restriction of a severity experienced by roughly 1 in 5 adolescents can significantly negatively impact their attention in day-to-day tasks, which outside of this study include driving and classroom work. While the current study focused on healthy teens, adolescents with acquired or neurodevelopmental disorders are at even greater risk for sleep problems, suggesting a need for further study.

Correspondence: *Melissa Stern, BMCP, CCHMC, 3166 Sagola Pl, Cincinnati, OH 45209. E-mail: mstern1981@yahoo.com*

N.M. TAYLOR & L.S. JAKOBSON. Persisting Deficits in Mirror-Normal Discrimination Among Preterm Youth.

Objective: Preterm children show predilection for cortical visual processing deficits, including problems processing and representing motion (Taylor et al., 2009) — abilities thought to involve regions of the cortical visual system (e.g. Zacks, 2008) that are often damaged in these children (Back et al., 2001). Previously, we tested 5-8.5 year old preterm children on a mental rotation task thought to involve these same brain regions (Podzbenko et al., 2002). While both preterm and full-term groups showed a typical mental rotation function (thus ostensibly showing similar ability to mentally rotate objects along a picture plane), the

preterm group was less accurate overall, a result we attributed to difficulties making mirror-normal discriminations, which require a rotation (flip) out of the picture plane. Given lack of response time data, we were not able to conclude whether the preterm group performed mental rotation as efficiently as their full-term peers.

Participants and Methods: In the present study, we assessed mental rotation ability in 11, 9-14 year-old children born at ≤ 32 weeks gestation, and in 28 full-term controls. The two groups were matched for age, SES and gender distribution.

Results: While preterm children were as accurate as their full-term counterparts, there was a significant interaction between degree of rotation and group for response time ($F=3.65$, $p<.05$). Follow up t-tests showed that the preterm group took significantly longer than controls on trials involving the 180°, 'up-down' discrimination ($t=1.98$, $p=.05$), resulting in their mental rotation function having a significant quadratic component ($F=5.8$, $p<.05$).

Conclusions: This study provides further evidence of persisting deficits in mirror-normal discrimination in preterm children into adolescence, and is consistent with other evidence suggesting the dissociability of (planar) mental rotation and mirror-normal discrimination ability (e.g. Davidoff & Warrington, 2001; Lawson et al., 2000).

Correspondence: *Nicole M. Taylor, Ph.D., Clinical Health Psychology, University of Manitoba, PZ-162 771 Bannatyne Ave., Winnipeg, MB R3E 3N4, Canada. E-mail: ntaylor@hsc.mb.ca*

F. VAN DER FLUIT, J.I. KOOP & A.K. HEFFELFINGER. Examination of the Effects of Perinatal Neurological Insult on Visual Attention.

Objective: The developing brain reorganizes following early injury, but alterations in function remain. Visuospatial, attention, and inhibition remain affected. Also, classic neuropsychological syndromes, such as neglect, can occur following early neurological injury. Preschoolers with presumed pre/perinatal stroke are hypothesized to have persistent attentional neglect.

Participants and Methods: Participants included 11 children (4 male) ages 3 and 7 years old, $IQ > 70$. Children were clinically referred and completed an evaluation including IQ and the NEPSY Visual Attention task, CATS. Total, left, and right number of omissions and commissions were calculated and compared between left versus right early stroke groups.

Results: Results show that 36.4% had impaired inattention including 50% with right-sided injuries and 28.6% with left-sided injuries. 27.3% had impaired impulsivity including 42% of those with left-sided injuries. In contrast, none with right-sided injuries had impaired impulsivity.

Two with right-sided injury had evidence of unilateral neglect. The first child was a 46 month male with right-sided hydrocephalus. Full-scale IQ was within the normal. He omitted 100% of the left and 80% of the right-sided targets. He made 0 commissive errors on the left and 12 on the right side. The second child was a 41 month male with right-sided intrauterine stroke. Full-scale IQ was within the normal range. He omitted 30% of the left and 20% of the right-sided targets. He made 0 commissive errors on the left and 3 on the right side.

Conclusions: Approximately 1/3 of the children with perinatal lateralized injury demonstrated some degree of visual attention impairment. Children with right-sided injuries were more likely to show an inattentive pattern and some evidence of left unilateral neglect. Children with left-sided injuries were more likely to show an impulsive pattern, but without evidence of visual neglect. These results demonstrate the need for early assessment/intervention for attention including neglect.

Correspondence: *Faye van der Fluit, Psychology, University of Wisconsin, Milwaukee, PO Box 413, Milwaukee, WI 53201. E-mail: vanderf2@uwm.edu*

J. WALTER, M. LACY, T. NADAR & D. FRIM. Effects of Congenital Hydrocephalus and Prematurity on Intellectual Functioning.

Objective: It has been established that children with congenital hydrocephalus often demonstrate long-term intellectual deficits. Many chil-

dren with hydrocephalus are also born preterm (< 37 weeks gestation), and prematurity alone is associated with long-term neurocognitive deficits. The purpose of this study was to examine whether intellectual functioning deficits in children with congenital hydrocephalus are driven by hydrocephalus, prematurity, or a combination of the two.

Participants and Methods: Seventy-six participants completed the Wechsler Intelligence Scale for Children- Third edition (WISC-III; 44 males, mean age 10y 3mo). Fifty-two children with a history of congenital hydrocephalus (29 full term and 23 preterm) were compared to 19 healthy controls.

Results: Children with hydrocephalus, regardless of weeks gestation, performed below healthy controls on a measure of global intellectual functioning (full-term FSIQ $SS=89.54$, preterm FSIQ $SS=77.59$, healthy controls FSIQ $SS=106.88$). ANOVA revealed a main effect for FSIQ ($F=15.28$, $df=69$, $p\leq.001$). There was a nonsignificant trend seen between the hydrocephalic groups ($p=.073$).

Conclusions: We found that children with congenital hydrocephalus, regardless of gestational age, consistently performed significantly below healthy controls on a measure of intellectual functioning. While nonsignificant, there was a trend of less developed intellectual skills in premature children compared to full-term children born with hydrocephalus. Results suggest that while prematurity likely has an impact on intellectual functioning, hydrocephalus impacts intellectual functioning above and beyond the effects of prematurity.

Correspondence: *Jamie Walter, M.A., Psychology Department, Roosevelt University, 2023 W Webster Ave, #2, Chicago, IL 60647. E-mail: JamieLD9@yahoo.com*

Multiple Sclerosis/ALS/Demyelinating Disorders

C. ARREOLA, B. BERTADO, J. GUERRERO, C. CUEVAS, H. SALGADO & I. GRIJALVA. Efficacy and safety of 4-aminopyridine treatment on cognitive performance of patients with Multiple Sclerosis: A randomized, blinded, and placebo-controlled study.

Objective: Evaluate the effect of 4-AP in cognitive performance (attention, memory, executive functions and processing speed) of patients with relapsing remitting MS (RRMS) comparing with placebo.

Participants and Methods: Ten patients over the age of RRMS, a similar degree of disability, and with an evolution of at least 6 months, who are in first-line immunomodulatory therapy and have a stable disease (no more than one outbreak per year, were included in the present study. Patients were administered with the neuropsychological test battery 8, selected for this study and divided into two sessions of one-hour each. Emotional state was assessed with the Beck Depression Inventory and a trait anxiety scale in a different session. Cognitive impairment was defined as the alteration of two or more neuropsychological tests. Patients were divided randomly into two groups where one received placebo and the other one 4-AP for a period of three months in increasing doses.

Results: Changes were found in two pre and post treatment processes that are most affected in patients with MS, such as: the rate for acquiring and processing new information and executive functions.

Conclusions: Cognitive impairment, especially on speed of processing new information and on executive functions, occurs frequently in patients with RRMS, as well as different alterations in visuospatial memory that could be affected positively after 4-AP treatment.

Correspondence: *Claudia Arreola, Master, FES-Itacala UNAM, Calle E No. 33-2 Col. Alianza popular revolucionaria, México D.F. 04800, Mexico. E-mail: arremocla@yahoo.com.mx*

M.R. BASSO, A. MILLER, A. CARTER, E. ESTEVIS, D. COMBS, J. JOHNSON, S. WOODS & P. CANDILIS. Memory Impairment in MS is Characterized by Deficits in Acquisition and Retention.

Objective: Cognitive impairment occurs in 60% of patients with multiple sclerosis (MS), and memory deficits are especially common. Early research characterized memory deficit as one of retrieval, with patients

showing poor recall but normal recognition. Recent research implies that the primary deficit involves acquisition. With extended rehearsal, patients recall and recognize material normally. One aspect of memory impairment that has received little attention is retention of information. Wright et al. (2009) computed indices reflecting acquisition, retrieval, and retention using the CVLT, and this has been validated in patients with neurological disease and HIV (Cattie et al., 2012). We utilized this method using the CVLT-II to assess these three memory functions in people with MS.

Participants and Methods: 44 control subjects and 91 patients with MS were recruited from the community. They were administered measures of intelligence, executive function, information processing speed, working memory, language, psychomotor speed, and the CVLT-II. Number of impaired tests (excluding CVLT-II) was summed to classify patients as cognitively impaired or not, yielding 70 unimpaired patients and 21 impaired. The Item-Specific Deficit Approach was applied to CVLT-II performance to generate acquisition, retrieval, and retention indices.

Results: ANOVA and Bonferroni contrasts showed that impaired subjects acquired and retained fewer words, but retrieval was equivalent to controls and unimpaired patients. Effect sizes were moderately large. Impaired patients failed to acquire nearly half of the items, and they failed to retain 32% of the information they initially acquired.

Conclusions: These data confirm previous research (e.g., DeLuca et al., 1994) in showing that acquisition deficits are common among cognitively-impaired MS patients. They extend those data by showing that MS patients also fail to retain what they learn. These data have salient implications for endeavors that aim to remediate memory impairment in people with MS.

Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michael-basso@utulsa.edu*

A. MILLER, M.R. BASSO, D. COMBS, P. CANDILIS, J. JOHNSON & S. WOODS. The Influence of Pain on Prospective Memory in Multiple Sclerosis.

Objective: Although memory for newly-learned semantic information is often impaired in people with Multiple Sclerosis (MS), few studies have examined effects of MS on prospective memory. The initial data imply that people with MS manifest impaired prospective memory. Yet, only some patients showed this impairment, implying that other patient variables contribute to such dysfunction. Chronic pain occurs commonly in people with MS, and may diminish ability to attend to and learn information pertaining to intentions in MS.

Participants and Methods: Participants included 97 patients with MS (age: $M=45.29$, $SD=10.61$; education: $M=14.41$, $SD=2.30$) and 34 controls (age: $M=40.29$, $SD=13.21$; education: $M=14.35$, $SD=2.21$). All were administered the Memory for Intentions Test (MIST), a validated measure of prospective memory, and a battery of neuropsychological tests.

Results: Patients and control subjects were equivalent in demographic characteristics, but the patients performed significantly worse on the MIST ($p's < .05$) and reported more pain ($p's < .001$). Multiple regression evaluated the effect of age, education, diagnosis, and pain on MIST performance. Only pain severity emerged as a significant predictor ($p's < .05$), and semi-partial correlations of pain with MIST ranged from .20 to .23.

Conclusions: These data suggest that higher levels of self-reported pain lead to greater prospective memory dysfunction in people with MS. Presumably, pain distracts patients from attending to their intentions, leading to worse memory to perform future actions. This suggests that a more thorough investigation of manifestation of pain will prove beneficial in this population. Further, it may be helpful to examine the relationship of pain with other aspects of neuropsychological functioning.

Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michael-basso@utulsa.edu*

J.N. BECKSTRAND & R.B. FROST. Alternate Formulations of the MSFC and Their Correlation with Cognition in Patients with Remitting-Relapsing Multiple Sclerosis.

Objective: The Multiple Sclerosis Functional Composite (MSFC) is a quantitative functional outcome measure used in patients with multiple sclerosis (MS). The MSFC consists of a timed 25-foot walk (leg function), a 9-hole pegboard task (arm/hand function), and Paced Auditory Serial Addition Task (PASAT, cognitive function). The PASAT is lengthy to administer and patients often report frustration. The Digit Symbol Modalities Test (DSMT) has been used in place of the PASAT due to good measurement characteristics, short administration time, and relative equivalence with the PASAT. We aimed to examine the relationship between the PASAT MSFC (PMSFC) and Digit-Symbol MSFC (DMSFC) using an external measure of cognitive functioning.

Participants and Methods: Twenty-five patients with remitting-relapsing MS underwent cognitive and neurological testing. Neurological outcome was assessed by the MSFC calculated using both the PMSFC and DMSFC. Cognitive function was assessed by the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).

Results: Of the 25 patients, 22 were female, with a mean age of 49 ± 8.5 years and mean length of disease of 9 ± 4.8 years. The PMSFC and the DMSFC were positively correlated ($r=0.88$, $p < .01$). Both the PMSFC and the DMSFC positively correlated with the RBANS Total score ($r=0.62$, $p=.01$ and $r=0.58$, $p=.01$, respectively) and the Immediate Memory ($r=0.42$, $p=.04$ and $r=0.46$, $p=.02$), Language ($r=0.47$, $p=.02$ and $r=0.49$, $p=.01$), and Attention ($r=0.58$, $p=.01$ and $r=0.65$, $p=.01$) index scores, respectively. No differences were found between the PMSFC and DMSFC with a Steiger's Z test.

Conclusions: Both the PMSFC and DMSFC were positively correlated with cognitive functioning in MS patients, as measured by the RBANS. We found the PMSFC and DMSFC were equivalent, similar to previous findings. Since the DMSFC is shorter, less frustrating, and equally efficacious it is an excellent cognitive screening option for use in MS populations.

Correspondence: *Jason N. Beckstrand, Neuroscience Center, Brigham Young University, Neuroscience Center, S192 ESC Brigham Young University, Provo, UT 84602. E-mail: jnbeckstrand@gmail.com*

D.A. DENNEY, A. HOLLAND, L. HARDER, S.Y. PANDYA, B. GREENBERG, D. GRAVES & L.H. LACRITZ. Symbol Digit Modalities Test as a Predictor of Memory Performance in Children and Adults with Multiple Sclerosis.

Objective: Processing speed is known to be compromised in patients with Multiple Sclerosis (MS), though the relationship of processing speed to other cognitive domains in this population is uncertain. This study examined whether a brief measure of processing speed (Symbol Digit Modalities Test [SDMT]) could predict memory performance using the California Verbal Learning Test (CVLT). Differences in pediatric versus adult samples were explored.

Participants and Methods: 28 pediatric [age=15.0(2.54)] and 83 adult [age=44.4(11.38)] patients with demyelinating disease [MS or Clinically Isolated Syndrome (CIS)] were administered the Oral SDMT and CVLT within a larger battery of neuropsychological tests. Separate linear regressions were performed to examine the utility of using SDMT to predict performance on CVLT-C or CVLT-II Total Trials 1-5 (ToT) and Long Delay Free Recall (LDFR; Z scores were converted to standard scores).

Results: SDMT was average for the pediatric sample [$T=48(13.96)$] and above average for adults [$SDMT T=55(15.66)$]. CVLT Learning and memory were low average to average across samples [Pediatric ToT= $44(11.94)$; LDFR SS= $94(15.49)$; Adult ToT= $51(11.42)$; LDFR SS= $99(20.53)$]. Standard linear regressions were significant for CVLT in both samples, with SDMT performance accounting for 52% of the variance in the pediatric sample [$F(1, 26)=26.83$, $p < .001$] and 23% of the variance in the adult group [$F(1, 73)=21.71$, $p < .001$]. The variance accounted for on CVLT LDFR was also significant for both groups, but higher in the pediatric=42% [$F(1, 26)=18.17$, $p < .001$] than adult=23% [$F(1, 73)=20.85$, $p < .001$] sample.

Conclusions: Oral SDMT was a significant predictor of CVLT learning and memory performance, with greater variance accounted for in the pediatric than adult sample. These results support that processing speed plays a role in learning and retrieval of verbal information in MS.

Correspondence: *David A. Denney, M.S., Psychiatry, UT Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390-8846. E-mail: david.denney@utsouthwestern.edu*

R. FROST, J.N. BECKSTRAND, M.J. LARSON, J.J. FOLEY & R.O. HOPKINS. Lower and Slower: Comparison of the Performance of Multiple Sclerosis Patients and Controls on a Sternberg Paradigm Task.

Objective: Individuals with multiple sclerosis (MS) have deficits in working memory and processing speed. The Sternberg Paradigm task (SPT) is sensitive to deficits in these domains. Accuracy of response is associated with working memory, while response time is associated with processing speed. We assessed the relationship between MS and performance on the SPT to determine its potential as a screening tool for cognitive deficits.

Participants and Methods: Twenty-six patients with remitting-relapsing MS and 18 age, sex, and education matched normal controls completed a Sternberg Paradigm task, which included light and heavy memory load trials. An independent sample t-test was used for comparison of demographic variables and SPT data was analyzed using factorial ANOVA.

Results: Demographic characteristics of the MS patients were 23 females; mean age 49.2±8.5 years; mean education level 15.2±2 years; and mean length of MS was 9.1±4.9 years. There were no between groups differences on any demographic variables. There were significant within subjects main effects for accuracy and response time by memory load ($F=8.66$, $p=.01$, $\eta^2=.17$) and ($F=31.85$, $p=.000$, $\eta^2=.43$), respectively, indicating the light memory load was easier than the heavy load. Significant between group differences were found for both accuracy and response time by load ($F=8.39$, $p=.01$, $\eta^2=.16$ and $F=14.15$, $p=.00$, $\eta^2=.25$), indicating a reduction in accuracy and response slowing in the MS group compared to controls for both the light and heavy loads.

Conclusions: Our findings showed a positive linear relationship between response time and working memory load on the SPT. Additionally, we found significant differences between MS patients and normal controls on the SPT, regardless of load; with deficits in both response accuracy and speed across light and heavy loads. While the effect sizes are small to medium, given the sample size, our findings suggest the SPT may be an effective screening tool for cognitive deficits in individuals with MS.

Correspondence: *R Brock Frost, Psychology, Brigham Young University, 1500 E Pusch Wilderness Drive, #6208, Oro Valley, AZ 85737. E-mail: brock.frost@gmail.com*

H.M. GENOVA, J. LENGENFELDER, G. WYLIE, J. DELUCA & N. CHIARAVALLI. Speed Accuracy Face Off: the interplay of speed and accuracy of facial processing in Multiple Sclerosis.

Objective: Social functioning in everyday life can be contingent upon successfully understanding fleeting cues such as changing facial affect. New literature suggests that impairments in social functioning and emotional processing exist in individuals with Multiple Sclerosis (MS). Given the propensity of processing speed impairments in persons with MS, we hypothesized that processing speed would play an important role in performance on emotional processing measures.

Participants and Methods: We utilized the Facial Emotion Identification Task (FEIT) to identify problems in emotional processing. The typical administration and scoring of the FEIT takes into account only accuracy, not the speed with which the subject responds. For the purposes of our analysis, we added a processing speed variable: the time it took the subject to recognize facial affect. We hypothesized that this measure would be sensitive to impairments in facial affect recognition.

Results: No impairment was noted in MS participants in terms of accuracy on the FEIT. As hypothesized, however the MS subjects were significantly slower than HCs ($p<.047$). In addition, a correlation existed between reaction time on the FEIT and the SDMT in the MS group ($r=.781$, $p<.05$).

Conclusions: We conclude that processing speed impairments may negatively impact emotional processing in MS, specifically facial affect recognition. Even though subjects were not impaired in terms of accuracy, they were impaired in terms of time with which they recognized the stimuli. Slower recognition of changes in facial affect can have significant implications for social functioning. Tests of facial affect and other forms of emotion processing should include a timed component as it may be more sensitive to processing-speed related impairments in emotional processing. Correspondence: *Helen M. Genova, Ph.D., Kessler Foundation Research Center, 300 Executive Dr., Suite 70, West Orange, NJ 07052. E-mail: hgenova@kesslerfoundation.org*

M.B. GLUSMAN, B. ROBERG, A. NESS, J. THELEN, T. FEASTER & J. BRUCE. Speeded Eye Tracking is Associated with Performance on Cognitive Tests that Require Visual Scanning in Multiple Sclerosis.

Objective: Neuropsychologists routinely control for upper extremity motor difficulties that could confound cognitive test performance. However, little is known about how oculomotor speed impacts cognitive test performance. Recent studies suggest that visual acuity problems correlate strongly with poor performance on many cognitive tests in MS. The current study examined the association between speeded eye movements and performance on cognitive tests that require visual scanning in a sample of participants with multiple sclerosis (MS).

Participants and Methods: MS participants ($N=73$) were recruited from the MidAmerica Neuroscience Institute as part of a larger study examining visual acuity in association with visual and non-visual neuropsychological tests. Participants were given the Speeded Eye Tracking Tests (SETT) and a neuropsychological battery that assessed executive function, attention, and speed of information processing.

Results: Slower eye movements were associated with greater disease burden ($r=-.46$, $p<.01$), longer disease duration ($r=.23$, $p<.05$), older age ($r=.42$, $p<.01$), and less education ($r=-.25$, $p<.05$), but not sex or ethnicity. Partial correlations controlling for age and education revealed that slower eye movements were significantly associated with poorer performance on the Symbol Digit Modalities Test ($r=-.34$, $p<.01$), the Stroop ($r=-.56$, $p<.01$), Benton's Judgment of Line Orientation ($r=-.34$, $p<.01$), Trails A ($r=.28$, $p<.05$) and Trails B ($r=.25$, $p<.01$).

Conclusions: Slower speeded eye tracking is associated with worse performance on cognitive tests requiring visual scanning. Controlling for oculomotor functioning may provide a purer measure of cognitive functioning in MS. Further exploration of these associations may help researchers and clinicians better understand the relationship between oculomotor speed and performance on neuropsychological tests in MS. Correspondence: *Morgan B. Glusman, B.A., Psychology, University of Missouri - Kansas City, 5030 Cherry Street, Room # 350, Kansas City, MO 64110. E-mail: mbg522@mail.umkc.edu*

W.N. HAVINS, C. GAMSON, S.H. APPEL, E.P. SIMPSON, M.Y. PLEITEZ & M.F. DULAY. The relationship of apathy, depressive symptoms, and anxiety to cognitive functioning in individuals with amyotrophic lateral sclerosis (ALS).

Objective: Depression, emotional lability and apathy are the most common psychiatric issues found in individuals with ALS, with prevalence rates of up to 50%. Cognitive impairments also exist in a subgroup of individuals with ALS, especially on measures of memory, verbal fluency, and other executive functions. A relationship between emotional status and cognitive impairment has been demonstrated in patients with Alzheimer's disease, multiple sclerosis, stroke, and TBI such that poor mood state and increased apathy are associated with impairments over and above the deficits associated with the neurologic disease alone. This study related apathy, depressive symptoms and anxiety to cognition in individuals with ALS.

Participants and Methods: One hundred and eight individuals (mean age 60.7 years; 44 women) diagnosed with ALS underwent psychological and neuropsychological assessment. Emotion and behavioral measures included the Beck Depression Inventory-II, Beck Anxiety Inventory, and Frontal Systems Behavioral Scale (family report). Neuropsychological assessment used standardized measures covering all domains.

Results: Apathy was not associated with depressive or anxiety symptoms ($p > .05$). Severity of depressive symptoms was associated with level of anxiety ($r = .64$, $p < .01$). Increased apathy was significantly associated with reduced performance on tests of focused attention ($r = -.24$), mental flexibility ($r = -.27$), unstructured problem solving ($r = -.39$), semantic fluency ($r = -.26$) and phonemic fluency ($r = -.39$; all p values $< .01$). Increased depressive symptoms was related to reduced focused attention, memory, mental flexibility, and disorganization (all p values $< .05$). Anxiety level was associated with reduced memory performance.

Conclusions: Results are consistent with previous studies showing associations between cognition and emotion. Disruption in brain regions involving both emotion regulation and cognition may explain these associations, or apathy and depressive symptoms may transiently impair cognitive test performance.

Correspondence: *Whitney N. Havins, M.A., Department of Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204. E-mail: whavins615@gmail.com*

J.J. RYAN, L. GLASS UMFLEET & S.T. GONTKOVSKY. WMS-IV Performance of Patients with Multiple Sclerosis: Preliminary Findings.

Objective: There are no published studies that report Wechsler Memory Scale-IV (WMS-IV) results in patients with MS. This investigation provides information on WMS-IV performance of patients with relapsing-remitting disease and tested two hypotheses: (a) Patients will demonstrate significant variability across the five index scores and (b) actual index scores will be significantly below General Ability Index (GAI) predicted index scores at both the group and individual levels.

Participants and Methods: Thirty-four patients with MS were administered the Wechsler Adult Intelligence Scale-IV (WAIS-IV) and WMS-IV. Means for age, education, and duration of diagnosis were 43.15, 14.88, and 8.39 years, respectively. Means for GAI and FSIQ were 95.09 and 93.00. Using tables provided in the WMS-IV Technical and Interpretative Manual, predicted indexes were determined based on each patient's GAI score. Predicted WMS-IV indexes were then compared to actual indexes.

Results: Mean index scores did not differ significantly across the five WMS-IV domains. Table 1 provides means and standard deviations for GAI predicted WMS-IV indexes compared to actual indexes. In all instances, mean predicted indexes were significantly higher than actual mean indexes (all $ps < .001$). Comparisons for individual participants yielded significantly lower actual versus predicted index scores for 55.9% on Auditory Memory, 70.6% on Visual Memory, 52.9% on Visual Working Memory, 64.7% on Immediate Memory, and 61.8% on Delayed Memory.

Conclusions: The first hypothesis was not supported since patients with MS demonstrated similar scores across the five indexes. The second hypothesis was supported as mean GAI predicted indexes were significantly higher than actual mean indexes. When individual cases were considered, the majority of participants demonstrated one or more domains in which the obtained index was significantly below the ability-based expectation.

Correspondence: *Joseph J. Ryan, PhD, Psychological Science, University of Central Missouri, Loring Building, Warrensburg, MO 64093. E-mail: ryan@ucmo.edu*

J. SPAT, V. D'ORIO, M.J. SHUMAN, F.W. FOLEY & R. HOLTZER. The Effect of Time on Verbal Fluency Performance in Individuals with Multiple Sclerosis and Age-Matched Controls.

Objective: Phonemic and semantic fluency are sensitive to the effect of Multiple Sclerosis (MS) on cognitive function. However, research concerning the effect of time on verbal fluency in patients with MS is scarce. The current study examined the effect of time on phonemic and semantic fluency in patients with MS and healthy controls.

Participants and Methods: Thirty patients diagnosed with Relapsing-Remitting MS ($M = 43$ years) and thirty matched controls ($M = 44$ years) participated in the current study. The 60-sec time limit for Phonemic ("F," "A," "S") and Semantic (Animals) fluency tasks were further divided into three 20-sec intervals without changing the standard administration of the test.

Results: Linear mixed effect models were conducted, each with a three-level time interval (i.e., 20, 40, 60 secs) serving as the within subject repeated measures, word generation as the dependent measure, and group status (i.e., MS, age-matched controls) as the independent variable. Results revealed that for both phonemic and semantic fluency, there was a significant effect of time with a reduction in number of words generated when comparing the first 20-sec to the second ($p < .001$) and third ($p < .001$) intervals. There was a significant main effect of group, with individuals with MS producing less words overall in the phonemic fluency task ($p < .05$). Group differences in the semantic fluency task were not significant ($p > .05$). The group by time interaction was not significant for phonemic or semantic fluency tasks.

Conclusions: Word generation in phonemic and semantic fluency declined over time in both the MS and control groups. Phonemic but not semantic fluency was significantly reduced in patients with MS relative to healthy matched controls. These findings suggest that for individuals with MS and healthy controls, phonemic and semantic word retrieval is based on the initial automatic production of readily available words that over time becomes more effortful and less productive.

Correspondence: *Jessica Spat, MA, Yeshiva University, 1165 Morris Park Avenue, Bronx, NY 10461. E-mail: spatjl@gmail.com*

M. SHUMAN, J.S. SPAT, V. D'ORIO, F.W. FOLEY, C. WANG & R. HOLTZER. Learning and Cognitive Fatigue Trajectories in Multiple Sclerosis Defined using a Burst Measurement Design.

Objective: Learning and cognitive fatigue can influence cognitive test scores in single or serial assessments.

We aim to determine the effects of repeated exposures within and across study visits on learning and cognitive fatigue in patients with Relapsing-Remitting Multiple Sclerosis (RRMS).

Participants and Methods: Thirty RRMS patients and thirty controls were recruited. Using a burst measurement design the oral version of the Symbol Digit Modalities Test (SDMT) was administered three times during the baseline and two consecutive monthly follow-up visits for a total of nine test administrations. Learning was assessed within and across study visits whereas cognitive fatigue was assessed during the course of each test administration.

Results: Using linear mixed effect models we found that relative to controls RRMS patients showed compromised learning within (95%CI: 2.6355-3.9867) and across (95%CI: 1.3250-3.1861) visits. Among RRMS patients worse self-rated cognitive dysfunction predicted poor learning within (95%CI: -0.1112- -0.0020) and across (95%CI: -0.0724—0.0106) visits. RRMS patients demonstrated worse cognitive fatigue during the course of each test administration compared to controls (95%CI: -2.1761—0.1720).

Conclusions: Burst design is optimal to study learning and cognitive fatigue. This methodology, using the SDMT or other time-efficient tests as outcome measures, can be successfully implemented in clinical trials and longitudinal studies.

Correspondence: *Melissa Shuman, MA, Yeshiva University, 1165 Morris Park Avenue, Bronx, NY 10461. E-mail: mjshuman@gmail.com*

E.J. WALDRON, J. BARRASH & D. TRANEL. Personality Ratings Detect Early Neurobehavioral Changes in ALS Before Deficits Are Evident on Cognitive Tests: A Case Study.

Objective: Patients with amyotrophic lateral sclerosis (ALS) often show deficits on neuropsychological tests that tap functions related to the integrity of the prefrontal lobes. Various aspects of personal-

ity are also known to be mediated by prefrontal lobe regions, particularly ventromedial prefrontal cortex (VmpFC). Personality changes have not been widely reported in patients with ALS, although clinical observations indicate such changes might be relatively common. Here, we report on a patient with ALS whose neuropsychological exam documented normal cognitive abilities but significant changes in personality.

Participants and Methods: The patient is a 59 y.o., female, RH, HS-educated, disabled secretary. She was diagnosed with bulbar onset ALS in 06/2011, and is anarthric. She completed comprehensive neuropsychological evaluation in Spring, 2012.

Results: The patient demonstrated intact cognitive functioning across all assessed domains, including executive functioning (TMT, CFT, and WCST). Her scores were generally in the average to high average range. She demonstrated mild microsmia. Self-report measures of mood and personality were largely unremarkable. However, her husband and two daughters each completed the Iowa Scales of Personality Change (Barash et al., 1997). Independently, they rated her as having developed significant disturbances since disease onset including impulsivity, poor judgment, inflexibility, perseveration, lack of planning, lack of persistence, emotional dyscontrol, insensitivity, irritability, and lack of insight. There was strong correspondence between raters for personality characteristics that changed significantly and those that did not.

Conclusions: Results indicate that personality disturbance may manifest prior to cognitive changes in ALS, and careful assessment of personality functioning may be important for documenting early neurobehavioral changes in some ALS patients. The results provide further evidence that ALS can compromise VmpFC integrity.

Correspondence: *Eric J. Waldron, Ph.D., Neurology, University of Iowa, 200 Hawkins Dr., 2007 RCP, Iowa City, IA 52246. E-mail: eric-waldron@uiowa.edu*

L. WALKER, J. BERARD, M. BOWMAN, M. FREEDMAN & H. ATKINS. Cognitive Correlates of Health-Related Quality of Life in MS Patients Undergoing Immunoablative Therapy and Autologous Hematopoietic Stem Cell Transplantation (IA-HSCT).

Objective: Cognitive functioning and health-related quality of life (HRQOL) were examined in individuals with MS who underwent immunoablative therapy and hematopoietic stem cell transplantation (IA-HSCT) to determine if they were significantly correlated as has been demonstrated in other MS samples.

Participants and Methods: Seven individuals with rapidly progressive MS and poor prognosis underwent IA-HSCT. All 7 participants completed a comprehensive neuropsychological battery at baseline, including questionnaires designed to assess depressive symptomatology, subjective fatigue and HRQOL. Four then completed the same battery 24 months after IA-HSCT.

Results: At baseline 71% of the sample (5 of 7 participants) was impaired on 2 or more cognitive measures, compared to 75% at follow-up (3 of 4 participants). Measures of information processing speed and executive functioning correlated with HRQOL (Cognitive Function subscale and Mental Health Composite score) at baseline. At 24 months none of the cognitive variables were related to HRQOL; however, depression correlated with the Mental Health Composite score and cognitive aspects of fatigue correlated with the Cognitive Function subscale of the HRQOL measure. Examination of mean values showed a marginal improvement in HRQOL over the 24 month interval, although this did not reach statistical significance.

Conclusions: Although limited by a small sample size, results suggest that cognition impacts HRQOL pre-IA-HSCT but there is no such relationship exhibited 24 months post-IA-HSCT. HRQOL improved marginally (but not significantly) over this interval therefore IA-HSCT may ameliorate the negative influence of cognition on HRQOL. Findings suggests that participants subjectively see cognition as having less impact on HRQOL at follow-up despite the fact that objectively, levels of cognitive impairment are comparable at both time points. Mood and aspects of fatigue appear to influence HRQOL at follow-up.

Correspondence: *Lisa Walker, Ph.D., Psychology, The Ottawa Hospital, 501 Smyth Road, rm. 7300, Ottawa, ON K1H 5L6, Canada. E-mail: lwalker@ottawahospital.on.ca*

S. ATIF, L. WALKER, J. BERARD, L. REES & M. FREEDMAN. Relationship between MSNQ and objective cognition in early relapsing-remitting multiple sclerosis: Self and informant ratings.

Objective: The Multiple Sclerosis Neuropsychological Questionnaire (MSNQ) is a self-report measure of cognitive difficulties encountered by individuals with multiple sclerosis (MS) completed by patients (self) and an informant (someone familiar with the patient). The relationship between the MSNQ and both objective cognition and depression were examined in an early relapsing-remitting MS (RRMS) sample. Degree of impairment across various cognitive domains was also examined.

Participants and Methods: Seventy individuals with early RRMS and 72 matched healthy controls underwent neuropsychological assessment of: information processing speed (IPS), working memory (WM), learning/memory, and executive functioning (EF). Participants completed the MSNQ and a self-report measure of depression.

Results: A greater proportion of patient ratings (37.1%) reached cut-off for impairment on the MSNQ compared to informant ratings (18.6%). Patients and controls rated themselves as more cognitively impaired than did their respective informants. More patients were objectively impaired on measures of IPS, EF and WM. Informant ratings correlated more often with objective cognition than self ratings, with the exception that self ratings correlated with some measures of IPS. Contrary to expectation, both self and informant ratings correlated with depression.

Conclusions: Individuals in this MS sample were more likely to rate themselves as cognitively impaired than their informants. The trend was consistent with the literature in general in that informant ratings showed more correlation with objective cognitive impairment but this was not exclusively the case. Patient ratings showed some correlation with IPS measures. Also, both self and informant forms were correlated with patient ratings of depression. This sample of individuals with early RRMS may be better at rating some aspects of their cognition than has been demonstrated in other MS samples in the literature.

Correspondence: *Lisa Walker, Ph.D., Psychology, The Ottawa Hospital, 501 Smyth Road, rm. 7300, Ottawa, ON K1H 5L6, Canada. E-mail: lwalker@ottawahospital.on.ca*

G. WICAS, L. BENJAMIN, J. EPPIG, C. NIEVES, D. TABBY, J. DELUCA, D. PENNEY, R. DAVIS & D. LIBON. Processing Speed and Decision Making in Multiple Sclerosis: The Digital Clock Drawing Test (dCDT).

Objective: Little research has examined the utility of clock drawing in Multiple Sclerosis. The current study used the new Digital Clock drawing Test (dCDT) to examine subtle deficits in processing speed and decision making.

Participants and Methods: 34 normal controls (NCs) and 43 MS patients were administered the dCDT to command and copy as well as a neuropsychological protocol. Using errors derived from a 10-point analog scoring system, MS patients were divided into impaired (n= 20) and non-impaired (n= 23) groups based upon NC determined cut-scores. dCDT variables of interest included intra-component latencies (i.e. elapsed time between drawing one component of the clock to the next) and quartile drawing time.

Results: There were no differences in age or education between any of the groups. The command intra-components, pre-first hand and inter-digit latencies, were longer in impaired MS vs. non-impaired MS (pre-first hand: $p < .037$; inter-digit: $p < .006$) and NC (pre-first hand: $p < .030$; inter-digit: $p < .008$) participants. No differences were noted for time spent drawing during the first two quartiles; longer latencies were obtained for impaired MS patients compared to other groups for the 3rd ($p < .035$) and 4th ($p < .005$) quartiles. Copy intra-component measures were longer for impaired vs. non-impaired MS and NCs on post-clock face ($p < .005$), pre-first hand ($p < .005$),

.003), and inter-digit latencies ($p < .004$). Impaired MS patients produced longer drawing times for all four quadrants compared to NCs ($p < .005$), but only slower times on the 3rd and 4th quadrants than non-impaired MS patients ($p < .015$). Command and copy regression analyses associated longer intra-component latencies with reduced working memory, mental search, and simple processing speed.

Conclusions: The dCDT is able to capture behavior previously unobtainable. Intra-component latencies and quartile drawing time could provide a means to better understand subtle processing speed and complex decision making deficits in MS.

Correspondence: *Graham Wicas, BA, Neurology, Drexel University College of Medicine, 1015 N Providence road, Media, PA 19063. E-mail: gwicas@gmail.com*

Visuospatial Functions/Neglect/Agnosia

V.W. MARK & M.E. COLLINS. Touchscreen vs. Paper Cancellation Testing in Brain Injury.

Objective: To compare the reliability of target marking on touchscreen vs standard paper administration of cancellation tests in acute brain injury.

Participants and Methods: 15 adults with acute brain injury (stroke, TBI) were administered the Star Cancellation Test 4 times each on both a touchscreen computer and similar-sized sheets of paper placed on a graphics tablet. Order of test method was randomized across subjects. Software automatically calculated the number of contacts at targets, nontargets, or blank areas between stimuli and search organization measures, except that paper tests were judged by 2 raters blinded to patients' identities to assess whether ink marks appeared directed at targets or contacted nontargets or blank areas.

Results: The total number of targets contacted did not differ between methods, but touchscreen testing led to more contacts between targets ($p < .001$) or at non-targets ($p = 0.007$). In addition, sequential markings were more disorganized on the touchscreen (more pathway intersections and greater distance moved between sequentially marked targets, $p = 0.02$). We observed patients frequently reattempting finger contacts on the touchscreen due to the screen's failure to show targets marked after finger contact.

Conclusions: Although touchscreen administration can facilitate measuring cancellation outcomes, the technology may be unforgiving for registering contacts at targets, particularly if patients have difficulty with aiming their fingers (e.g., due to impaired visuomotor planning), do not lift their fingers away from targets fast enough for contacts to be registered, or smear their fingers on the screen. In contrast, paper cancellation tests (the gold standard), while not using fully automated scoring methods, allow patients to self-correct (drag) their initially misdirected pen contacts without penalty. Consequently, paper cancellation tests may more reliably evaluate cognitive (as opposed to motor) processes involved with visuomanual search than touchscreen assessment.

Correspondence: *Victor W. Mark, M.D., Physical Medicine and Rehabilitation, University of Alabama at Birmingham, 1720 2nd Avenue South, SRC 190, Birmingham, AL 35294-7330. E-mail: vumark@uab.edu*

G. MORALES, E. MATUTE, E. O'CALLAGHAN & J. MURRAY. Visual Perception and Visuospatial Abilities among Children with Hemophilia: A Mexican Sample Who Experienced Cerebral Hemorrhage.

Objective: The study of children with hemophilia with a history of stroke provides a unique opportunity to study a clinically-relevant model of the developing human brain and its reaction to cognitive injury and could augment our understanding of how the developing brain responds to early injuries. The goal of this study was to examine the impact of focal brain injury on visual perception and visuospatial abilities outcomes in Mexican children with hemophilia who had intracranial hemorrhage.

Participants and Methods: We assessed ten boys with hemophilia with hemorrhagic stroke (HIC), six boys with hemophilia without hemorrhagic stroke (HH), and ten boys without hemophilia as controls (CTL). Each participant with hemophilia was matched case-by-case with a male control subject without hemophilia chosen from the same classroom, living in the same neighborhood, sharing similar socioeconomic status and age. Each child in the HIC and HH groups underwent a magnetic resonance imaging (MRI) in order to verify evidence of new bleeds or brain injury prior to the neuropsychological assessment. Full Scale (FSIQ) from the Wechsler Intelligence Scale for Children-Mexican Revision and Visual Perception and Visuospatial abilities domains from a neuropsychological assessment battery for Spanish-speaking children (ENI) were employed for our analysis.

Results: The results showed that the HIC group performed in the low average range on the FSIQ, which was significantly worse than the control group (HH). The HIC group showed significantly lower performance on superimposed shapes and blurred figures (HIC < HH) and visuospatial abilities and line orientation (HIC < CTL) than its controls.

Conclusions: The present results suggest that it is not the ability to recognize objects that is impaired in the HIC group, but the ability to identify objects under less favorable conditions. Our findings may have therapeutic and rehabilitative implications for the management of children with hemophilia with early focal brain lesions.

Correspondence: *Guadalupe Morales, Neuropsychology; Psychology; CSPP-Alliant International University; 1000 South Fremont, Unit 5, Alhambra, CA 91803. E-mail: guadalupe_morale@hotmail.com*

L. SCHMIDT, K.S. UTZ, F. ARTINGER, O. STUMPF & G. KERKHOFF. Effects Of Age And Spatial Plane On The Subjective Visual Vertical (SVV) – Results Of A Novel Testing Apparatus.

Objective: The subjective visual vertical (SVV) is a fundamental measure of human spatial orientation and is often impaired in patients with neurological or vestibular disease. Moreover, a reduced precision in the SVV has been found in aging individuals. Typically, the SVV in the frontal (roll) plane is assessed, but only rarely the SVV in the sagittal (pitch) plane.

Participants and Methods: We describe a precise, novel device for testing the SVV in the roll and pitch plane, both for healthy subjects and clinical populations. We investigated 95 healthy subjects (20-40 years, 41-60 years, 61-85 years), with intact stereoscopic vision to analyze the effects of age, sex and spatial plane (roll vs. pitch) on the SVV, and to obtain normative data. Three measures of the SVV were analyzed: the constant error (CE), the unsigned error (UE) and the interval of perceptual uncertainty (IU).

Results: CEs in the SVV did not differ significantly in the pitch vs. roll plane for all age groups. Moreover, perceptual judgments of the SVV were close to the veridical SVV in both roll and pitch. However, UEs and IUs were significantly higher for SVV in pitch vs. roll for all age groups. Furthermore, UEs significantly increased with advancing age for both spatial planes of the SVV, and were highest in the 61-85 year old subjects in the pitch plane. In contrast, no gender-specific differences in SVV performances could be found. Clinical examples of stroke patients highlight the usefulness of the novel device for the assessment of SVV tilts and the assessment of therapeutic effects in patients with a tilted SVV.

Conclusions: The SVV can be precisely measured in pitch and roll with the novel device. Normative data show significantly less precise SVV settings in pitch vs. roll. Aging is associated with a significant increase in perceptual uncertainty in SVV judgments. This study provides implications for perceptual and postural disorders in older healthy subjects as well as clinical applications in stroke patients.

Correspondence: *Lena Schmidt, Clinical Neuropsychology Unit & University Ambulance, Saarland University, University Campus, Building A.1.3., Germany; Saarbruecken 66123, Germany. E-mail: lena.schmidt@mx.uni-saarland.de*

A. WELFRINGER, R. SCHMIDT-VIERECK & T. BRANDT. Constraint-Induced Movement Therapy (CIMT) in Patients Showing Chronic Neglect Symptoms – A Randomized Controlled Study.

Objective: The study investigated (1) the feasibility of CIMT without strain imposed by suffering in patients showing chronic neglect symptoms, (2) the effects of CIMT in comparison to a stable baseline in a multidimensional test battery, (3) the sustainability of CIMT-effects in follow-up testing, (4) the superiority of CIMT compared to an equally intensive bimanual motor training.

Participants and Methods: 15 patients with neglect symptoms at least six months after onset were randomly allocated to a small group à 1-2 participants. 4 measurements with a baseline over 2 weeks and a catamnesis after 3 months were executed by an independent blinded tester. Feasibility was assessed using therapy protocols. Efficacy was determined using standardized functional-outcome measures to assess neglect symptoms, body awareness, arm functions and activities of daily living (ADL). The intervention included six hours of repetitive motor exercises daily over 2 weeks à 5 days with restraint of the non-affected upper limb for the CIMT-group and without restraints in a bimanual training for the control group (CG).

Results: (1) All participants reported increased awareness of the left side of the body. The CIMT-group especially achieved therapy goals in the domain of activities/participation. (2) The CIMT-group improves significantly in line bisection and motor functions (WMFT, MAL, hand force). The CG improved in hand force. (3) The effects were stable. (4) Variance analyses showed no significant differences between the groups.

Conclusions: We conclude that neglect should not be an exclusion criterion for CIMT per se. Compliance and subjective gains were high. Functional improvements can be achieved even in a chronic state since onset. CIMT leads to additional effects on neglect symptoms and motor functions compared to a similar intensive bimanual training. The effects are relevant in ADL and were consolidated. Body-related and representational aspects should be more considered in neglect rehabilitation as CIMT may reduce motor neglect.

Correspondence: *Anouk Welfringer, Dr., Abteilung Neuropsychologie, Kliniken Schmieder Heidelberg, Speyererhof, Heidelberg 69117, Germany. E-mail: anoukwelfringer@gmail.com*

M. WULFF & G. HUMPHREYS. Effects of Unfamiliar Object Pairs on Recovery from Extinction.

Objective: Previous studies indicate that grouping objects for action ameliorates visual extinction in neuropsychological patients. However, it still unclear which factors modulate this effect. Recently, it has been shown that recovery from extinction was stronger for familiar action-related than for action-unrelated objects when seen from a first-person compared with a third-person perspective. Here we examined whether extinction was also sensitive to action relations and reference frame when unfamiliar pairs of objects were presented (e.g., paint pot and bottle opener).

Participants and Methods: Ten patients with visual extinction saw pictures of unfamiliar action-related and action-unrelated object pairs presented either from a first-person or third-person perspective.

Results: There was greater recovery from extinction when objects were action-related compared to when they were not, in line with previous studies. In addition, patients performed better overall when they saw objects from a third-person than from a first-person perspective. The effect of action-relations was also greater when the active object did not align with the hand the patient usually would use for action. An analysis of extinction trials, where only one item of the object pair was reported, indicated a striking reversal of the standard extinction effect when (i) stimuli were seen from a first-person perspective, (ii) when the objects were related and (iii) the active partner was on the contralesional side - in this case contralesional items were reported better than ipsilesional.

Conclusions: The data indicate effects of perspective, hand-object congruence, and action familiarity on the effects of action relation on extinction, and that attention can be cued to active items on the contralesional side based on the implicit detection of action relations. The data may have important implications for rehabilitation.

Correspondence: *Melanie Wulff, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom. E-mail: mxw127@bham.ac.uk*

Behavioral Neurology

M. ROTBLATT, L. HAMIWKA & K. VANNATTA. Peer Relationships In Adolescents With Epilepsy: How Do They Compare With Their Peers With Asthma?

Objective: Previous studies have found a decrease in social competence and psychosocial functioning in adults with a history of epilepsy, even if their seizures were controlled. The poor social functioning in adulthood may be directly linked to difficulties with peer relationships during adolescence. The goal of this study was to characterize the peer relationships in adolescents with epilepsy compared to those in adolescents with non-neurologic chronic disease and to identify factors that predict poor relationships in adolescents with epilepsy.

Participants and Methods: This study used a cross-sectional, cohort design of adolescents with epilepsy attending the pediatric neurology clinic at Nationwide Children's Hospital and adolescents with asthma attending the pediatric pulmonary clinic at Nationwide Children's Hospital.

Results: Adolescents with epilepsy showed greater loneliness with family ($p=0.01$) and poorer family integration among adolescents with epilepsy ($p=0.012$) on the Relational Provisions Questionnaire. Adolescents with epilepsy experienced greater stigma than those with asthma ($p=0.05$). A trend for poorer relationship quality was noted on the Network of Relationships Inventory for same-sex relationships for adolescents with epilepsy as compared to adolescents with asthma ($p=0.07$) and for opposite-sex relationships in both groups ($p=0.07$).

Conclusions: Adolescents with epilepsy experience more loneliness and difficulties in their families than adolescents with a chronic illness such as asthma supporting previously reported data raising concerns about family function in children with epilepsy. Our data also suggests that the diagnosis of epilepsy may have a negative impact on the formation and maintenance of opposite sex and same sex relationships in adolescents. Correspondence: *Melissa Rotblatt, Neurology, Nationwide Children's, 101 East 11th Avenue, Columbus, OH 43201. E-mail: msrotblatt@gmail.com*

Invited Address:

Can We Detect Alzheimer's Disease a Decade before Dementia (and why would we want to)?

Presenter: Reisa Sperling

10:15–11:15 a.m.

R. SPERLING. Can We Detect Alzheimer's Disease a Decade before Dementia (and why would we want to)?

The pathophysiological process of Alzheimer's disease (AD) is thought to begin years, if not decades, prior to the onset of clinical dementia. Converging data from PET amyloid imaging, cerebrospinal fluid studies and large autopsy series suggest that approximately one-third of clinically normal older individuals harbor a substantial burden of cerebral amyloid- β . Our multi-modality imaging studies, using PET amyloid imaging and functional MRI, have demonstrated that amyloid deposition in key nodes of the default network is associated with aberrant default network fMRI activity during the encoding of new memories, as well as disrupted default network connectivity at rest. Furthermore, we have found evidence of early cortical thinning in amyloid-laden regions in cognitively intact normal older individuals. A small number of studies have also reported an association between higher amyloid burden and lower memory performance even among the range of clinically normal elders. These findings provide support for the hypothesis that amyloid pathology is linked to synaptic dysfunction in the networks supporting

memory processes, detectable prior to the emergence of significant cognitive impairment. Longitudinal studies are ongoing to determine if these amyloid positive older individuals are indeed in the preclinical stages of AD, and are at increased risk for the development of AD dementia. We are also planning secondary prevention clinical trials in amyloid-positive older populations, including the “A4” trial—Anti-Amyloid Treatment in Asymptomatic AD—to determine if decreasing amyloid burden prior to cognitive symptoms will impact markers of neurodegeneration and prevent the emergence or at least slow the progression of cognitive decline.

Learning Objectives:

(1) become familiar with the emerging concept of Preclinical Alzheimer’s disease and the various imaging and clinical data supporting this concept

(2) gain knowledge of the clinical pre-precursors of Alzheimer’s disease and the current thinking of what is being done to prevent this devastating disease.

Correspondence: *Reisa Sperling, Department of Neurology, Brigham and Women’s Hospital, 221 Longwood, Boston, MA 02115. E-mail: rsperling@rics.bwh.harvard.edu*

**Invited Address:
Primary Progressive Aphasia and the Language
Network**

Presenter: Marsel Mesulam

11:30 a.m.–12:30 p.m.

M. MESULAM. Primary Progressive Aphasia and the Language Network.

Dementias can be classified as amnesic, comportmental or aphasic, according to the nature of the major impairment. Alzheimer’s disease typically leads to an amnesic dementia where memory loss is the ma-

ior cause of impaired daily living activities. This is consistent with the hippocampal/entorhinal location of the initial neurodegeneration. The frontotemporal Lobar Degenerations (FTLD) constitute the second major class of dementias. The neuropathology is characterized by focal neuronal loss, gliosis, tau inclusions, or TDP-43 inclusions. FTLD can lead to pure cognitive changes as in primary progressive aphasia (PPA) and the behavioral variant of frontotemporal dementia (bvFTD).

The principal focus of this talk will be PPA, a focal neurodegenerative syndrome characterized by an isolated and gradual dissolution of word finding and word usage. The language disturbance is initially the most salient deficit and the major obstacle to the execution of daily living activities. This does not mean that there are no deficits other than the aphasia, but that such additional deficits are relatively minor in the first two years following symptom onset. Some patients develop prominent agrammatism, others profound word comprehension (semantic) deficits. The speech output in PPA can be fluent or non-fluent. Memory, visual processing and personality remain relatively preserved during the initial stages. The current practice is to classify PPA into three subtypes, agrammatic (PPA-G), logopenic (PPA-L) and semantic (PPA-S).

Structural and physiological neuroimaging confirms the selective predilection of PPA for language-related cortices of the left hemisphere. The majority of the autopsies in PPA have shown the neuropathology of FTLD but approximately 30% of PPA can be caused by atypical forms of AD neuropathology. The mechanisms that determine the initial selectivity of the cognitive impairment and the asymmetry of atrophy in PPA remain to be elucidated. This syndrome also offers unique opportunities for exploring the cognitive architecture of language processing and the neurobiological fingerprints of the language network.

Learning Objectives:

(1) become familiar with Primary Progressive Aphasia and its various subtypes

(2) gain knowledge of the differential diagnosis and neuropathological findings of Primary Progressive Aphasia and other Frontotemporal disorders.

Correspondence: *Marsel Mesulam, Cognitive Neurology and Alzheimer’s Disease Center (CNADC), Northwestern Feinberg School of Medicine., 320 E. Superior, Chicago, IL 60611 . E-mail: mmesulam@northwestern.edu*

THURSDAY AFTERNOON, FEBRUARY 7, 2013

**Poster Symposium:
Brain Structure and Function in Alcoholics**

1:00–2:00 p.m.

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

G. FEIN, A. PFEFFERBAUM, D. MEYERHOFF, M. ENDRES & D. GREENSTEIN. Brain Structure and Function in Alcoholics.

Symposium Description: Alcoholism is a chronic disease with morbid effects on brain structure and function. Recovery varies in extent and rapidity across structures and functions. These phenomena are affected by predisposing factors and by the presence of comorbidities (e.g., psychiatric illnesses, other drug abuse and/or dependence, comorbid HIV infection). This symposium, will examine the state-of-the-art with regard to these issues.

Pfefferbaum, Rosenbloom, and Sullivan will present on the effects of comorbid alcoholism and HIV infection on the brain.

Meyerhoff will present data on brain structural and functional differences early in alcoholism treatment that predict subsequent abstinence vs. relapse.

Endres and Fein will present data on psychological mechanisms underlying impairments in abstinent alcoholics in processing affective laden words.

Greenstein and Fein will present data on gait and balance disturbance and its partial recovery with abstinence.

Dr. Fein will be the discussant.

Correspondence: *George Fein, Ph.D., NRI, 1585 Kapiolani Blvd, Honolulu, HI 96814. E-mail: george@nbresearch.com*

A. PFEFFERBAUM, M.J. ROSENBLUM & E.V. SULLIVAN. Alcoholism, HIV Infection, Hepatitis C, and the Brain.

Excessive alcohol use is often a significant factor in the acquisition of HIV infection, and HIV infected people who continue heavy alcohol use face dramatically reduced survival odds over light drinkers. Our MR imaging and diffusion tensor imaging (DTI) studies have revealed that HIV infection and alcoholism each have deleterious effects on the brain, and these effects can be more pronounced in HIV patients who abuse alcohol. We have also found that brain deficits were greater in older HIV-infected individuals and predictive of cognitive-motor processing speed impairment in HIV-infected individuals with alcohol use disorder (ALC). Longitudinal analysis revealed accelerated volume loss in medial frontal and anterior cingulate cortex and central white matter. Slopes of the thalamus and hippocampus indicated a graded effect, where volume declines were faster in HIV than controls and yet faster in HIV+AIDS. HIV+hepatitis C (HCV) coinfection resulted in steeper decreases than HIV without HCV in medial frontal, anterior cingulate, hippocampal, and amygdala volumes. DTI revealed that HIV+HCV coinfection was a significant factor in hastening the degrading effects of aging on callosal, pontine, and centrum semiovale microstructure. History of alcoholism exerted an additional burden to HIV+HCV coinfection with faster

anisotropy decline and diffusivity increase with advancing age. Even though all patient groups showed faster aging rates of radial diffusivity trajectories than controls, HIV+ALC aging rates were faster than those with ALC alone. HIV+ALC with cognitive scores indicating moderate to severe impairment had steeper age trajectories of centrum anisotropy and diffusivity than HIV without ALC. These data present novel evidence for accelerated aging in HIV infection and compounded effects of ALC and HCV on white matter microstructure, indicative of axonal and myelin disruption and suggestive of functional substrates of functional decline. Support: AA017347, AA017168.

Correspondence: *Adolf Pfefferbaum, SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025. E-mail: dolj@synapse.sri.com*

M.J. ENDRES. Emotion-word Processing Difficulties in Long-term Abstinent Alcoholics with and without Other Lifetime Externalizing Disorders.

Background: Difficulties detecting the valence of emotional facial expressions have been documented in alcoholics with weeks, months, and even years of sobriety, suggesting that this functional impairment does not fully recover with extended abstinence. However, the magnitude and extent to which alcoholics with multi-year abstinence have difficulties processing other types of emotion-laden stimuli is unclear. The current study examined whether emotion-word processing difficulties were present in long-term abstinent alcoholics (LTAA; 18+ months of sobriety) with and without a history of other externalizing (EXT) disorders.

Method: Subjects (N=121) completed an affective go/no-go (AGNG) task with positive, negative, and neutral emotion-word stimuli, and a lexical decision-making (LDM) task with non-emotion word and non-word stimuli. Non-substance abusing controls (NSAC; n=38, 50.0 % Female, mean age=48+7.8) and LTAA (n=83, 44.6% Female, mean age=48.7+6.6) were compared on similar measures of LDM task and AGNG task performance: signal discriminability (d') and mean RT for correct responses (mcRT).

Results: In the LDM task, LTAA had lower (d') values and slower mcRT than NSAC. In the AGNG task, LTAA and NSAC did not differ in AGNG task mcRT. LTAA had lower (d') values than NSAC, and this effect was partially associated with group differences in LDM task (d') values. Lower AGNG (d') values in LTAA also were associated with an earlier age of first drink, greater lifetime alcohol use, and a history of EXT disorder.

Conclusions: Our findings suggested that emotion-word processing difficulties are present in LTAA, and this functional impairment is over and above LTAA's more general lexical processing difficulties. Results also suggested that specific emotion-word processing difficulties in LTAA may be exacerbated by a greater lifetime alcohol burden and history of co-occurring EXT disorders.

Correspondence: *Michael J. Endres, 1555 Kapiolani Blvd Ste 1030, Honolulu, HI 96814. E-mail: mendres@nbresearch.com*

D.W. GREENSTEIN & G. FEIN. Gait and Balance Ataxia in Abstinence Alcoholics.

We will present data on gait and balance disturbance in chronic alcoholics and its partial recovery with extended abstinence. The Fregly Ataxia battery was used to assess gait and balance in 35-60 year old samples of non-substance abusing controls (NSAC), short-term (about 11 weeks) and long-term (about 7 years) abstinent alcoholics (STAA and LTAA). There was some persistent gait and balance disturbance in LTAA, particularly with eyes-closed (i.e., without visual support). It is important to point out that this investigation is silent with respect to gait and balance disturbance at the initiation of abstinence, and how this might change over the first couple of months of abstinence. The findings presented here suggest that some of the impairment in gait and balance function present at 2-3 months abstinent recover with extended abstinence, however not to the level of healthy controls. This data will be presented in the context of corollary clinical (e.g. nicotine co-dependence) and cortical and cerebellar brain imaging. These findings

suggest that some of the impairment in gait and balance function in STAA is recoverable with extended periods of abstinence, however not to the level of healthy controls. In addition, there will be further discussion on how this partial recovery of gait and balance coordination relates to other behavioral measures (e.g. nicotine co-dependence) as well as structural cortical and cerebellar brain data.

Correspondence: *David W. Greenstein, 1555 Kapiolani Blvd Ste 1030, Honolulu, HI 96814. E-mail: dgreenstein@nbresearch.com*

Poster Session 2: Autism/Behavioral Neurology/Cancer/Executive Functions

1:00–2:00 p.m.

Autism Spectrum Disorders

J.C. GIDLEY LARSON, J.C. SHEEHAN, J.E. WILSON & Y. SUCHY. The Role of Self-Directed Speech in Motor Control in Children with Autism.

Objective: The current study examined the contribution of self-directed speech, both spontaneously generated and prompted, to motor control (M-CNT), as measured by the smoothness of a double-tap movement, in a novel computerized motor learning task.

Participants and Methods: Forty-three (21 HFA and 22 typically developing (TD)) participants, ages 10-17, learned to perform a five-movement sequence that included a double-tap movement. Participants completed the five-movement sequence across three Verbalization Conditions: (1) Natural Strategy Condition (NSC), (2) Task-Congruent Verbalization Condition (CVC), and Task-Incongruent Verbalization Condition (IVC). During NSC participants used their natural strategy to perform the task, during CVC participants verbalized words congruent to their actions (e.g., "push"), and during IVC participants verbalized words incongruent to their actions (e.g., say "push" while turning). M-CNT (i.e., latencies (in ms) between the first tap and the second tap) was recorded electronically.

Results: Using repeated measures ANOVA, two sets of analyses were conducted: (1) NSC vs. IVC and (2) NSC vs. CVC. When comparing NSC to IVC, repeated measures ANOVA revealed a significant Group X Condition interaction ($p=.023$); post-hoc analyses indicated that the HFA group was not impacted by task incongruent verbalizations while the TD group was deleteriously impacted. When comparing NSC to CVC repeated measures ANOVA revealed a trend towards a Group X Condition interaction ($p=.105$) suggesting that the HFA group may have benefited more from verbalizing action congruent words than the TD group. However, this should be examined in a larger sample.

Conclusions: The findings suggest that TD children engage self-directed speech in the service of M-CNT, while children with HFA do not. However, evidence suggests that children with HFA may benefit from being prompted to use self-directed speech to help guide motor behavior.

Correspondence: *Jennifer C. Gidley-Larson, M.S., M.A., Psychology; University of Utah, 5654 W Warren Dr, Lakewood, CO 80227. E-mail: jen.larson@utah.edu*

R. BREWSTER, T. KING, D. ROBINS & C. HENRICH. Differential relationships between white matter integrity, facial emotion perception, and socialization skill in participants with ASDs and controls.

Objective: The white matter tract bridging the amygdala and fusiform face area is theorized to contribute to facial emotion perception, an aspect of the social deficits seen in Autism Spectrum Disorders (ASDs). The current study explores relationships between white matter integrity (WMI), facial emotion perception, and socialization skill in participants with ASDs and healthy controls. Based on previous studies, we hypothesized that WMI would be positively correlated with facial emotion perception and socialization skill for both groups.

Participants and Methods: Measures of tract WMI including fractional anisotropy (FA) and mean diffusivity (MD) were obtained from diffusion tensor imaging data and analyzed using the FMRIB's Diffusion Toolbox v2.0. Behavioral measures including Facial Emotion Perception (mean of both Child and Adult facial expressions subscales of the DANVA-II; FEP) and informant interview for Socialization Skill (Vineland Adaptive Behavior Scales-II; SS) were obtained for 9 (mean age=17.22, SD=6.93; 42% female) participants with ASDs and 17 (mean age=15.78, SD=5.72; 54% female) controls. Bivariate correlations examined the relationships between measures.

Results: There was a strong positive correlation between tract FA and FEP in the control group ($r=.54$, $p=.02$), but no relationship between FA and FEP in the ASD group ($r=-.03$, $p=.94$). There was a strong positive correlation between tract MD and SS in the ASD group ($r=.72$, $p=.02$), but no relationship between MD and SS in the Control group ($r=-.04$, $p=.87$).

Conclusions: The control group demonstrated the expected relationship between FA and FEP, whereas no relationship was observed in the ASD group. Similarly, the unexpected relationship between MD and SS was identified for the ASD group. This implies that along the amygdalo-fusiform tract, measures of white matter integrity developed from healthy controls may not generalize to populations with ASDs.

Correspondence: *Ryan Brewster, Georgia State University, 1114 Westshire Place NW, Atlanta, GA 30318. E-mail: rbrewst@gmail.com*

A.M. CARSON, B. DOLAN, S. STEVENS, J.S. KARST, K. SCHOHL & A.V. VAN HECKE. Social Anxiety and Electroencephalogram Coherence in Teens with and without Autism Spectrum Disorders.

Objective: Anxiety has been found to be highly comorbid with Autism Spectrum Disorders (ASD) and may increase in adolescence as social worlds become more complex. Given the role of parietal and frontal lobes in social interactions and anxiety, this study investigated EEG coherence and social anxiety in teens with and without ASD.

Participants and Methods: Adolescent males [29 ASD; 31 typically developing (TYP)] participated in baseline EEG. Coherence was computed in Compumedics-Neuroscan and Mathworks MATLAB at delta, theta, alpha, beta, and gamma frequencies. Coherences between electrodes in left-right parietal lobes (P3-P4) and frontal and parietal lobes (left:F3-P3; right:F4-P4) were computed. Teens completed the Social Anxiety Scale for Adolescents (SAS). Independent samples t-tests compared SAS scores and coherences. Pearson's correlations examined relationships between SAS scores and coherence.

Results: Results of the t-test show a significant difference between groups in left-right parietal coherence in delta ($t(58)=-3.08$, $p=.003$), beta ($t(58)=-3.00$, $p=.004$), and gamma ($t(58)=-3.29$, $p=.002$) frequencies. No group differences in social anxiety emerged.

Results of the correlation (whole sample) found SAS scores were negatively correlated with left-right parietal lobe theta and alpha coherence ($p<.05$). Left-right parietal lobe theta, beta, and gamma coherence was negatively correlated with SAS for teens with ASD. TYP teens displayed a negative correlation between SAS scores and left-right parietal alpha coherence.

Conclusions: Teens with ASD showed increased left-right parietal coherence in delta, beta, and gamma bands. Lower scores on SAS were correlated with increased left-right parietal coherence for the whole sample (theta, alpha), teens with ASD (theta, beta, gamma), and TYP teens (alpha). Lower levels of social anxiety may be supported by neural synchronization of left and right parietal cortices. However, the pattern of relations amongst EEG frequency bands and social anxiety differs between teens with and without ASD.

Correspondence: *Audrey Carson, MS, Psychology, Marquette University, 7676 Phoenix Drive, Apt 1213, Houston, TX 77030. E-mail: audreymcarson@gmail.com*

D. DE LEEUW & G. HORNEMAN. Prevalence of Autism in Patients with Laurence Moon Bardet Biedl Syndrome.

Objective: The objective of this study was to explore the presence of autism in subjects with Laurence Moon Bardet Biedl Syndrome (LMBB).

Participants and Methods: The present study is population based. In Sweden a total of 35 individuals are known with the diagnosis LMBB. The symptom that is most often associated with LMBB is Retinitis Pigmentosa, which is a progressive visual impairment leading to blindness. Apart from these medical symptoms, cognitive symptoms such as learning disabilities have been described as one additional impairment. Behavioural characteristics, including disinhibited behaviour, and an inability to recognize social cues, and obsessive and compulsive tendencies have been described which confirmed the notion that a specific part of this group showed autism.

Twenty-nine subjects were contacted and invited to take part in the study. Twenty-six accepted to participate. A half-structured interview was performed in the subjects home. Further more, the SCQ (Social Communication Questionnaire), a 40-item, parent report screening measure was presented as well as Uta Frith's "Triangels", which is considered to be a test of mentalizing ability.

Results: The results from the SCQ showed autism in twenty-two subjects (85%). The results of Uta Frith's "Triangles" showed that none of the subjects with vision had mentalizing ability. The parental interview also suggested that the majority of the subjects had autistic symptoms. Thirteen subjects had a late language development.

Conclusions: The results from this study showed that autism in the LMBB group is a common disorder.

The behavior characteristics have previously been recognized as a result of the progressive visual decrease, rather than lack of mentalizing ability associated with autism.

Therefore, when developing pedagogical programmes, it is important to address the issue of autism, in order to meet the subject's special needs.

The results also point to the necessity to reconsider the diagnose criteria for this group of patients.

Correspondence: *Ditte de Leeuw, privat practice, Röntmästargatan 85, Örebro 702 25, Sweden. E-mail: d.deleeuw@telia.com*

V.A. DELBENE, J.S. BUTLER, G.N. ANDRADE, S. MOLHOLM & J.J. FOXE. Atypical visual habituation in children with autism: A high density electrical mapping study.

Objective: Sensory issues are prevalent in the autism spectrum (ASD) population, and sensory habituation can be a potential biomarker - a measurable difference in neuronal activity that is unique for that clinical population, such as hypo- and hyper-sensitivity to sensory stimulation in the ASD population, or those at risk. Sensory habituation is a reduction in response amplitude to repeated presentations of a stimulus, which likely represents a filter for redundant sensory stimulation. Our aim was to better understand how children with autism habituate to visual stimuli.

Participants and Methods: We compared the visual evoked potentials (VEP) of children on the autism spectrum (N=24) with those of neurotypical controls (N=48). In a continuous block paradigm, we used a ring shaped checkerboard patterned stimuli presented continuously with varying interstimulus intervals (ISI) of 200 milliseconds (ms), 300 ms, 550 ms, 1050 ms, and 2550 ms, with participants instructed to maintain focus on the central fixation cross in the ring. High density electroencephalogram (EEG) was used to acquire the electrophysiological measurements, followed by epoch averaging to produce VEP waveforms.

Results: Habituation to the visual stimulus, as measured by the mean peak amplitudes, with respect to the ISI was observed at the parietal-occipital electrode sites ($F(8, 72) = 5.063$, $p < 0.001$) over the 170 to 190 ms temporal window. There was an observed Diagnosis X ISI interaction effect at a latency of 140 to 160 ms between the clinical and typically developed groups ($F(1, 4) = 2.846$, $p < .05$). VEP waveforms indicate atypical sensory habituation in the ASD population.

Conclusions: Atypical sensory habituation can be a potential biomarker for this clinical population, while further explaining differences in perception of visual sensory information between typically developed children and ASD children.

Correspondence: *Victor A. DelBene, B.A., Yeshiva University - Albert Einstein College of Medicine and the Ferkauf Graduate School of Psychology, 263 Cedar Road, East Northport, NY 11731. E-mail: victor.delbene@gmail.com*

T. DUFFIELD, H. TRONTEL-DUFFIELD, R. GREEN, M. DUBRAY, A. FROELICH, A. CARIELLO, J. COOPERRIDER, J. NIELSEN, E. BIGLER, A. ALEXANDER, J. ANDERSON, T. FLETCHER, N. LANGE, B. ZIELINSKI & J. LAINHART. Finger Tapping, Strength-of-Grip and Grooved Peg-Board Performance in Autism.

Objective: Motor impairments have been reported in autism. However, few studies have systematically examined basic measures of motor integrity like finger tapping, strength of grip and peg-board fine motor coordination, and their interrelationships with MRI correlates of motor functioning in autism. The purpose of the current investigation was to compare performance on the finger tapping test (FTT), strength of grip (SOG) and grooved peg-board test (GPT) in autism compared to age and sex-matched (all males) controls and examine brain morphology relationships with a priori defined known motor regions.

Participants and Methods: Autism was rigorously diagnosed. All subjects had a nonverbal IQ score greater than 65, were male, and ranged in age from 5-33. MRI was performed on a 3T scanner where region of interest (ROI) volumes were calculated based on FreeSurfer analyses for the following ROIs: primary motor and somatosensory cortex, basal ganglia, and cerebellum in 61 individuals with autism spectrum disorder (ASD) and 30 typically-developing controls. FTT, SOG and GPT were all administered according to standard protocol and in the same testing session.

Results: Analyses, controlling for age, head circumference, and IQ revealed motor performance differences on the GPT for individual peg completion time for both hands, with ASD performing slower than controls. ASD individuals also had a significantly higher GPT drop rate for the non-dominant hand than controls. For the FTT, typically-developing controls performed significantly better than the ASD group for both hands. The two groups did not differ on SOG. Brain volumes for ROI motor regions did not significantly differ between participants with ASD and controls.

Conclusions: From a motor hierarchical standpoint, the SOG network is the simplest with FTT intermediate and the GPT most complex. While basic motor areas of the brain did not differ between ASD and controls, reduced FTT and GPT performance is consistent with hypothesized abnormalities of connectivity in autism.

Correspondence: *Tyler Duffield, M.A., Clinical Neuropsychology, Brigham Young University, 11251 S. State St., Sandy, UT 84070. E-mail: tduffield2009@yahoo.com*

R. FUKATSU, E. TSUTAMORI, H. ITO, E. TSUTAMORI, H. TAKAHASHI, Y. ICHIYA & K. YAMAGUCHI. Basic Motor Skill and Praxis in 5-year-old Boys with Autism.

Objective: Children with autism often have difficulty performing skilled movements. Praxis performance requires basic motor skill and knowledge of representations of the movement. The purpose of this study was to investigate the basic motor skill and acquisition level of this knowledge in 5-year-old children with autism spectrum disorder (ASD).

Participants and Methods: We studied 5 year and 7 month-old and 5 year and 5 month-old boys with ASD, Case A and Case B, respectively, by having them complete the Test of Gross Motor Development 2 (TGMD-2) to assess their basic motor skill, and gesture to imitation (GTI), gesture with tool use (GTU), and pantomime recognition task (PRT) tests to assess their knowledge acquisition levels. For the GTI and PRT tests, both transitive and intransitive gestures were included.

Results: Based on the TGMD-2, the equivalent age for locomotor for the Case A and B were 5 year and 0 month-old and 4 year and 6 month-old, respectively, whereas the equivalent age for object control were 3

year and 0 month-old and younger than 3 year-old, respectively. While the GTI, GTU and PRT scores with transitive gestures for Case A were 2/10, 8/10 and 9/10, those for Case B were 2/10, 9/10 and 6/10. The GTI and PRT scores with intransitive gestures for Case A were 6/10 and 6/10, whereas those for Case B were 8/10 and 3/10.

Conclusions: As for the basic motor skill, their motor skills were low for their ages, and their developments of object control were especially poor. As for their praxis performances, their GTI scores were especially low, and the PRT scores was clearly poor for Case B compared with a typically developing 3 year and 3 month-old boy, whose scores were 8/10 with transitive gestures and 6/10 with intransitive gestures. It is important to investigate the praxis performance of preschool age children with ASD, who are in the process of acquiring linguistic ability and knowledge of representations of the movement.

Correspondence: *Reiko Fukatsu, Ph.D., Clinical Research, National Rehabilitation Center for the Persons with Disabilities, Hospital, Namiki 4-1, Tokorozawa 359-8555, Japan. E-mail: fukatsu-reiko@rehab.go.jp*

R. GREEN, D. KIM, E.D. BIGLER, M. DUBRAY, A. FROELICH, A.L. ALEXANDER, N. LANGE & J.E. LAINHART. Visual-Motor Integration Deficits and Neurological Correlates in Autism Spectrum Disorder.

Objective: The current study compared individuals with Autism Spectrum Disorder (ASD) to typical developing controls (TD) to further our understanding of the relationship between visual-motor integration (VMI) performance and magnetic resonance imaging (MRI) quantitative measures of brain regions of interest (ROI).

Participants and Methods: VMI was measured using the Beery-Buktenica Developmental Test of Visual-Motor Integration. Subjects were male, 4- to 26-years-old with ASD ($n = 30$, mean age = 12.59) and TD ($n = 35$, mean age = 12.04). ASD was diagnosed using the ADOS and ADI. No significant differences were found in age, handedness, intracranial volume, or verbal IQ. Verbal and non-verbal IQ were restricted at a standard score of 80. Participants underwent 3.0T MRI. Image quantification was performed by FreeSurfer software v5.0.

Results: The ASD group ($M = 93.47$, $SD = 15.47$) demonstrated poorer VMI performance compared to TD ($M = 105.03$, $SD = 14.00$); $t(63) = 3.16$, $p = .002$. Non-verbal IQ was significantly different between groups (ASD: $M = 106.77$, $SD = 15.98$) (TD: $M = 115.03$, $SD = 15.08$); $t(63) = 2.14$, $p = .036$. After controlling for age, non-verbal IQ correlated with VMI performance in the TD group; $r = .457$, $p = .007$ but not in the ASD group; $r = -.097$, $p = .62$. In the TD group, significant correlations between VMI performance and neurological ROIs were found, after controlling for age and non-verbal IQ, in left postcentral gyrus volume ($r = .48$, $p = .007$), right postcentral gyrus volume ($r = .46$, $p = .01$), and left precentral gyrus volume ($r = .55$, $p = .002$). An association was found in the posterior corpus callosum in the ASD group ($r = .40$, $p = .043$).

Conclusions: Results suggest that VMI is impaired in ASD compared to TD. VMI performance appears to be associated with non-verbal IQ in the TD group but not in the ASD group. Findings suggest that brain development, in relationship to visual-motor ability, between ASD and TD differs in right and left postcentral gyri and left precentral gyrus.

Correspondence: *Ryan Green, Brigham Young University, 776 n 645 w, Centerville, UT 84014. E-mail: ryanrgreen@yahoo.com*

N.M. KLEINHANS, S. HUANG, G. PAULEY, T. MADHYASTHA, A. ESTES & S.R. DAGER. Association between Early Rapid Head Growth and Reduced Connectivity in Adolescents with Autism Spectrum Disorders.

Objective: Several lines of evidence suggest that abnormal connectivity is associated with the neuropathology of autism spectrum disorders (ASD). Early brain enlargement is one of the most replicated biomarkers in ASD and has been theoretically linked to abnormal connectivity observed in the adolescents and adults. However, the relationship between early brain enlargement and connectivity abnormalities has not been tested within the same participants.

Participants and Methods: We included 61 adolescents (ASD $n=28$, control $n=33$ [developmental delay (DD) 12, typical development (TD) 21]) who have been longitudinally followed since 3-4 years of age. Of these, 12 participants with ASD and 5 participants with DD had fMRI, DTI, and head circumference (HC) data. A task-free fMRI and 32-direction DTI scan were acquired. Tests for between-group differences and correlational analyses of the fMRI data were conducted using dual regression. FSL's probabilistic tractography was used to identify the uncinate fasciculus (UF), cingulum bundle, and corpus callosum tracts. HC growth rates were modeled using nonlinear mixed effects.

Results: The dual regression analyses showed a trend toward reduced connectivity in the default network ($p < .1$) and significantly reduced connectivity in the lateral occipital gyrus in the ventral attention networks in the ASD group. Faster HC rate was associated with reduced connectivity in the medial prefrontal cortex in the ASD group. Widespread reduced white matter integrity was found in the ASD group compared to the control sample. A significant ($t=2.208$, $p < .05$) group by HC interaction effect was found in the UF.

Conclusions: Faster head growth in the first few years of life is associated with reduced white matter integrity of the UF and reduced connectivity in the medial prefrontal cortex in ASD during adolescence. Early, rapid brain growth may have the greatest long-term impact on frontal lobe structures associated with socioemotional processing.

Correspondence: *Natalia M. Kleinhaus, Ph.D., University of Washington, Box 357115, Seattle, WA 98195. E-mail: nkleinha@u.washington.edu*

L. MOTTRON, E.B. BARBEAU, M. DAWSON, I. SOULIÈRES & T.A. ZEFFIRO. Inspection Time Confirms that the Raven Matrices are the Optimal Measure of Autistic Intelligence.

Objective: Whereas autistics are known to achieve higher Raven progressive matrices RPM scores than their Wechsler IQ predicts (Dawson et al., 2007; Soulières et al., 2011), there are still disagreements on which of Raven or Wechsler scales represents the actual measure of autistic intelligence. To advance this question, we investigated the relationships among an independent measure associated with intelligence, Inspection Time (IT) on the one hand, and RPM scores and Wechsler IQ measures on the other, in autistic and typical individuals. IT Task estimates neural information processing time through visual processing speed, and is strongly correlated with the Wechsler IQ in typical populations.

Participants and Methods: We measured IT, RPM & Wechsler performance in autistic ($n=21$) IQ and typical participants ($N=28$). In the inspection time task, two vertical lines of different length are presented 10 to 200 ms and then masked. Participants indicate the longer of the two lines by pressing one of two response keys. The stimulus duration varies according to a staircase psychophysical procedure. Between group IT comparisons were made in subsamples matched for either FSIQ or RPM percentile using a mixed effects model.

Results: Compared to a typical control group, mean inspection time for the autistics was 31 % shorter. However, shorter autistic inspection time was evident only when groups were matched on Wechsler IQ, and disappeared when they were matched using Raven's Progressive Matrices.

Conclusions: The finding that Raven Matching suppresses the autism IT superiority over controls supports our hypothesis that RPM indexes actual intelligence in autism.

Correspondence: *Laurent Mottron, Md, PhD, Université de Montréal, 7070 Bvd Perron, Montréal, QC H1E1A4, Canada. E-mail: mottron@univ.quebec.ca*

A. NAIR, S. KIRTLAND, A. ABBOTT, D. GOBLE & R. AXELMULLER. Impaired balance correlated with repetitive behavior severity in Autism Spectrum Disorders.

Objective: Motor impairments are a frequent finding in autism spectrum disorders (ASD) and are among the earliest occurring signs in

infants with ASD. Most of the relevant literature has focused on fine motor skills, gross motor skills and imitation, whereas less is known about balance. Early motor deficits may contribute to social impairments in ASD (e.g., Minshew et al., 2004; Bhat et al., 2011). A more comprehensive understanding of the motor system in ASD is therefore crucial.

Participants and Methods: The current study involved a balance task whereby body sway was measured using a customized Wii Balance board (WBB). Specifically, 12 typically developing (TD) and 11 ASD participants had center of pressure (COP) data collected from the WBB at 50 Hz during performance of four 20-second balance conditions. The conditions varied in difficulty based on manipulations of vision (i.e. eyes open/closed) and support (i.e. single versus double stance).

Results: The results showed that ASD participants demonstrated impaired balance ability (indicated by greater COP path length) when compared to TD participants. Differences between groups were particularly pronounced in the more difficult single stance conditions regardless of whether the participant had their eyes open or closed. Pearson correlation analyses with ADOS, ADL, and RBS-R scores indicated significant positive correlations for total COP path length on single stance eyes closed condition with scores on the repetitive behavior indices of the ADOS ($r = .74$, $p < .001$) and ADL-R ($r = .65$, $p = .001$) for the ASD group. For both groups, significant positive correlations were also found between total COP path length on single stance eyes closed condition and RBS-R total scores ($r = .56$, $p = .006$).

Conclusions: These results indicate that poor balance is associated with symptom severity in ASD, specifically with respect to the motor impairments and ritualistic behaviors domain.

Correspondence: *Aarti Nair, University of California, San Diego, 4455 Vision Drive #2, San Diego, CA 92121. E-mail: anair@ucsd.edu*

K.E. ONO, C. MCMAHON & H.A. HENDERSON. Response Monitoring as a Predictor of Developmental Trajectories in Higher Functioning Adolescents Diagnosed with Autism.

Objective: Autism Spectrum Disorder is a neurodevelopmental disorder characterized by social, communicative, and repetitive impairments. It is hypothesized that disruptions of the prefrontal cortex (PFC), an area associated with executive response monitoring, may contribute to the cognitive and social difficulties (Chugani et al., 1997; Levitt et al., 2003). The current study assesses behavioral measures of response monitoring as a predictor of developmental change in social skills and activities of daily living over adolescence in higher functioning children diagnosed with autism (HFA).

Participants and Methods: Forty HFA and 43 age- and IQ-matched typically-developing adolescents (age range 8-19 years) participated in a longitudinal study. At the initial assessment, response monitoring was assessed using a modified Flanker task and at multiple later assessments parent-reported Behavior Symptoms were measured using the Behavior Assessment System for Children (BASC-2). Growth curve analyses via HLM6 were used to assess the role of response monitoring in predicting variability in growth rates in Behavior Symptoms.

Results: After controlling for diagnostic group, individual differences in post-error slowing on the Flanker Task, an index of response monitoring, significantly predicted greater improvements in Behavior Symptoms over the course of adolescence ($\beta_{12} = 1.80$, $SE = 0.85$, $p = .039$). Thus, aspects of neurocognitive response monitoring appear to be important predictors of developmental variability in social skills and activities of daily living in both HFA and typically-developing adolescents.

Conclusions: During critical adolescent years, it appears that response monitoring has a generalized effect on adaptive skills, facilitating learning and development. Findings will be discussed in relation to the combined role of ventromedial PFC and medial temporal lobe systems in autism (Cunningham & Zelazo, 2007).

Correspondence: *Kim E. Ono, M.S., Psychology, University of Miami, 300 S. Biscayne Blvd, #3011, Miami, FL 33131. E-mail: kim.e.ono@gmail.com*

B.A. PERSSON & R. CARLSSON. Autism and Schizophrenia – Overlap, Differential Aspects, and Comorbidity.

Objective: Autism spectrum disorder and Schizophrenia psychosis spectrum disorder have common deficits in social functioning, recognition and understanding of affects and theory of mind. A model of comorbidity and differential diagnosis will be presented.

Participants and Methods: Persons with Autism spectrum disorder (ASD) and Schizophrenia psychosis spectrum disorder (SCH) presents overlap and differences in anamnesis, neuropsychological results, psychiatric symptoms and aspects of everyday functioning. A review of current findings will help to differentiate the diagnosis.

Results: Deficits in impulse control, attention, executive functions, perception, working memory and a tendency to understand and think concretely are common. Regulation of sleep, eating, attention, thought, mood and social interaction, also appear to be common in both groups. The negative symptoms of schizophrenia correspond to the lack of mimicry, prosody and eye contact, as well as disorganized thought and talk often seen in ASD. The lack of Central Coherence also appears to be a common trait.

Differential traits are the positive symptoms of hallucinations and delusions, or rather the quality of them, i.e., those symptoms are florid in SCH, as the ASD phenomena of misunderstanding and visual style of cognition and therefore remembering can look quite similar.

Conclusions: A childhood anamnesis must be taken in order to differ between SCH without positive symptoms and those of ASD, since the latter are present from birth or early childhood while SCH usually debut in adolescence or later. Aspects on differential diagnosis between ASD and SCH regarding anamnesis will be discussed, and a proposal of differential clinical examination will be presented.

Correspondence: *Roger Carlsson, PhD, Department of Psychology; Linnaeus University, Växjö 351 95, Sweden. E-mail: roger.carlsson@lnu.se*

J.B. PETERS, J.W. MURPHY, J.J. FOXE & S. MOLHOLM. Intersensory Selective Attention and Task Switching in Autism Spectrum Disorders: A High-Density Electrophysiological Investigation.

Objective: Stereotyped and restricted behaviors and interests represent a core cluster of symptoms in Autism Spectrum Disorders (ASD). Aberrant attentional mechanisms have been hypothesized to account for related symptoms such as perseveration, behavioral rigidity, and difficulty adapting to change. Here we used high-density electrophysiological recordings of brain activity to probe the integrity of different stages of selective attention in children and adolescents with high-functioning ASD. Given clinical reports of difficulty with changes in task demands, we were particularly interested in whether individuals with ASD would show deficits in switching attention between the sensory modalities.

Participants and Methods: Nineteen children and adolescents with ASD (9-15 years old) and 19 typically-developing (TD) participants matched on chronological age and performance IQ participated. 64-channel EEG was recorded while participants performed an intersensory selective attention task in which they were cued on a trial-by-trial basis to attend to stimuli in either the visual or auditory modality to detect an oddball stimulus.

Results: The ASD group's task performance was found to be remarkably typical. However, there were differences in brain measures of attentional processes, showing reduced preparatory activity in anticipation of the cued target, and reduced enhancement of the processing of task relevant stimuli in ASD. Contrary to expectation, task switching was not problematic in this group.

Conclusions: The combination of intact behavior and different brain activity indicates that individuals with ASD used a different, yet equally effective, strategy to perform the task. These data will be considered in the context of current theories of autism.

Correspondence: *Joanna B. Peters, M.A., Ferkauf Graduate School of Psychology/Albert Einstein College of Medicine Cognitive Neurophysiology Laboratory, 101 Hickory Avenue, Unit A1, Bergenfield, NJ 07621. E-mail: jopete317@yahoo.com*

P. RAY. Executive Functioning In Children With Autistic Spectrum Disorder On The Behavioural Assessment Of Dysexecutive Syndrome In Children.

Objective: Research shows children with Autistic Spectrum Disorder (ASD) have significant deficits in executive abilities including cognitive flexibility, verbal reasoning, self-monitoring and planning. However, these studies have not accounted for the effects of IQ and have administered isolated executive functioning subtests rather than a comprehensive battery.

The aims of this study were to administer a complete battery of executive functioning tests specifically normed for the child population; to account for intellectual ability by administering a test of intellectual functioning, and to identify the cognitive profile of children with ASD on the Behavioural Assessment of Dysexecutive Syndrome in Children (BADS-C).

Participants and Methods: The experimental group included 13 males and six females (mean age = 10.63), ten met criteria for ASD and nine for Asperger's Disorder. The control group included nine males and two females (mean age = 11.75). The Wechsler Abbreviated Intelligence Scale and BADS-C were administered. Parents completed the Gilliam Autism Rating Scale (GARS-2; Gilliam, 2005) to verify diagnosis.

Results: MANOVA tests revealed significant impairments for children with ASD compared with controls on BADS-C subtests The Playing Cards Test and The Six Part Test. Results for the remaining BADS-C subtests were within normal limits. IQ was not a significant covariate.

Conclusions: There was no evidence of a global dysexecutive syndrome in children with ASD. Significant executive deficits were found in cognitive flexibility, planning and self-monitoring. This profile was thought to be influenced by a number of factors including processing speed, working memory, cognitive workload and perseveration. The findings support previous research that children with ASD do not exhibit global executive deficits but rather experience focal areas of executive impairment. Correspondence: *Phil Ray, BA (Hons), PsychD, MSc, Psychological Medicine, The Children's Hospital at Westmead, Corner Hawkesbury Road and Hainsworth Street, Westmead, NSW 2145, Australia. E-mail: phil.ray@health.nsw.gov.au*

O. REINVAL, A. VOUTILAINEN, P. LAHTI-NUUTILA & T. KUJALA. Developmental and Behavioural Problems in Children and Adolescents with Autism Spectrum Disorders.

Objective: To assess developmental and behavioural problems in higher functioning children and adolescents with autism spectrum disorders (ASD).

Participants and Methods: Fifty five children and adolescents aged 5–15 years who had been diagnosed with ASD participated in the study and underwent further assessments. Cognitive capacity was evaluated with eight subtests of the Wechsler Intelligence Scales third edition (WISC-III). All participants had the Full Scale Intelligence Quotient (FSIQ) above 70. The ASD diagnoses were confirmed using the Autism Diagnostic Interview Revised (ADI-R). Developmental and behavioural aspects were assessed with the Five to Fifteen parent questionnaire (FTF).

Results: Children and adolescents with ASD had significantly more problems (scores \geq 90th percentile) compared to the age-specified norms of the FTF in the domains of Social skills ($p < .001$), Emotional/Behavioral problems ($p < .001$), Perception ($p < .001$), Executive functions ($p < .001$), Memory ($p < .001$), Motor skills ($p < .001$), and Learning ($p < .05$). In more detailed subdomain level, the most frequent problems were as follows: internalizing (44%) and obsessive-compulsive (42%) symptoms in the Emotional/Behavioral problems domain, body perception impairments (59%) in the Perception domain, attention difficulties (42%) and hypoactivity (41%) in the Executive functions domain, impairments in gross motor (68%) and fine motor skills (41%) in the Motor skills domain, and difficulties with coping in learning (19%) in the Learning domain.

Conclusions: The results indicate that parents commonly report developmental and behavioural problems in children and adolescents with higher functioning ASD. Particularly social skill impairments, emotional or behavioural problems, perception difficulties, and executive-function deficits were frequent.

Correspondence: *Outi Reinvald, University of Helsinki, PO Box 9, University of Helsinki FI-00014, Finland. E-mail: outi.reinvald@helsinki.fi*

A. RICHARD, R. LAJINESS-O'NEILL, A. MANSOUR, J. MORAN, A. MOORE & S. BOWYER. Neural Synchrony during Direct and Averted Gaze in Autism Spectrum Disorder (ASD) Using MEG.

Objective: Abnormal processing of direct versus averted eye gaze has been documented in ASD. However, few studies to date have investigated abnormal connectivity between brain regions, and none have investigated coherence within various frequency bands in ASD during eye gaze processing. The following study investigated coherence between cortical regions during eye gaze viewing in ASD.

Participants and Methods: Participants included 10 ASD (mean age = 16.6 yrs) and 8 age- and IQ-matched neurotypicals (NT; mean age = 17.5 yrs) who underwent magnetoencephalography (MEG) while passively viewing direct and averted gaze. Coherence in the evoked signal was calculated for each pair of 54 brain regions in α (1-15 Hz), β (15-30 Hz), and γ (30-45 Hz) frequency bands and combined frequency bands. Coherence values were compared with independent sample t-tests with the False Discovery Rate controlled at 0.10.

Results: Averted gaze – in the α band, ASD showed higher coherence between left parieto-occipital regions and right temporo-parieto-occipital regions and lower coherence between bilateral frontal and right fronto-temporo-parietal regions compared to NT. In the β band (associated with long range connectivity), ASD showed higher coherence between left parieto-occipital regions and bilateral temporo-occipital and left parietal regions. In the γ band, (associated with short range transmission and higher order cognition), ASD showed higher coherence between bilateral temporo-parieto-occipital regions as well as bilateral parietal and orbitofrontal regions. In both β and γ bands, ASD showed lower coherence between bilateral frontal and right superior temporal regions. Direct gaze - ASD showed higher coherence within frontal regions in combined frequency bands.

Conclusions: These results provide preliminary findings on increased coherence in posterior, short range connectivity and decreased coherence in anterior to posterior, long- and short-range connectivity while viewing averted gaze in ASD.

Correspondence: *Annette Richard, Psychology, Eastern Michigan University, 611 W Cross St, Ypsilanti, MI 48197. E-mail: annette.e.richard@gmail.com*

M.E. SEMRUD-CLIKEMAN, J. GOLDENRING FINE & J. BLEDSOE. Hippocampal and Amygdala Volumetric Differences in Asperger Syndrome, NVLD, and Controls.

Objective: Previous studies have found significantly stronger activation and larger volume differences in children with Asperger Syndrome (AS) in the amygdala and hippocampal regions. In addition, children with AS have also been found to show a possible anterior cingulate cortex anomaly (ACC). While children with nonverbal learning disabilities (NVLD) also frequently show social perception difficulties, there have been no studies that have evaluated these same regions volumetrically. In addition, the incidence of attentional problems in children with NVLD is higher than that found in control children. Our purpose was to compare volumetric MRI with children AS or NLD to controls following a comprehensive evaluation of neuropsychological functioning.

Participants and Methods: 3 groups of children were compared (AS = 28; NVLD = 31; Controls = 32) on structural 3T MRI. Measures were made using FSL and AFNI for the volume of the amygdala, hippocampus, ACC, and caudate. Reliability of measures exceeded .91.

Results: We hypothesized that the amygdala and hippocampus would be larger in the AS and NVLD groups compared to the other groups. This finding was confirmed only for the AS group ($p < .001$). We also

hypothesized that the ACC would differ in children with AS and NVLD. This hypothesis was confirmed as the ACC was significantly smaller in the AS and NVLD groups compared to the controls ($p < .001$). Finally the caudate was hypothesized to differ only in the NVLD group due to an increase in attention difficulties; a finding that was confirmed ($p < .02$).

Conclusions: These findings suggest that children with AS show different brain structure volumes in crucial regions responsible for emotional processing in both the NVLD and control groups. Both clinical groups showed anomalies in the ACC possibly reflecting difficulty in self-monitoring and correcting. The NVLD group showed smaller caudate volumes indicating that this region is compromised and may relate to the attentional problems seen with children with NVLD.

Correspondence: *Margaret E. Semrud-Clikeman, Ph.D., Pediatrics, University of Minnesota Medical School, Box 486 Mayo, 420 Delaware St. SE, Minneapolis, MN 55455. E-mail: semru002@umn.edu*

G.A. STEFANATOS, K. O'CONNOR & G. O'HERRON. Demographic Factors Are Not Differentially Predictive of Early Onset and Regressive Autism Spectrum Disorder.

Objective: Recent studies have suggested that risk for Autism Spectrum Disorder (ASD) is associated with demographic factors such as advanced parental age and low birth weight. Some studies have suggested that particular predictors (e.g., maternal age) are differentially associated with risk of early onset autism (EOA) versus regressive autism (RA). We therefore evaluated the independent effects of a number of demographic variables on the different developmental trajectories seen in a large group of children ASD.

Participants and Methods: Retrospective parental questionnaires, interviews, and medical records were used to document demographic characteristics and chart the developmental trajectories of 156 children with a history of autism spectrum disorder.

Results: Children with RA and EOA demonstrated dissociable group developmental trajectories. Kaplan-Meier survival analyses and non-parametric statistical comparisons (log rank, Mann-Whitney U) of developmental milestones revealed no group differences in the age of attainment of early motor and language milestones (sitting alone, crawling, first syllables). However, significant differences were observed in later emerging milestones (e.g., first steps, walking alone, and the production of first words). No statistically significant group differences were observed in birth weight, maternal age or paternal age.

Conclusions: These results suggest that several of the demographic factors proposed as increasing the risk of AD were not differentially predictive of the developmental trajectories of RA and EOA. This is broadly compatible with previous findings that despite clear differences in the children's developmental courses, there are minimal differences in family history or demographics.

Correspondence: *Gerry A. Stefanatos, D.Phil., Communication Sciences and Disorders, Temple University, 1701 N. 13th St., Philadelphia, PA 19122. E-mail: stefang@temple.edu*

H. TRONTEL-DUFFIELD, T. DUFFIELD, G. RYAN, M. DUBRAY, A. FROEHLICH, A. CARIELLO, J. COOPERRIDER, J. NIELSEN, E. BIGLER, A. ALEXANDER, J. ANDERSON, T. FLETCHER, N. LANGE, B. ZIELINSKI & J. LAINHART. Volumetric Relationships of Medial Temporal Lobe Structures with Memory in Autism.

Objective: Impairments in memory are well documented in autism. The hippocampus and related medial temporal lobe (MTL) structures are known to play crucial roles in memory. The current investigation explores anatomical correlates of MTL structures with memory performance in autism and age-matched typical developing controls.

Participants and Methods: Autism was diagnosed by ADOS-G, ADI-R, and DSM-IV criteria. All subjects were (N= 77) males ranging in age from 5 to 19. There were no group differences in age or head size. Region of interest (ROI) volumetrics were based on 3T MRI studies using FreeSurfer for volume quantification that included total intracranial,

brain, and MTL (hippocampal, amygdala, entorhinal, and parahippocampal volumes summed) volume. Memory was assessed using the Test of Memory and Learning (TOMAL) comparing the following index measures: Composite Memory Index (CMI), Verbal Memory Index (VMI) and Nonverbal Memory Index (NVMI). Correlational analyses were performed between MTL structures and TOMAL indexes.

Results: Amygdala volume was larger in the autism group, but only significant on the left. No other ROI volumes significantly differed between groups. Although not significant, MTL volume was positively correlated with the CMI in controls. In contrast, significant negative correlations were observed in autism. Similarly, CMI was negatively correlated with right hippocampal volume. Also, VMI was significantly negatively correlated with total entorhinal, right and total hippocampal, and total and right MTL volumes in autism. There were no significant correlations with NVMI measures in subjects with autism. No significant VMI or NVMI correlations were observed in controls with any MTL ROI.

Conclusions: Different patterns of MTL correlations with memory performance were observed in autism. Specifically, in autism memory performance was negatively correlated with ROI volume of the MTL. Results are discussed in terms of aberrant connectivity and size-function relationships of MTL structures in autism.

Correspondence: *Haley Trontel-Duffield, M.A., Univ Montana, 104 Tox-teth St, Apartment 1, Brookline, MT 02446. E-mail: htrontel@gmail.com*

E.L. WODKA, R. BUHLMAN, T. KORIAKIN & S. MOSTOFSKY. The Relationship Between Sensory and Motor Functioning in Two Clinical Groups.

Objective: Although abnormal sensory and motor functioning are common to both autism spectrum disorders (ASD) and attention deficit/hyperactivity disorder (ADHD), the pattern and overlap of motor and sensory behaviors between groups is not well-understood. We aim to examine motor and sensory functioning in children with ASD as compared to ADHD (and Typically Developing children:TD), as well as examine predictors of motor functioning across groups.

Participants and Methods: Sensory behavior was measured via parent-report (Sensory Processing Measure:SPM). Performance-based motor functioning was assessed with the Movement Assessment Battery for Children (MABC-2). Groups included ASD (n=38), ADHD (n=40) and TD (n=67). Children included were age 8-12 years (M=10.2, SD=1.3), and were of at least average nonverbal intelligence (WISC-IV: PRI): ASD (M=106.9, SD=14.5), ADHD (M=101.9, SD=15.8), and TD (M=110.4, SD=12.6). There were no group differences in demographic characteristics.

Results: MANOVA revealed highly significant differences ($p < .001$) between groups on the total score from the SPM ($F(2, 143)=85.8, p < .001$) and MABC ($F(2, 135)=42.4, p < .001$), with ASD showing greatest relative deficits. While both were significant predictors of MABC performance, linear regression suggested parent-reported sensory behavior ($t(2, 134)=-5.4, p < .001$) was a stronger predictor than diagnosis ($t(2, 134)=-2.1, p=.04$), accounting for 27% and 14% of the variance in motor performance, respectively.

Conclusions: Though parents of children with ASD and ADHD report greater concern than TD children with regard to abnormal sensory behaviors, the level of concern is statically and clinically greatest for children with ASD across multiple aspects of sensory functioning. Additionally, parent-reported sensory behavior is almost twice as strong of a predictor of motor performance than diagnostic group, suggesting some degree of shared variance in motor performance explained by sensory behavior (regardless of diagnosis).

Correspondence: *Ericka L. Wodka, Ph.D., Center for Autism, Kennedy Krieger Institute, 3901 Greenspring Ave., Baltimore, MD 21211. E-mail: wodka@kennedykrieger.org*

E.L. WODKA, R. BUHLMAN & S. MOSTOFSKY. Evidence for Specificity of Motor Impairments in Catching and Balance in Children with Autism.

Objective: Motor impairments are common to both children with Autism Spectrum Disorders (ASD) and attention deficit/hyperactivity

Disorder (ADHD); however, when learning a new motor task, children with ASD rely more heavily on proprioceptive (as opposed visual) feedback than ADHD and typically developing (TD) children. As such, we hypothesize to uncover particular impairment on tasks involving greater visual input to guide motor expectation (i.e., catching versus dexterity) for children with ASD as compared to ADHD and TD. Additionally, we expect that those tasks with greater visual-motor demand will best discriminate between children with ASD as compared to ADHD and TD.

Participants and Methods: Performance-based motor functioning was assessed with the Movement Assessment Battery for Children (MABC-2) through individual item scores. Groups included ASD (n=38), ADHD (n=40) and TD (n=67). The age of the sample ranged from 8-12 years (M=10.2, SD=1.3). All participants had at least average intelligence (WISC-IV).

Results: MANOVA revealed highly significant differences across items of the MABC-2; when ASD was compared to ADHD, the most robust differences were for catching ($t(2, 70)=-3.8, p < .001$) and balance beam items ($t(2, 70)=-3.8, p < .001$). When significant items were entered into a stepwise discriminant function analysis, highly significant differences (Wilks' Lambda=0.56, $p < .001$) between groups were identified on these two factors (1. Catch; 2. Balance), correctly classifying 62% of the sample as ASD, ADHD, or TD.

Conclusions: Consistent with our hypothesis, children with ASD are more impaired in catching than children with ADHD (or TD). In addition, robust differences were observed between groups for balancing on a beam, another task requiring high demand for visual input. As such, findings suggest that autism is associated with difficulty using feedforward models to rapidly incorporate sensory, particularly visual, feedback into guiding motor control.

Correspondence: *Ericka L. Wodka, Ph.D., Center for Autism, Kennedy Krieger Institute, 3901 Greenspring Ave., Baltimore, MD 21211. E-mail: wodka@kennedykrieger.org*

Behavioral Neurology

L. ACOSTA, S. HAQUE, D. ESTALILLA, D. SZELES, H. APPEL, I. FISCHLER, J. AUSTIN, K. HEILMAN & J. WILLIAMSON. Mindfulness Based Stress Reduction and Creativity.

Objective: Creativity has been defined as the ability to discover, understand, and produce (express new) novel, orderly relationships. In addition to skills and knowledge, creativity depends on disengagement and divergent thinking mediated by frontal executive networks, as well as associative and convergent thinking brought about by interactions between multiple cognitive modules. Rest and relaxation enhance creativity and EEG studies of subjects undergoing Mindfulness Based Stress Reduction (MM) have revealed a significant increase in alpha and theta activity. In addition neuroimaging studies showed that MM practice activates the prefrontal cortex (PFC). Therefore, the objective of this study is to evaluate whether MM enhances verbal and/or visuospatial creativity.

Participants and Methods: Nine healthy participants prior to and upon completion of an eight-week MM course, were assessed with a neuropsychology battery, including the full version of the Torrance Test of Creative Thinking, which explores both verbal and figural creative expressions. Results of testing before versus after MM training were analyzed using paired sample t-tests.

Results: MM training appeared to improve verbal creativity ($p < .05$), but not figure creativity.

Conclusions: These findings indicate that MM may augment verbal creativity. The reason for this selective improvement is not known but may be related the form of meditation. Therefore, further research is needed to test this hypothesis.

Correspondence: *Lealani Mae Acosta, MD, Neurology, The University of Florida Health Science Center/Shands, PO Box 100236, Department of Neurology, Gainesville, FL 32610-0236. E-mail: lealani.acosta@neurology.ufl.edu*

G. ARCARA, F. MENEGHELLO, F. BURGIO, S. BENAVIDES, B. BUTTERWORTH & C. SEMENZA. Numerical Activities of Daily Living In Neurological Diseases.

Objective: The aim of this study was to build and validate an instrument, the Numerical Activities of Daily Living (NADL), apt to measure the impact of acalculia on everyday life. An important issue is whether awareness of calculation problems is directly related to awareness of impairment in general.

Participants and Methods: Participants were 100 normal controls, and 154 people affected by different neurological conditions.

Two batteries were specifically designed for this investigation: The number and calculation battery ("The Formal Test", an extensive evaluation of mathematical abilities) and The Numerical Activities of Daily Living (NADL). The NADL battery consisted of: The Informal Test of Numerical Competence, meant to assess the numerical competence in everyday life, an Interview with Participant (IP, questions on how he/she uses numbers in everyday life), meant to measure the patient's awareness about his/her numerical deficit and an Interview with Caregiver (IC, same questions concerning the patient's behaviour). These tests were administered to participants along with known clinical batteries: the Mini Mental Scale Examination (MMSE), The Montreal Cognitive Assessment (MoCA) and the Instrumental Activities of Daily Living (IADL).

Results: The IC was more reliably correlated than IP with the results of both the Formal Test (IC: .67; IP: .42) and the Informal Test (IC: .62; IP: .43). It may be considered a good estimator of the patients' mathematical abilities. The IP correlated much better with IADL (.64) than with NADL (see above). Different mathematical disabilities seem to distinguish different neurological diseases.

Conclusions: These findings suggest that patients are much less aware of their mathematical deficits and of how these deficits interfere with their daily living than they are of other more generic deficits. Remediation programs should take these facts into account.

Correspondence: *Carlo Semenza, Medicine, Neurosciences, University of Padova, via Giustiniani 5, Padova 35128, Italy. E-mail: carlo.semenza@unipd.it*

A.D. FALCHOOK, D. BURTIS, L.M. ACOSTA, L. SALAZAR, V.S. HEDNA, A.Y. KHANNA & K.M. HEILMAN. Crossed Aphasia Without Apraxia In A Right-Hander.

Objective: Hand preference has been posited to be determined by language laterality or hemispheric asymmetry of movement control systems. If handedness is determined by the laterality of movement control networks, then a right handed patient with crossed aphasia from a right hemisphere stroke should not demonstrate ideomotor or limb-kinetic apraxia.

Participants and Methods: This report describes a right-handed man with global aphasia from a right middle cerebral artery territory infarct.

Results: When using his right hand, our patient had a linguistic but not apraxic agraphia, and when performing transitive movements he made perseverative and body part as object errors but not temporal-spatial errors. His right hand also remained deft.

Conclusions: The absence of ideomotor or limb kinetic apraxia in this right-handed man with a global aphasia and neglect from a large right hemispheric stroke is consistent with the postulate that parallel bi-hemispherically distributed processing networks that simultaneously program "how" and "where" may facilitate people's interactions with environmental stimuli, and this facilitation may occur independent of which hemisphere is specialized for mediating language and speech.

The full manuscript for this report is currently under review for publication in *Neurocase*.

Correspondence: *Adam D. Falchook, MD, Neurology, University of Florida, UF Health Science Center, Box 100236, Gainesville, FL 32610-0236. E-mail: Adam.Falchook@neurology.ufl.edu*

E. KEIFER, M.T. MORAN, P.L. RAMBO & M.W. HAUT. Motor Perseverations in Older Patients.

Objective: Motor perseverations are considered a sign of brain dysfunction and have been observed in patients with neurological and psy-

chiatric conditions. A. Luria devised simple tasks eliciting motor perseverations and our goal was to use two of these tasks to determine if motor perseverations are more common and severe in older patients compared to normal controls, and if motor perseverations are associated with other cognitive findings.

Participants and Methods: Participants included patients (N=26) and normal controls (N=13) age 65 or older. The majority of the patients were diagnosed with Dementia or MCI. Normal controls were community-dwelling individuals without concerns of cognitive or functional decline or significant neurological/psychiatric history. All participants were administered Luria's loops and ramparts in a standardized manner. The number and frequency of perseverations were scored blindly with interrater reliability >.95.

Results: Patients and normal controls did not significantly differ with regard to age, education, or WRAT-4 Reading scores. Continuous perseverations on loops and ramparts were significantly correlated with each other ($r=.57, p=.00$). Patients had more perseverations on the loops [$F(1, 37)=6.29, p=.02$]. Furthermore, 46.2% of patients had at least one continuous perseveration on the loops, while none of the normal controls made this response [$X^2(1, N=26)=8.76, p=.003$]. Patients with perseverations on the ramparts performed significantly worse on multiple neuropsychological measures.

Conclusions: Motor perseverations on Luria's loops task are more common and more severe in older patients with MCI and dementia compared to matched normal controls. However, perseverations on the ramparts task are more indicative of cognitive dysfunction, particularly in the area of executive skills. Future directions include increasing sample sizes and stratifying patients by diagnosis.

Correspondence: *Ekaterina Keifer, PhD, Behavioral Medicine and Psychiatry, West Virginia University, 930 Chestnut Rudge Road, Morgantown, WV 26505. E-mail: katya.keifer@gmail.com*

M.S. MENNEMEIER, C.M. HEIMANN, G.J. BROWN, T.M. GUIDRY & K. GARRISON. Perception of Strength and Balance is Influenced by Stroke Laterality and Arousal Level.

Objective: Arousal level is known to influence perception and to be altered in different ways by RH and LH stroke. A subset of patients with right hemisphere stroke (RH) underestimate limb weakness and a subset of patients with left hemisphere stroke (LH) overestimate weakness (*Neurology*, 66: 1444-6). We hypothesized that differences in strength perception would relate to differences in arousal level. We also sought to extend this hypothesis to balance perception.

Participants and Methods: Participants were 12 controls (M=50 years), 4 RH (M=67) and 6 LH (M=64) of both genders. RH patients had greater functional impairment (Barthel Index: M=67.50, SD=3) than LH patients (M=97.00, SD=4) but no patients had neglect or aphasia. Arousal level was operationally defined by the amplitude of the P50 auditory evoked potential - a marker of RAS activity in response to sensory stimulation. Strength and balance perception accuracy (SPA and BPA) were determined by comparing objective performance on measures of strength (strain gauges assessing 4 upper and 3 lower contralesional limb movements) and balance (force plates assessing unsupported standing balance) with a patient's numerical rating of performance.

Results: We found that the P50 amplitude of controls (M=2.19 μ V, SD=1.09) was not well correlated with SPA and BPA. In contrast, P50 amplitude was highly correlated with SPA and BPA in both patient groups but in opposite directions (SPA $r^2 = -.98$ RH & $.78$ LH; BPA $r^2 = -.89$ RH & $.45$ LH). Further, P50 amplitudes were lower among RH (M=0.82 μ V, SD=0.77) than LH patients (M=2.99 μ V, SD=0.91).

Conclusions: Lesion laterality and arousal level appear to interact to bias perception of strength and balance even in moderately impaired patients. Diminished arousal in RH patients is associated with underestimating weakness and balance instability; whereas increased arousal in LH patients is associated with overestimating weakness and instability.

Correspondence: *Mark S. Mennemeier, PhD, Neurobiology, University of Arkansas for Medical Sciences, 4301 W Markhams, Slot 826, Little Rock, AR 72205-7199. E-mail: msmennemeier@uams.edu*

C.Y. YOUNG, R.L. ERICKSON, L.K. PAUL & W.S. BROWN. Academic Achievement in Children and Adults with Agenesis of the Corpus Callosum.

Objective: Individuals with agenesis of the corpus callosum (ACC) often have learning difficulties despite normal intelligence, which in some cases results in the diagnosis of a learning disability. To investigate academic skills in this population, we compared children and adults with ACC to age- and IQ-matched controls on the WRAT-III. It was expected that individuals with ACC would have more difficulty than controls on Arithmetic, but not on Reading and Spelling, because the former requires more complex novel problem-solving while the others place more demand on over-learned cognitive skills.

Participants and Methods: Thirty-six children (age 6-17, $M = 10.97 \pm 3.14$) and 26 adults (age 18-56, $M = 28.47 \pm 9.78$) with complete or partial ACC, all with FSIQ > 80, were compared with 21 child and 34 adult age- and FSIQ-matched controls. Two group x subtest Repeated Measures ANOVAs were conducted to compare children with ACC to child controls, and adults with ACC to adult controls.

Results: A significant subtest x group interaction effect was found in the child comparison ($\eta^2 = .20$, $p = .002$). Post-hoc analyses revealed that children with ACC performed worse than controls on the Arithmetic subtest of the WRAT-III. There were no significant effects in the analyses involving adults.

Conclusions: In the case of children, these analyses support the hypothesis that individuals with ACC have difficulty with complex novel problem-solving. For children, solving arithmetic problems is more likely to be complex and novel. By adulthood, arithmetic has become a rote skill that relies more heavily on crystallized knowledge.

Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 150 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

M. POTE GAL, B.D. YUND, K. RUDSER, K. DELANEY, I. NES-TRASIL, C.B. WHITLEY & E. SHAPIRO. Klüver–Bucy-like Symptoms in Sanfilippo syndrome.

Objective: Sanfilippo type A (MPS IIIA) is a rare genetic neurodegenerative disease with childhood onset and progressive dementia. Severe and unusual behavioral abnormalities have been described. Children with MPS IIIA exhibit hyper-orality, explore novel environments almost continuously, disregard danger, and have diminished sociality and compliance. We hypothesized that patients with MPS IIIA might have a Klüver–Bucy-like syndrome (K-BS) with diminished fear and startle response, orality, and reduced social interest.

Participants and Methods: Thirty participants with MPS IIIA (ages 2-18) were compared to 8 MPS IH (Hurler syndrome) patients, who have cognitive impairment but no behavioral abnormalities, in a behavioral laboratory study. We used a “Risk Room” paradigm from the Laboratory-Temperament Assessment Battery that contained a variety of attractive and frightening stimuli.

Results: Comparing MPS IIIA with MPS IH patients, the following statistically significant effects were found: MPS IIIA participants 1) Left mother sooner, 2) wandered more, 3) were more likely to approach frightening objects, 4) were less likely to respond to loud noise with whole body startle, 5) were less likely to avoid the attractive toy associated with the startle noise, 6) interacted less with mother when she returned from a brief absence, and 7) complied less with her clean-up/command. Effect size was stronger in the children diagnosed with MPS IIIA before age six.

Conclusions: MPS IIIA may be the first pediatric disease that presents systematically as a K-BS variant. If validated, the K-BS hypothesis of MPS IIIA would provide important markers for natural disease progression and for assessing the effects of therapeutic intervention. Due to the findings of K-BS-like behaviors, future research will investigate the role of the amygdala in MPS IIIA.

Correspondence: *Brianna D. Yund, B.A., Pediatrics, University of Minnesota, 516 Delaware St SE, 12-170 PWB, Minneapolis, MN 55455. E-mail: bdy@umn.edu*

Cancer

L. SINGH, T.M. BRINKMAN, C. KIMBERG, J. LUXTON, C. PUI, M.M. HUDSON & K.R. KRULL. Processing Speed as a Predictor of Social and Adaptive Functioning in Survivors of Childhood Acute Lymphoblastic Leukemia (ALL).

Objective: Survivors of childhood ALL are at risk for neurocognitive impairment, which may adversely affect daily functioning. Deficits in intelligence have been associated with reduced social and adaptive functioning in childhood cancer survivors; yet the independent contribution of processing speed is not well understood.

Participants and Methods: 147 survivors of childhood ALL were treated on a chemotherapy only protocol (i.e. Total XV) at St. Jude Children’s Research Hospital were recruited for a comprehensive neuropsychological assessment. Parents provided ratings of the survivors social and adaptive functioning. Multivariable linear regression models, adjusted for sex and age, were used to examine the association between measures of cognitive processing speed and parent-reported social and adaptive function.

Results: Survivors were on average 14.3 years of age (range: 8.1-26.5) and 7.6 years from diagnosis (range: 5.1-11.2). After accounting for Full Scale IQ from the Wechsler Abbreviated Scale of Intelligence, performance on the coding subtest significantly predicted leadership skills ($\beta = 0.51$, $t(120) = 4.04$, $p < 0.001$), withdrawal ($\beta = -0.34$, $t(120) = -2.29$, $p = 0.02$), activities of daily living ($\beta = 0.31$, $t(120) = 2.20$, $p = 0.03$), and functional communication ($\beta = 0.37$, $t(120) = 2.67$, $p = 0.009$). Measures of motor dexterity, visual scanning, focused attention, and working memory were not significantly associated with social or adaptive behaviors, suggesting a specific contribution of visual-motor processing speed to these functional outcomes.

Conclusions: These data suggest that cognitive processing speed uniquely contributes to social and adaptive functioning in long-term survivors of childhood ALL. Future studies should investigate objective measures of social skills in relation to specific cognitive processes.

Correspondence: *Tara M. Brinkman, PhD, Epidemiology and Cancer Control, St. Jude Children’s Research Hospital, 262 Danny Thomas Place, MS 735, Memphis, TN 38105. E-mail: tara.brinkman@stjude.org*

M. EDELMANN, T.M. BRINKMAN, D.A. MULROONEY, C. KIMBERG, M.M. HUDSON & K.R. KRULL. Uric Acid is Associated with Neurocognitive Function in Survivors of Childhood Acute Lymphoblastic Leukemia.

Objective: Long-term survivors of childhood acute lymphoblastic leukemia (ALL) are at risk for numerous late effects, including cardiac, renal, and neurocognitive morbidity, yet the interaction between these is unclear. The aim of this study was to examine associations between biomarkers of renal and cardiovascular function with neurocognitive performance.

Participants and Methods: Neurocognitive function was evaluated in 84 adolescent long-term survivors of ALL (mean [SD] age of diagnosis = 6.5 [4.7] years, age at evaluation = 14.3 [4.9] years) treated with chemotherapy only. Physical evaluations performed within 48 hours of neurocognitive testing, included fasting serum measurements of uric acid, creatinine, and glucose, as well as assessment of resting blood pressure, and body mass index (BMI). For each biomarker, survivors whose serum concentrations fell within the highest quartile were designated as “at risk” and were compared to survivors in the lower quartiles. Neurocognitive function was compared between groups for each biomarker using Mann-Whitney U tests.

Results: Compared to national norms, survivors demonstrated lower performance on measures of visuospatial skills, processing speed, attention, and executive function. Survivors in the highest uric acid quartile performed significantly lower on measures of executive function (Rey-O Complex Figure, $p = 0.03$; D-KEFs Letter Fluency, $p = 0.03$) and

focused attention (D-KEFs Trail Making, $p=0.05$) compared to those in the lowest 3 quartiles. Gender and age did not impact the association between biomarkers and neurocognitive measures. There were no significant associations between neurocognitive performance and creatinine, blood pressure, BMI, or glucose.

Conclusions: These results suggest that uric acid may be useful in identifying survivors of childhood ALL at higher risk for neurocognitive problems, and support the need for further examination of interactions between this marker of vascular and renal health and adverse late neurocognitive effects. Correspondence: *Michelle Edelmann, St Jude Children's Research Hospital, 262 Danny Thomas Place, Mailstop 735, Memphis, TN 38103. E-mail: michelle.edelmann@stjude.org*

M.C. GROSCHE, L. LACRITZ, J. KENDALL, L. HYNAN, J. HART & C. CULLUM. Executive function in breast cancer survivors.

Objective: Reports of chemotherapy-related cognitive dysfunction range widely (i.e., incidence/prevalence from 15% to 75%), the pattern of which often implicates disruption of frontal-subcortical networks (Meyers, 2008). However, knowledge of the cognitive domains typically affected by damage to these networks is difficult to interpret. The current study examined the frequency of executive function deficits in post-chemotherapy breast cancer survivors.

Participants and Methods: Female breast cancer survivors between the ages of 40 and 70 underwent a brief battery of neurocognitive tests of attention and executive function approximately one year following completion of chemotherapy (N=72). Tests administered included Animal Fluency, WAIS-IV Coding, D-KEFS Color-Word Interference, WAIS-IV Digit Span, FAS, Paced Auditory Serial Addition Test (PASAT), and Trail Making Test. Impairment was defined as ≥ 2 tests >1.5 SD below the normative mean.

Results: Frequency of impairment and rank-ordered performance were examined on each test. The overall rate of impairment in our sample was 18% (N=13), which is generally consistent with the available literature, albeit at the lower end of the reported range. The greatest frequency of impairment was seen on PASAT (22.2%) and FAS (13.9%), and the least frequent was 0% for Coding. Impairment status was not associated with age, education, time since treatment, or self-reported symptoms of depression, anxiety, or fatigue. However, estimated premorbid IQ was significantly lower among subjects who showed evidence of cognitive impairment. Participants consistently scored the lowest on Animal Fluency, FAS, and PASAT relative to the other tests in the battery.

Conclusions: Each of the lowest-ranked measures (Animal Fluency, FAS, PASAT) requires verbal output under time constraints, suggesting that there may be an executive-based verbal component to chemotherapy-related cognitive dysfunction. This has yet to be explored in the literature and merits further investigation.

Correspondence: *Maria C. Grosch, Ph.D., Baylor College of Medicine/Texas Children's Hospital, 7300 Brompton St, Apt 4232, Houston, TX 77030. E-mail: maria.grosch@utsouthwestern.edu*

K.K. HARDY, S.A. HOSTETTER & K.S. WALSH. Computerized Cognitive Training for Newly-Diagnosed Children with Cancer: Cognitive, Medical, and Psychosocial Predictors of Feasibility.

Objective: Children diagnosed with brain tumors (BT) and acute lymphoblastic leukemia (ALL)

are at risk for late-occurring sequelae, including working memory (WM) deficits. There remains a critical need for interventions to delay or mitigate neurocognitive late effects in this population. Because WM deficits are hypothesized to underlie changes in intellectual and academic functioning, increasing WM may be a reasonable treatment target. As a first step, we sought to examine the feasibility of WM training in a small sample of children with ALL and BT.

Participants and Methods: We conducted a single-arm trial evaluating the feasibility of WM training using the CogmedRM computer program. Seventeen children (64.7% male, 58.8% Caucasian; mean age=10.9, SD=2.40, range=7-15) diagnosed with either BT (35.3%) or ALL completed assessments of their intellectual, psychosocial, and WM functioning within six months of

diagnosis. All were then asked to complete 25 sessions of WM training at home within 9 weeks, and then return for follow-up testing.

Results: Participants had average intellectual (WASI FSIQ=107.7, SD=15.09), WM (WISC-IV WMI=102.1, SD=9.13), and executive functioning (BRIEF GEC T=45.4, SD=8.21) at baseline. Despite high levels of participation (81% of those approached), less than half completed the training program within the 9-week period. Of interest, children who were closer to diagnosis ($r=-.38$), reported less fatigue ($r=-.50$), and had better spatial WM at baseline ($r=.49$) tended to complete more sessions. At follow up, modest increases in both verbal and visual WM were observed on traditional paper-and-pencil measures, with those who completed more sessions showing more improvement in verbal WM ($r=.60$).

Conclusions: Implications of these findings will be discussed, but we hypothesize that children further from diagnosis require additional support to complete WM training, given that training may compete with resuming school and social demands following initial treatment.

Correspondence: *Kristina K. Hardy, PhD, Neuropsychology, Children's National Medical Center, 111 Michigan Ave NW, Department of Neuropsychology, Washington, DC 20010. E-mail: kkhardy@childrensnational.org*

S. HILE, C.L. EMMONS, A.S. KUNIN-BATSON, L.A. HOLMQUIST, K.R. KRULL, L. EMBRY, R.B. NOLL & R.D. ANNETT. The Developmental Trajectory of IQ Deficits Following Cranial Radiation Therapy for Acute Lymphoblastic Leukemia (ALL).

Objective: Research has indicated that childhood cancer survivors are at risk for experiencing deficits in intellectual functioning (Campbell et al., 2007; Montour-Proulx et al. 2005). Cranial Radiation Therapy (CRT) has been consistently associated with these deficits (Anderson et al., 1999; Moore 2005). The developmental trajectory of this intellectual decline for children diagnosed with acute lymphoblastic leukemia (ALL), however, remains unclear. This study presents findings from secondary analyses of an ALL trial within the Children's Cancer Group (CCG) to determine the developmental trajectory of intellectual deficits related to the use of whole-brain CRT.

Participants and Methods: 187 children were enrolled from participating CCG pediatric cancer centers. Children were between the ages of 3 and 18 with a diagnosis of pre-B ALL. Children were randomized to receive either 18 Gy whole brain CRT (n=81) or chemotherapy without CRT (n=106). Full scale IQ, Performance IQ, and Verbal IQ were assessed at 9 months, 21 months, and 48 months post diagnosis. Multilevel modeling was used to determine the degree to which CRT impacted the developmental course of intellectual deficits.

Results: Results indicated a significant cross level interaction between rate of change and treatment condition for Full Scale IQ, $b=-2.78$, $p<.05$, as well as Verbal IQ, $b=-3.20$, $p<.05$. Children treated without CRT demonstrated a slight increase in IQ across the 48-month interval (mean FSIQ at 9, 21 and 48 months = 101, 105 and 108, respectively). Children treated with CRT demonstrated an initial increase in IQ followed by a drop off across time (mean FSIQ at 9, 21 and 48 months = 102, 104 and 100, respectively).

Conclusions: Results indicated that the developmental course was influenced by the treatment condition. Children exposed to whole-brain CRT are at risk for reduced intelligence over time.

Correspondence: *Sarah Hile, MS, Psychology Department, University of New Mexico, 1 University of New Mexico, MSC03 2220, Albuquerque, NM 87131-0001. E-mail: shile@unm.edu*

R.A. HOWARTH, H.M. CONKLIN, J.M. ASHFORD, S. JACKSON & A. BRONISCHER. Cognitive Outcomes among Long-Term Survivors of Diffuse Intrinsic Pontine Glioma Diagnosed in Childhood.

Objective: The overall survival rate for children diagnosed with diffuse intrinsic pontine glioma (DIPG) remains less than 20% at two years. Children are typically diagnosed between 5 to 10 years of age, often with rapid symptom onset. Standard treatment involves radiation therapy

with more recent studies examining benefits of adjuvant chemotherapy. Given the poor survival rate, little is known about cognitive outcomes of long-term survivors. Accordingly, the current study investigated neurocognitive outcomes among a unique group of long-term DIPG survivors.

Participants and Methods: Participants included five DIPG survivors (male=2, female=3; mean survival=8.4 years, range=4.8-11.4) who underwent (neuro)psychological assessment. Four patients were younger than 8.4 years at diagnosis whereas one patient was diagnosed at 16.4 years. On average, patients were 14.3 years (range=8.0-20.7) at the time of assessment. Performance across cognitive domains was examined through retrospective chart review.

Results: For the combined group, mean intellectual (FSIQ=76), academic (e.g., Word Reading=72, Calculation=71), and adaptive functioning (Vineland-ABC=82) was below average (all means of 100 ± 15). Parent ratings (BRIEF, BASC-2) reflected significant concerns with aspects of executive functioning (working memory, planning/organization), but not social-emotional or behavioral factors. When examining individual performance, the patient diagnosed as an adolescent was globally intact.

Conclusions: Among this small group of long-term survivors, neurocognitive functioning was below expectations across domains whereas social-emotional and behavioral functioning were generally within normal limits. Consistent with existing literature, older age at diagnosis emerged as a protective factor against more significant cognitive sequelae. Current findings may inform continuing efforts to balance survival and quality of life for children treated for brain tumors.

Correspondence: *Robyn A. Howarth, Ph.D., St. Jude Children's Research Hospital, 262 Danny Thomas Place, MS#740, Memphis, TN 38105. E-mail: robyn.howarth@stjude.org*

C.I. KIMBERG, L. SINGH, M. EDELMANN, T. BRINKMAN, L.L. ROBISON, M.M. HUDSON & K.R. KRULL. Visuospatial Construction in Long-term Survivors of Childhood Acute Lymphoblastic Leukemia (ALL): Evaluation of a Developmental Scoring System.

Objective: The Rey-Osterrieth Complex Figure test (ROCF) measures several cognitive functions including visuospatial constructional ability and executive function (EF). Traditional scoring evaluates accuracy for details and location, but does not consider organization, the approach used or the types of errors. The purpose of the current study was to adapt a developmental scoring system (DSS) to adult survivors of childhood cancer.

Participants and Methods: 40 survivors of ALL (mean [SD] current age = 26.5 years [3.2], time since diagnosis = 23.6 years [2.7]) were recruited for neurocognitive assessment. Participants completed the ROCF, which was scored using the traditional and the DSS approaches. Intra-class correlations were calculated to determine between-method consistency. Comparisons between CRT exposure (18 Gy vs. 24 Gy) and associations with specific cognitive functions were examined using nonparametric tests.

Results: The organizational score from the DSS was consistent with the traditional scoring system across the copy, immediate and delay conditions ($ICC = .68$ -.76). The DSS discriminated between CRT dose groups for the immediate (Incidental Element Score (IES) $U = 98.50$, $p < .05$) and delay conditions (Organization $U = 126.00$; IES $U = 114.00$, p 's $< .05$). In contrast, the traditional approach did not differentiate between CRT intensity. Current age and time since diagnosis were not associated with performance for either scoring method. DSS organization and errors made across the three conditions were associated with other measures of visuospatial ability ($\rho_{organization} = .38$ to $.50$; $\rho_{errors} = -.33$ to $-.47$) and EF ($\rho_{organization} = .37$ to $.39$; $\rho_{errors} = -.36$ to $-.45$).

Conclusions: Findings suggest that the DSS is sensitive to CRT dose and is associated with visuospatial skills and executive function. Future directions include examining the associations between ROCF performance and neuroimaging data.

Correspondence: *Cara I. Kimberg, Ph.D., St. Jude Children's Research Hospital, 262 Danny Thomas Place, MS 735, Memphis, TN 38105. E-mail: cara.kimberg@stjude.org*

A. MEIER, A. WONG, K. BARRERA, C. MOORE, A. GHELANI & S. PATEL. Impact of Clinically Elevated Distress on Baseline Neurocognitive Performances.

Objective: Neurocognitive dysfunction in cancer patients is primarily attributed to the neurotoxic effects of chemotherapy. However, recent studies suggest these symptoms are present even prior to adjuvant treatments and possibly associated with tumor effects rather than psychological stress. We evaluated the hypothesis that mood disturbance impacts cognitive baselines in newly diagnosed cancer patients prior to any treatment.

Participants and Methods: The sample consisted of 163 postmenopausal women with breast cancer. Participants were administered the Brief Symptom Inventory, a self-report mood measure, and neurocognitive measures (i.e., WAIS-IV, HVLIT, and D-KEFS) prior to treatment. Distress symptoms were categorized into those within the normal range and those with clinically elevated levels ($T \geq 65$). 12% of patients had elevated depressive symptoms and 17% had elevated anxiety. ANCOVAs controlling for age and education examined differences in neurocognitive performance between groups.

Results: Significant differences were found between those with clinically elevated depressive symptoms and those in the normal range on the Color-Word Inhibition, $F(1,28) = 4.17$, $p = .025$, HVLIT Recall, $F(1,28) = 7.01$, $p = .009$, and Digit Span Sequencing, $F(1,28) = 4.08$, $p = .045$. For anxiety symptoms, differences emerged on Digit Span Sequencing only, $F(1,28) = 3.98$, $p = .048$.

Conclusions: Clinically elevated depressive symptoms are associated with relatively lower performance on measures of mental control and short-term memory in newly diagnosed breast cancer patients, prior to cancer treatment. Depressive symptoms had a broader effect on neurocognitive performance than anxiety symptoms. However, the overall group means for all groups were within the normal range. Further research should investigate if cancer patients with elevated distress at baseline are at risk for relatively worse neurocognitive outcomes following neurotoxic cancer treatments.

Correspondence: *Adrienne Meier, M.A., City of Hope Medical Center, 1500 East Duarte Road, Duarte, CA 91010. E-mail: adrienne.meier@yahoo.com*

E. MELLOTT, E. HANDEL & J.M. MILLER. Long-Term Neurocognitive Outcome of Children Treated for Standard-Risk Acute Lymphocytic Leukemia: A Case Comparison.

Objective: The findings regarding the long-term neurocognitive outcome of children treated for standard-risk acute lymphocytic leukemia (ALL) are largely inconsistent. In general, the neurocognitive functioning of these children is believed to be relatively less impacted by treatment protocols than their high-risk peers, with the majority exhibiting an IQ that is approximately average. Factors found to contribute to poorer neurocognitive functioning include younger age at diagnosis, female gender, and treatment protocols which include cranial radiation and intense infusion rates.

Participants and Methods: The current study examined the neuropsychological test data of two young males who underwent treatment for standard-risk ALL. Child A was diagnosed and began treatment at age two, and child B was diagnosed and began treatment at age four. Both children received the same combination chemotherapy protocol which included intrathecal administration of Methotrexate, to which child A exhibited poor tolerance. The children underwent initial neuropsychological evaluation in 2008 and were re-evaluated in 2012. The performances of Child A and Child B were compared on measures of intellectual functioning, verbal learning and memory skills, visual perceptual skills, and simple attention, visuomotor speed and tracking, and set-shifting.

Results: Results indicated that Child A's performance on all measures at initial evaluation was well below average, whereas Child B's performance fell in the average range overall. Over time, however, Child B's performance declined significantly; particularly in the area of verbal learning and memory, whereas Child A's performance remained relatively unchanged.

Conclusions: These findings illustrate the vast differences that exist with regard to the neurocognitive functioning of children treated for standard-risk ALL. Further, results suggest the possibility of severe neurocognitive impairment secondary to Methotrexate intolerance, and highlight the importance of continued research within this population.

Correspondence: *Erika Mellott, M.A., Wright State University, 61 Fitzooth Dr, Miamisburg, OH 45342. E-mail: livers.2@wright.edu*

T. RIDDLER, B. CIORDANI, J. OSUCH, R. KHATTREE, W. XUE, P. HAAN, A. BLOW, L. SYMONDS & M. BOIVIN. Adjuvant Score at Breast Biopsy: Relationship With Cognitive Ability and Quality of Life.

Objective: Prior research has focused on cognitive and psychological effects of breast cancer treatment, such as chemotherapy, but there is less information regarding the early course of illness. The goal of this study was to better understand the relationship of severity of illness with cognition, mood, and quality of life (QOL) at the time of breast biopsy.

Participants and Methods: Participants were 159 women undergoing breast biopsy, recruited from several health care sites within a large metropolitan area. Groups were coded based on biopsy outcome, and if malignant, their adjuvant score, representing prognosis. Groups included benign biopsy (N=72), cured (adjuvant =0; N=14), better prognosis (adjuvant < 20; N=29), or worse prognosis (adjuvant >20; N=44). All participants were administered a series of questionnaires regarding quality of life and mood symptoms (Hope Quality of Life Scale, PHQ-9), and completed a brief computerized cognitive assessment battery (CogState).

Results: Prognostic groups were compared using ANCOVA adjusting for demographic factors. Patients in the benign biopsy and better prognosis groups performed significantly better on tests of sustained vigilance and associate learning. Patients with worse prognosis also self-rated their cognition as significantly worse than those with better prognosis or benign biopsies. Patients with benign biopsies or better prognoses reported higher overall QoL, particularly within social and psychological domains. However, patients with a worse prognosis reported increased spiritual wellbeing compared to those with benign biopsies. Patients with worse prognosis also reported significantly greater levels of depressive symptoms than individuals with benign biopsies.

Conclusions: Results highlight the association of cancer prognostic factors with women's cognitive efficiency and QoL. Better understanding of these relationships can inform support and intervention decisions early in diagnosis and treatment, including attention to spirituality and social support issues.

Correspondence: *Tara Riddle, Ph.D., Psychiatry-Neuropsychology Section, University of Michigan, 2101 Commonwealth Blvd., Suite C, Ann Arbor, MI 48105. E-mail: tariddle@med.umich.edu*

J.E. SCHREIBER, S.L. PALMER, S. CHEN, H. ZHANG, M. SWAIN, M.L. CHAPIESKI, M.J. BONNER, D.J. MABBOTT, C.L. ARMSTRONG, S. KNIGHT, R. BOYLE & A. GAJJAR. Change in Academic Skills Following Treatment for an Embryonal Tumor.

Objective: Cognitive decline following treatment for brain tumors has been documented in the literature. This multi-institutional, prospective, longitudinal study examined the effects of treatment arm (high risk versus average risk) and age at diagnosis on the change in IQ and academic skills over five years following treatment for embryonal tumors.

Participants and Methods: Data from at least two assessment time points were available from 201 patients (77 females) who were treated for an embryonal tumor with risk-adapted craniospinal irradiation (CSI) and four courses of high-dose chemotherapy (cyclophosphamide, cisplatin, and vincristine) with stem cell support. Patients were 3 to 21 years of age at diagnosis (Mean=9.8, SD=4.2). High risk patients (N=54) received CSI to 36 to 39.6 Gy. Average risk patients (N=147) received a reduced dose of CSI (23.4 Gy). Both groups received a boost treatment of the primary site to 55.8 Gy. All patients underwent serial evaluation of cognitive and academic functioning spanning from baseline up to five years following treatment.

Results: Linear mixed-effect modeling revealed statistically significant declines in IQ scores (-0.50 points/yr, $p<.05$), reading scores (-0.74

points/yr, $p<.01$), and math scores (-1.11 points/yr, $p<.01$) for the entire sample. Children in the high risk group exhibited a significantly steeper decline in IQ and academic scores compared with children in the average risk group. Children who were younger than 7 years of age at diagnosis exhibited significantly steeper declines in IQ and reading scores compared with children who were 7 years or older at age of diagnosis. Children in the high risk group who were younger than 7 years of age at diagnosis exhibited the steepest declines in IQ and academic scores.

Conclusions: Younger age at diagnosis and higher doses of CSI are associated with a steeper decline in IQ and academic skills in children treated for an embryonal tumor.

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*

Executive Functions/Frontal Lobes

T. FRY & J.W. ANDERSON. The Relationship between Time Estimation and Executive Functioning.

Objective: Time estimation abilities have been argued to assist with the ability to organize activities and be important for activities of daily living, such as cooking. Past research has argued that frontal-executive functioning, specifically attention and executive control, are important cognitive factors in time estimation accuracy. We examined the relationship between time estimation and self-report measures of frontal-executive functioning.

Participants and Methods: 77 participants completed a prospective verbal time estimation paradigm for sixteen filled intervals of 10, 25, 45, and 60 s. Measures of time estimation accuracy included absolute discrepancy (AD), duration judgment ratio (ratio score), and coefficient of variance (COV) scores. To assess executive functioning, participants completed the Barratt Impulsiveness Scale (BIS) and Dysexecutive Questionnaire (DEX). Factor scores of the BIS (Attention, Motor, Perseverance, Self-Control, Cognitive Complexity, and Cognitive Instability) and DEX (Executive-Cognition, Self-Regulation, and Metacognition) were correlated with measures of time estimation accuracy.

Results: Results revealed that participants who provided a greater magnitude of error in timing at the 10 s interval reported higher levels of cognitive instability. In addition, higher scores on Cognitive Instability were associated with a greater degree of underestimation (i.e., ratio score) at the 10 s interval. Individuals who reported more difficulties with attention tended to provide the highest timing variability (i.e., COV) at the 25 s interval. Individuals with higher scores on Self-Control were more accurate estimating time at the 45 s interval. Finally, individuals with higher scores on Perseveration tended to demonstrate the highest response variability at the 60 s interval. No correlation emerged between time estimation accuracy and the DEX.

Conclusions: These results support past research that frontal-executive functioning is associated with time estimation.

Correspondence: *Jonathan W. Anderson, Department of Psychology, Eastern Washington University, 135Q Martin Hall, Cheney, WA 99004. E-mail: janderson@ewu.edu*

J.W. ANDERSON & T. FRY. Are People Aware That Time Flies While Having Fun?

Objective: The ability to accurately estimate the passage of time plays an important role in helping to structure daily activities. We examined whether individuals are aware that accuracy of time estimates depends on demands of a task.

Participants and Methods: Eighty-seven participants completed a prospective verbal time estimation paradigm to investigate time perception during non-demanding (saying numbers aloud) and demanding (serial addition) tasks. Verbal time estimates were made for sixteen filled intervals of 10, 25, 45, and 60 seconds. Before completing each time estimation task, the examiner presented a description of the task and asked participants to make predictions about the accuracy of their time estimates. Specifically, participants predicted how far from the actual time interval their time estimate might be if the time interval to be

estimated were in a given range (predicted error differences; i.e., 0 to 20 s, 10 to 30 s, 30 to 50 s, and 40 to 60 s). Prediction accuracy was evaluated by calculating the difference between participants' predicted error differences and actual absolute error differences (i.e., difference between time estimation and actual time duration).

Results: The findings showed that participants predicted they would perform more poorly estimating time on the demanding task compared to the non-demanding task, and that their estimates would be less accurate as the time to be estimated increased. The prediction accuracy data revealed that participants were more accurate predicting their performance on the non-demanding task than the demanding task. In addition, participants' predictions were less accurate as the time interval to be estimated increased. **Conclusions:** The present results suggest that although individuals are aware that different task demands influence their ability to accurately estimate time, they may not be fully aware of the extent different task demands impact time estimation accuracy.

Correspondence: *Jonathan W. Anderson, Department of Psychology, Eastern Washington University, 135Q Martin Hall, Cheney, WA 99004. E-mail: janderson@ewu.edu*

G. ARAUJO, C.G. SALLEY, K. VANNATTA, V. ANDERSON & K. YEATES. Patterns of Executive Function Deficits in Children with Distinct Brain Disorders.

Objective: Many children with neurologic damage display executive dysfunction. Less clear is whether different childhood brain disorders result in distinct executive function deficits. This study examined patterns of executive function across three distinct childhood brain disorders.

Participants and Methods: Participants were children with TBI (N = 82, 8-13 years), arterial ischemic stroke (AIS; N = 36; 6-16 years), and brain tumor (BT; N = 75; 9-18 years) and corresponding matched comparison groups consisting of children with orthopedic injury (N = 61), asthma (N = 15), and classmates without medical illness (N = 68), respectively. Switching, inhibition, and working memory were assessed using Creature Counting, Walk-Don't-Walk, and Code Transmission from the TEA-Ch. Patient groups differed significantly in mean time since diagnosis and age at testing. Comparison groups did not differ in TEA-Ch performance and were merged into one control group. Profile analysis was used to examine group differences in TEA-Ch scaled scores after controlling for maternal education and age at testing.

Results: The overall group X test interaction was significant. Post hoc tests revealed that the TBI and BT groups performed more poorly than controls on Creature Counting; children with AIS and BT performed more poorly than controls on Walk-Don't-Walk. Importantly, performance on TEA-Ch subtests differed among brain disorder groups. Children with TBI performed more poorly than those with AIS on Creature Counting, whereas children with AIS and BT performed more poorly than children with TBI on Walk-Don't-Walk. The same pattern of results was observed using only 8-13 year old children.

Conclusions: Childhood brain disorders result in distinct patterns of executive dysfunction. Children with TBI demonstrate selective deficits in switching, but more intact inhibition, whereas children with AIS demonstrate a reverse pattern. Children with BT show deficits in switching similar to children with TBI, but comparatively greater deficits in inhibition. Correspondence: *Gabriel Araujo, Ph.D., Psychology, Nationwide Children's Hospital, 700 Children's Drive, Columbus, OH 43205. E-mail: gabriel.araujo@nationwidechildrens.org*

C.N. ARESHENKOFF, J.E. KARR, E. CREVIER-QUINTIN & M.A. GARCIA-BARRERA. The Benefits of Physical and Cognitive Training Programs on Executive Functions among Older Adults: A Meta-Analytical Comparison.

Objective: A burgeoning body of literature has assessed the effects of physical and cognitive training interventions on executive functions during both healthy and pathological aging. Through meta-analytical methods, this study examined the impact of each intervention style on executive functions, comparing the efficacy of each treatment and evaluating predictors of effect size.

Participants and Methods: A systematic review (1966-2012) identified 35 eligible studies (18 physical, 16 cognitive, 1 both), involving controlled physical or cognitive interventions for participants over 65, with an executive-related outcome measure and information to calculate an effect size (ES). All ESs were pretest-posttest-controlled design ESs weighted by sample size. A random-effects meta-analysis compared cognitive and physical training using weighted t-test and meta-regression techniques.

Results: Estimated ESs (95% CI) were 0.20 (0.16 - 0.24) for all studies, 0.26 (0.2 - 0.31) for cognitive training alone, and 0.14 (0.09 - 0.19) for physical training alone. No significant difference was found between cognitive training and exercise interventions, $t(48.2)=1.49$, $p=0.65$. Meta-regression indicated a trend towards decreased ES with higher mean age of the study sample ($\beta=-0.24$, $p=0.07$). No relationship occurred between ES and year of publication ($\beta=.005$, $p=0.37$), but a negative relationship occurred between ES and study quality ($\beta=-0.37$, $p<0.01$).

Conclusions: Despite practical differences between them, the two treatments did not differ in their benefits on executive functions. With increased age trending towards less benefit, early intervention appears particularly important. Regarding study quality, higher rated studies produced lower ESs, implying a potential inflation of ESs by lower quality reports. With no link between ES and publication year, limited growth has occurred for treatment effectiveness over time. To guide future interventions, further predictors of ES will be discussed along with the implications of combining treatments.

Correspondence: *Mauricio A. Garcia-Barrera, Ph.D., Psychology, Univ of Victoria, PO BOX 3050 STN CSC, Victoria, BC V8W 3P5, Canada. E-mail: mgarcia@uvic.ca*

J.M. ASHFORD, M.A. SCOGGINS, M.M. JONES, M.F. MCCOOL, Z. PATAY, R.J. OGG & H.M. CONKLIN. Cognitive Performance and fMRI Findings among Healthy Volunteers with Incidental Structural Neuroimaging Findings.

Objective: Neuroimaging research with healthy volunteers necessitates policy to effectively address incidental findings (IF) both ethically and scientifically. Adhering to policy may dictate participant notification and/or exclusion of data even in cases of clinically nonsignificant findings, with potential for participant distress and greater utilization of limited neuroimaging resources. Given these potential costs, this study examined whether asymptomatic neuroanatomical variants resulted in differences in cognitive performance or neural network activation.

Participants and Methods: Healthy volunteers (mean age=25.5) participated in an fMRI study of working memory. MRI was performed with a 3.0-T Siemens Trio scanner. High-resolution three dimensional T1-weighted images were acquired for anatomic visualization (TR=1.8s, TE=2.74ms, flip angle=15°, voxel size=1x1x1mm³). Healthy participants (N=25; 48% male) were compared to excluded participants with IF (N=7; arachnoid, pineal and pituitary cysts; 43% male) on cognitive outcomes and neural activation during fMRI. Preprocessing and fixed-effect analysis of fMRI data was performed using SPM5. Non-parametric permutation group comparison was done with SnPM5.

Results: No differences were found between groups on intelligence (WASI, $p=.60$) or self-reported executive functioning (BRIEF, $ps>.13$). No systematic statistical differences were found on measures of attention and working memory (Digit Span, N-Back, Self-Ordered Search, $ps>.05$), with sporadic evidence of better performance by the IF group. No differences in brain activation were found ($p>0.9$, FWE corrected for multiple comparisons). **Conclusions:** Given unnecessary participant distress over innocuous findings and additional resources with recruitment of replacement participants, absence of cognitive and neural network activation correlates may warrant less restrictive IF exclusion criteria. In cases when asymptomatic abnormalities do not directly impact the research question, incidental findings may be simply that - incidental.

Correspondence: *Jason M. Ashford, MS, Psychology, St Jude Children's Research Hospital, 262 Danny Thomas Place, MS740, Memphis, TN 38105. E-mail: jason.ashford@stjude.org*

L. AVERILL, N. WISDOM, J. MIGNOGNA, J. ROBINSON & R.L. COLLINS. Executive functioning across the lifespan: An examination of the D-KEFS.

Objective: A growing body of evidence suggests executive functioning may be one of the first cognitive faculties to decline with increasing age. In the neuropsychological evaluation of older adults, the ability to accurately differentiate between normal age-related cognitive changes and pathologic brain dysfunction is critical. Considering cognitive performance relative only to average normative scores can be a considerable oversimplification as this fails to recognize disparate subtest heterogeneity and intragroup differences that occurs with normal aging. The purpose of the present study is to characterize the patterns of raw score change and associated variability on the Delis-Kaplan Executive Function System (D-KEFS) subtests across age groupings.

Participants and Methods: Raw D-KEFS subtest means and standard deviations (SD) for each group were tabulated from the Examiner's Manual along with the coefficient of variation (CV), a measure of score dispersion that is the ratio of the SD to the mean. The CV further informs the magnitude of variability represented by each SD and allows for more meaningful comparisons both within and between populations.

Results: Moderate variability was noted on Category Fluency, Word Context, Tower Test Achievement, and 20 Question Initial Abstraction with CV percentage increases ranging from 24% to 38%. Trails Number-Letter Switching, Letter Fluency, Category Fluency, Stroop Inhibition, Inhibition/Switching and Proverbs were more homogeneous with CV increases from 5% to 20%. Tasks requiring cognitive-switching had the most dramatic mean percentage changes with Stroop Inhibition, Inhibition/Switching and Trails Number-Letter Switching ranging from 68% to 98%.

Conclusions: Results suggest a fairly linear decline in executive function while the heterogeneity of subtests increases in variability with age. Better understanding of subtest variability will help to identify test limitations and aid in clinical sensitivity to normal aging versus pathologic executive function decline.

Correspondence: *Nick Wisdom, Ph.D., Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd, Houston, TX 77030. E-mail: nickandjen@gmail.com*

N. WISDOM, J. BOOTH, K. MCCULLOCH, J. STINSON, L. AVERILL & R.L. COLLINS. Learning stories vs. word lists: The role of executive functioning.

Objective: It has been proposed that primary memory processes are partially facilitated by the frontal lobes. Organization of incoming information, search, selection, retrieval, and self-monitoring are theoretically clustered as frontal-mediated executive functions. This theory has been tested by only a few studies that compared groups with varying levels of executive dysfunction on different measures of verbal memory. It was hypothesized that individuals with executive dysfunction would perform better when learning stories, given their inherent organization, as opposed to seemingly unstructured word lists that require more effort during the encoding process; findings from these studies were discrepant. The purpose of the present study is to replicate these studies using a clinically heterogeneous sample of older adults.

Participants and Methods: 84 men and 2 women, referred for a comprehensive neuropsychological evaluation by the neurology clinic at a southern Veterans Affairs hospital, were included in this study. Relevant measures for the current study included Trails, COWAT, Animal Naming, Similarities, CVLT-II, and logical memory subtests from the WMS-III. Patients with zero or one executive measure in the impaired range (>1 S.D.) were classified as having Minimal Executive Dysfunction (MED) whereas two or more impaired tests were classified as Significant Executive Dysfunction (SED).

Results: No significant demographic differences were noted between the SED and MED groups. The SED group performed significantly worse than the MED when recalling word lists from the CVLT following a long delay ($p < .05$). However, no significant differences were noted between the SED and MED groups when recalling stories (WMS-III) following a long delay ($p = .18$).

Conclusions: As hypothesized, findings from the current study suggest that learning word lists places greater cognitive demand on frontal processes than learning stories. Limitations of this study include a referral selection bias, nearly all males, and the use of a flexible battery.

Correspondence: *Nick Wisdom, Ph.D., Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd, Houston, TX 77030. E-mail: nickandjen@gmail.com*

P. BANERJEE, E.D. LONDON, F.W. SABB & R.M. BILDER. Impact of Non-planning Impulsivity and Psychological Distress on Executive Functioning in a Non-Clinical Sample.

Objective: We examined the impact and potential interaction of non-planning impulsivity, general psychological distress, and demographic factors on performance during a variety of executive tasks.

Participants and Methods: 1046 healthy participants from 21 to 50 years of age were administered the Barratt Impulsiveness Scale (BIS), Hopkins Symptom Checklist (HSCL), Color Trails Test, Matrix Reasoning, and Letter Fluency. Non-planning impulsivity from the BIS, general psychological distress from the HSCL, completion time and interference index from the Color Trails Test, and total scores on Matrix Reasoning and Letter Fluency (FAS) were analyzed. Age, gender, bilingualism, ethnicity, and education were also considered.

Results: Regression revealed a significant Non-planning Impulsivity x Psychological Distress interaction for Letter Fluency performance ($F(1, 1037) = 5.56, p < .05$), a significant Gender x Non-planning Impulsivity x Psychological Distress interaction for Matrix Reasoning performance ($F(1, 1036) = 5.19, p < .05$), and main effects of Psychological Distress on Color Trails performance ($p < .05$).

Conclusions: Higher levels of psychological distress resulted in poorer performance on Letter Fluency and Matrix Reasoning, with significantly impaired performance observed in individuals exhibiting high levels of both psychological distress and non-planning impulsivity. On Matrix Reasoning, performance in men appeared to be more greatly impacted by non-planning impulsivity than in women. Psychological distress was also associated with reduced performance on the Color Trails Test. These results suggest that psychological distress, level of non-planning impulsivity, and gender play important roles in executive functioning in non-clinical individuals.

Correspondence: *Pia Banerjee, M.A., Psychology, Washington University in St. Louis, 760 Westwood Plaza, #CS-746, Los Angeles, CA 90095. E-mail: pbanerjee@wustl.edu*

P. BANERJEE & D.A. WHITE. Organizational Strategic Processing: A Latent Variable Analysis.

Objective: We sought to establish an empirically-based conceptualization of organizational strategic processing (OSP). Despite the importance of using organizational strategies in daily life and extensive studies of the conceptualization of other cognitive constructs, no empirically-based conceptualization of OSP as a construct exists. The widespread mention of organizational strategies in studies of strategic processing suggests that OSP is a unitary construct; however, empirical data are needed to confirm or refute this notion.

Participants and Methods: 200 healthy adults were administered a battery of eight cognitive tasks that have been used in previous research to measure OSP. Confirmatory factor analysis was used to examine three proposed models of how OSP may be conceptualized: (1) as a unitary construct, (2) on the basis of cognitive domain (e.g., organizational memory strategies versus organizational fluency strategies), or (3) on the basis of semantic versus non-semantic processing.

Results: Contrary to hypothesis, none of the proposed models provided an accurate representation of OSP. In fact, the findings demonstrated that a very good-fitting model of the data was one in which none of the strategic variables shared significant variance aside from method variance ($RMSEA < .0001, SRMR = .045, CFI = 1.000, X^2 = 34.29, p > .05$).

Conclusions: Our findings suggest that OSP may be best conceptualized within the context of specific task demands rather than as a unitary construct. From a neuropsychological perspective, the present study suggests that a variety of strategic measures should be administered for the assessment of OSP until researchers identify a particularly robust measure of OSP, if one exists. This conclusion may also extend to rehabilitation and education settings, in which different organizational strategies may need to be taught within the context of specific tasks due to the apparent lack of common variance across strategic measures.

Correspondence: *Pia Banerjee, M.A., Psychology, Washington University in St. Louis, 760 Westwood Plaza, #CS-746, Los Angeles, CA 90095. E-mail: pbanerjee@wustl.edu*

F. BARCELO. Card Sorting Revamped: Lessons from Cognitive Electrophysiology of Task Switching.

Objective: Here I present a task-switching version of the Wisconsin card sorting test (WCST) adapted for the recording of event-related potentials (ERPs) as indexes of task-set shifting, updating and inhibition operations. As a case example, this new protocol is used to assess whether individual differences in age and executive control contribute additively (or multiplicatively) towards task-switch costs, under the hypothesis that these factors influence distinct (or similar) stages in the temporal dynamics of cognitive control.

Participants and Methods: A normalization sample of N= 50 younger (25-59 yo) and N= 50 older adults (60-90 yo) performed the new WCST adaptation while they had their ERPs recorded. Target cards had to be sorted either by their color or shape, and tonal pre-cues instructed either to switch or repeat the task rule (e.g., Barcelo, 2003). Each age group was split into high and low 'executive' control subgroups according to median z-scores in a composite of neuropsychological indexes (Stroop, TMT, Digits, COWAT FAS, and Brixton). Switch-specific (local) and -unspecific (restart, mixing) behavioral costs, as well as cue- and target-locked ERPs were obtained from all participants.

Results: Task-set updating as indexed by local switch costs and cue-locked P3 ERPs (350–460 ms post-cue onset) was preserved in both older and low control adults. In turn, low control adults showed larger restart costs and enhanced cue-locked P2 (190–250 ms), suggesting lesser preparatory control in the face of interference. Finally, only target card-locked ERPs were sensitive to age-related effects.

Conclusions: The additive association found between age and executive control for behavioral switch costs suggests a differential influence of these factors upon two successive processing stages: anticipatory task-set updating, and target response selection and/or execution, respectively.

Acknowledgements: Supported by Fundació La Marató TV3 and MICINN grant PSI2010-17419.

Correspondence: *Francisco Barcelo, PhD, Psychology, University of Illes Balears, Ed. Beatrui Pinos, University of Illes Balears, Cra. Valldemossa km 7.5, Palma de Mallorca 07122, Spain. E-mail: f.barcelo@uib.es*

A.R. CASSIDY & D.P. WABER. Developmental Continuity and Discontinuity in Organization of Executive Functions: Evidence for an Early Adolescent Transitional Period.

Objective: Cognitive development is not a simple linear process, but can be marked by transitional periods of disequilibrium and reorganization. In this study, we examined the organization of executive functioning (EF) across developmental epochs using a latent variable approach to test whether the factor structure is variant or invariant across childhood and adolescence.

Participants and Methods: Using data from the NIH Study of Normal Brain Development, we conducted Confirmatory Factor Analyses to determine whether the structure of latent EF factors is invariant across 4 developmental epochs (7-8, 9-11, 12-14, & 15-18 years) in a large, nationally-representative sample of healthy children/adolescents (N=352). Neurocognitive data included CANTAB, Digit Span, and Word Fluency tasks. A psychosocial adjustment questionnaire (CBCL) was included for exploratory purposes.

Results: Although the predicted full-sample model fit closely ($\chi^2(66)=100.68$, $p<.01$; RMSEA=.039; NNFI=.983), a series of increasingly restrictive tests led to rejection of the hypothesis of invariance across developmental epochs. Descriptively, results identified a latent factor structure resembling the late adolescent pattern in childhood, followed by decreased integration among EF factors in early adolescence (12-14 years), with establishment of a well-organized structure in later adolescence (15-18 years). Working memory and externalizing were correlated among 9-11 year olds; no other significant associations were detected.

Conclusions: Early adolescence was identified as a period of disorganization of executive functioning as measured by laboratory tests. A potential disorganization and reorganization of self-regulatory functions may inform understanding of the increased vulnerability to behavioral problems commonly encountered during this period as well as developmentally appropriate goals for schooling.

Correspondence: *Adam R. Cassidy, Boston Children's Hospital/Harvard Medical School, 300 Longwood Avenue, Boston, MA 02115. E-mail: adamrcassidy@gmail.com*

C.L. CHÁVEZ, S. ROJAS, G. YÁÑEZ & A. GARCÍA. Developmental course of cognitive and executive functions in three adolescents with prefrontal injury.

Objective: Few studies have been done about neuropsychological consequences of lesions in prefrontal cortex during adolescence. The objective of this research is to understand the evolutionary course of the cognitive processes of adolescents who were undergoing surgery for resection of a focal frontal lesion.

Participants and Methods: At the beginning of the assessment participants were between 15 and 16 years old, two of them had MAV and one had cavernous angioma. Various instruments were applied for information of intellectual coefficient, verbal comprehension, perceptual organization, working memory, mental flexibility, planning, inhibitory control and behavior. They were assessed three times, before the surgery and six months and 2 years after being discharged.

Results: The results suggest that intellectual coefficient increase between the first and the second time of evaluation, but decrease between the second and the third time, the same happened with verbal comprehension. Two of the participants showed increase of perceptual organization between the first and the second evaluation, followed by a decrease between the second and the third evaluation, the other participant showed constant decrease. In planning, two participants showed an increase between the first and the second evaluation, followed by a decrement between the second and the third evaluation, the other participant showed constant increase. Two of the participants showed constant increase of working memory, the other participant did not exhibit these changes. In mental flexibility the three participants showed improvement between the second and the third evaluation.

Conclusions: Cognitive changes after surgery are not homogeneous, some functions seem to improve after six months but later (two years) show a decrease while some improve steadily and others show a decline over time.

Correspondence: *Clara L. Chávez, Bachelor, Posgrado FES Iztalaca, Universidad Nacional Autónoma de México, Convento de San Diego 3 Santa Mónica, Estado de México 54050, Mexico. E-mail: claraluz96@hotmail.com*

P.T. CIRINO. Contributions of Executive Function to Academic Skills.

Objective: Executive functions (EF) have been linked to academic outcomes including reading (Booth et al., 2010; Locascio et al., 2010) and math (Cirino et al., 2007; Fuchs et al., 2010). However, EF is defined in many ways (e.g., frontal lobe functions; working memory; self-regulation). EFs were derived from neuropsychological (e.g., fluency, planning), cognitive (e.g., working memory, inhibition, shifting), and educational (e.g., self-regulation) literatures/models. We expected that EFs from each type of model would have predictive power.

Participants and Methods: Participants were 96 students in Grades 4 and 5 administered a battery of EF measures, including measures of inhibition (stop signal, go-no-go, stroop), attentional control (n-back, listening span, spatial span), fluency (verbal/design), planning, shifting, and self-regulation. Outcomes were WJ-III Calculations and G-M Reading Comprehension. Regression analyses explored hypotheses.

Results: Most zero order correlations of EF (assessed behaviorally or cognitively) with either outcome were significant (median math $r = 1.361$; median reading comprehension $r = 1.431$). Backwards regression models first selected predictors from behavioral, cognitive, and language/decoding measures, and further regressions combined predictors across areas. Overall models for both computations ($R^2 = 50\%$) and reading comprehension ($R^2 = 75\%$) were significant. Unique predictors for computations included measures of shifting and self-regulation. Unique predictors for reading comprehension included shifting, fluency, phonological awareness, and self-regulation (all $p < .05$).

Conclusions: The present pilot study identified strong contributions of EF toward both reading comprehension and computational skill in later elementary school. These contributions remained after including language variables in the models. Future directions include a full latent-variable measurement model of EF, and predictive models for reading comprehension, including their use as potential moderators of intervention.

Correspondence: *Paul T. Cirino, PhD, Psychology, University of Houston, UH TMC Annex, 2151 W Holcombe Blvd, 224a, Houston, TX 77204-5053. E-mail: pcirino@uh.edu*

R.E. DELISLE, D.J. PARKER, M.K. PASTERNAK, A.N. SCHNEIDER, J.B. HALE & A. KRAWITZ. Refining the EMO-CPT for Measuring “Hot” and “Cool” Executive Circuit Function.

Objective: Utilizing neutral and emotional faces as stimuli, the revised Emotional Continuous Performance Task (EMO-CPT) was developed to measure both “cool” dorsal and “hot” ventral frontal-subcortical circuit (FSC) executive functions.

Participants and Methods: University undergraduates (29 male, 80 female; Age: $M = 20.20$ years, $SD = 4.06$) completed the revised EMO-CPT, Counting Stroop (CS), Iowa Gambling Task (IGT), Behavior Rating Inventory of Executive Function (BRIEF), and a demographic survey. The EMO-CPT consists of 240 trials counter-balanced into 8 blocks of neutral and emotional faces with short (1500 ms) and long (3000 ms) inter-stimulus intervals (ISIs). Dependent measures include accuracy and reaction time, and emotional-neutral contrast scores were calculated to index “hot” FSC circuit function.

Results: Accuracy on EMO-CPT stop trials was substantially lower on the revised version ($M = 81.5\%$) than the original ($M = 94.5\%$), removing the ceiling effect. Principle axis factor analysis with varimax rotation for the EMO-CPT replicated our previous finding of “cool” Sustained Attention/Speed (SS) (Eigenvalue = 4.40) and “hot” Accuracy/Inhibition (AI) (Eigenvalue = 2.30) factors, accounting for 55.8% of the shared variance. Modest significant correlations were found for the SS factor and CS reaction times (r 's .26 to .28) and IGT deck selections ($r = .21$), while the AI factor was related to CS accuracy (r 's .19 to .28). EmoCPT stop trial accuracy with angry faces was correlated with IGT deck selections ($r = .27$).

Conclusions: This study replicates and extends the original EMO-CPT findings of “cool” SS and “hot” AI factors, with correlations with the well-established CS and IGT strengthening evidence that the EMO-CPT captures emotional and cognitive control in the same task. The ISI addition improved sensitivity by removing the ceiling effect on stop trial accuracy. Developed for use with fMRI, the EMO-CPT has diagnostic potential for clinical populations.

Correspondence: *Richard E. Delisle, B.A. Psychology, Psychology, University of Victoria, 3-3189 Quadra St., Victoria, BC V8X 1E9, Canada. E-mail: richdeli@uvic.ca*

K.G. DENNY, M.A. ROSSETTI, M. BROZ, J. RUIZ, H. KATZEN, K.R. SHARMA, K.L. ARHEART, A. MAUDSLEY, B.E. LEVIN & V. GOVIND. MRS Correlates of Executive Function and Depression in ALS.

Objective: Amyotrophic Lateral Sclerosis (ALS) is fatal neurodegenerative disease with well-documented cognitive and affective changes. Little is known regarding neuroimaging parameters associated with these changes. The purpose of this study was to investigate the relationship between the distribution of proton magnetic resonance spectroscopy (MRS) observed brain metabolites in the anterior cingulate cortex (ACC) with measures of executive function and depression in a sample of patients with confirmed ALS.

Participants and Methods: 44 ALS patients (mean age: 54.3, $sd=10.2$; mean symptom duration in months: 7.2, $sd=7.7$) and 43 age-matched controls (mean age: 48.1, $sd=10.6$) were evaluated with a comprehensive neuropsychological battery that included the Beck Depression Inventory-II (BDI-II) and executive function measures (semantic and phonemic fluency, Stroop Color-Word Test). All participants underwent MRI and volumetric MR Spectroscopic Imaging (MRSI). Average values of signal normalized metabolites in the ACC were calculated for N-acetyl-aspartate (NAA), total-choline (Cho), and total-creatine (Cre) and their ratios.

Results: For the ALS group, partial correlations, adjusting for age, education, gender, ethnicity, and symptom duration, revealed that Cho/NAA in the right ACC is negatively associated with executive function ($p < .001$) and positively associated with depression ($p < .001$). These correlations were not observed in controls.

Conclusions: Increased Cho/NAA in the ACC is associated with diminished executive function and increased symptoms of depression in ALS but not among healthy control subjects. This study highlights the potential involvement of the ACC in select behavioral changes in ALS and demonstrates the utility of using MRS to examine brain metabolites that cannot be detected by conventional MRI.

Correspondence: *Katherine G. Denny, M.A., Psychology, University of Miami, 5665 Ponce de Leon Blvd, Coral Gables, FL 33146. E-mail: katie.denny@gmail.com*

E. DIRENFELD, J.E. KARR, M.A. GARCIA-BARRERA & D.A. PINEDA. Cross-cultural Validation of a Screener for Executive Functions.

Objective: Garcia-Barrera et al. (2011) derived a 25-item screener of executive functions from the Behavior Assessment System for Children (BASC), measuring four latent executive constructs: problem solving and attentional, behavioral, and emotional control. The current study aimed to cross-culturally validate this model and test its stability in a clinical sample, using data from Colombian children with and without ADHD. It was hypothesized that (a) the Colombian sample would present the same four-factor structure of executive functions as the initial study and (b) children with ADHD would share the underlying factor structure, predicting that executive functions do not differ in structure in ADHD.

Participants and Methods: BASC teacher ratings were gathered for children ages 6-11 from Medellin, Colombia (controls = 849, $M = 8.0$ years; ADHD = 155, $M = 8.2$ years). Using MPlus (v.6.12), the model obtained in the derivation study was subjected to confirmatory factor analysis for both groups. Next, factorial invariance was examined across gender, age group (6-8/9-11 years), and diagnosis group.

Results: A CFI $> .90$, and $\Delta CFI = \geq .01$ were used as model fit criteria. The overall four-factor model fit for the controls was adequate, CFI = .94. Configural invariance was demonstrated across gender, CFI = .92, and age group, CFI = .94. Metric (CFI: gender = .94; age = .95) and scalar (CFI: gender = CFI = .93; age = .95) invariance was found for both groups. The model fit the data well for the ADHD group alone and when model fit was examined across controls and the ADHD group (CFI = .93).

Conclusions: Results support using the screener in a cross-cultural context. Invariance findings indicated that the same four-factor structure

is accurately measured in each group. There were no significant differences across gender, age, or clinical group. This is consistent with the idea that there are no cross-cultural or clinical differences in the nature of executive functioning in childhood, but rather differences in level of performance.

Correspondence: *Esther Dierenfeld, Psychology, University of Victoria, P.O. Box 3050, University of Victoria, Victoria, BC V8W3P5, Canada. E-mail: edirenfe@uwic.ca*

Z. FETTERMAN, K.M. STANEK, M. SELBOM, M. SPITZNAGEL & J. GUNSTAD. An Investigation of Potential Threshold Effects in the Prediction of Cognitive Dysfunction from Body Mass Index in Healthy Adults.

Objective: Existing evidence has shown support for a linear relationship between increased BMI and dysfunction in multiple cognitive domains; however, greater effect sizes have been identified within samples composed of more severely obese individuals, suggesting the possibility of a threshold at which the relationship between BMI and cognitive dysfunction might become more apparent. The current study was designed to examine this possibility.

Participants and Methods: A total of 580 individuals (55% women; ages 18-87; BMI range 19-66) without medical/psychiatric disorders underwent neurocognitive assessment. Standardized composite variables were created by cognitive domain and residualized (adjusted for age, gender, and education). Locally weighted regression smoothing (LWRS) was used to assess for any nonlinearity in slope when predicting performance on each composite variable using BMI. Spline regression models were estimated to test the statistical significance of alternative slopes identified in LWRS curves.

Results: LWRS curves suggested a discontinuity in a linear slope for executive function, at BMI=34, consistent with a threshold effect. Spline regression models indicated a statistically significant slope above the BMI=34 knot ($\beta = -.10, p = .02$), but not below ($\beta = .01, p = .75$). LWRS and spline regression models did not support discontinuity of linearity in the prediction of other cognitive domains; however, a significant overall inverse linear relationship was found for predicting attention ($\beta = -.15, p < .001$).

Conclusions: Results provide support for a significant threshold in the prediction of executive dysfunction from BMI (but not other cognitive domains), suggesting that while increased BMI may be linearly associated with attentional dysfunction in healthy adults, executive dysfunction may not become apparent until a BMI of about 34 or above. Subject to replication, particularly in non-healthy samples, these findings carry important implications for patient care and mechanistic research. Correspondence: *Zachary Fetterman, B.S. in Psychology, Psychology, University of Alabama, 162 30th Street, Tuscaloosa, AL 35405. E-mail: zjfetterman@crimson.ua.edu*

C.V. FLAHERTY-CRAIG, D. HOFFER, C. YANG & Z. SIMMONS. Equivalence Between Gender Specific Profiles in Amyotrophic Lateral Sclerosis (ALS) Behavioral Impairment Frontotemporal Disease (biFTD) and Attention Deficit Hyperactivity Disorder (ADHD): A Neuroendocrine Hypothesis.

Objective: We hypothesize that male gender in biFTD is associated with a more disinhibited presentation due to relatively greater release of prefrontal self-regulatory neural networks that are both under neuroendocrine regulation and identical to the neural network processes implicated in ADHD. Our objectives are to 1) characterize gender differences in the 3 recognized subtypes of biFTD, including disinhibited (DIS), apathetic (APA) and stereotypic (STE), 2) evaluate the degree of concordance between gender differences in biFTD and ADHD, and 3) propose a model of neuroendocrine regulation to explain the self-regulatory deficiencies characteristic of both ADHD and biFTD.

Participants and Methods: A convenience sample of 120 subjects (61 M) was evaluated by completion of the Frontal Behavioral Inventory (FBI). Based upon Neary et al. classification, 5 FBI items were combined for each behavioral subtype. Comparisons were made by Mann-Whitney U.

Results: A significantly greater proportion of males evidenced the DIS subtype ($p = .002$).

Conclusions: Our sample of 55 peri-menopausal female biFTD subjects (mean age 60.6 years) demonstrated significantly less evidence of orbital frontal associated disinhibition. We contend that menopause associated decline within the orbital frontal regions resulted in the characteristically less disinhibited presentation evidenced in ALS females during the biFTD prodrome, concomitantly contributing to a more widespread frontal pathology extending into the dorsolateral convexities of the frontal lobes. This is consistent with 1) VBM studies evidencing relatively greater grey matter volumes for women on estrogen replacement for regions that include the bilateral orbitofrontal cortices and 2) ADHD literature evidencing lower levels of disruptive behavior in ADHD females. We propose a remediation approach based upon a neuroendocrine model involving the use of hormone replacement as an intervention strategy to enhance healthy self-regulation in early stage biFTD. Correspondence: *Claire V. Flaherty-Craig, PhD, Neurology, Penn State College of Medicine, East Campus (EC037), 30 Hope Drive, Hershey, PA 17033. E-mail: cflahertycraig@hmc.psu.edu*

E.I. FRANCHOW, T. MEADOWCROFT & Y. SUCHY. High Suppression and Poor Behavioral Control: an Executive Effect.

Objective: Affect suppression (AS) is an emotion regulation strategy key to interpersonal functioning. However, experimentally-induced AS is associated with temporary decrements in executive cognition (Inzlicht & Gutsell, 2007; Schmeichel, 2007) and with lapses in behavioral control (Baumeister & Alquist, 2009). We found that self-reported high AS on the day of testing also depletes executive cognition. This study investigated the association between self-reported AS and behavioral dyscontrol.

Participants and Methods: 41 adults aged 18-44 ($M = 23.37$; 65.9% female) with 12-17 years of education ($M = 14.07$) completed the Push-Turn-Tap task (Suchy & Kraybill, 2007), which measures initiation/planning time [MPLN], learning/accuracy [MLRN], and motor speed [MSPD] components of behavioral control during performance of a motor programming task. Participants also completed the Beck Depression Inventory (BDI-II) and the Burden of State Emotion Regulation Questionnaire (BSERQ), which measures the burden of AS on the day of testing (AS-today) and over the previous two weeks (AS-2weeks).

Results: Three hierarchical regressions were run with MPLN, MLRN, and MSPD as the criterion variables and with age, education, and sex as predictors on Step 1, BDI-II as a predictor on Step 2, BSERQ AS-today and AS-2weeks on Step 3, and the AS-today/AS-2weeks interaction on Step 4. Results showed that the AS interaction accounted for an additional 17.5% of variance in MPLN above and beyond demographics and depression [$F_{change}(1,27) = 7.9, p < .05$], such that higher AS on the day of testing relative to recent levels was associated with slower initiation/planning time. However, suppression did not contribute significantly to MLRN [$F_{change}(1,27) < 1.0, p > .05$] or MSPD [$F_{change}(1,27) = 4.2, p > .05$].

Conclusions: These results show that AS does not have a global impact on behavioral control. Rather, only MPLN, which has been previously shown to be highly related to executive cognition, appears to be significantly affected.

Correspondence: *Emilie I. Franchow, BS, Psychology, University of Utah, 220 E. 3300 S., Apt. 136, Salt Lake City, UT 84115. E-mail: emilie.franchow@psych.utah.edu*

K.K. FULCHER & A. FEDOR. Greater Physical Activity is Independently Associated with Better Cognitive Function in Older Adults with Heart Failure.

Objective: Nearly 6 million American are currently diagnosed with heart failure (HF) and up to 70% demonstrate reduced cognitive performance in memory, attention, executive function, and language. Despite the sedentary lifestyle of many HF patients, no study has examined the contribution of physical inactivity to cognitive function in this population.

Participants and Methods: 102 older adults with HF (Mage = 67.5, \pm 10.57; 33% female) wore an actigraph for 1 week and average daily step count served as a measure of physical activity. HF severity was quantified by noninvasive impedance cardiography. Participants also completed a battery of cognitive tests measuring global cognitive function, attention/executive function, and memory.

Results: Linear regression analyses controlling for high blood pressure, diabetes, depression, and heart failure severity showed physical activity was associated with the domains of executive function/attention (R^2 change = .12, $p < .001$) and global cognition (R^2 change = .07, $p < .05$). No such association emerged for memory.

Conclusions: The current findings indicate that physical activity is an independent predictor of cognitive function in persons with HF. Future work should look to confirm these findings as well identify the mechanisms by which physical activity may provide neuroprotective effects.

Correspondence: *Krysten K. Fulcher, Psychology, Kent State University, 3834 Oneida Street, Stow, OH 44224. E-mail: kknecht1@kent.edu*

C.M. GOLDSTEIN, T.A. KEARY, C.C. MATTSO, J.W. HUGHES, T. HAMMONDS, K. RAWSON, D. WAECHTER, J. ROSNECK & J. GUNSTAD. Health Literacy is Associated with Performance on a Test of Frontal Systems Functioning in Phase-II Cardiac Rehabilitation.

Objective: Cognitive impairment on tests of executive function is common in cardiac rehabilitation (CR) patients and associated with poorer outcomes in this population. The mechanisms by which cognitive impairment may reduce adherence in CR are unclear, but may involve reduced health literacy, which has been linked with negative outcomes in diabetic and asthmatic samples.

The relationship between health literacy (HL) and executive function in phase-II CR was examined. It was expected that better executive function would be associated with better health literacy in CR patients.

Participants and Methods: Participants were 96 male (74%) and female (26%) predominantly Caucasian (94%) CR patients. As part of a larger study, participants were administered the Frontal Assessment Battery (FAB) and completed the Medical Term Recognition Test (METER), a pencil-and-paper test of HL in which participants must identify real medical terms in the midst of distraction (fake) items. Data were collected within the first few weeks of CR immediately before or after a CR session.

Results: Controlling for age, gender, race, and highest-grade level completed, FAB total score accounted for 30.1% of the variance in METER scores ($R^2 = .301$, $F(5,90) = 7.734$, $\beta = .283$, $p < .01$).

Conclusions: Executive function predicted health literacy after adjusting for demographic and psychosocial factors in CR patients. Further research examining HL in CR should consider whether HL predicts improvements in health-promoting tasks requiring high levels of executive function, including increased intent to exercise and to adhere to medically-recommended behaviors.

Correspondence: *Carly M. Goldstein, B.A., Psychology, Kent State University, 3877 Lake Run Blvd, Stow, OH 44224. E-mail: cgoldst1@kent.edu*

J. GRAVANO, D. KAUFMAN, C. SOZDA, D. BOWERS, M. OKUN & W. PERLSTEIN. Variability in Executive Control of Attention in Parkinson's Disease.

Objective: Parkinson's disease (PD) is thought to disrupt reciprocal frontal cortical-subcortical loops, which negatively impacts efficient cognition. Evidence suggests that PD may affect the frontal mediation of attentional allocation. We sought to better characterize the nature of attentional dysfunction in PD through the Attention Network Test (ANT). The ANT purports to measure the efficiency of three interactive neural networks that support alerting, orienting, and executive control of attention by measuring reaction time (RT) benefits and costs of cuing (Posner paradigm) and interference (Erikson Flanker paradigm). Traditionally, average RT (e.g., mean, median) has been used to evaluate

these attentional processes without consideration of variability in responses. As damage to frontal grey and white matter structures has been shown to increase intra-individual variability (IIV) on cognitive tasks, indices of IIV may contain important information about attentional functioning in this population.

Participants and Methods: Participants were 11 idiopathic Parkinson's disease patients and 14 demographically-matched controls. Participants performed the ANT and their RTs were recorded.

Results: The standard deviation (SD) of reaction times was analyzed in a three factor REML-ANOVA (Group X Cue X Flanker). PD patients were more variable in RT overall, and both groups became more efficient following spatial cueing (versus no cue). The main effect of Flanker was moderated by the presence of a Group X Flanker interaction. Decomposition of this effect revealed that PDs were most efficient in responding to neutrally flanked targets (vs. incongruent) while controls' efficiency was facilitated by congruent flankers (vs. incongruent).

Conclusions: This finding may suggest that RT variability in PD may be more dependent on stimulus complexity than congruency. This supports the view that PD disrupts executive control of attention.

Correspondence: *Jason Gravano, M.S., University of Florida, 3901 SW 20th Ave # 608, Gainesville, FL 32607. E-mail: jtgravano@phhp.ufl.edu*

A.M. HANRATTY, M.K. TANABE, E.T. O'CALLAGHAN & B.M. HOUSKAMP. Intellectual Ability as a Predictor of Performance on the Wisconsin Card Sorting Test.

Objective: The aim of this study was to explore the relationship between intelligence and executive functioning by comparing intellectual ability as measured by the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) General Ability Index (GAI), and understanding of sorting principles as measured by conceptual level responses on the Wisconsin Card Sorting Test (WCST). The authors hypothesized 1) there would be differences in conceptual level responses on the WCST between intellectual groups, and 2) there would be a positive correlation between WISC-IV GAI and conceptual level responses on the WCST.

Participants and Methods: Neuropsychological assessment data for 182 children (mean age=10.87 years) were collected by a pediatric neuropsychologist in a clinical setting. Subjects were assigned to either average (GAI=90-109), above average (GAI=110-129), or gifted (GAI \geq 130) intellectual groups.

Results: A one-way analysis of covariance confirmed our first hypothesis, revealing a significant relationship between intellectual ability and understanding of sorting principles on the WCST after controlling for age, $F(2,178) = 7.896$, $p = .001$. Additionally, hierarchical regression analyses revealed the variance in conceptual level responses was best described by a quadratic relationship after controlling for age, and curve estimation indicated that children in the above average intellectual group performed better than those in the average and gifted groups, $R^2 = .081$, $F(2,179) = 7.917$, $p = .001$. Post-hoc analyses exploring the effect of age range on these results indicated that while intellectual ability in children 5-8 years of age, and 12-16 years of age did not significantly predict conceptual level responses, intellectual ability predicted over 21% of the variance for children ages 9-11, $R^2 = .212$, $F(2,66) = 8.881$, $p < .001$.

Conclusions: Results help clarify the relationship between intelligence and executive functioning, as well as the effects of age on this relationship, and reveal a surprising trend among children ages 9-11.

Correspondence: *Ashley M. Hanratty, M. A., Alliant International University, 219 Avenida Montalvo #B, San Clemente, CA 92672. E-mail: amhanratty@gmail.com*

L.K. HECHT & R.D. LATZMAN. Examining the Contribution of IQ-Executive Functioning Discrepancies to Externalizing Behaviors in Youth.

Objective: Research indicates that externalizing behaviors (EXT) are associated with both intelligence (IQ) and executive functioning (EF). Correlations between IQ and EF have repeatedly been found to be relatively small, illuminating the divergent nature of these two cognitive

domains. Further, although a subset of youth demonstrate significant EF strengths relative to IQ, little is known about the clinical significance of this discrepancy and how it may relate to EXT. The current study therefore aimed to understand the nature and extent of the relations between strengths in EF (in light of IQ) and EXT among adolescent males.

Participants and Methods: Participants were drawn from the Iowa-Youth Development Project and included 174 males aged 11-16 (M_{age}=13.6; 87.4% White). Youth were administered the Delis-Kaplan Executive Functioning System (D-KEFS) and the Kaufman Brief Intelligence Test (KBIT). To assess Rule Breaking Behavior (RBB) and Aggression (AGG) aspects of EXT, youth and their mothers completed the Youth Self Report (YSR) and the Child Behavior Checklist (CBCL), respectively. Discrepancy scores were computed between KBIT and D-KEFS Executive Functioning Quotient (EFQ) scores, as well as three EF components: Conceptual Flexibility, Monitoring, and Inhibition.

Results: In relation to IQ, strengths in EFQ were associated with both youth- and mother-reported RBB (Mdn $r = -.18$). When examining second order EF components specifically, strength in Inhibition (as compared to IQ) emerged as a contributor to both youth- and mother-reported RBB, and strength in Monitoring was associated with youth-reported RBB (Mdn $r = -.19$). AGG was not associated with any of the discrepancy scores.

Conclusions: Taken together, results indicate that executive strengths (particularly in Monitoring and Inhibition), relative to IQ, may contribute to rule breaking behaviors, but not aggression. Importantly, these findings were largely informant invariant. Implications for research and practice will be discussed.

Correspondence: *Lisa K. Hecht, B.S., Georgia State University, 353 South Howard St., SE, Atlanta, GA 30317. E-mail: lhecht1@student.gsu.edu*

H. HUBSHER, M.M. VALMAS, K.S. SAWYER, S.M. RUIZ, Z. GRAVITZ, R. LUHAR, P. PARIKH, G.J. HARRIS & M. OSCARBERMAN. Associations Among Alcoholism, Impulsivity, Executive Functioning, and Frontal Cortical Volumes in Men and Women.

Objective: Alcoholism is linked to cognitive, behavioral, and emotional impairments, as well as defects in the brain regions supporting these functions. Because impulsivity and executive dysfunctions are abnormalities associated with disruption of frontal brain circuitry in alcoholism, we examined the interactions among impulsivity, executive functioning (EF), and frontal cortical volumes. We hypothesized that (1) alcoholics (ALC) would have high impulsivity and show EF impairments; (2) increased impulsivity would be associated with lower scores on EF tests; (3) increased impulsivity would be associated with smaller frontal brain region volumes, and high EF scores would be associated with larger frontal lobe volumes; and (4) these relationships would vary with alcoholism and gender.

Participants and Methods: Participants were 44 abstinent ALC (22 men) with a mean drinking history of 16 years and sobriety period of 9 years, and 42 nonalcoholic controls (NC; 20 men). Impulsivity was measured with the Barratt Impulsivity Scale and Dickman Functional and Dysfunctional Impulsivity scores. Measures of EF were WAIS-IV Cancellation Omissions and Letter Number Sequencing, Trails B, and Wisconsin Card Sorting Test perseverations. T1 structural MRI scans were collected and then analyzed using FreeSurfer's automated parcellation algorithm to determine frontal volumes bilaterally in 5 subregions.

Results: Results revealed that ALC had higher impulsivity and lower EF scores than NC. Further, high EF scores were associated with low impulsivity in NC, but not in ALC. In both groups, impulsivity was negatively associated with frontal volumes. Smaller frontal volumes also were associated with lower EF scores among ALC men and women. In NC, this effect was observed for women only. Overall, ALC had smaller frontal volumes than NC; this effect was significant mainly among men. **Conclusions:** These data provide evidence of relationships among alcoholism, measures of impulsivity, EF, and brain volumes.

Correspondence: *Kayle S. Sawyer, BA, Behavioral Neuroscience, Boston University School of Medicine, 72 E. Concord St L-815, Boston University Laboratory of Neuropsychology, Boston, MA 02118. E-mail: kslays@bu.edu*

L. KAKOS, E. GLICKMAN, K. BURNS, N. HAUGHT, C. PEACOCK, B. POLLOCK, M. REBOLD, Y. SEO & J. GUNSTAD. Cognitive Function Following Exercise-Induced Dehydration: Role of Sports Drink Supplementation.

Objective: Strenuous exercise has been linked to acute decline in cognition, particularly attention and executive function. Dehydration and heat exposure are known contributors to these deficits, though the role of blood sugar changes is unclear.

Participants and Methods: Healthy males (N= 10, age= 21.9± 0.20) presented for two trials in a 100°F chamber. Each trial consisted of baseline glucose and cognitive function measures, assessed by the Logical Relations (LR) and Running Memory Continuous Performance Task (RMCPT) subtests of the Automated Neuropsychological Assessment Metrics- 4th Edition. Participants completed 75 minutes of exercise on a cycle ergometer, with glucose and cognitive function measured post-exercise. Participants served as their own controls and were rehydrated with a zero- or full-sugar beverage for each trial. Experimental measures were repeated post-rehydration and post-recovery.

Results: Repeated measures ANOVA results indicate no significant effect of time on LR (F(1.92, 17.31)= 3.09, p= 0.07); however time was significant for RMCPT (F(2.21, 19.93)= 5.48, p= 0.01), with cognition improving post-exercise. There was not a significant effect for beverage type and LR (F(1,9)= 0.63, p= 0.81) or RMCPT (F(1,9)= 1.44, p= 0.26). Similarly, there was not a significant interaction of time and beverage for either LR (F(1.72, 15.46)= 0.17, p= 0.81) or RMCPT (F(2.01, 18.13)= 1.25, p= 0.31). Finally, there were significant effects for glucose level and time (F(1.90, 17.06)= 9.62, p= 0.02), beverage (F(1, 9)= 29.90, p= 0.00), and the interaction of time and beverage (F(1.80, 16.23)= 23.01, p= 0.00), with glucose increasing after rehydration with the full-sugar beverage.

Conclusions: Contrary to past studies, cognition improved with heat exposure, dehydration, and hypoglycemia in this sample. The exact cause for the findings is unclear and future studies should utilize a more strenuous exercise component or produce greater dehydration, counteracting the potential positive impact of exercise on cognition.

Correspondence: *Lynn Kakos, M.A., Kent State University, 3 East Hamburg St., Baltimore, MD 21230. E-mail: lreese3@kent.edu*

K. KASZYNSKI, N.S. KARNIK & S.J. HUNTER. Executive Functioning, Self-Restraint, and Distress in Homeless Youth.

Objective: Homeless youth are vulnerable to many detrimental cognitive, behavioral, and social-emotional outcomes. Research indicates deficits with executive and emotional functioning, although little is known about the relationship between these deficits and emerging personality characteristics. Examination of this relationship will help inform interventions targeting long-term psychological health. The current project investigates executive functioning in relationship with trait-based self-restraint and distress among homeless youth.

Participants and Methods: Fifty youth, recruited from two homeless shelters in Chicago, were administered neurocognitive and personality trait measures (i.e., D-KEFS, TOL-Dx, BRIEF, and WAI, among other tests). Mean age was 19.25 years and gender was approximately evenly split. The majority of participants were African American (78%).

Results: Significant relationships between self-reported executive dysfunction and maladjustment were found. Problems with inhibition, shifting, emotional control, monitoring, initiation, working memory, planning, and task completion were positively associated with subtypes of distress, including negative affect, anxiety, and depression, and negatively associated with subtypes of self-restraint, including impulse control and responsibility. Visual memory and rapid naming were positively associated with self-restraint, and the anger subscale of distress was positively associated with visual memory. The distress subscale of depression was positively associated with inhibition.

Conclusions: Results indicate significant executive dysfunction among homeless youths who report maladjustment. Those reporting problems with behavioral aspects of executive functioning demonstrated poorer visual memory and rapid naming, and elevated distress and decreased self-restraint. Conversely, dispositional negative affect facilitated inhibition of impulsive responding among homeless youths. Implications of these findings will be discussed.

Correspondence: *Katie Kaszynski, M.S., Illinois Institute of Technology, 3300 S Federal St, Chicago, IL 60616. E-mail: katiekaz@gmail.com*

J. KLAVER, S.E. LEE, S.M. DYER, L.A. BEYES, J.M. CONSTANCE, B.A. WEBSTER & M.Y. KIBBY. Inferior Frontal Lobe Volume Predicts Working Memory Abilities and ADHD Symptoms in a Mixed Sample.

Objective: Children with Attention-Deficit/Hyperactivity Disorder (ADHD) commonly have deficits in executive functioning. Functional neuroimaging studies of ADHD have shown dissociations in activation of the frontal regions when investigating executive functions (EF) such as working memory (WM). Thus, this project assessed the relationship between inferior frontal (IF) gyrus volume and aspects of EF in a mixed sample of children with ADHD and/or reading disability and controls.

Participants and Methods: Forty children, aged 8-12 years, completed a full-day neuropsychological test battery as part of university-based projects (R03 HD048752, R15 HD065627) funded by NIH/NICHD, which included measures of executive functioning. T-1 weighted MRI scans were obtained on all children included in this mixed sample. The right and left IF gyri were manually traced using the Analyze 10.0 Region of Interest tool. Both inter- and intra-rater ($r > .90$) reliability were attained before data collection began.

Results: Backward linear regression was used for these exploratory analyses. Right IF volume significantly predicted Digit Span Backward (DSB) performance on the WISC, $b = -.372$, $t(37) = -2.37$, $p = .023$, and parent-rated hyperactivity on the BASC, $b = -.373$, $t(37) = -2.27$, $p = .030$, despite entering age and verbal and performance reasoning indices from the WISC into the equation. Left IF volumes did not significantly predict performance on these measures, $p > .20$.

Conclusions: Larger right IF volume is associated with worse WM performance but less parent-reported hyperactivity. This points to potential brain-behavior connections underlying executive dysfunction in children with ADHD. These findings also are consistent with studies suggesting a dissociation between right and left IF volumes in WM abilities. Given the limited sample size and exploratory analyses run, further work in this area is warranted using a larger N.

Correspondence: *Jacqueline Klaver, M.A., Southern Illinois University Carbondale, 1829 Spruce St, Murphysboro, IL 62966. E-mail: jklaver@siu.edu*

K. KLIPFEL, D. HALACHOFF, J. GUNSTAD, J. DUNLOSKY, C. WAS & M. VAN DULMEN. Investigation of the Role of Executive Dysfunction in Dating Aggression.

Objective: The role of neuropsychological risk—and executive dysfunction (EDF) specifically—has been neglected in the study of dating aggression. This is problematic due to a large body of literature suggesting that EDF is associated with an increased propensity for interpersonal aggression (Morgan & Lilienfeld, 2000). The current study investigated whether EDF is associated with dating aggression in a normative sample of young adults.

Participants and Methods: Heterosexual dating couples ($N=51$) were recruited through a psychology subject pool. The sample was predominantly Caucasian, between 18 and 29 years-of-age, and dating for at least one month. Both members of the dyads completed the Conflict in Adolescent Dating Relationships Inventory (Wolfe et al., 2001) to assess emotional/verbal (EVA), physical (PA), and sexual (SA) aggression and the Wisconsin Card Sorting Task (Heaton, 1981) to assess EDF (trials to complete first category) as part of a multi-method assessment battery.

Results: Bivariate Pearson correlations suggested that EDF demonstrated a trend in association with female ($r = .22$, $p = .06$)—but not male—PA perpetration. Female EDF was significantly associated with PA victimization ($r = .25$, $p = .04$) only. EDF was associated with male SA perpetration ($r = .30$, $p = .02$), and demonstrated a trend in association with female SA perpetration ($r = .25$, $p = .04$). EDF also demonstrated a trend with female ($r = .22$, $p = .06$) and male ($r = .20$, $p = .09$) SA victimization. In regard to partner effects, males' EDF demonstrated a trend in association with female EVA perpetration ($r = .21$, $p = .09$). These results were also confirmed in a multivariate framework using the Actor-Partner Interdependence model (Kenny, Kashy, & Cook, 2005).

Conclusions: To our knowledge, this is the first study to demonstrate an association between EDF and dating aggression in a normative sample of young adults. These findings are promising, and this topic warrants further investigation as cognitive dysfunction is modifiable (Paschall & Fishbein, 2002).

Correspondence: *Katherine Klipfel, MA, Psychology, Kent State University, 345 Kent Hall, Kent State University, Kent, OH 44242. E-mail: kklipfel@kent.edu*

J. LACOURSIÈRE-GIRARD, M. HENRY, L. JACOB, C. JOYAL & P. NOLIN. Evaluating brain frontal activation in clinical practice: A preliminary study with passive near-infrared imaging.

Objective: Assessing the level and speed of brain response could help clinical neuropsychologists to confirm a diagnosis or establish treatment plans. Yet, available techniques are usually expensive and inaccessible. The main goal of this study was to test the capacity of newly developed passive near-infrared sensors to detect modifications of frontal brain activation in healthy persons.

Participants and Methods: Participants ($N = 47$) were volunteers recruited among the general population (36♀ and 11♂, mean age: 27.4 ± 11.0 , 21-63). They were seated in front (2 m) of a 52" monitor, wearing a headgear with two passive infrared sensors placed at F3 and F4 (dorsal prefrontal, left and right), approximately 100 mm from the skin (PIR HEG, Thought Technology Ltd, Montreal). Three tasks were generated in counterbalanced order: 1) simple visual presentation of 2D color boxes; 2) bimodal (audio-visual) presentation in a virtual environment of colored boxes and colored words with 50% of conflictual presentations (Stroop effect); 3) the Balloon Analogue Task, a risk taking video game involving gains and loss of real money.

Results: The area under the temperature curve recorded during the experiment significantly differed between each condition, in the expected direction: color presentation (98.2 ± 0.45) < Stroop task (102.6 ± 3.9) < Balloon task (129.2 ± 14.7).

Conclusions: These preliminary data suggest that a simple, low-cost, easy-to-use headgear device might help evaluating gross level of frontal cortex activation. Future studies larger groups of clinical and nonclinical participants are warranted.

Correspondence: *Jessica Lacoursière-Girard, Jessica Lacoursière-Girard, UQTR, 17170 rue beaupré, 17170 rue beaupré, Bécancour, QC G9H 1V1, Canada. E-mail: l.girard.jessica@gmail.com*

J.A. LAFO, J.D. JONES, M.S. OKUN, R.M. BAUER, C.E. PRICE & D. BOWERS. Memory Dissociations in Essential Tremor and Parkinson Disease: A Final Common Pathway?

Objective: An increasing body of literature supports the view that essential tremor (ET) involves alteration of cerebellar-thalamo-cortical networks which can result in working memory and executive deficits. In this study we tested the hypothesis that individuals with ET would exhibit worse performance on memory tasks requiring more intrinsic organization and structuring (i.e., word lists) relative to those with less "executive" demands (i.e., stories), similar to that observed in individuals with Parkinson disease (PD).

Participants and Methods: Participants included a convenience sample of 74 ET patients and 326 idiopathic PD patients who underwent

routine neuropsychological evaluation assessing recent memory, attention, language, and executive function. Memory measures included the Hopkins Verbal Learning Test-R and the WMS-III Logical Memory. Patients were excluded if they scored below the 5th percentile on the Dementia Rating Scale and/or below 26 on the Mini-Mental State Exam. **Results:** Both ET and PD patients performed significantly worse on word list than story memory recall tasks. The magnitude of the difference between these two memory tasks was similar for ET and PD patients (i.e., nonsignificant). Among ET patients, measures of executive function (i.e., set-shifting, cognitive inhibition) were significantly correlated with word list recall, but not story recall. A similar pattern was observed in PD patients.

Conclusions: These findings suggest that fronto-executive dysfunction in both ET and PD may negatively influence performance on memory tests that are not inherently organized. Although the pathophysiology of these two "movement disorders" are quite distinct, both have downstream effects on thalamo-frontal circuitry which may provide a common pathway for a similar memory phenotype. Findings will be discussed in terms of neuroimaging evidence, conceptual models, and best practice.

Correspondence: *Jacob A. Lafo, Clinical and Health Psychology, University of Florida, P.O. Box 100165, Gainesville, FL 32610. E-mail: jlafo@phhp.ufl.edu*

J. MAROLA, M. MITCHELL, S. BLACK & D. NYENHUIS. Executive Function (EF) and Depressive Symptoms in Ischemic Stroke Participants.

Objective: Previous research demonstrates both cognitive and depressive symptoms following stroke, with executive function (EF) deficits playing a prominent role in the pattern of cognitive deficits. H1: Stroke patients will be more impaired than controls in EF; EF will be more impaired than memory (MEM), language (L), and visuospatial (VS). H2: Depressive symptoms will account for additional variance in EF in stroke patients above other factors including age, gender, achieved education level, premorbid intelligence, and number of strokes.

Participants and Methods: 66 stroke patients (Male=38, Female=28, Age Mean (M)=64, Education (ED) M=15, Barona M=108, MMSE M=27, Days Post Stroke M=422, # Strokes M=2) and 100 matched healthy control participants (Male=44, Female=56, Age M=63, ED M=15, Barona M=111, MMSE M=29) completed background information and neuropsychological testing including EF, MEM, VS, and L.

Results: M depressive symptoms on the Center for Epidemiological Studies Depression Scale (CES-D) = 12.5 for stroke patients, 35% had mild depressive symptoms, 12% had probable depression. M CESD=7 for control participants. A profile analysis found significantly different neuropsychological profiles in the two groups, $F(1, 164) = 66.68, p < .001$, partial $\eta^2 = .29$ with stroke participants scoring lower. Simple effects analysis found EF, L, VS, and MEM were significantly different in stroke patients, $F(3, 63) = 3.382, p = .024$ with EF the lowest. Multiple linear hierarchical regression analysis testing whether depressive symptoms accounted for additional variance in EF in stroke patients above age, gender, ED, Barona, and # of strokes was non-significant, R^2 change = .000, F change (1, 59) = 0.019, $p = .89$.

Conclusions: Results provide support for the prominent role EF has in post-stroke cognitive impairment. Surprisingly, depressive symptoms did not account for additional variance in EF. Future research should have a larger n and consider other ways to measure depressive symptoms.

Correspondence: *Jennifer Marola, M.A., Illinois Institute of Technology, 3396 Columbus Lane, Ann Arbor, MI 48103. E-mail: jamarola@hotmail.com*

D.F. MARSHALL, K.A. RYAN, A.L. WELDON, E.F. SAUNDERS, M. KAMALI, M.G. MCINNIS & S.A. LANGENECKER. Deficient Inhibitory Control as an Outcome of Childhood Trauma in Bipolar Disorder and Healthy Controls.

Objective: Childhood trauma may be a potential environmental factor that adversely impacts aspects of cognition, particularly executive func-

tioning, and has also been linked to the development and recurrence/severity of psychiatric disorders later in life. This study aimed to elucidate the performance of euthymic bipolar disorder (BD) and healthy controls (HC) with or without a history of childhood trauma on measures of inhibitory control, an aspect of executive functioning.

Participants and Methods: Groups were selected from the Prechter Longitudinal Study of Bipolar Disorder and were equivalent in age, education, gender, and Wechsler Vocabulary. One hundred fifteen individuals with euthymic BD and 99 HCs completed diagnostic interviews, childhood trauma questionnaires, go/no go task, and symptom severity scales. Four comparison groups were created using a 1.0 standard deviation cut-off of the mean of the total CTQ score (e.g., BD high trauma, BD low trauma, HC high trauma, HC low trauma).

Results: A significantly greater proportion of individuals with BD had a history of childhood trauma compared to those in the HC group ($X^2=10.9, p=0.001$). A significant group effect was found for inhibitory control accuracy ($p=0.007$) and response time ($p=0.002$), with poorer performance in BD groups. There was a significant main effect of trauma ($p=0.02$) and a significant interaction effect of diagnosis and trauma ($p=0.008$) on inhibitory control accuracy, with the HC high trauma and BD low trauma groups performing significantly poorer than the HC low trauma group. BD high trauma did not differ significantly from any groups.

Conclusions: In our sample, those with BD had higher rates of childhood trauma compared to those without psychiatric illness. Healthy controls with childhood trauma showed greater dysfunction in inhibitory control, suggesting that early trauma might adversely impact the development of circuits supporting executive functioning in healthy individuals.

Correspondence: *David F. Marshall, Ph.D., University of Michigan, 2101 Commonwealth Blvd., Suite C, Ann Arbor, MI 48105. E-mail: davimars@med.umich.edu*

S. NA, R. BREWSTER & T. KING. Fluid and Crystallized Intelligence Relationships with N-back Performance.

Objective: Recent studies have reported relationships between n-back performance and measures of intelligence (IQ). The present study examined the potential specificity of this relationship with measures of fluid (Gf) and crystallized IQ (Gc). As previous literature has suggested that the processes involved in Gf are related to skills necessary for the n-back, we hypothesize that Gf and n-back performance would be significantly related, while Gc and n-back performance would not.

Participants and Methods: A verbal n-back task and the 4 subtest Wechsler Abbreviated Scale of Intelligence (WASI) were administered to 48 healthy individuals (mean age=21.6(4.1); 56% female) without histories of neurological conditions or significant psychological diagnoses on the Structured Clinical Interview for DSM-IV. Bivariate correlations were conducted between Full Scale IQ (FSIQ) (mean score=109(10.1)), and the percentage of correct responses on the 1, 2, & 3-back tasks (M=93(6.4); M=88(7.3); M=85(8.5)). IQ was bifurcated into Gc (WASI-Vocabulary score) and Gf (WASI-Matrix Reasoning score) and analyzed in relation to n-back performance.

Results: FSIQ was correlated with accuracy on 1, 2, & 3-back tasks ($r=.46, p=.001$; $r=.42, p=.003$; $r=.34, p=.02$). Gc was correlated with accuracy on the 1 & 2-back tasks ($r=.36, p=.01$; $r=.34, p=.02$) but not on the 3-back task ($r=.18, p=.22$). In contrast, Gf was significantly correlated with the accuracy of the 3-back task ($r=.40, p<.01$) but exhibited trends on the 1 & 2-back tasks ($r=.26, p=.08$; $r=.25, p=.09$).

Conclusions: Results show that FSIQ is a strong predictor for performance on the n-back task. Specifically, Gf is related to performance in the most difficult 3-back task, whereas Gc was related to 1 & 2-back performance. Consistent with previous literature, more challenging versions of the n-back (i.e. the 3-back task) may be more sensitive to fluid skills, such as working memory, and should be further explored.

Correspondence: *Sabrina Na, Georgia State University, 235 Lincoln Court Avenue, Atlanta, GA 30329. E-mail: s.diana.na@gmail.com*

C. NZEREM. Executive Dysfunction is Associated with Clinical Symptomatology in 22q11.2 Deletion Syndrome.

Objective: By adulthood, 25%- 30% of individuals with 22q11.2 deletion syndrome (22qDS) develop a psychotic disorder, often schizophrenia, and it is not understood why. Due to the high rate of conversion to schizophrenia in 22qDS, this group offers the possibility of defining a seemingly homogenous maturational pathway to psychosis, as the 22q11.2 locus may be considered a main schizophrenia susceptibility location in humans. Neurocognitive deficits have been increasingly recognized as an important dimension of schizophrenia, particularly in the executive domain. Thus, we assessed multiple aspects of executive cognition in 22qDS, in order to: 1) characterize performance across this domain as compared to age-matched controls; and 2) determine whether executive function performance is significantly associated with positive and negative psychotic symptoms in 22qDS.

Participants and Methods: Participants included 22qDS patients (N= 33, mean age: 13.52) and controls (N= 36, mean age: 13.78). We assessed psychomotor speed and mental flexibility (Trails-B), working memory (Letter-Number Sequencing: LNS), and verbal letter fluency. Psychotic symptomatology was measured using quantitative scores obtained from the Structured Interview for Prodromal Syndromes (SIPS). **Results:** 22qDS patients showed the greatest impairment relative to controls on measures of set-shifting and mental flexibility. Results indicated significant inverse correlations (adjusting for age) between both positive and negative psychotic symptoms and LNS, verbal fluency category switching, switching accuracy (all $p < .02$); that is, poorer task performance was associated with more severe symptomatology. Trails-B completion time was significantly associated with positive and negative psychiatric symptoms ($p < .05$).

Conclusions: Given significant associations with both positive and negative symptoms and executive function in 22qDS, these findings suggest that executive function may be an important domain for providing information about the development of psychosis.

Correspondence: *Chinonyere Nzerem, Masters, Psychology; Loma Linda University, 11130 Anderson Street, Suite 106, Loma Linda, CA 92350. E-mail: cnzerem@llu.edu*

D.J. PARKER, A.N. SCHNEIDER, R.E. DELISLE, M.K. PASTERNAK, I. GORDON, B. XU, N.C. WAGNER, A. KRAWITZ & J.B. HALE. EMO-CPT: A Measure of "Hot" and "Cool" Executive Circuit Function?

Objective: Using neutral and emotional faces as stimuli, the Emotional Continuous Performance Task (EMO-CPT) was designed to measure both "cool" dorsal and "hot" ventral frontal-subcortical circuit (FSC) executive functions.

Participants and Methods: University undergraduate students (22 Male, 55 Female; M = 21.57 years, SD = 3.15) completed the EMO-CPT, Counting Stroop (CS), Balloon Analogue Risk Task (BART), Behaviour Rating Inventory of Executive Function (BRIEF), and a demographic survey. The EMO-CPT consisted of 240 trials counterbalanced into 8 separate blocks of neutral ("cool" FSC function) and emotional faces ("hot" FSC function) with accuracy and reaction time, and emotional-neutral contrast scores calculated for subsequent analyses.

Results: EMO-CPT principle axis factor analysis with varimax rotation revealed "cool" Sustained/Speed (SS) (Eigenvalue = 4.26) and "hot" Accuracy/Inhibition (AI) (Eigenvalue = 2.47) factors accounting for 48.6% of the variance. SS moderately correlated with Counting Stroop Reaction Time variables (r 's .30 to .36) and the BRIEF Metacognition Index (MI) ($r = .25$), but also the BRIEF Behavioral Regulation Index (BRI) ($r = .27$). The AI was related to BART Adjusted Inflation SD ($r = -.22$) and the BRI ($r = -.25$). In addition, the EMO-CPT contrast scores for angry and happy trials were correlated, $r = .48$, $p < .001$. The angry contrast scores positively correlated with the CS Stroop effect RT, $r = .29$, $p < .011$, whereas the happy contrast scores negatively correlated with the BRIEF BRI, $r = -.25$, $p < .027$.

Conclusions: The EMO-CPT is related to established "cool" CS/MI and "hot" BART/BRI measures, suggesting it can potentially capture emo-

tional and cognitive control in the same measure. Furthermore, the correlations with the happy and angry stimuli differed, suggesting that the "hot" circuit consists of multiple interacting subcomponents. Research using typical children and clinical populations may reveal EMO-CPT diagnostic and treatment utility.

Correspondence: *Daniel J. Parker, B.A. Psychology, Psychology, University of Victoria, 1205 St. Patricks St., Victoria, BC V8S 4Y3, Canada. E-mail: djamesparker@gmail.com*

F.A. PINARD, D.P. WABER, C.P. BRYCE, J. GIRARD & J.R. CALLER. Intergenerational Associations between Executive Functioning of Parents and their Adult Offspring.

Objective: Parental behavioral regulation can have a powerful effect on young children's behavior, yet little is known about potential long-term associations as children become adults. We examined associations between parental self-report ratings of executive functioning (EF), using the Behavior Rating Inventory of Executive Function (BRIEF), and ratings on the same instrument by their young adult offspring, hypothesizing that parents' EF would predict their adult children's EF.

Participants and Methods: Data were collected as part of 40-year longitudinal and intergenerational study of effects of early malnutrition in Barbados. The sample included 17 middle-aged parents, 76.5% of whom had experienced moderate to severe protein-energy malnutrition as infants, and their healthy adult offspring. Participants were of Afro-Caribbean descent and predominantly low to low-middle SES. All completed the Self-Report version of the BRIEF. Correlations between parents' scores and those of their young adult offspring were calculated.

Results: Preliminary analyses indicated that age and sex were not correlated with any BRIEF scores; adult offspring SES was correlated with Self Monitoring only ($p < .05$). Parent Behavioral Regulation scores were positively correlated with their adult children's ratings on the Behavioral Regulation ($p < 0.05$), Metacognitive and Global Executive Composites (both $p < 0.01$). Parent Metacognitive scores were not significantly related to their adult children's ratings. Inhibition was the most consistent predictor of adult children's scores.

Conclusions: Parents' self-reported EF is significantly associated with their adult children's self-reported EF, suggesting potentially lifelong impact of parental behavioral style on a child's functioning, with inhibition the most consistent predictor. Mechanisms underlying these potentially important associations and their relationship to the parental nutrition history merit further investigation in a larger sample.

Correspondence: *Ferne A. Pinard, Ph.D, Psychiatry; Boston Childrens Hospital, 300 Longwood Ave, Fegan S, Boston, MA 02115. E-mail: ferne.pinard@childrens.harvard.edu*

R.M. PLOTKIN. Texting While Driving: An Investigation of Divided Attention Resources Among Deaf Drivers.

Objective: While attention can be divided, cognitive resources are limited. Treisman and Davies (1973) found that the limits of attention are reduced when multiple channels of information are presented to one sensory modality. Cognitive resources are taxed if one must attend to two tasks using the same modality. Differences have been found in visual processing between hearing and deaf individuals. For example, deaf adults appear to allocate their visual resources across a wider range than do hearing adults (Bavelier, Dye & Hauser, 2006) and detect the onset of peripheral visual targets faster than do hearing controls (Chen, Zhang, & Zhou, 2006). These differences in visual processing between hearing and deaf individuals may impact the driving ability of deaf adults. The current study aimed to examine the nature of divided attention while operating a driving simulator and texting among deaf drivers.

Participants and Methods: The sample consisted of 45 deaf participants. Twenty-seven (60.0%) of the participants were female. Participants engaged in a simulated driving task; driving performance was monitored while they drove with (i.e., receiving and sending text messages) and without distraction.

Results: A t-test was used to compare driving performance in baseline (i.e., not texting) and texting conditions. Results revealed significant differences between conditions ($p < .001$), indicating that participants drove significantly worse when texting and driving than when only driving. Participants also experienced nearly twice as many simulated collisions while texting and driving.

Conclusions: The results indicated a significant relationship between driver distraction and poorer driving performance in drivers with hearing loss. Although the results are similar to what would be expected from hearing driving research, the next step in this field of research is to design a study of divided attention comparing the driving performance between hearing and deaf individuals.

Correspondence: *Rachael M. Plotkin, MA, Gallaudet University, 1600 Fillmore Street, Apt 237, Denver, CO 80206. E-mail: rachael.plotkin@gallaudet.edu*

H. RAU, Y. SUCHY, J. BUTNER & P. WILLIAMS. Profiles of Executive Functioning in Healthy Young Adults.

Objective: Different profiles of executive functioning (EF) weaknesses appear to exist based on evidence from neurologically-impaired populations. Duffy and Campbell (1994) describe three EF syndromes that correspond to prefrontal cortex (PFC) convexities (i.e., dysexecutive, disinhibited, apathetic). Alternatively, Osmon (1996) proposed two profiles characterized by imbalanced opponent processors (i.e., cognitive flexibility, set maintenance), and evidence suggests that these processes may be hemispherically lateralized (e.g., Rogers et al., 1998, Stefanatos & Wasserstein, 2001). This study aimed to identify EF profiles in the general population and examine these with respect to extant theoretical frameworks.

Participants and Methods: 305 young adults (age 18-30, 50% male) were administered a modified switching task that generates switch, form, and maintain variables under conditions designed to differentially tax hemispheric processing (Suchy & Kossou, 2006).

Results: Profiles of EF were identified via latent profile analysis, a classification procedure for grouping participants according to performance patterns. A 3-profile model provided optimal fit (VLMR $p = .033$, $ss-BIC = 5631.92$), identifying one large group (72%), characterized by overall good performance, and two smaller groups differentiated by weaknesses in either cognitive flexibility (13%) or set maintenance (15%).

Conclusions: Three profiles of EF were identified in a sample of healthy young adults, suggesting that most individuals exhibit balanced EF abilities and that those with an EF weakness are best characterized according to opponent processor imbalances. Given that individuals with EF weaknesses display poorer stress regulation and increased risk for various psychopathologies (Williams, Suchy, & Rau, 2009), these profiles could inform investigations about which aspects of EF are associated with particular stress processes.

Correspondence: *Holly Rau, M.S., Department of Psychology, University of Utah, 380 South 1530 East, Salt Lake City, UT 84112. E-mail: hollyrau@gmail.com*

G.Z. RECKESS, B. SHPRITZ, M.D. ROGERSON, L.S. ROSENTHAL, C.C. UMEH, R. DORSEY, Z. MARI & J. BRANDT. Decision-Making in Parkinson's Disease: Effects of Deep Brain Stimulation of the Subthalamic Nucleus.

Objective: Patients with Parkinson's disease (PD) commonly exhibit cognitive dysfunction and, occasionally, troublesome impulsive behaviors. Deep brain stimulation (DBS) of the subthalamic nucleus (STN) may further alter aspects of decision-making and "cognitive control." This pilot study compared the decision-making behaviors of patients with DBS to neurologically normal individuals and compared PD patients' decision-making during STN stimulation with their own performance when DBS is turned off.

Participants and Methods: This pilot study consisted of eight participants with PD who were treated with DBS and eight age-matched, neurologically healthy adults. PD patients were tested on two occasions, once with DBS on and once with DBS off. Session order was pseudo-

randomized. Each test session consisted of five cognitive tasks specifically selected to distinguish among components of decision-making: Balloon Analogue Risk Task, Game of Dice Task, Deal or No Deal, Temporal Discounting Task, and a Framing Paradigm. Due to small sample size, nonparametric tests (i.e., Mann-Whitney U and Wilcoxon rank-sum test) were used to analyze differences between group (PD versus control) and DBS condition (on versus off).

Results: On the Game of Dice task, PD patients displayed greater risk-taking than control participants, regardless of DBS condition ($p \leq .01$). There was also a trend on other tasks. For example, PD patients were more reluctant to delay gratification on the Temporal Discounting Task ($p = .10$). On the Framing Paradigm, a larger proportion (37.5%) of patients chose the risky option compared with the healthy participants (12.5%). There was also evidence that DBS activation may reduce the gap between PD and control participants.

Conclusions: Results from this pilot study suggest that individuals with PD may choose more risky options and be less patient in waiting for rewards. DBS of the STN does not seem to have a deleterious effect on decision making, and in fact may somewhat attenuate deviations from normal behavior. Correspondence: *Gila Z. Reckess, PhD, Psychiatry, The Johns Hopkins University School of Medicine, 600 North Wolfe Street, Meyer 218, Baltimore, MD 21201. E-mail: greckes1@jhmi.edu*

H. ROBINSON & D. TRANEL. Lesion Correlates of Executive Functions: A Neuropsychological Approach Using the EXAMINER Battery.

Objective: The EXAMINER battery was developed to provide comprehensive measurement of executive functions (EF), and basic reliability and validity have been established. We used a neuropsychological approach to investigate brain-behavior relationships for various subtests in the EXAMINER battery, by contrasting EXAMINER performance between patients with frontal versus non-frontal focal lesions.

Participants and Methods: The EXAMINER was administered to patients with lesions to the ventromedial (vmPFC, $n=23$) or dorsolateral (dlPFC, $n=16$) prefrontal cortex, patients with non-frontal brain lesions ($n=28$), and a neurologically intact comparison group ($n=20$). We analyzed Dot Counting, N-Back, Flanker, Anti-Saccades, Set Shifting, Verbal and Categorical fluency, the Unstructured Task, the Social Norms Questionnaire, Dysexecutive Errors, and the subscales of the FRSB. Lesion effects were established using nonparametric voxel-based lesion symptom mapping (VLSM).

Results: Preliminary results suggest weak, but consistent differences between groups, whereby patients with frontal lesions tended to have lower performance on EXAMINER subtests than patients with non-frontal lesions. In addition, some regional specificity within the prefrontal lobes was observed, with cognitive control measures being more associated with dlPFC lesions and decision-making measures being more associated with vmPFC lesions.

Conclusions: A neuropsychological approach using VLSM in patients with focal brain lesions provided modest support for the construct and predictive validity of the EXAMINER battery. It will be interesting to explore how this battery compares to classic EF measures, and to other omnibus approaches such as the Delis-Kaplan Executive Function System. This study was supported by NINDS P01 NS19632 and the Kiwanis Foundation.

Correspondence: *Heather Robinson, B.S., University of Iowa, E420E Seashore Hall, 328 Iowa Avenue, Iowa City, IA 52242. E-mail: heather-robinson@uiowa.edu*

A. RODRÍGUEZ-VILLEGAS & J. SALVADOR-CRUZ. Executive functions and coping in healthy adults.

Objective: The objective of the current investigation was to determine whether there is an association between executive functions and coping strategies in neurologically intact mild aged and healthy adults. It was hypothesized that individuals with better scores in executive functions had more adaptive coping strategies. This study takes into account the ecological validity of executive function assessment, highlighting the importance of extra-test variables such as health and emotional state.

Participants and Methods: 60 healthy adults, 30 males and 30 females, mean age 48.2 (SD=3.3) underwent the Questionnaire neurological and psychiatric history, the Beck Depression Inventory and the Beck Anxiety Inventory, Wisconsin Card Sorting Test (WCST) to measure executive function and Coping Strategies Inventory (CSI) to assess coping strategies. Associations between cognitive function and coping strategies were analyzed using the bivariate Spearman correlation coefficient test.

Results: A significant association was found between the adaptive strategy of problem solving and conceptual level responses (.371**) and percentage of errors (.331**).

Conclusions: The primary purpose of executive functions is voluntarily directed toward a goal. This organization requires continued feedback to generate an adaptive response (Zelazo & Cunningham, 2007). On the other hand, Skinner and Zimmer-Gernberck (2007) characterize the multidimensional and multifunctional structural coping strategies. They propose this construct as the highest point of a hierarchical model. The finding in this study shows that executive functions and adaptive coping show positive association within an ecologically valid approach. Therefore, it is possible to suggest that if we strengthen the conceptual levels responses and benefits the solving problems we may impact on the remaining adaptive coping strategies.

Correspondence: *Ana Rodríguez-Villegas, graduate, Programa de Doctorado, Universidad Nacional Autónoma de México, Callejon Pablo Galeana 19C Col. San Juan de Aragón, México 07950, Mexico. E-mail: kitty_2162@hotmail.com*

M. SCHMID & ÅSA. HAMMAR. First Episode Major Depressive Disorder- Sustained Impairment in Inhibition and Semantic Fluency in a 1 year Follow up Assessment.

Objective: The present study investigated the Executive Functions (EF) of inhibition, mental flexibility and phonemic- and semantic fluency in a 1 year follow up assessment of patients diagnosed with first episode Major Depressive Disorder. In the acute phase, the patient group performed significantly poorer compared to the control group in inhibition and semantic fluency. The aim of the present study was to pursue these findings in a longitudinal perspective.

Participants and Methods: Twenty eight patients and 28 individually matched healthy control subjects were included at the follow up assessment. EF was assessed using the Color Word Interference Test, Verbal Fluency Test and the Trail Making Test, from D-KEFS (the Delis Kaplan Executive Function System). Mean severity score of depression showed that the patient group was in symptom reduction/remission at the time of testing.

Results: Results showed a sustained impairment in inhibition and semantic fluency. However, the performance in inhibition was more severe when additionally mental flexibility was required (inhibition/switching). There were no differences between the patient group and control group in the other EF functions measured.

Conclusions: The present findings show that poor performance in inhibition and semantic fluency are prolonged despite symptom reduction, following patients from their initial episode. In conclusion, impaired inhibition and semantic fluency may represent trait markers in MDD.

Correspondence: *Marit Schmid, PhD student, Department of biological and medical psychology, University of Bergen, Jonas Liesvei 91, 5009 Bergen, Bergen 5009, Norway. E-mail: marit.schmid@psybpb.uib.no*

H. SCHNEIDER, L.A. JACOBSON, A. PRITCHARD, M. MCCURDY & E. MAHONE. Factor Structure of the BRIEF-Preschool Version: How Many Executive Skills Are There, Anyway?

Objective: The Behavior Rating Inventory of Executive Function - Preschool (BRIEF-P) is a parent-report measure of executive functioning for preschoolers. The 63 items are hypothesized to load onto five clinical scales and an overall Global Executive Composite (GEC). The present study analyzed the proposed factor structure to determine model goodness of fit in a clinical population.

Participants and Methods: Participants included 246 children (71% boys) referred for neuropsychological evaluation. BRIEF-P item-level scores were subjected to exploratory (EFA, using maximum likelihood estimation to yield estimation of fit) and confirmatory (CFA) factor analyses to analyze the fit of the published model.

Results: EFA suggested that a one-factor model [i.e., GEC: ($\chi^2(1890) = 4746.93$)] provided a poor fit to these data from clinically-referred preschoolers. A five-factor EFA also showed limited fit to the data ($\chi^2(1648) = 2697.21$). CFA of a second order model using the five published (correlated) scales also fit these data poorly ($\chi^2(1881) = 3633.24$). EFA suggested that ten factors provided a better, though not ideal fit ($\chi^2(1368) = 1835.96$). Removal of 6 items that did not load with any of the hypothesized scales improved the model further (57 items, 8 factors; $\chi^2(1168) = 1644.28$). Regardless of method employed, items from the Working Memory and Planning/Organization scales consistently loaded together ($\alpha = .962$), providing support for the published Emergent Metacognition Index. Items from the Emotional Control and Inhibit scales tended to load as indicated in the test manual. Items related to environmental unawareness loaded on a unique factor.

Conclusions: Although the BRIEF-P's published five-factor model does not appear to provide adequate fit in this clinical sample, there is some evidence to support published higher order factors. However, these data are not consistent with a unitary latent factor of executive functioning (i.e., GEC) in this age group.

Correspondence: *Heather Schneider, Kennedy Krieger Institute, 1750 E. Fairmount Ave, Baltimore, MD 21231. E-mail: schneiderh@kennedykrieger.org*

C. SETER, T. GIOVANNETTI & D. OTTEMILLER. Do Traditional Neuropsychological Measures of Planning Measure the Same Construct?

Objective: Planning is conceptualized as a double-level process involving formulation and execution. However, it is unclear whether tests of planning measure a single or multi-dimensional construct of planning. We hypothesized that planning tests would reflect the two components of planning, measured by planning time and planning behaviors.

Participants and Methods: 80 participants (51% female; $M_{age} = 21.96$ years) completed the D-KEFS Tower, NAB Mazes, and BADS Zoo Map tests. Two planning variables from each measure were included in analyses: Tower Test Total Planning Time & Achievement Score, NAB Mazes Total Planning Time & Total Errors, and Zoo Map Total Planning Time & Total Errors.

Results: Through PCA analyses with varimax rotation, the six neuropsychological variables were meaningfully reduced to two components (explaining 64.03% of variance; $KMO = .52$; Bartlett's test $\chi^2(6) = 13.58, p = .035$) and two independent planning variables. Component 1 represents Planning Accuracy (Zoo Map Total Errors, Tower Test Achievement Score); Component 2 represents Planning Time (Tower Test Total Planning Time, NAB Mazes Total Planning Time). The two independent neuropsychological variables were NAB Mazes Total Errors and Zoo Map Total Planning Time.

Conclusions: The six neuropsychological variables were reduced to two components that are consistent with the double-level model of planning. However, not all planning variables reflected one of these constructs. The results support the need to carefully consider the selection of planning tests and to consider plan formulation and execution separately when evaluating planning ability.

Correspondence: *Colette Seter, MA, Psychology, Temple University, 1701 North 13th Street, Weiss Hall- Room 857, Philadelphia, PA 19122. E-mail: tua93506@temple.edu*

A.E. SØLSNES, G. LØHAUGEN & J. SKRANES. Self-Evaluation of Executive Functions in Very-Low-Birth-Weight Preterm Born Young Adults Does Not Correspond to Results on Neuropsychological Tests Assessing Attention/Executive Functions.

Objective: Behavioral Rating Inventory of Executive Functions-Adult version (BRIEF-A) is a standardized self-report measure of executive

functions and self-regulation in every-day life. Adults who were born preterm with very low birth weight (VLBW: bw \leq 1500g) are found to display significantly lower scores on full scale IQ and on neuropsychological tests of executive functions. We hypothesized that the BRIEF-A scores would correlate with the scores on neuropsychological tests assessing aspects of attention/executive functions.

Participants and Methods: Forty-two VLBW (mean bw 1237g, sd 219g and gestational age 29.3 weeks, sd 2.4 weeks) and 62 term born controls at age 19 years completed BRIEF-A and T-scores from the individual subscales, the indices and the sum score were compared between groups. T-scores from the BRIEF-A have a mean of 50 (sd 10), and scores \geq 65 are considered clinically significant. The Wechsler Adult Intelligence Scale (WAIS) III was applied to obtain full scale IQ scores and test scores on the Delis-Kaplan version of Trail Making Test (TMT)1-5 and Stroop1-4 were registered.

Results: There were no significant differences in mean subscale-, index- or sum-scores on the BRIEF-A between groups. Mean IQ in the VLBW and the control group was 89 and 101, respectively. There were no differences in BRIEF-A scores between those with normal and low IQ in the VLBW group. The VLBW scores were significantly worse than controls on TMT1-4 ($p < 0.001$ – $p < 0.000$) (TMT5 $p < 0.057$) and Stroop1, 3 and 4 ($p < 0.013$, $p < 0.003$, $p < 0.035$). These results did not correlate to BRIEF-A scores.

Conclusions: Our results show that the VLBW young adults do not report problems with executive function in their every-day life. However, this group displays significantly lower results on neuropsychological tests assessing attention/executive functions. These findings indicate that a non-clinical result on the BRIEF-A in young adults born preterm is not sufficient to rule out attention/executive deficits.

Correspondence: *Anne E. Solsnes, Faculty of Medicine, NTNU, Olav Kyrres g. 9, Trondheim 7491, Norway. E-mail: anne.e.solsnes@ntnu.no*

M. VANDERMEER, A. ZANJANI, E. JEFFAY, P. KLAS, S. HANNA & K.K. ZAKZANIS. On the Nature of a Novel, Ecologically Valid Measure of Executive Functioning in Patients with Mild Traumatic Brain Injury: A Pilot Study.

Objective: While cumulative research demonstrates that patients with mild Traumatic Brain Injury (mTBI) recover by 3 months post-injury in terms of neuropsychological (NP) outcome, many patients complain of persistent cognitive dysfunction in their daily life after this expected window of recovery secondary to a host of moderating variables. This contrast between self-report and NP test results may stem from deficiencies in currently available measures. A frequently noted limitation of traditional NP tests is a lack of ecological validity; one dimension of which is verisimilitude, or the degree to which tests resemble tasks found in daily life. The purpose of the present study was to examine an ecologically valid virtual reality (VR) measure of executive function (EF) – the VR Office Task (VROT) – in order to determine its utility in discerning executive dysfunction in patients who sustained a mTBI.

Participants and Methods: Participants were to virtually deliver a series of poorly labeled packages to one of four possible office doors. It was assumed that the greater verisimilitude of the realistic environment of VR would allow for a more robust discrimination between control subjects ($n = 30$) and patients with mTBI ($n = 5$) compared with traditional tests of EF. Group performances were compared using Mann-Whitney U and two-tailed t tests and the magnitude of differences was analyzed using Cohen's d .

Results: Of the traditional EF tests, only the Tower of London execution time showed significant difference; $U = 19.5$, $p = 0.030$. All scores of the VROT reached significant differences (incorrect deliveries [ID]; $U = 11.0$, $p = 0.022$; failure to maintain set [FMS]; $U = 7.50$, $p = 0.009$; perseverations [PS]; $U = 30.0$, $p = 0.002$). In addition, all VROT scores showed large effect sizes (ID; $d = -2.33$; FMS; $d = -2.54$; PS; $d = -2.25$).

Conclusions: The results suggest that the VROT may have clinical potential in assessing the presence of executive dysfunction in patients with mTBI, otherwise undetected by traditional EF tests.

Correspondence: *Eliyas Jeffay, M.A., University Of Toronto, 1265 Military Trail, Scarborough, ON M3A1A5, Canada. E-mail: eliyas.jeffay@utoronto.ca*

E. VERA-ESTAY, J.J. DOOLEY & M.H. BEAUCHAMP. Precursors of Sociomoral Reasoning in Adolescence: The Contribution of Executive Functions.

Objective: Sociomoral reasoning (SMR) is an important skill during adolescence because it guides social decisions, improving social competence. Although several factors have been associated with SMR maturity, their relative contribution remains unclear because most studies have studied these variables in isolation. The aim of this study was to explore the precursors of SMR maturity in adolescents and the specific contribution of executive functions (EF) using an ecologically valid tool for assessment in the adolescent population.

Participants and Methods: A new visual measure known as the Socio-Moral Reasoning Aptitude Level task, ('So-Moral', Dooley, et al., 2010) was developed to account for adolescent reality and developmental stages of SMR. The So-Moral, the WASI and five subtests of the D-KEFS battery were administered to 92 healthy developing adolescents aged 13 to 20 ($M = 16.3$ years, $SD = 2.1$ years, 65% female) Participants also completed a demographic form and a questionnaire measuring pubertal development (PD).

Results: SMR maturity was positively correlated with age, PD and estimated intelligence (EI), as well as with three EF (cognitive flexibility (CF), verbal fluency (VF) and abstract thinking). Hierarchical multiple regressions indicate that together these EF explain 11% of the variance in adolescents' SMR maturity, after controlling for age, PD and EI (R^2 change = .11, F change (3, 78) = 6.214, $p = .000$). In the final model, only age ($\beta = .33$, $p < .003$), EI ($\beta = .27$, $p < .003$), CF ($\beta = .26$, $p < .001$), and VF ($\beta = .19$, $p < .029$) were significant individual predictors of SMR maturity in adolescence.

Conclusions: Our study provides new evidence of the influence of EF on SMR maturity in healthy adolescents. Taken together, the findings of this study contribute to better understanding moral development during adolescence and highlight the importance of using ecologically valid tools to measure social skills.

Correspondence: *Evelyn Vera-Estay, Ms, Psychology, University of Montreal, C.P. 612S, Succ. Centre-Ville, Montréal, QC H3C 3J7, Canada. E-mail: ec.vera.estay@umontreal.ca*

J. WARNER, M.F. GINDLESBERGER, V.A. WELLS, A.C. YANG, R.G. FRIED, R.J. PEARLSTEIN, H. KAKAVAND, K.J. JACKSON, S.M. KOHLMAN & J.Y. HSU. Neurocognitive Late-Effects of Pediatric Oncology: Annual Screening as Standard of Care with the KP-NCLE Brief Assessment Battery.

Objective: Pediatric cancer treatment is known to impact the development of white matter, the brain's connective tissue supporting basic information processing abilities. Because one's ability to access learning opportunities is limited by deficits in processing of novel information, unsupported weaknesses may stunt global development. While "regular evaluation to monitor development after cranial radiation therapy &/or anti-metabolite chemotherapy" is recommended (COG), this is often difficult to obtain due to limited insurance coverage/resources. In response, we developed the KP-NCLE, a brief battery designed for annual screening of neurocognitive late-effects of treatment & to track patient development over time. Building on prior work, we predicted that the KP-NCLE would show adequate properties when used in lieu of lengthier, more costly assessment.

Participants and Methods: Participants included 31 pediatric oncology patients presenting to the clinic for initial and annual follow-up screening. Complete data are available for a subset; n varies thusly from 9-31. The 40-minute battery includes tests of auditory attention/work-ing memory, visual processing speed, verbal fluency, rapid naming & fine motor speed.

Results: Composite scores were calculated based on the full IQ battery & KP-NCLE data, then compared via t-test & Spearman correlation. Results show strong convergence validity with the FSIQ ($r = .72$; $p < .01$) & high test-retest reliability from Time 1 to Time 2 of assessment ($r = .88$; $p < .002$). There was no significant decline in mean scores from Time 1 to Time 2 of assessment ($t = -.86$; $p < .86$).

Conclusions: Though preliminary, the results support the utility of the KP-NCLE in providing annual screening assessment as standard of care for all pediatric oncology patients. In addition to longitudinal tracking of development, these data afford well-informed academic & treatment planning for the individual patient, and thus support functional outcome & quality of life into adulthood.

Correspondence: *Juliet Warner, Ph.D., Pediatrics Department, Kaiser Permanente, Los Angeles Medical Center (LAMC), 4700 Sunset Blvd, Module 1B, Los Angeles, CA 90027. E-mail: juliet.warner@gmail.com*

R. WEBER & A. JOHNSON. Selective Attention in Bilingual and Monolingual Children.

Objective: The purpose of this study is to further investigate the bilingual selective attention advantage discussed by Bialystok (2001). Previous research has demonstrated that bilingual children outperform their monolingual peers on tasks requiring them to selectively attend to cues while simultaneously ignoring other information (e.g., Bialystok, 2010; Bialystok & Martin, 2004). It is hypothesized that bilingual advantages will be observed on task conditions requiring selective attention.

Participants and Methods: Participants were recruited from elementary schools and community centers in multiple urban areas in the Southwestern United States. Children, ages 4-7, and their families, were contacted through the distribution of recruitment materials. Demographic information was collected via parental forms while children completed four conditions of a selective attention task (Humphrey, 1982). Bilingualism was determined by parental report and receptive vocabulary in both English and Spanish.

Results: A MANCOVA model was utilized to examine multivariate differences in selective attention scores across three distracting task conditions. Age was included as a covariate, due to a significant relationship between age and environmental distraction condition performance ($r = .246, p < .05$). This analysis yielded a nonsignificant multivariate effect for language group ($\lambda = .975; F(3, 61) = .527; p > .05$; partial $\eta^2 = .025$). Follow-up univariate analyses were also nonsignificant for language group but age significantly predicted scores on the environmental and simple distraction conditions.

Conclusions: The hypothesis was not confirmed. This was surprising, as previous research has established bilingual advantages in selective attention. These results may be partially explained by differences between the current study methods and population and those discussed in previous literature. Additional explanations will be provided.

Correspondence: *Rachel Weber, Ph.D., Pediatric Clinical Neuroscience, University of Minnesota, 420 Delaware St. S.E., Mayo Mail Code 486, Minneapolis, MN 55455. E-mail: rcweber@umn.edu*

J. WILSON, D. SHUM & G. ANDREWS. Hot and Cool Executive Functioning during Middle Childhood: Development and Association with Academic and Psychological Outcomes.

Objective: Although executive functioning (EF) continues to develop from birth into early adulthood, the majority of developmental EF research has focused on the early emergence of EF up to age 5 years. To better understand the interaction of cognitive and affective processes in older children, it is important to consider the development of hot and cool aspects of EF together in children 5 years and older. This study examined the development of hot and cool EF during middle childhood (5 to 12 years) and explored their relationships with academic and psychological outcomes.

Participants and Methods: Participants ($N = 126$; about 15 in each age group from 5 to 12 years) were typically developing children who completed a battery of hot and cool EF tasks and standardized measures of intelligence, academic achievement and psychological functioning. EF tasks included selected subtests of the CANTAB, a new delay of gratification task, and a measure of advanced theory of mind (Happé, 1994).

Results: Significant age-related gains were observed on two cool EF measures (working memory and inhibition), and three hot EF measures

(gambling, delay of gratification, and theory of mind). All measures showed significant linear trends. Interestingly, no significant age-related gains were observed for one cool EF measure (shifting). Differential relationships between hot and cool EF with academic and psychological outcomes were also found. For example, poorer performance on the gambling task was associated with higher levels of parent-reported psychological problems (whereas cool EF measures were unrelated).

Conclusions: This study provides a comprehensive characterization of EF development during middle childhood and highlights the interaction between cognitive and emotional development. Associations between hot and cool EF with important outcome variables corroborate the significance of these constructs.

Correspondence: *Jennifer Wilson, BPsych (Hons), School of Psychology, Griffith University, Mount Gravatt Campus, Messines Ridge Road, Mount Gravatt, QLD 4122, Australia. E-mail: j.s.wilson@griffith.edu.au*

G. WOCHOS & K.S. WALSH. Parent Ratings of Executive Function in Pediatric Brain Tumor Survivors May be Inadequate in Identifying Executive Function Late Effects.

Objective: Executive function (EF) is one of the most vulnerable neurocognitive domains in pediatric brain tumor (PBT) survivors. Despite advances in treatment, chemotherapy and cranial radiation continue to be primary treatment modalities. While performance based measures have traditionally been used to examine treatment related effects, assessment of EF in naturalistic settings has received less attention. We explored parent and teacher ratings of EF in PBT survivors following treatment, compared to typically developing peers.

Participants and Methods: PBT survivors off all therapies ($n=65$; mean age=12.42; $SD=3.93$) were compared to healthy controls ($n=130$; mean age=12.19; $SD=3.54$) on parent and teacher ratings of everyday EF (BRIEF). A profile analysis was conducted as a mixed repeated measures MANCOVA, using age as a covariate. Scores on each of the eight BRIEF scales served as a within-subjects variable, while treatment groups (PBT and healthy controls) served as a between-subjects variable.

Results: Of the three omnibus tests examining group differences for parent BRIEF ratings, there was a significant group by EF domain interaction ($p=0.001$). However, the effect size was weak ($\eta^2=0.02$) and only Inhibit was significantly different, and in the unpredicted direction. In contrast, teacher rating analysis revealed significant main effects for EF and group, and an interaction effect. Significant group differences were found for Working Memory, Plan/Organize, Initiate, Shift, and Organization of Materials ($p<.05$).

Conclusions: Teacher ratings were consistent with previous literature of EF difficulties in PBT survivors, in the areas of working memory, organization, flexibility, and initiation. In contrast, parents of PBT survivors appeared to under-report EF symptoms compared to teachers. This finding raises questions about additional factors that might influence parent perceptions of EF following treatment of a PBT, including a lack of opportunities to observe survivors with typically developing peers or a reporting bias.

Correspondence: *Gregory Wochos, Ph.D., Neuropsychology, Children's National Medical Center, 10300 Westlake Dr. #206, Bethesda, MD 20817. E-mail: gwochos@cnmc.org*

Invited Symposium: Diagnosing Challenging Cases Using Biomarkers and the New AD Research Criteria

Chair: Stephen Salloway

1:30–3:00 p.m.

S. SALLOWAY. Invited Symposium: Diagnosing Challenging Cases Using Biomarkers and the New AD Research Criteria.

Symposium Description: This symposium will use an interactive format where participants will learn to apply the new research diagnostic

criteria to challenging cases presented by experts in dementia including: Paul Malloy, Keith Johnson, Sandra Weintraub, Dorene Rentz, Marsel Mesulam, and Reisa Sperling. Participants will become familiar with the clinical and biomarker features that differentiate challenging cases with cognitive decline. The strengths and weaknesses of specific biomarker tests will be discussed within the new diagnostic framework.

Correspondence: *Stephen Salloway, Alpert Medical School, Brown University, x, Providence, RI. E-mail: ssalloway@butler.org*

Symposium 2: Social Outcomes in Pediatric Traumatic Brain Injury: Results from the SOBIK Project

Chair: Keith Yeates

1:30–3:00 p.m.

K. YEATES, K. YEATES, E. BIGLER, M. DENNIS, H. TAYLOR & K. YEATES. Social Outcomes in Pediatric Traumatic Brain Injury: Results from the SOBIK Project.

Symposium Description: Surprisingly little is known about the nature, basis, and consequences of the social problems associated with traumatic brain injury (TBI) in children. This symposium will present the results of the Social Outcomes in Kids with Brain Injury (SOBIK) project, a multi-level study of social outcomes following childhood TBI. The multi-site project was guided by a model of social outcomes in childhood brain disorder that draws on both social neuroscience and developmental psychology. The project had four primary aims: (1) to characterize the social interactions and adjustment of children with TBI; (2) to examine social information processing in children with TBI; (3) to determine the integrity of brain systems vulnerable to TBI and implicated in social information processing; and (4) to study the linkages among brain abnormalities, social information processing, and social behavior and adjustment. Keith Yeates will begin the symposium with a review of the model of social outcomes that guided the SOBIK project and a summary of study methods. Study results then will be illustrated by presentations on three key aspects of the model. Erin Bigler will discuss structural neuroimaging findings and their relevance to understanding the “social brain” in pediatric TBI. Maureen Dennis will present results on measures of various types of theory of mind, and discuss their potential implications for children’s social behavior and adjustment. Gerry Taylor will describe the effects of pediatric TBI on children’s social adjustment as rated by peers, parents, and themselves, and the relationship of social adjustment to injury severity and behavior problems. Keith Yeates will conclude the symposium with a summary of the major study findings to date in light of the guiding model and a discussion of future planned analyses.

Correspondence: *Keith Yeates, Nationwide Children’s Hospital, 700 Children’s Dr., Columbus, OH 43205. E-mail: keith.yeates@nationwidechildrens.org*

K. YEATES. Social Outcomes in Kids with Brain Injury (SOBIK): A Multi-Level Study of Social Outcomes in Pediatric Traumatic Brain Injury.

Introduction: The SOBIK project’s primary goal was to better understand the social outcomes of traumatic brain injury (TBI) in children. The project was guided by a model of social outcomes based on social neuroscience and developmental psychology. **Method:** The project involved a cross-sectional, concurrent cohort design comparing 8 to 13 year old children with complicated-mild to severe TBI ($n = 82$) to children with orthopedic injuries ($n = 61$). Participants were recruited at three sites: Nationwide Children’s Hospital, Columbus, Ohio; Rainbow Babies and Children’s Hospital, Cleveland, Ohio; and The Hospital for Sick Children, Toronto, Canada. Participants completed a series of assessments on average 2.5 years post-injury: (1) magnetic resonance imaging; (2) measures of social cognition; (3) direct observations of interactions with friends and unfamiliar peers; (4) measures of social adjustment; and (5) measures of potential environmental moderators.

Results: Analyses to date, discussed in the other presentations, indicate that children with TBI show a heterogeneous pattern of abnormalities on MRI that overlaps with the “social brain” network. Children with TBI also display deficits in social cognition and social adjustment that are related to the severity of injury and to volumetric differences in specific brain regions.

Discussion: The SOBIK project provides critical insights into the social outcomes of pediatric TBI that may guide future intervention efforts. Future analyses will examine group differences in direct interactions; explore the moderating effect of the environment; and model linkages between brain abnormalities, social cognition, and social behavior and adjustment.

Correspondence: *Keith Yeates, Dept. of Psychology, Nationwide Children’s Hospital, Columbus, OH 43205. E-mail: keith.yeates@nationwidechildrens.org*

E. BIGLER. How to Image the Social Brain in Pediatric Traumatic Brain Injury.

Introduction: Brain abnormalities on CT or MRI in TBI are heterogeneous and dependent on quantification method. By analyzing day-of-injury (DOI) CT and follow-up MRI (1–4 years post-injury), the SOBIK project provides an excellent vehicle to examine different methods of image analysis in relationship to social outcome.

Method: The study examined 82 children with TBI (mild-complicated to severe) and 61 with orthopedic injury (OI). They completed routine DOI clinical CT and follow-up 1.5 Tesla MRI, including T1 volume acquisition, T2/proton density dual echo, gradient recalled (GRE) and fluid attenuated inversion recovery (FLAIR). Qualitative rating schemes were applied. Region of interest (ROI) volumetric computation was used for MRI quantification along with FSL-based, automated methods including voxel-based morphometry, white matter lesion burden, and lesion mapping. These imaging methods were examined in relationship to cognitive and social outcome.

Results: Heterogeneity in lesions and quantitative abnormalities characterizes pediatric TBI. Although frontotemporal pathology is commonplace, each method provides unique information about the size and location of parenchymal damage. Whole brain quantitative and VBM analyses documented robust differences in white matter integrity, inversely related to injury severity. ROI analyses showed that damage to specific regions within the social brain network were related to severity of injury and method of quantification. However, considerable variability was observed between imaging analysis method and relationship to social outcome.

Conclusions: No one neuroimaging method captures all of the potential abnormalities that may occur within the social brain network of the child with TBI. Neuroimaging correlates with social outcome vary depending on the imaging modality and qualitative and quantitative methods used. Recommendations for the type of analysis given the social outcome variable being examined are discussed.

Correspondence: *Erin Bigler, Brigham Young University, 1001 Kimball Tower, Provo, UT 84602. E-mail: erin_bigler@byu.edu*

M. DENNIS. Modeling Theory of Mind in Pediatric Traumatic Brain Injury.

Introduction: Theory of mind (ToM), a component of social cognition, involves mindreading, the ability to think about mental states in oneself and others. The term ToM has been applied to an ever broadening range of constructs, from inferences about other’s judgments regarding object locations to self-reports of lending money to others as a measure of empathy. To better understand ToM, we have parsed it into cognitive (concerned with beliefs and mind reading), affective (how facial emotion expresses both inner feelings and socially deceptive feelings), and conative (how people influence each other’s mental and emotional states, as in irony and empathy) components. We aimed to understand ToM in children after traumatic brain injury (TBI), and to delineate differences in ToM between milder and more severe forms of childhood TBI.

Method: Participants were 8-13-year-old children with TBI or orthopedic injury (OI). Cognitive ToM was measured with a computer cartoon task of false belief. Affective ToM was measured with tasks comparing felt (emotional expression) vs. socially expressed emotions (emotive communication). Conative ToM was measured with tasks probing the comprehension of irony and empathy.

Results: Cognitive ToM was more accurate than affective (but not conative) ToM, and conative ToM was more accurate than affective ToM. Compared to OI controls, children with TBI had difficulty with cognitive, affective, and conative ToM. Children with severe TBI had more widespread deficits, although even mild-moderate TBI disrupted affective and conative ToM.

Discussion: Participants in social dyads must develop an on-line representation of a dynamic mental model of another person's beliefs, expectations, emotions, and desires and update this model with a representation of their personal history of social-affective influence on (and from) that person. This is a challenge for children with TBI, who lack some or all of the cognitive skills needed for dyadic participation.

Correspondence: Maureen Dennis, Hospital for Sick Children, 555 University Ave, Toronto, ON M5G 1X8, Canada. E-mail: maureen.dennis@sickkids.ca

H. TAYLOR. Social Adjustment after Pediatric Traumatic Brain Injury.

Introduction: Many children with TBI develop difficulties in social adjustment, but we know little about the range of these difficulties and their relation to behavior problems. The aims of this study were to determine the effects of TBI severity on multiple measures of social adjustment and explore associations of these measures with each other and with parent ratings of behavior problems.

Method: The sample included 25 with severe TBI (GCS score <9), 57 children with mild/moderate TBI (GCS score 9-12, or 13-15 with neuroimaging abnormality), and 61 with orthopedic injuries (OI). The children were 8-13 years of age and had sustained their injuries 2½ years (SD 1.1) earlier. Measures included parent ratings of child behavior, adaptive social functioning, and social participation; self-ratings of competence; parent and friend ratings of social supports; and peer evaluations of friendship and social acceptance using peer ratings and nominations.

Results: Compared to the OI group, the severe TBI group had more total behavior symptoms, lower ratings of social functioning, and higher rates of less than full social participation. Although the groups did not differ on self ratings of competence, children with severe TBI children were more often rejected by peers and had fewer mutual friendships than those with OI. The mild/moderate TBI and OI groups did not differ on these measures, but the former was rated as having higher levels of social support. Among children with TBI, different aspects of social adjustment were correlated with one another and with behavior symptoms.

Discussion: Children with TBI have problems in multiple dimensions of social adjustment but do not view themselves as less competent. The findings suggest related effects of TBI on multiple aspects of behavior and social adjustment and imply a need for comprehensive assessments of social outcomes.

Correspondence: H Gerry Taylor, BioEnterprise Bldg., 11000 Cedar Avenue, 4th floor, Cleveland, OH 44106. E-mail: hgt2@case.edu

Paper Session 3: Cognitive Interventions for Memory and Brain Training

Moderator: Bonnie Sachs

1:30–3:00 p.m.

G. ROWE, A. TROYER, K. MURPHY, L. HASHER, R. BISS & E. SVOBODA. Memory for Implicitly Presented Information in Amnesia.

Objective: Recent work has shown that healthy older adults pick up irrelevant information implicitly, and unknowingly use that information

when it becomes relevant for a later task. Implicit processes are typically spared in amnesia; however, no previous studies investigating cognitive abilities in amnesia have investigated the role that implicit processes might play in the conscious performance of cognitive tasks. Here we report findings showing that individuals with moderate to severe amnesia not only effectively use implicitly processed information to enhance their performance, the benefit is significantly greater than that seen with healthy older adults

Participants and Methods: Twenty individuals with amnesia and 20 matched controls participated in a picture judgment task in which they were instructed to ignore distraction in the form of words from one of two experimental lists. After a delay, during which they performed a computerized version of the Corsi Block Task, memory for the distracting words was tested with a word-fragment completion task.

Results: Memory for the implicitly presented distractors (target words) was measured as priming, and calculated as the difference between the proportion of target word fragments correctly solved compared to baseline (fragments of non-presented words solved). Both the experimental and control group showed a priming effect ($M = 0.21$, $SD = 0.08$; $M = 0.10$, $SD = 0.06$ respectively); that is, they were significantly more likely to solve a higher proportion of fragments of previously presented than non-presented words. However, the amnesic group had significantly higher proportion priming scores than the healthy controls, $t(38) = 4.92$, $p < .01$.

Conclusions: Our findings suggest that individuals with moderate to severe amnesia can enhance their performance on an explicit cognitive task, in this case problem solving, if previously exposed to the relevant information implicitly. These findings open up a number of exciting possibilities for cognitive intervention in amnesia.

Correspondence: Gillian Rowe, PhD, Neuropsychology and Cognitive Health, Baycrest, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: groue@baycrest.org

A.K. VAS, S. TUTHILL, M. KEEBLER, C. MARQUEZ DE LA PLATA, T. JANTZ, N. EVENSON, W. YU, G.F. SCHAUER, D.C. KRAWCZYK & S.B. CHAPMAN. Brain Training to Enhance Frontal Lobe Reasoning in Adult Traumatic Brain Injury.

Objective: Traditional cognitive remediation following a TBI, in both veterans and civilians, falls short of addressing higher-order cognitive deficits that hinder optimal functioning in daily life. The current randomized, controlled study compared the benefits of two intensive short-term training programs aimed at (a) improving advanced reasoning versus (b) increasing knowledge about the brain.

Participants and Methods: Sixteen participants (10 male, 6 female), 20 to 63 years old ($M = 39$, $SD = 15.95$), completed 18 hours of group training over eight weeks. Of the 16 participants, 7 received advanced reasoning training, and 9 participated in the brain-related information program. The advanced reasoning training taught cognitive strategies of strategic attention, integration, and innovation. The educational protocol informed participants about brain anatomy, effects of lifestyle on brain health, and cognitive changes following TBI. Both were equally engaging training programs that involved group activities, discussions, and home assignments.

Results: The advanced reasoning training group showed significant gains in the trained domain of abstract reasoning ($p < .05$). The benefits of the training extended to the untrained frontal domains of switching and verbal fluency ($p < .05$). Positive trends ($p < .10$) were also found on inhibition and working memory performance. Furthermore, participants in the advanced reasoning training group reported significantly improved functional outcomes (FSE and GOS-E) and improved sense of well-being (BDI) ($p < .05$). In contrast, gains in the education control group were limited to verbal fluency and BDI ($p < .05$).

Conclusions: This current study provides preliminary evidence that a top-down approach to improve abstract reasoning has wide-ranging benefits, including improved cognitive performance and enhanced functional recovery.

Correspondence: *Daniel C. Krawczyk, PhD, Center for BrainHealth, University of Texas at Dallas, 2200 W Mockingbird Ln, Dallas, TX 75235. E-mail: daniel.krawczyk@utdallas.edu*

T. NOVAKOVIC-AGOPIAN, A. CHEN, G. ABRAMS, M. MURPHY, A. ROSSI, D. BINDER, J. MUIR & M. D'ESPOSITO. Training in Attention Regulation Applied to Individually Defined Goals in Veterans with Chronic TBI.

Objective: Some of the most disabling consequences of brain injury are impairments in executive control processes, including selection, maintenance, and execution of goal-relevant information and activities. Goal-Oriented Attentional Self-Regulation (GOALS) training was designed to target deficits in executive control processes with attention regulation training applied to participant-defined goals. In a pilot study individuals with chronic ABI significantly improved post GOALS, but not control training, on measures of attention/executive function, functional task performance, and goal-directed control over neural processing on fMRI (Novakovic-Agopian, Chen et al 2011; Chen, Novakovic-Agopian et al 2011). The objective of ongoing study is to assess effectiveness of GOALS training in Veterans with chronic TBI.

Participants and Methods: 19 Veterans with chronic TBI 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 and 10 included neuropsychological, functional task performance and self-report measures

Results: Post GOALS training, but not post EDU, participants significantly improved on measures of attention/executive function, complex functional task performance, and on emotional regulation and daily functioning self-report. Participants reported incorporating some trained strategies into their daily life

Conclusions: The preliminary results suggest that GOALS training may be promising in Veterans with chronic TBI. Improving cognitive control functioning may also improve functioning in other domains such as functional performance and emotional regulation. The challenges and importance of: a) assessing change in functioning at different levels; b) using participant-defined goals applied to relevant training, and c) using ecologically valid assessment measures, will be discussed

Correspondence: *Tatjana Novakovic-Agopian, Ph.D, UCSF, SFVA, 661 Myra way, San Francisco, CA 94127. E-mail: tna@cns-site.com*

J. SMITH, K.A. NIELSON, J.L. WOODARD, M. SEIDENBERG, S. DURGERIAN, N.N. HANTKE, M.A. LANCASTER, M.A. MATTHEWS, M.A. SUGARMAN, C.M. FIGUEROA, K.E. HAZLATT, C.D. KAY, A.L. NORMAN, C.C. KANDAH & S.M. RAO. Longitudinal Associations Between Physical Activity, Cognitive Decline, and Hippocampal Volume in Healthy APOE-ε4 Carriers.

Objective: Physical activity (PA) has been shown to preserve and even increase the size of the hippocampus in healthy older adults. A presumption has been that these effects will result in stable memory performance and contribute to a reduction in incident dementia. Indeed, it is unknown if these effects occur in people most at risk for cognitive decline and Alzheimer's disease (AD), particularly carriers of the apolipoproteinE-epsilon4 (APOE-ε4) allele. The objective of this study was to examine the effects of PA on hippocampal volume and episodic memory performance over an 18-month interval in 32 cognitively intact APOE-ε4 allele carriers (ages 65-85).

Participants and Methods: A standard neuropsychological battery, including the Rey Auditory Verbal Learning Test and Mattis Dementia Rating Scale-2, was administered at baseline and after 18-months. Baseline PA level (Low PA vs. High PA) was assessed by self-reported frequency and intensity. Hippocampal volume was measured at baseline and 18-months later by MRI at 3T and analyzed using FreeSurfer 5.1.

Results: At baseline, the two PA groups were equivalent on sex, age, education, cognitive status, episodic memory performance, and depression. From the baseline to the 18-month follow-up, the Low PA group

declined significantly in delayed recall memory performance compared to the High PA group ($p = .03$), and 13/16 Low PA ε4 carriers declined by at least 1 SD compared to only 5/16 High PA ε4 carriers ($p = .011$). Moreover, right anterior hippocampal volume decreased in the Low PA ε4 carriers, and increased in the High PA ε4 carriers, over 18-months ($p = .021$).

Conclusions: These findings suggest that physical activity preserves anterior hippocampal volume, which may help to maintain memory abilities in cognitively intact but genetically at-risk older adults. Randomized clinical trials are required to determine whether physical activity in APOE-ε4 allele carriers reduces conversion to Alzheimer's disease.

Correspondence: *J. Carson Smith, PhD, Department of Kinesiology, University of Maryland, SPH Bldg 2351, College Park, MD 21114. E-mail: carson@umd.edu*

S. MORENO, Y. LEE, G. BIDELMAN, A. MOUSSARD & C. ALAIN. Cognitive Benefits of Music and Art Training in Healthy Older Adults.

Objective: It is well documented that music training offers a variety of cognitive benefits. Emerging evidence suggests that musical activity late into life may preserve cognitive functioning in old age [Hanna-Pladdy and MacKay, 2011, *Neuropsychology*, 25(3), 378-386]. Cognitive aging is associated with inhibitory deficits, e.g., older adults show difficulties attending to relevant information while ignoring irrelevant information. Considering the rapidly growing aging population, it is crucial to study the effects of music or other types of training as a way to intervene such cognitive deficits. Here we explore whether short-term engagement with different forms of training (music and visual arts) can provide the aging brain with cognitive benefits. Specifically we assess whether or not training can improve attention and inhibitory control which often declines with age.

Participants and Methods: Based on age, education and IQ, older adults (age range: 58-82 years) were pseudo-randomly assigned to either a music training group ($n=18$) or a visual art training group ($n=19$). Each group received either music or visual art lessons with a professional teacher in a class for three months. Cognitive skills were assessed behaviorally with a neuropsychological test battery and a visual Go/NoGo task during electroencephalographic (EEG) recording before and immediately after training.

Results: Following training, both groups demonstrated improvement in Digit Symbol, Stroop, and Cattell. Additionally, the visual art group was faster in color naming compare to pre-training (a subtest of Stroop). Evoked brain responses showed enhanced P3 amplitude in frontal channels of both groups but larger magnitudes in the art group suggesting enhanced attention and inhibitory control.

Conclusions: Results suggests the possibility that music and art training can be an effective intervention for cognitive aging.

Correspondence: *Yunjo Lee, PhD, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: ylee@research.baycrest.org*

**Poster Symposium:
Innovative Approaches to Examining the Long-Term
Outcomes of Survivors of Childhood Brain Tumors**

2:15–3:15 p.m.

Cancer

T.Z. KING. Innovative Approaches to Examining the Long-Term Outcomes of Survivors of Childhood Brain Tumors.

Symposium Description: Medical advances have improved the survival rate of children diagnosed with brain tumors, and significant progress has been made toward understanding the initial predictors and outcomes of children within the first five years of diagnosis. Specifically,

research has suggested the importance of age at diagnosis, socioeconomic status, radiation treatment, white matter integrity, and cognitive processes (processing speed and working memory) in predicting childhood cognitive and adaptive outcomes within the first five years of diagnosis. However, the role of these and other factors in predicting long-term outcomes, has received limited attention and is poorly understood. It is possible that adverse effects of brain tumors and treatment on outcomes may be unrecognized within the first years of recovery and manifest several years later; thereby, highlighting the need for developmentally informed, longitudinal research in this area.

Employing a variety of neuropsychological and neuroimaging techniques (i.e., functional MRI, volumetric analyses, & diffusion tensor imaging) and statistical approaches (e.g. longitudinal modeling, & mediational analyses) to examine cognitive and adaptive outcomes helps enhance our understanding of the resilience as well as the challenges that long-term survivors face. This symposium collectively presents an array of cognitive constructs such as processing speed, working memory, receptive vocabulary, and planning skills to examine outcomes in long-term survivors of brain tumor up to two decades after diagnosis. Comprehensive interdisciplinary and theory-driven research in brain tumor survivorship will: 1) enable the early identification of individuals at risk for adverse long-term outcomes and 2) provide direction to the development of interventions to mitigate the severity of late effects and optimize adaptive outcomes across the lifespan.

Correspondence: *Tricia Z. King, Ph.D., Psychology, Georgia State University, P.O. Box 5010, Atlanta, GA 30302-5010. E-mail: tzking@gsu.edu*

A.S. AILION, T.Z. KING, C. HENRICH & R. MORRIS. Childhood Brain Tumors: A Longitudinal Model of Factors Affecting Socialization Behaviors.

Objective: Medical advances have improved the survival rate of children diagnosed with brain tumors allowing research on long-term outcomes. Prior research suggests that social functioning is negatively affected by brain insults, and may be related to socioeconomic status (Yeates et al., 2004) and receptive vocabulary (Greenham et al., 2010) in children with traumatic brain injuries. The current study examined these hypotheses with children diagnosed with pediatric brain tumors longitudinally using multilevel modeling.

Methods: Using archival data, the sample consisted of 134 children with 459 evaluations, each with 1 to 8 assessments. All participants completed the Peabody Picture Vocabulary Test Revised (PPVT-R), Vineland Socialization Scale, and a measure of socioeconomic status (SES; Hollingshead, 1957). Participants were diagnosed with mixed tumor types and diverse tumor locations. The average SES was 3.08(1.21), average age at diagnosis was 7.31(4.20) years, and average age at the first assessment was 9.08(2.95) years.

Results: Age at exam was used as the temporal variable in the model, and results are based on the best fitting model using chi square difference test (χ^2 diff (2) = 123.66, $p < .00$). Socialization and PPVT-R scores were significantly positively correlated (intercept $\gamma = .19$, $p < .00$ & slope $\gamma = .02$, $p < .00$), as PPVT-R scores increased so did standard scores of socialization behavior. SES also contributed to the decline in socialization scores ($\gamma = -2.18$ $p = 0.02$). Additional factors such as radiation ($\gamma = .81$ $p = .15$), time since diagnosis ($\gamma = .23$ $p = .08$), and age at diagnosis ($\gamma = .55$, $p = .11$) were not significant factors in this model and thus were removed for parsimony. **Conclusion:** These data provide evidence that SES and change in vocabulary ability are associated with changes in socialization behavior. Future research should explore the relationship between receptive vocabulary, SES, and social skills, particularly as it applies to early intervention programs. Correspondence: *Alyssa S. Ailion, P.O. Box 5010, Atlanta, GA 30302. E-mail: tzking@gsu.edu*

T. KING & K. SMITH. Functional MRI Activation to Increased Working Memory Demands Among Long-Term Survivors of Childhood Brain Tumors.

Objective: Working memory is a key cognitive process that is susceptible to disruption in brain injury and related to outcomes of survivors of

childhood brain tumors. Prior fMRI research, in diverse neurological conditions relative to controls, has identified increased recruitment of neural resources during higher load n-back paradigms. We utilized fMRI to examine if long-term survivors of childhood brain tumors would evidence significantly increased activations relative to controls to high working memory demands.

Participants and Methods: 14 survivors of childhood brain tumors and 14 matched controls similar on age (M=23, SD=3, range=18-31), ethnicity (57% Caucasian), sex (57% female), and abstract reasoning (WASI Matrix Reasoning M= 11, SD=3) completed a 3-back fMRI paradigm in a 3T Siemens Trio. Survivors were on average 8 years old at diagnosis (SD=4, range=2-17y), and 15 years since diagnosis with heterogeneous brain tumor histories (71% infratentorial; 57% radiation).

Results: fMRI data processing was carried out using FSL FEAT v5.98. Z statistic images and cluster thresholding determined by $Z > 2.3$, corrected $p = 0.05$ were employed. The contrast of (3+2) - 0 back revealed that survivors evidenced significantly greater activation of the cingulate and temporal pole regions relative to controls. Both groups revealed jointly significant BOLD activation in the cingulate and bilaterally in the prefrontal cortex, superior parietal, insula, and cerebellum. N-back accuracy and reaction time by load were not different between groups.

Conclusion: On high working memory load tasks, long-term survivors of childhood brain tumors evidenced significant activation relative to controls in the context of comparable accuracy performance and reaction times. In addition, many common regions, consistent with working memory network, were activated in both groups. These findings also suggest survivors recruit the temporal pole and cingulate to support working memory performance.

Correspondence: *Tricia King, P.O. Box 5010, Atlanta, GA 30302. E-mail: tzking@gsu.edu*

K. SMITH, T. KING, R. MORRIS & C. HENRICH. The Mediating Role of Processing Speed in Reading-Related White Matter Tract Integrity and Word Reading Skills of Adult Survivors of Childhood Brain Tumor.

Objective: The study examined a theory-based moderated mediation model of the relationship between white matter integrity in the reading system and word reading skill is mediated by processing speed and this indirect effect is present for survivors but not controls. **Participants & Methods:** 37 adult survivors of childhood brain tumor (17 years post diagnosis) & demographically matched typically developing adults participated (age M=24.19(4.51) years, 62% female, 62% Caucasian). FSL Diffusion Toolbox (FDT 2.0) probabilistic tractography identified the dominant white matter pathways between ROIs in the left hemisphere reading system using previously published guidelines; IFG-OT = inferior frontal-occipital fasciculus (IFOF), IFG-PT = arcuate fasciculus (AF), & Parietotemporal-Occipitotemporal connection (PT-OT). Participants completed the WJ-III Letter-Word ID (word reading skills) & Oral Symbol-Digit Modalities Test (oral processing speed). **Results:** Fractional anisotropy of the IFOF and PT-OT tracts were significantly correlated with word reading in survivors ($r = .55$, $.46$, respectively; $p < .05$) and controls ($r = .59$, $< .01$ IFOF). The moderated mediation model was tested using the modmed script for SPSS (Preacher et al 2007) and was significant for IFOF and PT-OT pathways, such that the indirect effect of processing speed was only present for the survivor group (CI: 2.88, 28.33). A control tract (CST) and control task (Grooved Pegboard) were not significant when placed in the model separately. **Conclusion:** Consistent with previous research, the results suggest that the occipitotemporal area, is a critical component of the word reading system in adults. The function of the circuit (IFOF & PT-OT) is similar for both groups, however in long-term survivors of childhood brain tumors symbolic processing speed is the mechanism by which reading and white matter are related. Results align with the developmental cascade model.

Correspondence: *Kristen Smith, P.O. Box 5010, Atlanta, GA 30302. E-mail: tzking@gsu.edu*

M. IVANISEVIC & T. KING. Adult Survivors of Childhood Brain Tumor and Community Living Abilities: The Mediating Role of Planning Skills.

Previous research has shown a relationship between executive skills and Instrumental Activities of Daily Living (ADLs), but not Basic ADLs in dementia. We hypothesized that planning skills, as measured by the Boston Qualitative Scoring System (BQSS) of the Rey-Osterrieth Complex Figure (ROCF), would mediate the relationship between brain tumor diagnosis status and community living skills, but not personal living skills, as measured by the Scales of Independent Behavior-Revised (SIB-R). 36 survivors and 36 neurotypical controls completed the ROCF. BQSS scoring was completed by 2 trained staff with high reliability. 72 informants were administered the SIB-R. Survivors were on average 14 years since time of diagnosis ($SD=5.01$; range=4.6–24.2). Groups were matched on age (Mean=21.99, $SD=3.11$), education level (Mean=13.63, $SD=1.49$) and socioeconomic status (Mean=2.33, $SD=1.23$). Hierarchical regression analyses and bootstrapping (Preacher & Hayes, 2008) were employed to test the total indirect effect of diagnosis status on community living skills through planning skills. Group showed a significant relationship with community living skills ($\beta=-.270$; $p=.02$, $R^2=.07$). The relationship between group and community living skills was not significant when planning skill was entered into the regression model, while planning skills was significantly predictive of community living skills ($\beta=.239$; $p=.04$, $R^2=.13$). Bootstrapping (5000 samples) confirmed the significance of the indirect effect of group on community living through planning ($B=-.10$, $CI.95=-.7.22, -.11$). The mediation relationship was not present with personal living skills ($B=-.02$, $CI.95=-.7.13, .04$). These data suggest that planning accounts for the relationship between a childhood brain tumor diagnosis and community living skills in a group of young adults. These findings suggest the importance of planning skills in more complex everyday functions rather than basic self-care skills in adult survivors of childhood brain tumor.

Correspondence: *Mirjana Ivanisevic, P.O. Box 5010, Atlanta, GA 30302. E-mail: tzking@gsu.edu*

R. JAYAKAR & T. KING. Hippocampal Volume and Verbal Memory Skills in Long-Term Survivors of Childhood Brain Tumors.

Extant research demonstrates that a complex network of cognitive processes, supported by multiple brain regions, contributes to learning/memory. It has been shown that diagnosis and treatment for brain tumors (BT), in children, pose a risk for disruptions to a developing memory system. However, most research lacks a developmental perspective. We assessed (1) if adult survivors of childhood BT have smaller hippocampal volume relative to controls (2) the association between hippocampal volume & verbal learning & memory skills. 31 survivors & 31 controls were compared on hippocampal volume. CVLT performance on List A Trials 1-5 Total (verbal learning), Long Delay Free Recall (LDFR), and recognition discriminability were analyzed. Groups did not differ on age ($M=23.9$), gender (53% F), and ethnicity (60% Caucasian). Survivors were on average 16.9 yrs ($SD=6.2$) post-diagnosis. There was a significant association (one-tailed $p<.05$) between hippocampal volume & verbal learning $r(60)=.28$, & LDFR $r(60)=.24$, but not recognition discriminability $r(60)=.15$, $p=.13$. Thus, larger hippocampal volume was correlated with better verbal learning and recall ability. Hippocampal volume, $t(60)=-3.14$, one-tailed $p<.01$, was significantly lower for survivors. Post-hoc analyses showed that controls had significantly higher hippocampal volume compared to survivors who had radiation therapy; but there were no significant differences compared to survivors who did not have radiation. Long-term adult survivors of childhood BT exhibited lower hippocampal volumes, suggesting that disease and treatment related disruptions to a developing memory system may be seen almost two decades after diagnosis. In addition, lower hippocampal volume was associated with poorer verbal learning and long term memory, but not recognition. These findings emphasize the importance of using multiple CVLT indices to understand brain substrates that are believed to support learning and memory.

Correspondence: *Reema Jayakar, P.O. Box 5010, Atlanta, GA 30302. E-mail: tzking@gsu.edu*

Poster Session 3: Aging/Assessment (Child)/Imaging

2:15–3:15 p.m.

Aging

K. AGBAYANI & M. HISCOCK. Model comparisons of age-group differences in IQ after accounting for the Flynn effect.

Objective: Previous studies found that the Flynn effect accounts for a large proportion of the differences in norms for various age groups on the Wechsler intelligence tests. It appears to mask age-related gains on Verbal while exaggerating declines on Performance scale subtests. Thus after adjustment for the Flynn effect, IQ remains relatively stable across a large segment of the lifespan. The purpose of the current study is to replicate and refine prior studies of the Flynn effect by comparing methods of calculating age group differences in IQ for a cohort across successive revisions of the Wechsler test.

Participants and Methods: The cohort followed consisted of individuals aged 38 during norming of the 1955 WAIS, making them 63 during norming of the WAIS-R, and 80 during norming of the WAIS-III. Three models of estimating the true aging effect (TAE) for this cohort were compared. They differed in methods used to determine the magnitude of the Flynn effect. Model 1 used published Flynn effect estimates; Model 2 calculated the Flynn effect from raw scores for each version of the Wechsler test; Model 3 assumed the absence of a Flynn effect within the cohort.

Results: For Verbal subtests, an average TAE of -0.6, +0.6 and -0.2 scaled-score (SS) units per 50 years was found for Models 1, 2 and 3, respectively. For Performance subtests, an average TAE of -3.3, -1.4 and -2.2 SS units per 50 years was found for Models 1, 2 and 3, respectively. The overall TAE across subtests was -1.8, -0.3 and -1.1 SS units per 50 years was found for Models 1, 2 and 3, respectively.

Conclusions: Results are consistent with previous findings of relatively stable IQ across the adult portion of the lifespan after adjusting for the Flynn effect. Change in verbal abilities is small while Performance scale abilities show modest declines with age. Model comparisons suggest that Model 3 provides the most precise estimate of the Flynn effect. Model 1, used in the previous study, may underestimate the Flynn effect's influence but Model 2 may overestimate it.

Correspondence: *Kristina Agbayani, M.A., University of Houston, 7009 Almeda Rd., Apt. #835, Houston, TX 77054. E-mail: kaagbayani@gmail.com*

G.L. ANDREWS. Left Frontal Lobe Damage: A Case Study in Long-Term Effects.

Objective: The present case study highlights challenges of 39 years post head injury in the life of a left-handed male.

Participants and Methods: TS sustained injury to his left frontal and left posterior temporal during a motorcycle accident that occurred in the 1970s while serving in the Peace Corp. TS was taken to a small clinic with injuries to his left shoulder, rib cage, left leg, multiple broken bones, and a fractured skull, superior left to his left orbit/sinus region. He remained in a coma for at least 40 days while a missionary doctor monitored him. TS was flown to a nearby city hospital for initial surgeries after which he was transported to a U.S. Naval hospital. Following multiple surgeries over the next year, he returned to active duty, but was unable to remain due to difficulties with cognitive and emotional regulation.

In the 35 years since TS completed 2 master's degrees and attempted employment several times with remarkable but short-lived success. He

has suffered from seizures, GI distress, pain, clinical depression, and anxiety with noticeable decline in the past 5 years. His MRI revealed atrophy of approximately 75% of the left frontal lobe. The inferior, posterior left temporal area showed atrophy as well. His left sinus cavity is enlarged with tear duct damage and vulnerability to sinus infections.

Recent treatments included weekly therapy sessions, case management to facilitate meeting medical needs. Neuropsychological testing was completed in the past year including intelligence, executive functioning, and memory.

Results: Results indicate TS has above average intelligence, average memory for verbal information, and average to above average executive functioning abilities. His visual memory is slightly impaired but visual reasoning is average.

Conclusions: TS has no loss of language functions. His intellectual functioning and memory have declined but his difficulty with emotional regulation and managing daily stressors causes the most impairment.

Correspondence: *Glena L. Andrews, Ph.D., Behavior Science, Northwest Nazarene University, 623 S University Blvd, Nampa, ID 83686. E-mail: glandrews@nnu.edu*

E. BAENA & L. RYAN. The Effects of Age and Increasing Task Difficulty on the Neural Correlates of Semantic Knowledge and Episodic Memory: An fMRI Investigation of Functional Compensation.

Objective: Recent neuroimaging studies have shown that older adults engage bilateral frontal regions to a greater degree than young adults during memory tests, suggesting that older adults compensate for increasing task difficulty leading to better performance. However, whether the compensation response is specific to older adults or represents a more general response of any individual to increasing task difficulty is unclear.

Participants and Methods: The present fMRI study compared patterns of brain activation of 23 young (ages 18-26) and 24 older healthy adults (ages 60-75) while performing two memory tasks –episodic and semantic– as task difficulty increased. Difficulty was manipulated with word frequency. In the semantic task, participants judged whether pairs of words were either synonyms or antonyms. In the episodic task that followed, participants made yes/no recognition judgments for the word pairs previously presented.

Results: Behavioral results showed a double dissociation –older adults were adversely affected in the episodic but not the semantic task, while young adults were adversely in the semantic but not the episodic task. fMRI activations showed linear increases in bilateral frontal and parietal regions as a function of task difficulty in the older adults, for both tasks. In young adults, increases in left inferior frontal gyri were observed only as difficulty increased in the semantic task.

Conclusions: The results suggest that both young and older adults may demonstrate functional or strategic compensatory processes in the face of increasing task difficulty. Yet young adults show increased activation only at the hard version of the semantic task– paralleling their behavioral results. But older adults show increases in activation for both tasks, regardless of their behavioral performance. This suggests that young adults show a compensation response that is more task-network related, while older adults show a fronto-parietal compensation network that is task-independent.

Correspondence: *Elsa Baena, MA, Psychology, University of Arizona, 1503 E University Blvd., P.O.Box 210068, Tucson, AZ 85721. E-mail: ebaena@email.arizona.edu*

M. CHAPLEAU, M. WILSON & S. BRAMBATI. Reading aloud skills: their positive redefinition through aging.

Objective: Computational models claim the existence of two different reading procedures: 1) subword processes for the pronunciation of regular words without semantics or pseudowords ('ked'); 2) whole-word processes that recruit item-specific information regarding the pronunciation of words with atypical orthography-to-phonology mappings, i.e., exception words ('yacht'). Young readers are expected to

rely more heavily on subword strategies so that low-frequency exception words are often pronounced as spelled (regularised). This effect is predicted to be less marked in the elderly, as experience with the orthographic form and word semantics increase. However, little is known on the effect of aging on exception word reading, which is the aim of this study.

Participants and Methods: We compared reading abilities between 17 young (mean age=22) and 17 older (mean age=71) adults in an experimental reading task including low-frequency regular (RW), exception (EW) and pseudo- words (PW).

Results: A significant effect of word type, group and the interaction word type by group was found for errors. Young adults made significantly more regularisation errors than older subjects (55 vs. 81% of the total) for EWs with no difference in RTs. Conversely, young readers read PW significantly faster. To determine the impact of word knowledge on reading performance in the young, EW knowledge was tested with a word-picture matching task. Results showed no significant relationship between regularisations and word knowledge.

Conclusions: These results indicate that low-frequency EW reading abilities improve over the lifespan. The fact that young readers were faster than the elderly for PW reading, together with a larger number of regularisation errors, suggests that they relied on sub-word processes to a larger extent than the elderly. Additionally, the lack of a relationship between the EWs they mispronounced and their knowledge of these words indicates no reliable semantic mediation for rapid reading aloud. Correspondence: *Simona Maria Brambati, Centre de Recherche - IUGM, 4565, Chemin Queen-Mary, Montreal, QC H3W1W5, Canada. E-mail: simonabrambati@gmail.com*

T. BROWN, D. ZAMORA, L.S. BAJWA, S.M. GARCON & P.J. DONOVICK. The Relationship Between Education and Problem Solving Ability in Older Adults in a Stereotype Threat Context.

Objective: Education moderates memory in people of all ages within a stereotype threat context (Andreoletti & Lachman, 2004). We examined the relationship between education and problem solving ability in older adults under positive, negative, and neutral stereotype threat conditions.

Participants and Methods: Adults aged 60+ (N=75) were recruited and assigned to a positive, neutral, or negative priming condition. They were told that they would perform better, the same as, or worse than younger adults on problem solving tests respectively. Participants were administered the Raven Standard Progressive Matrices.

Results: Participants were on average 74 years old and had 15 years of education for all groups. Raven scores were highest in the negative (M=46.0;SD=5.4), followed by the positive (M=40.4; SD=7.8), and the neutral group (M=36.9; SD=6.5) ($F(1, 75) = 1.1, p=0.06$). There was a positive correlation between education and Raven scores in the positive ($r=0.289, p=0.06$) and negative ($r=0.35, p=0.05$) groups, but no significant correlation in the neutral group ($r=-0.024, p=0.933$).

Conclusions: The high scores of the positive group can be taken as evidence of positive priming. The apparently paradoxical even higher scores of the negative group may be attributed to the fact that the negative priming motivated them to perform well. This conclusion is supported by the fact that it took longer for this group to complete the matrices. Also, it appears that higher education is associated with better performance in the positive and negative groups, but has no effect in the neutral group. A possible explanation for the lack of correlation in the neutral group is that being told that people of all ages perform the same discourages educated individuals by downplaying their advantage.

Correspondence: *Taylor Brown, Psychology, Binghamton University, 4 Old Dutch Road, Warren, NJ 07059. E-mail: brownt@lafayette.edu*

D. CARR, O. HEMMY ASAMSAMA & K.J. MILLER. Interaction of Executive Functioning and Mood on Memory, Global Cognition and Activities of Daily Living (ADLs) in Older Adults at Follow-Up.

Objective: To identify interactions of executive functioning and mood that may be predictive of cognitive decline and ADLs in older adults.

Background: Neurodegenerative processes rarely affect singular domains (Bour et al., 2011), rather specific deficits create a profile indicative of cognitive decline. Mood disturbances (i.e., depression; Tam & Lam, 2012) and changes in executive functioning (Bieman et al., 2011) are significant predictors of decline. Hybels and colleagues (2009) found that over the span of 10 years, depression predicted a decline in ability to perform ADLs within 3 to 4 years. The current study examines whether an interactive modeling of mood and executive functioning accounts for differences in prediction of follow-up memory performance and activity levels.

Participants and Methods: With 89 participants (age $M = 62.44$; $SD = 11.45$). No significant differences between gender, education, age, and IQ emerged. Executive functioning (Stroop C) was split into two groups (<-0.50 SD, $>+0.50$ SD). Depression was assessed by participant responses to the Geriatric Depression Scale. Memory was assessed at least 1 year later by Logical Memory Delay scores. Global cognition was measured by the MMSE. Activity levels were measured by a questionnaire (Cognitive Symptoms Checklist). Follow-up Stroop scores were covaried out of model.

Results: The models for each ANOVA were significant, p values range from .000 to .004. Additionally, there was a significant interaction of executive functioning by depression in memory, $p = .033$, and ADLs, $p = .047$. Those with moderate depression and poorer executive performance had the worst scores for memory and ADLs at follow-up compared to all other combinations. The interaction predicting global cognition failed to reach significance, $p = .081$, but demonstrated the same trend.

Conclusions: This study suggests that executive functioning and depression affect cognition later in life, and may predict decline.

Correspondence: *Drew Carr, M.A., Fuller School of Psychology, 570 N Los Robles Apt 11, Pasadena, CA 91101. E-mail: drew.r.carr@gmail.com*

D. CARR, S. DEBOARD-MARION & M. HARRINGTON. Examining the relationship between blood pressures, triglycerides, lipids and executive functioning in cognitively healthy older adults.

Objective: Research indicates a positive relationship with blood pressure, lipids, and cognitive decline (Li et al., 2011). Nevertheless, blood pressure has been shown to markedly decrease three years prior to dementia (Qui et al., 2004), and low blood pressure was shown to reduce cognitive performance (Duschek et al., 2003). Similarly, Solomon (2007) found that decreases in cholesterol through midlife predict later impaired cognitive status. The current study examines the impact of varying levels of normal blood lipids and blood pressures on cognitive performance in older adults.

Participants and Methods: This cross sectional study recruited from news articles and local referrals. Blood pressures (systolic and diastolic) and lipids (HDL, LDL, and triglycerides) were assessed by standard methods. Participants with abnormal pressures or lipids were removed from the analyses. WMS-III Logical Memory, Trailmaking (Tombaugh), Stroop (Kaplan), and WAIS-III subtests were age standardized. Statistics were derived from the continuous physiological variables from standard methods using SPSS.

Results: 66 participants (age $M = 76.31$, $SD = 7.41$) had no significant differences of gender, age, or education (except on WAIS-III Information), and were within normal limits for systolic and diastolic blood pressures, triglycerides, HDLs and LDLs. Two-tailed bivariate correlations found positive relationships: diastolic pressure by Trails B, $p = 0.047$; triglycerides by Trails B, $p = 0.033$; HDLs by Matrix Reasoning, $p = 0.021$; LDLs by Sequencing, $p = 0.040$; and triglycerides and digit span, $p = 0.036$. Negative relationships were found for memory and verbal domains: systolic pressure by memory, $p = 0.047$; diastolic by memory, $p = 0.003$, and diastolic by information, $p = 0.027$.

Conclusions: This study suggests that lower levels of lipids and blood pressures within the normal ranges, may improve memory for older adults but reduce performance in executive functions.

Correspondence: *Drew Carr, M.A., Fuller School of Psychology, 570 N Los Robles Apt 11, Pasadena, CA 91101. E-mail: drew.r.carr@gmail.com*

D. CARR, S. DEBOARD-MARION & M. HARRINGTON. Additive models of dementia risk factors on cognitive dysfunction in a cognitively healthy older adult sample.

Objective: Research indicates hypertension, diabetes, cerebrovascular diseases, and hypercholesterolemia increase the risk for dementia conversion (Li et al., 2011). People with these factors at midlife often demonstrate cognitive decline and brain atrophy (DeBette et al., 2011). Less is known about how the accumulation of risk factors affects cognitive performance in an older, cognitively healthy sample.

Participants and Methods: This cross-sectional study recruited participants from news articles and local referrals. Hypertension, body mass index, cholesterol, and fasting glucose levels were assessed by standard methods. Participants were separated into three groups: healthy controls, one risk factor, or two or more risk factors. Memory was assessed by WMS-III Logical Memory II (LMII) and Rey-O three-minute delay. Processing speed was assessed by Trailmaking Test A (Kaplan). Statistics were derived from standard methods using SPSS.

Results: 70 cognitively healthy participants (age $M = 77.21$, $SD = 6.77$) with or without dementia risk factors were not significantly different for gender, age, or education. For Rey-O delay, the groups performed incrementally worse with more risk: zero risks $M = 2.00$, one risk $M = 1.03$, and two risks $M = 0.67$. For LMII, the groups also performed incrementally worse with more risk: zero risks $M = 2.00$, one risk $M = 1.00$, and two risks $M = 0.54$. For Trails A, the groups performed differently with each added risk: zero risks $M = 0.13$, one risk $M = 0.90$, and two risks $M = 0.69$.

Conclusions: This study suggests that the number of risk factors additively influence visual and verbal memory domains. For memory and information, those with zero risk factors had the highest level of performance and additional risk factors progressively decreased this performance, while for processing speed, those with zero risk factors had the worst performance.

Correspondence: *Drew Carr, M.A., Fuller School of Psychology, 570 N Los Robles Apt 11, Pasadena, CA 91101. E-mail: drew.r.carr@gmail.com*

R. GALIOTO, M. ALOSCO, M. SPITZNAGEL, K.M. STANEK & J. GUNSTAD. Cognitive reserve preserves cognitive function in obese individuals.

Objective: Obesity is an established risk factor for cognitive impairment. Theories of cognitive reserve suggest that premorbid factors, such as intellectual ability, may attenuate the expression of cognitive impairment due to age or disease. The current study examined whether cognitive reserve, defined as estimated premorbid intellectual ability, moderates the relationship between obesity and cognitive function in obese adults.

Participants and Methods: Participants without major medical or psychological conditions completed the Integneuro, a computerized battery of neuropsychological tests. Scores were calculated for the following domains: attention/executive function, memory and verbal fluency by averaging the z-scores for the tests which comprised these domains. Premorbid intellectual ability was assessed using a computerized adaptation of the Spot the Real Word test.

Results: Bivariate correlations revealed a significant association between BMI and memory ($r = 0.14$, $p < .01$) and attention/executive function ($r = 0.17$, $p < .01$) but no such association emerged for verbal fluency. Hierarchical regression models found a significant interaction between cognitive reserve and BMI such that the combination of high cognitive reserve and low BMI was associated with the best performance in attention/executive function ($\beta = 0.092$, $p < .01$) and memory ($\beta = -0.086$, $p < .05$). No such pattern emerged for verbal fluency as the interaction term was not significant ($\beta = 0.002$, $p > .05$).

Conclusions: The present study adds to the growing evidence that BMI is independently associated with reduced cognitive performance and demonstrates that cognitive reserve moderates the association between obesity and cognitive function. Longitudinal studies examining the possible influence of cognitive reserve on cognitive decline in obese older persons are needed to clarify its influence, particularly studies that include neuroimaging.

Correspondence: Rachel Galoto, BS, Kent State University, 1684S Willow Wood Dr, Strongsville, OH 44136. E-mail: rmgaloto@gmail.com

S.D. HAN, J.M. ALLMAN, K. ARFANAKIS, D.A. FLEISCHMAN, B.A. PATRICIA & D.A. BENNETT. Neuroimaging of Temporal Discounting and Memory Networks with a Frontal Insular Cortex Seed.

Objective: Von Economo Neurons (VENs) are a distinctive feature of fronto-insular cortex (FI) and may serve as a rapid relay of information from this area to other brain regions in the context of social decision-making. We investigated the functional connectivity of the frontal-insular cortex, and its relation to temporal discounting, the tendency to discount the value of larger but delayed rewards over smaller rewards available immediately.

Participants and Methods: One hundred and thirty-five nondemented older adults (mean age=83.10, male/female=28/104, mean MMSE=28.42) from the Rush Memory and Aging Project were scanned using a resting-state functional MRI sequence. A 4 mm radius spherical seed ROI was prescribed in the right (MNI coordinates: x=38, y=26, z=-10) and left FI (MNI coordinates: x=-38, y=26, z=-10) to quantify the functional connectivity association with temporal discounting, accounting for age, education, sex, and total gray matter volume.

Results: Voxel-wise differences ($p < 0.001$) in functional connectivity were observed such that the left FI correlated directly with regions in the right medial frontal ($t=3.7079$), right inferior temporal ($t=3.4123$), and left middle temporal gyrus ($t=3.7862$); and inversely with regions in the left temporal pole ($t=-3.7528$), bilateral parahippocampal gyrus (left $t=-4.3032$; right $t=-3.9059$), bilateral cerebellum (left $t=-3.7052$; right $t=-4.5180$). Interestingly, these associations were not seen with the right FI seed.

Conclusions: In older adults who exhibited higher levels of temporal discounting, greater connectivity was observed between the left FI and medial frontal regions. Older adults who exhibited less discounting showed greater connectivity between the left FI and memory networks. These results have implications for financial decision-making in older adults.

Correspondence: S. D. Han, PhD, Behavioral Sciences, Rush Alzheimer's Disease Center, 600 S. Paulina St., 1022, Chicago, IL 60612. E-mail: Duke_Han@rush.edu

A.J. ISOMURA-MOTOKI, Y. FUJITA, A. YAMAMOTO, S. IJIMA & M. MIMURA. At-Risk Older Drivers in Japan and Their Awareness.

Objective: Number of older drivers is rapidly increasing in Japan. Since 2009, individuals who are over 75 of age are required to take a cognitive screening test as well as a required "older drivers' driving seminar" for their licensing renewal. These requirements have been effective to identify who have significant cognitive dysfunction; however, those who are at-risk due to mild cognitive declines remain unidentified. This study was conducted to identify awareness of community dwelling older drivers in regard to their physical and cognitive changes and risks of driving and purposes of their driving.

Participants and Methods: 3967 older drivers, who took cognitive screening tests at designated driving schools, participated in this study. Each participant was provided with a questionnaire which consisted of questions such as purposes of own driving, frequency of driving, his/her awareness of risks of own driving, awareness of cognitive/physical changes, actual number of at-risk incidents.

Results: Participants were categorized based on their cognitive status into three groups (i.e., none, mild, and moderate-severe impairments) and cross tabulations were used to analyze the data. A number of significant group differences are observed. They include purposes of driving, frequency of driving, awareness of own physical/cognitive changes, incidents of at-risk driving in the past, intention of returning the license, and reasons for license renewal.

Conclusions: The results indicate that many of them who exhibit cognitive declines continue to drive every week. Those who exhibit

more significant cognitive declines have reduced a number of driving. Further, individuals who display more significant cognitive impairments indicate intentions to return their licenses; however, those who actually have returned their licenses remain a few. Further research is essential to reduce driving associated risks among older drivers.

Correspondence: Angelica J. Isomura-Motoki, Ph.D., Dept. of Neuropsychiatry, Keio University School of Medicine, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan. E-mail: angelica.isomura@gmail.com

B. KIM, S. KIM, J. KIM & H. KIM. Categorization of topic shift in autobiographical narratives of normal elderly.

Objective: Off-topic speech of the elderly has been widely investigated. However, the methodologies of discourse analyses concerning old people verbosity were mainly focused on individual word level. Thus, the purpose of the current study is to investigate meaning relationship about topic itself and how the relationship appears during narrative discourse.

Participants and Methods: Fourteen normal elderly women (age: 77.21 ± 5.2 , range: 66~85), with over 6 years of education and normal MMSE, completed autobiographical narrative task (e.g., raising children). The number of topic shift was counted and each topic shift was categorized by types (i.e., inserting, initiation, shading, and renewal) and by causes (i.e., decreased understanding, anecdotal speech, end of topic, and repetition of an idea).

Results: The results showed that among the topic types, inserting and initiation were 52% and 32%, respectively. The primary cause, 64% of topic shift, was 'anecdotal speech,' followed by 'decreased understanding of the topic' (20%).

Conclusions: The most prevalent type of topic shift was inserting, which was episodic and egocentric speech. This finding supports the pragmatic change hypothesis which indicates that older adults' communicative goals focus on life experience rather than conciseness in their personal narratives. In addition, when they were not able to be attentive to the question, or when they misunderstood it, they initiated topic about their personal experience, instead of focusing on the target topic.

The main reason for topic shift was 'anecdotal speech.' While producing on-topic speech, they should process the stored information about the past events concerning the target topic. But they digressed from the main topic into anecdotal speech, which may partly due to weakened inhibitory process. From the results of this study, we recommend that caregivers or clinicians who communicate with the old call their attention to conversation and remind them of topic more often.

Correspondence: Bo Seon Kim, Yonsei University, 101-1309 LineAPT DeungChonDong GangSeogu, Seoul 157-838, Republic of Korea. E-mail: fatalfair12@gmail.com

B.B. KIM. Gender Differences in Estimating Performance Speed on Instrumental Activities of Daily Living.

Objective: Studies have shown that men exhibit greater self-report bias than women when asked to rate their own performances in various tasks such as driving (McKenna, Stanier, & Lewis, 2002) and mental arithmetic on IQ tests (Furnham, 2001). However, it has yet to be determined whether self-report bias is present in the way older adults report the ability to perform instrumental activities of daily living (IADLs). The current study explores differences in self-reporting tendencies between older men and women on IADL assessments.

Participants and Methods: 65 community-dwelling adults aged 60-87 ($M=70.38$; 67% women) with 10-22 years of education ($M=14.26$, $SD=2.62$) completed Timed Activities of Daily Living (TIADL) test, and were asked to estimate whether they thought their speed on the TIADLs was faster, slower, or comparable to their peers. All scores were converted to z-scores to allow within-subjects comparisons.

Results: Repeated measures Analysis of Variance (ANOVA) using assessment Mode (i.e., performance speed vs. self-report of performance

speed) as a within-subjects factor and Gender as a between-subjects factor showed an interaction between Mode and Gender [$F(1,57)=4.986$, $p=.029$], with men and women performing at a comparable speed, but men estimating their performance as faster than that of their peers. The results held even after controlling for age, education, and cognitive status.

Conclusions: Although women and men performed comparably on the TIADLs, men overestimated their own performance over that of their peers. This is important considering that self-report is a major component of evaluating functional independence/difficulties in community-dwelling older adults.

Correspondence: *Borah B. Kim, BA, Psychology, University of Utah, 220 E 3300 S Apt 133, Salt Lake City, UT 84115. E-mail: borah.kim@utah.edu*

J. KIM & H. KIM. The Performance in MMSE in the Elderly of Rural versus Urban Communities.

Objective: The available normative data for most neuropsychological instruments are largely based on highly educated, urban-dwelling adults. Thus, it seems unreasonable to strictly apply cut-off scores to rural seniors based on normative data derived from urban-dwelling adults. This study aims to compare the performance of urban and rural seniors on MMSE and examine how demographic variables affect their performances.

Participants and Methods: 120 participants were recruited from all residents aged 65 or over in two areas (50% each, Seoul vs Gyeong-buk) of South Korea in 2011-2012. We administered MMSE and GDS to each subject and screened them based on the Korean normative data. Between the rural and the urban elderly groups, there was no significant difference in age (76.45 ± 6.02 , 77.30 ± 5.82 , respectively) ($p=.433$) as well as in years of education ($M=2.80\pm 1.13$, $M=1.89\pm 1.04$) ($p=.056$). We also analyzed demographic variables to determine their impact on seniors' performances on MMSE with a multiple regression analysis.

Results: As a results, the rural group ($M=23.60\pm 3.59$) showed a significantly lower total MMSE score than the urban group ($M=26.36\pm 3.19$) ($p<.001$). Furthermore, the rural group performed significantly lower than the urban group in some sub-domains (time orientation: $p=.004$; memory recall: $p<.001$; language: $p<.001$) of MMSE. In the urban elderly group, age, years of education, family structure (e.g., alone, with offspring, with spouse) were associated with the MMSE scores ($R^2=.267$, $F=5.944$, $p=.002$), whereas age alone was associated with MMSE in the rural sample ($R^2=.113$, $F=7.424$, $p=.008$).

Conclusions: The group difference may imply that one's place of dwelling or the urban-rural distinction is among the critical factors that must be accounted for when conducting a neuropsychological test for seniors. There is a need to revisit the existing practice of clinical neuropsychological testing, in which cut-off scores applied to rural seniors based on normative data derived from urban-dwelling adults.

Correspondence: *JungWan Kim, Ph.D., Daegu University, Jillyang, Gyeongsan, Gyeongbuk 712-714, Gyeongsan 712-714, Republic of Korea. E-mail: kimjungwan@daegu.ac.kr*

S. KIM & H. KIM. Effect of Active Communication Behaviors in Daily Living on Cognition and Language Abilities of the Elderly.

Objective: To describe communication behaviors in daily living of the elderly and to examine its relation to MMSE, COWAT, and BNT scores

Participants and Methods: One hundred and six normal, literate elderly over 65 years old (men : women = 14 : 92, mean age = 77.26 ± 5.38) filled out the following 4-item questionnaire (scoring categories): Q1) How often do you talk in everyday life? ('TALKING') (seldom, sometimes, frequently); Q2) How often do you read in everyday life? ('READING'); Q3) How often do you write in everyday life? ('WRITING'); and Q4) How many hours do you participate in daily conversation? ('CONVERSING TIME') (<30 min, 30 min~1 hr, 1~2 hrs, 2 hrs<). We also administered MMSE, COWAT, and BNT. MANOVA was used to compare cognition/language scores among the three scorings (i.e., 'seldom', 'sometimes', 'frequently') for the first three items and those among four scoring categories for conversing time.

Results: 44%, 39%, 17% of the elderly on TALKING; 57%, 21%, 22% on READING; 69%, 21%, 10% on WRITING reported 'seldom', 'sometimes', 'frequently', respectively. In addition, 26%, 22%, 22%, 30% answered '<30 min', '30 min~1 hr', '1~2 hrs', '2 hrs<', respectively on CONVERSING TIME. All scoring categories on TALKING ($p=.001$), READING ($p=.047$), WRITING ($p=.002$), and CONVERSING TIME manifested significant differences in MMSE score. The three scoring categories on WRITING ($p=.029$) also manifested significant differences in COWAT ($p=.004$) and BNT scores ($p=.001$).

Conclusions: Even though they are literate, reading and writing activities were performed less frequently than talking because of vision problem and less opportunity. The conversing time was distributed to various scoring categories depending on their life style (i.e., hours they stay in senior centers). The more frequently they talk, read, write, and converse in everyday life, the better they perform in cognition and/or language tests. Active communication behaviors in daily living might help to maintain cognition and language of older people.

Correspondence: *Soo Ryon Kim, Speech and Language Pathology, Yonsei University, 311-1006 SangnokMaeul Woosung Apt., Jeongja-dong, Bundang-gu, Seongnam-si 463-786, Republic of Korea. E-mail: azzigom@naver.com*

F.M. LALONDE & J.N. GIEDD. Gender Differences in Cortical Thinning Associated With Normal Aging and Alzheimer's Disease.

Objective: To investigate the effects of normal aging and gender on reductions in cortical thickness in a group of healthy elderly (HE) and Alzheimer's disease (AD) patients. More specifically, to analyze possible interactions between age and gender across groups.

Participants and Methods: MRI scans from a total of 189 HE participants (71 men, 118 women) and 33 AD patients (19 men, 24 women) met quality control standards and completed image processing through the CIVET pipeline. Men and women within the HE group did not differ from each other in terms of age, education, or score on the Mini-Mental Status Examination (MMSE). The same was true for the AD group. The HE and AD groups, however, differed significantly with respect to age and MMSE score.

Results: A mixed model ANOVA with age entered as a covariate was performed on 40962 vertices in each hemisphere. After correction for multiple comparisons, AD patients of both genders had significantly thinner cortex in the right inferior temporal gyrus compared to HE individuals ($t = 4.39$, $p < .0001$). The effect of age was also significant ($t = -2.43$, $p < .05$; older participants having thinner CT). There was no significant effect of gender when the data were collapsed across groups. A significant group by gender interaction indicated that the reduction in CT between HE and AD was significantly greater in males compared to females. Although healthy males had the thickest CT, AD results in a greater loss of CT for them. In fact, mean CT for AD males was lower than mean CT for AD females.

Conclusions: The results suggest that differences in cortical thickness between healthy elderly males and females become obscured by overall cortical thinning due to Alzheimer's disease. Although males begin with greater cortical thickness, they experience greater cortical thinning as a consequence of the disease and ultimately male and female AD patients present with indistinguishable patterns of regional cortical thickness throughout the brain.

Correspondence: *Francois M. Lalonde, Ph.D., Child Psychiatry Branch, NIMH/NIH, 10 Center Drive, Bethesda, MD 20892. E-mail: flalonde@mail.nih.gov*

S. LEE, S. KIM, J. KIM & H. KIM. Interval-based analysis of verbal fluency performance in the elderly.

Objective: Performance of semantic fluency tasks may dependent on inherent organization of semantic knowledge. The current study is to investigate difference on a measure of performance on each 5-second interval for 30 seconds across the different educational levels in the elderly.

Participants and Methods: The subjects included 71 old adults, ranging from 65 to 91 years ($M = 75.7$; $SD = 6.3$) and they were stratified into four educational groups (group 1: 0 year; group 2: 6-8 years; group 3: 9-11 years; and group 4: more than 12 years). None of the subjects had a history of neurological or psychological disorders. All subjects scored within the normal range ($M = 26.2$; $SD = 2.4$) on the MMSE. Three measures were analyzed: (1) the total number of animal names produced during the whole 30 s; (2) the number of the animals produced in each 5-second interval within 30 s; and (3) the time of the first word produced during the entire 30 s.

Results: The results are as follows: First, the total number of animal names during the entire 30 s was significantly smaller in group 1 compared to group 4 ($p = .010$). Second, we observed significantly smaller number of animal names in the first (0-5 sec) and the third (11-15 sec) intervals in group 1 compared to group 4, and in group 2 compared to group 4. Lastly, it took significantly more time in group 1 compared to group 4 to produce the first animal name.

Conclusions: Based on the results, we hypothesize that the elderly with higher educational level have better 'cognitive reserve' and 'cognitive efficiency'. The older adults with high education expand the network of semantic knowledge rapidly and are easy to produce the words in individual's verbal knowledge automatically.

Correspondence: *Seon Ha Lee, Yonsei university, 1501, 58-1, Songpa 1-dong, Songpa-gu, Seoul, Korea, Seoul 138-849, Republic of Korea. E-mail: taddybear7@naver.com*

B. LEMONDA & R. HOLTZER. The Association between High Neuroticism/Low Extraversion and Dual Task Performance in Healthy Older Adults.

Objective: Personality dimensions, in particular the combined effect of high neuroticism (N) and low extraversion (E), are related to cognitive functions, however their relationship to dual-task performance has not been examined. Because aging has a negative effect on dual-task performance, we examine whether individual differences in personality dimensions are related to dual-task decrements (DTD) in non-demented older adults. Specifically, we predict that the combined effect of high N and low E will be related to greater DTD.

Participants and Methods: Participants were non-demented older adults ($n=293$, age range=65-95, female=133). They completed the Big5 inventory and single and dual task paradigms where they were asked to: 1) walk at a "normal pace," 2) perform serial 7's subtraction while standing still, and 3) walk while performing serial 7's subtractions. Gait velocity was obtained using an instrumented walkway. Serial 7's performance was assessed by calculating accuracy ratio: [number of correct responses] / [number of total responses].

Results: Two separate 2 (single vs. dual condition) x 4 (N/E personality combination group: High N/Low E, Low N/High E, High N/High E, and Low N/Low E) repeated measures ANOVA models were run with serial 7's performance and gait velocity as dependent variables. Results revealed significant main effects in DTD for gait velocity ($p < .001$) and serial 7's performance ($p < .001$). Two-level interactions of task condition by group were significant for performance on serial 7's, ($p < .05$), and gait velocity, ($p < .05$). Contrast analyses revealed that the High N/Low E group demonstrated greater DTD in gait velocity compared to the Low N/High E group ($p < .01$) and greater DTD in serial 7's performance compared to the Low N/High E ($p < .05$) and High N/High E ($p < .01$) groups.

Conclusions: The combined effect of high neuroticism and low extraversion interferes with the allocation of attentional resources to competing task demands.

Correspondence: *Brittany LeMonda, Master's of Arts, Ferkauf Graduate School of Psychology, 1165 Morris Park Avenue, Bronx, NY 10461. E-mail: brittanylemonda@gmail.com*

J.R. MAHONEY, J. VERGHESE, K. DUMAS & R. HOLTZER. Visual-Somatosensory Integration in Aging: Does Space Really Matter?

Objective: Individuals are constantly bombarded by various sensory stimuli that must be integrated efficiently. Such multisensory integra-

tion (MSI) is said to be governed by stimulus properties including space, time, and magnitude. While there is a paucity of research detailing MSI in aging, we have demonstrated that older adults reveal the greatest reaction time (RT) benefit when presented with simultaneous visual-somatosensory (VS) stimuli. However, to our knowledge, the differential RT benefit of spatially aligned vs. misaligned VS inputs has not been investigated in aging. The current study investigated whether spatial alignment of VS inputs, where visual and somatosensory stimuli were presented to same and opposite hemifields, alters VS RT facilitation in older adults.

Participants and Methods: 13 older adults ($M=75$ years; 7 female) participated in the current study. Participants were determined to be non-demented and without any medical or psychiatric conditions that may affect their performance. Participants received eight randomly presented stimulus conditions (four unisensory and four multisensory) and were instructed to make speeded foot-pedal responses as soon as they detected any stimulation, regardless of spatial location and condition.

Results: Results from a linear mixed effect model, adjusted for speed of processing and other covariates, revealed that RTs to all multisensory pairings were significantly faster than those elicited by averaged constituent unisensory conditions ($p < 0.005$). Importantly, VS RT facilitation did not differ based on spatial alignment ($p=0.97$). Race model violation revealed that regardless of spatial location, RT facilitation across multisensory conditions could not be accounted for by simple probability summation.

Conclusions: In the current study, older adults demonstrated significant VS RT facilitation regardless of whether unisensory inputs were presented to the same or opposite hemifields; revealing a violation of the so-called "spatial rule" in aging.

Correspondence: *Jeannette R. Mahoney, Ph.D., Neurology, Albert Einstein College of Medicine, Roussou Building - Room 304, 1165 Morris Park Avenue, Bronx, NY 10461. E-mail: Jeannette.Mahoney@einstein.yu.edu*

C. LI & R. HOLTZER. The Effects of Attention Resources and Dual-Task Strategies on Gait Performance in Aging: a Comparison of Two Walking While Talking Paradigms.

Objective: We aimed to (1) examine dual-task costs in gait and cognitive performance in two walking while talking tasks: walking while reciting alternate letters of the alphabet (WWR) and walking while counting backward by 7s (WWC), and (2) assess dual-task strategies by examining interactions between dual-task costs in gait and cognitive performance.

Participants and Methods: Gait and cognitive performance were tested in 217 non-demented older adults (mean age 76, 56.2% female) under single and dual-task conditions. Quantitative gait measures including velocity, swing time, and stride length variability were obtained using an instrumented walkway. Cognitive performance was assessed by calculating accuracy ratio: [number of correct responses] / [number of total responses].

Results: Linear mixed effects models revealed significant dual-task costs including slower velocity ($p < 0.001$), longer swing time ($p < 0.001$), greater stride length variability ($p < 0.001$), and decreased accuracy ratio (< 0.001) in WWR and WWC compared to the single task conditions. Greater dual-task costs in velocity ($p < 0.001$) and stride length variability ($p = 0.001$) were observed in WWC compared to WWR. In the context of the linear mixed effects models significant interactions were observed between dual-task costs in cognitive performance (predictor) and gait (outcome measure) only in WWR (velocity, $p = 0.010$; swing time, $p = 0.026$; stride length variability, $p = 0.002$). Visual depictions of these interactions and correlation analyses revealed that increased dual-task costs in cognitive performance were associated with greater dual-task costs in gait performance.

Conclusions: Dual-task performance costs in walking while talking paradigms are attributed to limitations in attention resources and not to dual-task strategies where participants show a preference to either the gait or cognitive tasks.

Correspondence: *Clara Li, M.A., Yeshiva University, 1165 Morris Park Avenue, Bronx, NY 10461. E-mail: pochingclarali@gmail.com*

P. MCLAUGHLIN, J.B. RICH, N.D. ANDERSON & S. MURTHA. Cognitive Variability in Visual Search Performance: Auditory Cues Reduce Variance in Young, Middle-aged, and Older adults.

Objective: Older adults are more variable than younger adults across a variety of tasks, with some evidence of age-related differences increasing as a function of task complexity. To date, there is minimal research investigating whether such aging effects can be ameliorated with exogenous support. Furthermore, there is limited research on cognitive variability in middle-age adults. We recently showed that age-related increases in variability are not evident in middle age and can be mitigated with auditory cues on a Simon task (McLaughlin et al., 2012). To determine whether these aging and cueing effects are independent of experimental paradigm, we explored individual variability using a visual search task, and examined whether variability can be mitigated with auditory cues that spatially orient attention.

Participants and Methods: Young (ages 18-25), middle-aged (ages 40-54) and older (ages 65-82) participants (n=60) were administered a visual search task that varied in complexity. We manipulated search condition (single, conjoined), array size (5, 9, 17), target presence, and cue availability. Individual standard deviation scores were calculated for each participant after controlling for group differences in response speed and practice/fatigue effects, and were used as a measure of intraindividual variability.

Results: A five-factor mixed-model ANOVA was used to analyze the data. Overall, variability increased with task demand (single to conjoined, and array size). The older adults were more variable than the young and middle-aged groups (who were equivalent), particularly on conjoined feature searches when the target was absent. Finally, the auditory cues reduced variability, with cueing effects dependent on target presence, array size, and group.

Conclusions: These findings show that variability can be reduced in young, middle-aged, and older adults when provided with exogenous support. Furthermore, these results support our previous findings that age-related increases in variability are not evident in middle-aged adults. Correspondence: *Paula McLaughlin, UCLA, Semel institute, 38-232, 760 Westwood Plaza, Los Angeles, CA 90024. E-mail: PMcLaughlin@mednet.ucla.edu*

I. METHQAL, O. MONCHI, M. WILSON, J. PROVOST & Y. JOANETTE. Process-Dependant Neurofunctional Reorganization in Aging for the Semantic Processing of Words.

Objective: Understanding why language abilities are maintained with age is a unique window on the brain's neurofunctional adaptative capacities. This study explores the behavioural and neurofunctional age-related changes using a semantic categorization task.

Participants and Methods: Twenty old and 11 young healthy and high-educated adults realized a semantic categorization task under functional magnetic resonance imaging (fMRI). Older participants were classified into 2 groups (9 'Regular' Control 'RC' vs 11 Optimal Control 'OC') on the basis of their performance on a cognitive battery. Participants had to sort words according to semantic relation (categorical vs functional) through feedback supporting either rule maintenance or switching.

Results: Task accuracy was similar in all groups though response time was slower for both older groups. fMRI revealed a distinct pattern of brain activation according to age and cognitive profile. For rule maintenance, RC had less parietal activations while OC showed bilateral parietal and frontal activations similar to younger. During switching, RC had right frontal activation while OC and younger showed bilateral activation in frontal and parietal regions. Only younger had bilateral activations of the striatal regions.

Conclusions: This study suggests that the reduction of cerebral asymmetry with age is not limited to frontal regions. Older OC participants, who performed in the top tier, appear to have more efficient adaptative

mechanisms using alternative cognitive strategies. Thus, they appear to use different cognitive strategies engaging distinct cognitive processes supported by different brain activation patterns. In summary, this study highlights the importance of heterogeneity of cognitive profile and brain changes in aging as reflecting distinct adaptative trajectories.

Correspondence: *Ikram Methqal, student, criugm, 4565, queen mary, Montreal, QC H1W3W5, Canada. E-mail: ikram.methqal@criugm.qc.ca*

A.L. NORMAN, J.L. WOODARD, K.A. NIELSON, M. SEIDENBERG, J. SMITH, S. DURGERIAN, M.A. SUGERMAN, C.M. FIGUEROA, N.C. HANTKE, K.E. HAZLETT, C.C. KANDAH, C.D. KAY, M.A. LANCASTER, M.A. MATTHEWS & S.M. RAO. Changes in Verbal Learning Across Trial and Time: Predicting Cognitive Decline in Older Adults Over Five Years.

Objective: As episodic memory decline is associated with dementia, an examination of verbal learning over trials may differentiate healthy from pathological aging. The current study expands on previous research by examining changes in verbal learning growth in healthy, non-demented older adults who experience cognitive decline as compared to healthy aging.

Participants and Methods: Ninety-nine healthy older adults were administered the Rey Auditory Verbal Learning Test (RAVLT) at baseline and 18-months. Sixty participants received the RAVLT again after five years. They were classified as cognitively stable or exhibiting cognitive decline over each of the two follow-up periods as indicated by a >1SD decline on selective neuropsychological measures. Verbal learning growth across the five learning trials and across follow-up evaluations were examined with multilevel mixed effects modeling.

Results: From baseline to 18-month follow-up, the Stable group recalled an average of six words on Trial 1 and gained an average of 1.32 additional words over subsequent trials at baseline (ps<.001). The Declining group demonstrated less initial recall, recalling an average of five words on Trial 1 (p=.03). The two groups did not differ on trial-to-trial growth at baseline. From baseline to five-year follow-up (N=60), the Stable and Declining groups did not differ on the number of words recalled on Trial 1 across evaluations. However, the Declining group showed less trial-to-trial growth compared to the Stable group (p=.007). Further, relative to the average number of words recalled at baseline, the Declining group recalled fewer words at 18-month follow-up (p=.009).

Conclusions: Between baseline and 18-month follow-up, the Declining group demonstrated less initial learning (Trial 1) than the Stable group, while a reduction in verbal learning growth over trials emerged for the Declining group between baseline and five-year follow-up. Verbal learning growth trajectories may be useful for tracking progression of decline over time.

Correspondence: *Andria Norman, M.A., Psychology, Wayne State University, 5057 Woodward Ave., Detroit, MI 48202. E-mail: andria.norman@wayne.edu*

D. PHILLIPS. Relationships Between Sleep Quality, Perceived Cognition, and Quality Of Life in Older Adults.

Objective: The purpose of this study was to investigate the relationships between sleep quality, perception of cognitive performance and quality of life (QoL) in older adults. Results will provide healthcare professionals with increased insight into the overall impact of sleep disturbance in the elderly as it relates to everyday functioning and quality of life.

Participants and Methods: Fifty five community dwelling adults were recruited from local senior and community centers. Parametric statistics were used to determine relationships between sleep quality (Pittsburgh Sleep Quality Index, (PSQI)), the MOS Cognitive scale and the WHOQOL-BREF scale. The Insomnia Severity Index (ISI) was employed to determine if the scores and correlations from the PSQI were similar to those of the ISI.

Results: Internal consistency of data was determined by Cronbach's alpha. One-tailed Pearson 'r' correlations were run to analyze the relationships between sleep quality and quality of life, sleep quality and

self-perceived cognitive status, and quality of life and self-perceived cognitive status. Significant correlations were found between overall sleep quality and the physical ($r = -.417$, $p < .01$) and environmental ($r = -.304$, $p < .05$) dimensions of QoL, as well as between perceived cognition and the physical ($r = .289$, $p < .05$), psychological ($r = .366$, $p < .01$), and social ($r = .362$, $p < .01$) domains of QoL. A significant association was found between only one component (i.e., daytime dysfunction) of sleep quality and perceived cognition ($r = -.307$, $p < .01$).

Conclusions: Positive relationships were found between sleep quality and the physical and environmental domains of the QoL scale as well as between perceived cognition and the physical, psychological, and social domains of QoL. A significant correlation was found between daytime dysfunction and perceived cognition. These results suggest that QoL contributes to cognitive ability and sleep quality, but that reported sleep quality does not necessarily contribute to cognitive ability.

Correspondence: *Daphne Phillips, Ph.D., Scottsdale Healthcare, 493 E. Baylor Lane, Gilbert, AZ 8526. E-mail: daphne_phx@yahoo.com*

B. REED, M. CALAMIA, A. MACKAY-BRANDT, K. DAMS-O'CONNOR, A. MIKOS, J. JOHNSON, A. NAPOLES, C. DECARLI & D. MUNGAS. Effects of General and Cardiovascular Illness Burden on Memory and Executive Function in Aging.

Objective: To test the hypotheses that illness burden is negatively associated with cognition in older adults.

Participants and Methods: Participants; 371 members of the UC Davis Diversity Cohort: mean (SD) age = 78 (7); 44% white, non-Hispanic, 26% Hispanic, 25% Black; education range 0-20, mean = 13; 10% demented, 31% MCI, 59% cognitively normal. Mean N of evaluations = 4.3. General illness burden was measured using the physician-rated Cumulative Illness Rating Scale (CIRS). mCIRS excludes neurological disease directly affecting cognition. Cardiovascular illness was measured with 3 scales from the National Alzheimer's Coordinating Center Uniform Data Set (UDS): vascular risk (VR) (e.g hypertension), vascular risk and disease (VRD) (VR plus end organ disease) and heart disease (HD). Cognition outcomes were two IRT-derived, psychometrically matched scales, episodic memory (MEM) and executive function (EXEC). CIRS was obtained at baseline only. UDS variables were rated at each visit. Baseline and longitudinal outcomes were modeled using Random Effects Models covarying age, sex, ethnicity, language of test administration, education, diagnosis.

Results: Baseline general illness burden had no effect on baseline cognition or longitudinal change in cognition. Baseline VR ($p = .008$) and VRD ($p = .051$) were negatively associated with baseline EXEC, but not with change in EXEC. Modeled as time-varying covariates, VR ($p = .03$), VRD ($p = .02$), and HD ($p = .07$) were negatively associated with contemporaneous EXEC. VRD ($p = .02$) and HD ($p = .03$) were negatively associated with change in EXEC. The only effect of vascular health on MEM was that baseline VR was negatively associated with baseline MEM ($p = .035$).

Conclusions: We found no evidence of an adverse effect of general illness burden. Change in VRD and worsening heart disease were associated with more rapid decline in executive function. Cardiovascular disease appears to be of special importance to cognitive function, particularly executive abilities, in late life.

Correspondence: *Bruce Reed, PhD, Neurology, University of California, Davis, UC Davis ADC, 150 Muir Road (127a), Martinez, CA 94553. E-mail: brreed@ucdavis.edu*

S.A. ROGERS. Does Cognitive Status Influence Older Adults' Spiritual Importance?

Objective: Cognition and spirituality have not been common bedfellows, but emerging research has shown how cognitive states affect the importance given to spirituality. The current study examines how the importance of older adults' spirituality may vary with changes in age-related cognitive diagnosis.

Participants and Methods: At four time points, separated annually, 204 older adults (151 women; M age = 78), completed a neuropsychological battery and questions assessing the importance of their spirituality. Based on cognitive performance, participants were placed into aging-related diagnostic categories: normal aging, mild cognitive impairment (MCI), and dementia.

Results: ANOVAs ($ps < .05$) revealed that the spirituality of those whose diagnosis improved between times 1 and 2, and times 2 and 3, was of lower importance than those whose diagnosis worsened or remained stable. Those with dementia at time 3 experienced a significant increase in the importance of spirituality between times 2 and 3 compared to those with normal aging or MCI. From correlational analyses, the spirituality of those whose diagnosis worsened between times 1 and 3, and 2 and 3, was more important at time 3 than those who remained the same or experienced an improved diagnosis, $ps < .04$.

Conclusions: Older adults who had an improvement in age-related cognitive diagnosis reported that spirituality was of lower importance than those whose diagnosis worsened or remained the same. The spirituality of those whose diagnosis worsened was generally more important at later assessment than those who remained the same or experienced an improved diagnosis. Those who specifically had dementia at later assessment experienced a significant increase over time in the importance of spirituality relative to those with normal aging or MCI. Spirituality may therefore become less important when cognition improves and more important when cognition declines, perhaps due to shared neurobiology.

Correspondence: *Steven A. Rogers, Ph.D., Psychology, Westmont College, 955 La Paz Road, Santa Barbara, CA 93108. E-mail: sarogers@westmont.edu*

M. SAKAMOTO, M.V. SPIERS, N. MINAMI, R. AU, M.W. BONDI, L. DELANO-WOOD & D.J. LIBON. Cardiovascular Risk Predicts Differential Patterns of Impairment on the Philadelphia Verbal Learning Test – Japanese version.

Objective: While cardiovascular disease (CVD) and vascular dementia (VaD) are more prominent than Alzheimer's disease (AD) in Japan compared to western countries, little is known about patterns of verbal learning impairment in Japanese dementia patients with CVD. The current study (1) examined serial list learning profiles in Japanese dementia patients presenting with greater or lesser cardiovascular risk (CVR); and (2) investigated which serial list variables best predicted CVR.

Participants and Methods: 40 participants with mild/moderate dementia (MMSE 18-24) were recruited from Nanpu Hospital, Nara, Japan. Based on the Framingham Study Risk Score, all participants were divided into high (≥ 18) versus low (< 18) CVR groups. All participants completed the Philadelphia (repeatable) Verbal Learning Test–Japanese version (PVLJT-J), a test modeled after the California Verbal Learning Test.

Results: Groups did not differ on any free or cued recall measure, although the low CVR group made more free ($p < .001$) and cued recall ($p < .008$) intrusion errors. For recognition memory, the high CVR group obtained a better recognition discriminability index (85.7%) compared to the low CVR group (73.7%, $p < .01$). The high CVR group generated more interference foils than semantic foils ($p < .001$), whereas the low CVR generated more semantic than interference foils ($p < .001$). A series of logistic regression analyses revealed that free recall intrusions ($p < .04$), total recognition errors ($p < .02$), semantic foils ($p < .001$), and unrelated foils ($p < .02$) were significant predictors of greater CVR.

Conclusions: On the PVLJT-J, Japanese dementia patients with greater CVR produced a retrieval-based profile (VaD profile) versus an encoding-based profile (AD profile) of memory impairment, which is consistent with western studies. Importantly, the present study demonstrated the diagnostic utility of the PVLJT-J, a test specifically developed for patient care in Japan.

Correspondence: *Maiko Sakamoto, Ph.D., Psychiatry, UCSD, 220 Dickinson Street, Suite B, San Diego, CA 92103. E-mail: masakamoto@ucsd.edu*

A. SALAMI, A. RICKMAN, H. FISCHER & L. BÄCKMAN. The Effect of Aging on Successful Conflict Resolution: Evidence for Functional Reorganization of Cortical Networks.

Objective: Functional imaging studies of aging have demonstrated altered neural recruitment of a large scale attention network, specifically within prefrontal cortex (PFC) and anterior cingulate cortex (ACC). These functional alterations have been frequently observed in the context of equivalent task performance suggesting a compensatory reallocation of cognitive resources, but direct evidence for a facilitating effect has been lacking.

Participants and Methods: We used multi-source interference task and multivariate partial-least-squares to investigate functional differences in spatially distributed activity patterns associated to interference resolution, and their behavioral implications in a sample of young and old adults. Participants were given sets of three numbers (congruent and incongruent to their positions) and were asked to report the identity of the number which was different from the other two numbers while ignoring the number's position.

Results: We identified interference-related increase in activity, involving fronto-parietal as well as basal ganglia networks that were common across two age-groups. Additionally, significant task-by-age interaction effect was observed within dorsolateral PFC and ACC. The functional connectivity analysis revealed a unique network with dominant contributions of the posterior and the anterior brain regions in the old and in the young groups, respectively. Critically, activity in these networks was correlated with better performance in the respective group. Structural analysis revealed marked gray matter volume loss in the regions functionally connected to seed regions in the young group, suggesting that the age-related functional reorganization was accounted for by structural differences.

Conclusions: These findings suggest that age related structural brain changes underlie age-related reductions in the efficient recruitment of a youth-like interference network, which cascades into instantiation of a unique neural network facilitating conflict resolution in elderly people. Correspondence: *Alireza Salami, Karolinska Institute, Nybohovsgränd 8, Stockholm 11763, Sweden. E-mail: alireza.salami@ki.se*

S.C. SELIGMAN, J. SESTITO, T. GIOVANNETTI & D.J. LIBON. Coding of Everyday Action Inefficiencies in Older Adults.

Objective: There is growing evidence that mild cognitive impairment impacts everyday functioning, but direct assessment is challenging because problems may be subtle. Here we used the Naturalistic Action Test (NAT) to evaluate the reliability and validity of a coding system for assessing inefficient actions that reflect mild action difficulties. We hypothesized that this novel inefficiency category would be more sensitive to increases in task complexity than overt errors.

Participants and Methods: 36 older adults ($M_{age}=71.89$; $M_{educ}=12.86$) with varying cognitive complaints but without dementia ($M_{MMSE}=27.14$) were videotaped performing the NAT, a performance-based test of everyday action that includes 3 tasks of increasing complexity. Tapes were analyzed using an established error taxonomy for omission (i.e., steps never performed) and 4 types of commission errors (i.e., steps performed incorrectly). A novel error category was also coded to quantify non-overt errors deemed inefficient to task completion (e.g., reaching for a distractor object, etc.). A repeated-measures ANOVA was conducted using error type (overt error vs. inefficiency) and task (simple vs. complex) as within-subject factors. Inter-rater reliability for inefficient errors also was calculated.

Results: The main effects of error type ($F=110.57$, $p<0.01$) and task ($F=45.27$, $p<0.01$) and the interaction ($F=24.20$, $p<0.01$) were all statistically significant and revealed a steeper increase in inefficiencies than overt errors from the simple to the complex task. The mean number of inefficiencies coded by two raters differed by less than one, yielding a high inter-rater reliability estimate ($r=0.98$, $p<0.01$).

Conclusions: These data suggest that action inefficiencies can be reliably coded and that this coding system is more sensitive to mild difficulties than the coding of overt errors. This coding scheme may be useful in the early detection of everyday action impairment and the development of prevention strategies to preclude negative functional outcomes in older adults.

Correspondence: *Sarah C. Seligman, Psychology, Temple University, 1701 N. 13th Street, 6th Floor Weiss Hall, Philadelphia, PA 19122. E-mail: sarah.seligman@temple.edu*

C.M. SMART, S. SEGALOWITZ, B. MULLIGAN & S. MACDONALD. Mindfulness Training Increases Error Processing in Older Adults With and Without Subjective Cognitive Impairment.

Objective: Recent research suggests that the presence of subjective cognitive impairment (SCI) might represent the earliest stages of cognitive decline in certain individuals. Neuroimaging reveals structural changes intermediate between normal aging and dementia, despite no frank neuropsychological impairment and independent of psychiatric symptoms. The driving forces behind SCI are unclear; are seniors with SCI truly experiencing more frequent cognitive failures than healthy peers, or are they merely hypervigilant and emotionally reactive to normal cognitive aging? Those with SCI might be an ideal target group for intervention, with cognitive reserve relatively intact. Evidence suggests that mindfulness training (MT) can be effective in improving attention regulation and affective symptoms in healthy and clinical populations.

Participants and Methods: We employed a single-blind randomized controlled trial design to administer MT versus psychoeducation (PE) to healthy older controls (HC, $n = 23$) and those with SCI ($n = 15$). Participants did not differ at baseline in terms of age, education, pre-morbid IQ, depression, or neuroticism scores. Given the insensitivity of standard neuropsychometric measures, we administered a battery of cognitive electrophysiological measures, focusing on tasks sensitive to cognitive control and performance monitoring.

Results: Examining data from the Eriksen Flanker Task and the associated error-related negativity (ERN), we failed to detect differences between HCs and SCIs at baseline in behavioral or electrophysiological data. Collapsing across participant groups, we did find however a significant time by intervention interaction favoring MT, with an increase in the ERN amplitude ($p < .02$) and reaction time ($p < .05$) but not task accuracy ($p = 0.338$).

Conclusions: Findings suggest that MT can enhance cognitive processing in older adults, including those with SCI. Implications of the current findings are discussed in terms of the utility of cognitive training in older adults.

Correspondence: *Colette M. Smart, PhD, Department of Psychology, University of Victoria, PO Box 3050 STN CSC, Victoria, BC V8X 3A8, Canada. E-mail: csmart@uwic.ca*

M.A. SUGARMAN, J.L. WOODARD, K.A. NIELSON, J. SMITH, M. SEIDENBERG, S. DURGERIAN & S.M. RAO. Rapid Forgetting in the Prediction of Future Cognitive Decline in Healthy Older Adults.

Objective: A growing body of research has been dedicated to the identification of neuropsychological predictors of future cognitive decline. In this longitudinal study, we investigated the predictive utility of indices of rapid learning and forgetting from the Rey Auditory Verbal Learning Test (RAVLT). Additionally, we also observed whether these measures could provide predictive ability above and beyond more common RAVLT indices and the apolipoprotein E (APOE) genotype.

Participants and Methods: Ninety-nine cognitively intact older adults ($M_{age} = 73$, $SD = 4.9$) completed the RAVLT and Mattis Dementia Rating Scale-2 (DRS-2) and underwent APOE genotyping at baseline. At 18-month follow-up, participants were classified as cognitively Stable ($n = 65$) or Declining ($n = 34$), as determined by a 1 SD decline on at least one of three indices: DRS-2 Total Score, RAVLT Sum of Trials 1-5, and RAVLT Delayed Recall. Logistic regression tested whether several indices of rapid learning and forgetting were associated with decline status: Lost Access, Gained Access, Loss from Trial 5 to Immediate Recall, and Loss from Immediate to Delayed Recall.

Results: Gained Access, Lost Access, and Loss from Immediate to Delayed Recall were all significantly associated with 18-month decline

status, and provided predictive ability beyond APOE genotype and more traditional RAVLT indices (Trials 1-5, Immediate Recall, and Delayed Recall). Additionally, an interaction effect was observed between APOE genotype and Gained and Lost Access. Further analysis indicated these variables were predictive of cognitive status in APOE $\epsilon 4$ carriers only.

Conclusions: RAVLT indices of rapid learning and forgetting appear to be sensitive predictors of future cognitive decline, and may provide information above and beyond more common RAVLT indices and APOE genotype information.

Correspondence: *Michael A. Sugarman, BS, Psychology, Wayne State University, 10505 Borgman Ave, Huntington Woods, MI 48070. E-mail: mike.sugarman@wayne.edu*

S. TARDIF, S. TREMBLAY & C. HUDON. Associative Memory Processes in Healthy Aging and in Mild Cognitive Impairment.

Objective: The well-established decline of episodic memory with aging can be explained by a gradual deficit in the associative processes, responsible for linking feature components to a context (i.e., Associative Deficit Hypothesis of Naveh-Benjamin, 2000). According to this hypothesis, elderly people show greater deficits in associative memory than in item memory (i.e., memory for a feature component). There is accumulating evidence that associative memory might also be a sensitive cognitive marker of early pathological ageing, such as mild cognitive impairment (MCI). The objective of the present study is to characterize the associative processes that seem to be involved in the linking of items to spatial and temporal contexts, in normal ageing and MCI. A further objective is to test the universality of the ADH, that is, whether both spatial and temporal associations lead to the same pattern of results.

Participants and Methods: Fifteen young adults, 15 healthy older adults and 15 MCI patients performed an experimental memory task designed to test the ADH.

Results: Our results reveal that healthy elderly adults exhibit greater difficulty to link items to both spatial and temporal contexts than younger adults. However, age-related differences were much greater for spatial associations. MCI patients show a greater deficit than healthy elderly in item and associative memory. However, the group-related differences were similar in both tasks.

Conclusions: In conclusion, these results suggest that expected deficits in associative processes are found in spatial but not in temporal context, a finding that runs counter to the assumed universality of the ADH. Moreover, in MCI, associative deficits are quantitatively greater, but qualitatively similar, to that of healthy aging. This somewhat questions the notion that associative memory deficit is a cognitive marker of MCI. Correspondence: *Sarah Tardif, Psychology School, Laval University, 2325 rue des Bibliothèques, Pavillon Félix-Antoine Savard, Québec, QC G1V 0A6, Canada. E-mail: sarah.tardif.1@ulaval.ca*

H.S. TSUI, R.G. KNIGHT, C.M. SKEAFF & J.A. MCMAHON. Cognitive Decline in Older Adults: A Decade Follow-up.

Objective: The aim of this study was to examine longitudinal changes in the Rey Auditory Verbal Learning Test (RAVLT), Trail Making Test (TMT Part A and Part B), Mini-Mental State Examination (MMSE), and the Controlled Oral Word Association Test (COWAT, FAS version) to determine expected rates of cognitive decline in healthy older adults.

Participants and Methods: A total of 128 survivors (aged 73 to 97 years) from a cohort of healthy 258 persons over the ages of 65, who had been administered a large battery of neuropsychological tests approximately 10 years previously, were located and retested.

Results: Retest reliabilities were computed and correlations were significant for the RAVLT total (Trials 1-5, $r_{11} = .58$), RAVLT trial 7 (recall after 30 minute delay, $r_{11} = .63$), COWAT total ($r_{11} = .70$), TMT Part A ($r_{11} = .27$) and Part B ($r_{11} = .43$). Participants were divided into three groups based on their age at first testing (<70, 70 to 74, 75+) and changes in scores over time were analysed using a 3-

factor ANOVA (Age Group x Sex x Time) with repeated measures on Time. Rate of decline was found to be constant over the total age range on all tests except for MMSE, where only participants in the two older age groups declined significantly. Rate of decline was comparable for males and females except for the MMSE where males were significantly worse.

Conclusions: Retest stability over a decade-long period for the RAVLT total, RAVLT trial 7, TMT Part B and COWAT total was surprisingly high. Average rate of decline on the RAVLT delayed recall and RAVLT total score over a 10 year period was found to be 0.94 words and 2.46 words every five years, respectively. This is comparable to previously reported cross-sectional data.

Correspondence: *Helen S. Tsui, BSc(Hons), Department of Psychology, University of Otago, PO Box 56, Dunedin 9054, New Zealand. E-mail: helentsui@psy.otago.ac.nz*

A. VALLESI & O. PUCCIONI. Spatial Stroop and Cognitive Reserve in Normal Aging.

Objective: This study aimed at investigating whether conflict resolution between target and non-target (but interfering) information in the spatial domain is selectively affected by normal aging. Conflict adaptation, the capacity to increase conflict resolution after having experienced a conflict in a preceding trial, was also assessed. Additionally, we tested whether cognitive reserve (CR) plays a compensatory role against age-related deficits in conflict resolution and adaptation in the spatial domain.

Participants and Methods: The paradigm used was a spatial Stroop task with no feature repetitions between subsequent trials, to reduce priming-related effects. This task was administered to a sample of 17 non-demented older adults (69-79 years old) and 18 younger controls (18-34 years old) matched for gender and years of education. The two age groups were also administered a standardized questionnaire to measure CR (i.e., Cognitive Reserve Index questionnaire).

Results: Older adults showed generally slower responses than younger controls. The overall spatial Stroop effect was comparable in the two age groups, both for speed and for accuracy. The two age groups equally showed sequential effects for congruent trials: reduced RTs and accuracy at ceiling if another congruent trial preceded them. For incongruent trials, older adults, but not younger controls, were influenced by the congruency of the preceding trial, since RTs and errors increased with preceding congruent trials. Interestingly, this age-related modulation negatively correlated with the CR. Moreover, older adults' CR correlated negatively with errors and accuracy Stroop effect.

Conclusions: In conclusion, the current findings suggest that the performance on a Spatial Stroop task in aging is predominantly affected by unspecific factors such as general slowing, rather than by a more specific deficit in spatial conflict adaptation and resolution. However, a high level of CR is generally associated with better performance, both for specific and unspecific factors.

Correspondence: *Antonino Vallesi, PhD, Neuroscience, University of Padova, Via Giustiniani 2, Padova 35128, Italy. E-mail: antoniovallesi@yahoo.it*

C.R. WENDELL, L.I. KATZEL, A.B. ZONDERMAN, D.M. LEFKOWITZ, E.L. SIEGEL, W.F. ROSENBERGER & S.R. WALDSTEIN. Aerobic Fitness, Body Mass Index, and Brain Atrophy.

Objective: Aerobic fitness and obesity independently affect brain structure, especially in the context of aging. However, few studies have examined the concomitant effects of aerobic fitness and obesity. Here, we investigated the interaction between aerobic fitness and obesity in the prediction of structural brain outcomes.

Participants and Methods: Older adults ($n=150$, 56% men, mean age=66 yrs), free of major medical, neurologic, and psychiatric disease, underwent (a) treadmill exercise test for assessment of VO₂max, a measure of aerobic fitness, (b) body mass index (BMI) calculation, and (c)

brain magnetic resonance imaging (MRI). MRIs were neuroradiologist-rated for markers of subclinical cerebrovascular disease (SCD: periventricular/deep white matter hyperintensities, silent infarcts) and brain atrophy (BA: ventricular enlargement, sulcal widening). Two rank-sum variables (SCD, BA) served as outcome variables. Multiple regression analyses were adjusted for age, education, blood pressure, antihypertensives, smoking, glucose, and depressive symptoms. Sex-stratified analyses were performed due to known, pronounced sex differences in aerobic capacity.

Results: There were no significant findings among men. However, among women, analyses revealed that BMI was a significant effect modifier of VO₂max in the prediction of BA ($\eta^2 = .05$, $b = .62$, $p = .03$), but not SCD ($\eta^2 = .008$, $b = -.35$, $p = .37$). Probing of the interaction showed that among women with relatively lower BMI, higher VO₂max was associated with the lowest amounts of brain atrophy. In contrast, women with lower VO₂max and/or higher BMI demonstrated greater amounts of brain atrophy.

Conclusions: Results suggest that BMI is a significant effect modifier of associations between aerobic fitness and brain atrophy among women. A combination of lower BMI and higher VO₂max may be most neurologically beneficial. Singular intervention efforts to reduce BMI or enhance aerobic fitness may thus be insufficient for preservation of brain tissue with aging. NIA/NIH supported this research.

Correspondence: *Carrington R. Wendell, PhD, Johns Hopkins University School of Medicine, 600 N. Wolfe St, Baltimore, MD 21287. E-mail: carringtonwendell@gmail.com*

J.J. WOHLTMANN & E.L. GLISKY. Facebook for Seniors: A Pilot Study of the Effects of Online Social Networking on Cognitive Function in Healthy Older Adults.

Objective: Previous research suggests that older adults who remain socially active and cognitively engaged have higher levels of cognitive function and remain in better physical health than older adults who are socially isolated and disengaged. Regular use of an online social network service may tap into both social and cognitive processes, enabling increased social engagement and support, and potentially enhancing cognitive abilities in older adults. This pilot study aimed to test the efficacy of an online social networking website as an intervention to maintain or enhance cognitive function in older adults.

Participants and Methods: Participants were 3 men and 4 women with a mean age of 78.5 (Range = 75-86) and 16.14 years of education (Range = 10-20). Participants attended six 2-hour classes over a period of two weeks to learn how to use Facebook.com. Following the class, participants used the website at home for six weeks. A series of neuropsychological tests were administered before and after this 8-week period.

Results: A paired-samples t-test revealed a significant improvement in Trails B performance ($t(6) = 4.87$, $p = .003$) such that participants were faster after the Facebook intervention ($M = 71.60$, $SD = 28.07$) compared to baseline ($M = 86.69$, $SD = 28.51$). Qualitatively, all seven participants improved performance on Trails B following the intervention. Additional paired-samples t-tests revealed there were trends toward significant improvements in Rey-Osterrieth Complex Figure Test delayed memory ($t(6) = -2.23$, $p = .067$) and Category fluency ($t(6) = -2.28$, $p = .063$) performance following intervention.

Conclusions: While these results should be interpreted with caution because a comparison group was not included, they suggest that learning and using Facebook may have positive effects on some aspects of cognitive function. Further, these findings lay the groundwork for more well-controlled research, which is currently underway.

Correspondence: *Janelle J. Wohltmann, Psychology, University of Arizona, 1001 E. 17th St. #108, PO Box 210068, Tucson, AZ 85721. E-mail: jjw@email.arizona.edu*

K. YOSHIKAWA, K. OHKAWA, K. KURATOMI, K. KATO & Y. KIMURA. Effects of aging on the location-based conflict adaptation for visual selectivity.

Objective: Prior studies demonstrated that the modulation of visual selectivity observed in the S-R compatibility paradigm depends on the

conflict frequency in a trial block (block-wise conflict adaptation effect; CAE). Also, recent studies with younger adults provided the evidence that the modulation depending on conflict frequency is associated with the presentation locations. This study aims to investigate whether or not the location-based CAE appears in elderly adults.

Participants and Methods: Forty students (21.1 yrs.) and 40 healthy elderly adults (71.3 yrs.) participated in the present study. In each age group, they were assigned into two task-groups. Four types of five-digit-array (compatible: “44444” & “66666”; incompatible: “66466” & “44644”) in which 4 identical flankers were arranged in a cross-like fashion around a target were prepared. One was the LR task where the stimulus was presented at the left or right VF. Another was the UD task where it was presented at the up or down VF. Participants were asked to identify the central target while ignoring flankers. Half of them in each task firstly performed 4 blocks which conflict trials appeared more frequently in one VF and they did less frequently in the opposite VF, and then did 4 blocks with the inverse relation between VF and conflict frequency.

Results: An ANOVA with age group, task group, compatibility, conflict VF, and time course was conducted with the compatibility effects of RTs. The results suggested that while in the younger adults the location-based CAE appeared irrespective of time course, it appeared only in the first half blocks for the elderly adults.

Conclusions: We demonstrated that both the young and the elderly adults adapt visual selectivity associated with conflict frequency in each location. Also, we provided the evidence that the cognitive flexibility impairs with aging; in the elderly adults, when the relationship between the presentation location and conflict frequency is switched, the visual selectivity in each VF is perseverated.

Correspondence: *Kazuhito Yoshizaki, Ph. D., Psychology, Aichi Shukutoku University, 9, Katahira-Nagakute., Nagkute-cho, Aichi 480-1197, Japan. E-mail: yoshizak@asu.aasa.ac.jp*

S.C. YOU, M. HARRIS, R. KETELLE, J. KRAMER & K. POSSIN. Factor Analysis of the Geriatric Depression Scale.

Objective: The Geriatric Depression Scale (GDS) is a frequently used self-report measure of mood, but the items tap diverse symptoms. The objective was to determine distinct symptom factors and to validate those factors with the informant-based Neuropsychiatric Inventory (NPI). We hypothesized the GDS factors would reflect symptoms of dysphoria, restlessness, cognitive complaints, and social withdrawal.

Participants and Methods: The factor structure was generated using 1647 patients and 264 controls who completed the 30-item GDS during a clinic or research visit at the UCSF Memory and Aging Center between 2001 and 2012 and who scored ≥ 18 on the MMSE. Principal components extraction with Varimax rotation was conducted and factor scores generated. To explore validity of the factors, they were correlated with 3 NPI subdomains of depression, anxiety, and apathy using a Bonferroni corrected p-value of .0008 in 357 patients and 5 controls.

Results: The four factor solution accounted for 44% of the variance and the four factors were labeled Dysphoria, Restlessness, Cognitive Complaints, and Social Withdrawal. The Dysphoria factor only correlated with NPI depression, $r = .33$. The Restlessness factor correlated with NPI anxiety, $r = .24$ and NPI apathy, $r = .21$. The Cognitive Complaints factor correlated with NPI apathy, $r = -.22$, such that higher complaints were associated with lower informant-ratings of apathy. The Social Withdrawal factor did not correlate with the NPI subdomains.

Conclusions: We identified four underlying factors of the GDS that can be used to provide a clearer picture about the types of depressive symptoms patients are endorsing. The Dysphoria and Restlessness factors were validated by their correlations with NPI depression and anxiety. The Social Withdrawal factor may reflect symptoms other than apathy. The Cognitive Complaints factor revealed a negative correlation with NPI apathy, indicating individuals concerned about their cognition were less likely to be described as apathetic by their informants.

Correspondence: *Shou-Chin C. You, MS, UCSF, Sandler Neurosciences Center, 675 Nelson Rising Lane, Suite 190, San Francisco, CA 94158. E-mail: syou@memory.ucsf.edu*

H.D. ZIMMER. Shortage of Processing Relational Information during Encoding Contributes to the Age-related Association Deficit in Episodic Memory.

Objective: With advanced aging episodic memory is impaired and association memory is reduced more than item memory. This association deficit (AD) is partially an encoding deficit. Elderly people process relational information less strategically or they do this less efficiently than younger people. In two experiments we investigated this by measuring correlates of encoding behavior. Exp. 1 was an eye tracking experiment. We hypothesized that stronger relational processing causes an increase of fixation shifts between the two pair elements reflecting switching of attention between objects. Exp. 2 was an fMRI experiment and we analyzed subsequent memory effects expecting weaker memory related encoding activity for elderly than for younger people.

Participants and Methods: Older (age: 62 to 74; Exp. 1: 15, Exp. 2: 17) and younger (age: 18 to 31; Exp. 1: 13; Exp. 2: 18) participants memorized pairs of pictures and association memory was tested in a pair-recognition task. Intact, new and rearranged pairs (recombining two objects from different pairs) were presented in random order and participants had to judge which kind of pair it is. Additionally, task difficulty was manipulated. Half of the pairs depicted semantically related objects (easy) and half unrelated objects (difficult).

Results: We always found a strong age-related AD which was reduced for semantically related items.

In Exp. 1 the number of fixation shifts correlated with associative memory and elderly people showed less shifts than younger people. In Exp. 2 remembered pairs showed higher activation than forgotten ones mainly in perceptual processing areas. This activity was stronger for younger than for older people. Additionally, in the difficult condition, elderly people showed a higher activation of the default network than younger people.

Conclusions: A shortage of encoding contributes to the AD. Elderly people seem especially to discontinue processing of unrelated pairs. Training of relational processing therefore provides a chance to reduce the age-related AD.

Correspondence: *Hubert D. Zimmer, PhD, Psychology, Brain & Cognition, Saarland University, Campus A 2.4, Saarbruecken 66041, Germany. E-mail: huzimmer@mx.uni-saarland.de*

Assessment/Psychometrics/Methods (Child)

S. ANDERSON, D.L. ROBINS & L.B. ADAMSON. Inter-related Visual Reception and Receptive Language Scales of the Mullen Scales of Early Learning.

Objective: The Mullen Scales of Early Learning (MSEL) is widely used to assess visual reception (VR), fine motor (FM), receptive language (RL), and expressive language (EL), including in autism spectrum disorders (ASD). The MSEL was formulated to allow interpretation of individual domain scores. Analyses were conducted to determine whether VR and RL are independent and specific in a sample of toddlers with ASD, developmental language delay (DLD), global developmental delay (GDD), and typical development.

Participants and Methods: Data were collected in two larger, ongoing studies of early identification and developmental trajectories of ASD. In our sample of toddlers with ASD (N=84), DLD (N=19), GDD (N=29), and TD (N=90), clinical observations suggest a high degree of overlap between RL and VR skills, suggesting that the MSEL may not assess these domains independently, especially in ASD. Because many participants with ASD (40.5%) and GDD (48.3%) obtained T-scores at floor (T=20), developmental quotients (DQ; age equivalent/chronological age x 100) were computed.

Results: The VR DQ and RL DQ were significantly correlated in all groups (rASD=.467, rDLD=.564, rTD=.603, rGDD=.757). Linear regression with age, diagnostic group, and RL DQ accounted for 65% of the variance in VR DQ. Furthermore, RL DQ was a significant predic-

tor of VR DQ in the full model ($\beta=.650$, $t=9.128$, $p<.001$). Simple contrasts among diagnostic groups revealed that the amount of change in the outcome variable (VR DQ) as a result of the predictor (RL DQ) after controlling for age differs ($p<.05$) by diagnostic group, for ASD vs. DLD ($t=2.129$) and GDD ($t=-2.499$).

Conclusions: Because RL is a significant predictor of VR, even after controlling for age and diagnostic group, using VR scores as a measure of nonverbal IQ (e.g., Bishop, Guthrie, Coffing, & Lord, 2011) should proceed cautiously, particularly in populations with demonstrated verbal and nonverbal IQ discrepancies, such as ASD.

Correspondence: *Sharlet Anderson, M.A., Psychology, Georgia State University, 2303 Stratford Cmn, Decatur, GA 30033. E-mail: sharletanderson@gmail.com*

K.T. BAUM, M.K. STERN, L.M. JACOLA & D.W. BEEBE. Sleep Restriction Impacts Adolescents' Behaviors and Learning in a Simulated Classroom.

Objective: Sleep problems are common in both healthy and brain-injured adolescents. Correlational studies have linked sleep restriction with academic difficulties, but there is a lack of experimental data. Here we examine the psychometric quality of a simulated classroom that allowed for objective coding of behaviors and evaluation of learning, and assessed the impact of experimental sleep restriction on adolescents' functioning in that setting.

Participants and Methods: 36 healthy adolescents aged 14-16 years enrolled in a 3-week randomized, counterbalanced cross-over protocol in which they completed a baseline week, followed by a sleep restriction week (SR; 6.5 hours in bed per night for 5 nights) and healthy sleep duration week (HS; 10 hours in bed per night for 5 nights). Adherence to the sleep regimen was verified via actigraphy. Study visits were conducted on the Saturday morning immediately following each condition. At the baseline visit, subjects completed an IQ screener. At the SR and HS visits, subjects viewed half-hour recorded lectures while undergoing video/EEG monitoring, followed by a quiz. Pairs of condition-blind raters coded the video for several behaviors: inattention (lasting >1 sec), eyes closed (>1 sec), head down (>1 sec), yawning, stretching, and eye-rubbing.

Results: Teens averaged 2.5 more hours of sleep per night during HS than SR, $p<.001$. Complete quizzes were obtained on 34 teens, and complete video that allowed for coding was available on 30. There was strong interrater reliability (Spearman correlation =.50-.98, median=.83, $p<.005$), and the quizzes had good internal consistency ($\alpha = .70-.71$) and appropriate correlations with IQ ($r = .45-.47$, $p<.005$). Subjects showed greater inattention ($p = .03$) and eye closures ($p<.001$) and lower quiz scores ($p = .05$) after SR than HS.

Conclusions: Data support the psychometric qualities of the simulated classroom procedure and provide experimental evidence that sleep restriction during adolescence can worsen classroom learning and attention. Correspondence: *Katherine T. Baum, Ph.D., Behavioral Medicine & Clinical Psychology, Cincinnati Children's Hospital, 3675 Allview Circle, Cincinnati, OH 45238. E-mail: katherinetbaum@gmail.com*

J. DONDERS, B. ELZINGA, D. KUIPERS, E. HELDER & J. CRAWFORD. An 8-Subtest form of the WISC-IV for Use after Pediatric Traumatic Brain Injury.

Objective: To evaluate the degree to which an 8-subtest short form of the Wechsler Intelligence Scale for Children—Fourth Edition would yield acceptable estimates of the long-form Full Scale IQ index while clarifying the underlying factor structure.

Participants and Methods: Participants included 100 children and adolescents with traumatic brain injury (TBI) and no premorbid or comorbid complicating factors (e.g., prior ADHD or child abuse) who were evaluated between 1 and 12 months post injury. The short form eliminated Picture Concepts and Comprehension, leaving 2 subtests for each factor index. Paired samples t tests were used to compare the mean standard scores of the long- and short-form indices. The procedure described

by Levy (1967) was used for the correction of spurious part-whole correlations between short and long forms due to shared error variance. Exploratory factor analysis with oblique rotation was completed with both the standard 10 WISC-IV subtests and those comprising the 8-subtest short form.

Results: Median savings in administration time by elimination of 2 subtests was estimated at 20 minutes. The short form Full Scale IQ had 88% non-error covariance with its full-length counterpart. In addition, 85% of these short form estimates fell within the 90% confidence interval of the respective full-length scores. Factor analysis with 10 subtests yielded a solution where Picture Concepts failed to load meaningfully on any of the 4 factor indices. The elimination of 2 subtests resulted in a factor structure where each remaining subtest was fairly specifically associated with its intended scale.

Conclusions: An 8-subtest form of the WISC-IV (without Picture Concepts and Comprehension) can be used clinically in children with traumatic brain injury with modest time savings, without sacrificing reliability, and with more straightforward interpretability at the level of the factor index scores.

Correspondence: *Jacobus Donders, Mary Free Bed Rehab Hosp, 235 Wealthy, S.E., Grand Rapids, MI 49525. E-mail: jacobus.donders@maryfreebed.com*

M. GEURTEN, C. CATALE & T. MEULEMANS. Children's Knowledge About Memory: Adaptation and French Validation of a Scale to Assess it.

Objective: The present study aimed at adapting and testing a French version of Kreutzer et al.'s metamemory interview (1975).

Participants and Methods: Following Fritz et al. (2010), adjustments have been made to reduce language skill contamination as well as to increase the developmental appropriateness and sensibility of the scale. The scale has been tested in a group of 128 children aged of 4, 6, 9, and 12.

Results: Results show the emergence of two sub-scales ("strategy knowledge" and "general memory knowledge") on the factor analysis and reveal an excellent interrater reliability as well as a good internal consistency for the global scale and two sub-scales (respectively, Cronbach $\alpha = .79; .81$ and $.71$). As expected with regard to the literature, a significant correlation has appeared between the metamemory scale and short-term memory capacities (convergent validity). Similarly, the metamemory score has shown its ability to predict children memory performance (predictive validity). Finally, the lack of correlation between most of the scale's items and vocabulary measurement (Peabody Picture Vocabulary Test) and the very good ability of the scale to distinguish between age groups demonstrate that the adaptations made to improve the Kreutzer et al.'s scale in terms of language's contamination and developmental sensibility have reached their goal.

Conclusions: Regarding its psychometric properties, these results suggest that this interview can be considered as a useful and reliable tool for developmental research. Furthermore, they confirm the importance of metamemory knowledge in memory performance. Future studies will have to be carried out to show the utility of this scale in a clinical population.

Correspondence: *Marie Geurten, Psychology: cognition and behaviour, University of Liège, Chenestree 72A, Saint-André 4606, Belgium. E-mail: mgeurten@ulg.ac.be*

K.A. KERNS, K.D. TALBOT, C. HOPP, U. MÜLLER, F.R. LITMAN & I.S. BARON. The Tower of Monkeys: Investigation of Psychometric Properties of a Preschool Tower Task.

Objective: Objective: Few standardized measures of executive function (EF) exist for young children, despite an increasing awareness of the importance of EF development in this age range. We report on the development and validity of a computerized EF tower task, presented in an appealing and easy to use and understand format for preschoolers.

Participants and Methods: Forty-one extremely preterm, 150 late preterm, and 99 term children (age range = 3- to 9-years-old) were administered a computerized Tower of Hanoi type ("Tower of Monkeys") task via touch screen, along with several other computerized EF tasks measuring inhibition, working memory and attention in addition to measures of IQ and memory.

Results: Performance on the task was significantly correlated with age ($F(1,287)=262.86, p<.001$) accounting for ~48% of the variance in performance. Concurrent validity of the measure was examined by comparison of Tower scores to other EF measures collected. For overall correct Tower trials, correlations were high (all p 's < .01), and remained significant even after controlling for other factors such as IQ and age. Total tower trials completed, average number of moves or errors per trial correlated differentially to other EF tasks. Extremely preterm children performed significantly more poorly than did the late preterm or term children on total number of Tower problems correctly completed, after controlling for age and IQ ($F(2,278)=3.49, p<.05, ES=.03$), with a trend toward more errors per trial, providing evidence for the discriminant validity of the measure.

Conclusions: The Tower or Monkeys is an engaging, easily administered, developmentally appropriate EF task with applicability for preschoolers and young children. This task adds to, and complements, an increasing number of EF tasks that are being designed to specifically evaluate emergent EF in very young children.

Correspondence: *Kimberly A. Kerns, PhD, Psychology, Univ of Victoria, PO Box 3050 Stn CSC, Victoria, BC V8W 3P5, Canada. E-mail: kkerns@uvic.ca*

A. KHURSHID, D.G. NEMETH, A. GREMILLION, C. SONGY & J.R. HAMILTON. When Family and Physician Lack of Cooperation Interferes with Development.

Objective: The purpose of this case study is to highlight the importance of recognizing possible neurological co-occurrences early on and the need for a multidisciplinary and multidimensional approach to assessment and intervention. A 5 year old female was initially referred in 2003 for a psychoeducational evaluation. She was re-evaluated in 2010 and 2012. Results and recommendations based on the evaluations conducted over the period of 8 years are compared and discussed.

Participants and Methods: Data of 3 evaluations conducted to assess Intellectual, Attentional, Executive and Behavioral functioning of a now 13 year old girl were compared.

Results: Initial assessment (2003) suggested the possibility of seizure disorder, but the recommendations for a neurological evaluation to rule out seizure disorder were ignored by her physician. Re-evaluation conducted in 2010 revealed a decline in her intellectual and educational functioning and an increase in attentional and learning difficulties. An EEG was finally conducted with positive findings. She was started on anti-seizure medications. A diagnosis of bipolar disorder was explored. No meaningful behavior intervention with the child or parents was conducted, even though it was recommended. Some improvement in intellectual and attentional functioning was noted in the most recent evaluation (2012). Due to non-compliance with the recommendations, however, she continues to exhibit significant behavioral and social skills deficits.

Conclusions: A multidisciplinary and multidimensional approach to assessment and intervention is important. Neurologists, Neuropsychologists, and other professionals must work in collaboration to provide services to the patients. Although, evaluation can be very helpful in determining the correct diagnosis, if the recommendations are not followed, problems identified continue to exist and increase with time.

Correspondence: *Darlyne G. Nemeth, Ph.D., M.P., M.P.A.P., The Neuropsychology Center of Louisiana, LLC, 4611 Bluebonnet Blvd, Ste. B, Baton Rouge, LA 70809. E-mail: dgnemeth@gmail.com*

G. LALONDE, E. VERA-ESTAY, J. DOOLEY & M.H. BEAUCHAMP. The Influence of Age on Sociomoral Reasoning Maturity in Adolescents.

Objective: Sociomoral reasoning (SMR) skills are higher order cognitive abilities crucial for adaptive and adequate social functioning. Tra-

ditional SMR tools generally involve quintessential moral dilemmas; however, concerns have been raised as to whether these represent actual functioning in every day life (Dooley et al., 2010). The Socio-Moral Reasoning Task (So-Moral) (Dooley, Beauchamp, & Anderson, 2010) is a self-paced, visual, computer-based task that presents age-appropriate moral dilemmas. The aim of this study was to evaluate the influence of age on SMR using an ecologically valid tool, the So-Moral.

Participants and Methods: Ninety-two typically developing adolescents aged between 13 and 20 years old (mean = 16.36 years, SD = 2.16, males = 33) completed the So-Moral and a demographic questionnaire. Participants were divided into three developmental groups: early, middle and late adolescence.

Results: Results indicate a significant correlation between age and SMR skills ($r = 0.52$, $p = .001$). Age also explained 27% ($\beta = .52$, $SE = .04$, $t = 5.09$, $p = .001$) of the variance in SMR maturity. There was a statistically significant difference at the $p = .0001$ level in the SMR maturity for the three groups (early, middle and late adolescence): $F(2, 89) = 27.1$, $p = .0001$. Post-hoc comparisons using the Tukey test indicated that the mean score for early adolescence ($M = 39.42$, $SD = 8.09$), middle adolescence ($M = 49.2$, $SD = 8.57$) and late adolescence ($M = 54.47$, $SD = 10.24$) were significantly different from one another.

Conclusions: It appears that age is a strong predictor of SMR maturity. The significant difference in SMR maturity level between the three age groups suggests a continuous evolution of SMR skills during the entire adolescent period. This evolution is likely to be influenced by brain development and social environment. These results are consistent with Kohlberg's cognitive developmental theory of SMR and provide evidence for the validity of the So-Moral as an ecological tool of social cognition. Correspondence: *Gabrielle Lalonde, University of Montreal, 2900 Boulevard Edouard-Montpetit, Montreal, QC H3T 1J4, Canada. E-mail: gabrielle.lalonde@hotmail.com*

S.T. LI, S.E. TAPSAK, K.K. POPPERT, S. GREWAL & R.N. MARCIN. Objective and Subjective Measures of Executive Functioning in a Kindergarten Sample.

Objective: Continued interest in the construct of executive functioning (EF) has led to the proliferation of subjective report forms to evaluate EF in youth. At present, it is unclear the extent to which teachers can identify EF deficits using report forms. This study explored the validity of teacher reports of EF in kindergarteners in regards to the following questions: 1) Are teachers able to distinguish between children with intact versus problematic EF? 2) Are children identified by subjective and objective measures the same? And, 3) do subjective reports of EF skills relate in expected ways to objective tests?

Participants and Methods: The sample included 42 children ages 5 to 6 from three kindergarten cohorts. Three subscales from the BRIEF (monitor (MON), inhibition, and working memory (WM); Behavior Rating Inventory of Executive Functioning) were used based on teacher feedback regarding the appropriateness of the subscales. Subscales from the NEPSY-II were used to objectively assess EF (design/visual fluency (DF), inhibition (INI)) and verbal fluency (speeded naming (SpN)).

Results: Based on the teacher's report, 16 children (38%) had clinical elevations (t -score > 70) on one or more BRIEF scales and 4 children were elevated on all scales. Similarly, 16 children had low scores (i.e., 7 or below) on one or more NEPSY-II measures; yet, only 7 of these cases overlapped with the BRIEF. Only one child had problematic scores on all NEPSY-II and BRIEF scales. Contrary to expectation, objective and subjective inhibition scores were not correlated ($r = .06$). SpN was significantly correlated with WM ($r = -.58$, $p < .000$) and MON ($r = -.41$, $p < .01$), and WM had with the most overlap with the objective tests (i.e., for DF, $r = -.26$; for INI, $r = -.28$).

Conclusions: These findings underscore considerations that arise when subjective EF reports are used in place of objective tests in evaluations. Objective and subjective measures appear to measure different constructs and should not be used interchangeably in assessments with young children. Correspondence: *Susan T. Li, Ph.D., Pacific University, 190 SE 5th Avenue, Ste. 280, Hillsboro, OR 97123. E-mail: susanli@pacificu.edu*

K.S. WALSH, C.H. SEMERJIAN, S.A. HOSTETTER, B.T. HAREL & K.K. HARDY. Evaluating the Validity of a Computer-Based Neuropsychological Battery in Children with Medical Conditions at Risk for Neurodevelopmental Disruptions.

Objective: There is increased interest in use of computerized neurocognitive assessment tools, particularly in pediatric populations, to address problems with efficiency and access to services. The AACN and NAN recently put forth position statements on the use of such tools. As these are to be considered "new and different tests," we aimed to determine the feasibility and validity of using CogState (a computerized battery of tests) in several pediatric medical populations known to be at risk for neurodevelopmental disruptions.

Participants and Methods: Participants included children enrolled on two ongoing clinical trials including 6 with Brain Tumors (BT), 11 with Acute Lymphoblastic Leukemia (ALL), and 18 with Neurofibromatosis Type 1 (NF1; total $n = 35$). After consenting to the study, participants were evaluated with CogState, followed by assessment with traditional neuropsychological measures and parent questionnaires (Wechsler Scales, BRIEF, CBCL).

Results: Participants were 11 years ($SD = 2.46$) at the time of assessment, with 60% males. Group IQ was average ($M = 101.2$; $SD = 14.42$). Statistically significant correlations were found between traditional and computer-based measures of working memory (r ranged from .35 to .41). We also found significant differences in performance on CogState tasks as well as traditional measures of working memory between disease groups, such that the NF1 performed more poorly than the recently diagnosed cancer group.

Conclusions: Tasks on the computer-based neurocognitive battery, CogState, were significantly related to traditional measures of attention and working memory in our sample of at-risk children. This tool appears to be an efficient, feasible, and valid tool for monitoring neurocognitive domains that are vulnerable to disruption in these medical populations. Further evaluation of CogState and other such batteries is needed to determine predictive validity with respect to functional outcomes and change over time.

Correspondence: *Karin S. Walsh, PsyD, Children's National Medical Center, 111 Michigan Avenue, Suite 1200, Washington, DC 20010. E-mail: kwalsh@childrensnational.org*

S. BLAIN-MORAES, J. HUGGINS, J. CONNOLLY & S.A. WARSCHAUSKY. ERPs as Alternative Cognitive Test Access for Children with CP.

Objective: Children with moderate to severe cerebral palsy (CP) often do not have the ability to perform behaviours that are required for standardized cognitive assessment tests (Sabbadini, 2001). As a result, it is often impossible to accurately assess their level of cognitive ability, which is a critical step in establishing appropriate interventions and interaction techniques. In this pilot study, we investigate the potential clinical utility of an innovative assessment technique developed by Connolly et al. (1995) that uses electroencephalography (EEG) to record responses to a standardized cognitive assessment test directly from a child's brain, thereby bypassing the need for motor and oral responses.

Participants and Methods: Four participants (ages = 10-15 years; 3 male) with CP completed both standard and computerized versions of the PPVT-4. Participants had no history of seizure disorder, were preterm infants (32 +/- 4 weeks), and had GMFCS level I (2 participants) and V (2 participants). For the computerized version of the PPVT-4, participants were presented with matching or mismatching picture-word pairs. During the computerized test, EEG of the participants were recorded using eight Ag/AgCl electrodes, affixed to Fpz, F3, Fz, F4, Cz, P3, Pz and P4 (International 10-20 electrode system), with a ground and reference on the left and right ear, respectively. EEG signals were bandpass filtered from 0.5-30 Hz and baseline corrected to the second preceding stimulus presentation. When words were within a child's vocabulary level, mismatching picture-word pairs generated a N400 ERP, while matching picture-word pairs did not. When the words were outside of a child's vocabulary level, this pattern did not occur.

Results: For all four participants, vocabulary range determined by the EEG-based PPVT-4 matched that determined by the standardized PPVT-4.

Conclusions: These results demonstrate the potential of using non-motor, EEG-based responses as alternative access for cognitive assessment of children with CP.

Correspondence: *Seth A. Warschausky, PhD, University of Michigan, 325 E. Eisenhower Pkwy, Suite 300, Ann Arbor, MI MI. E-mail: sethaw@umich.edu*

A. WILKINSON-SMITH & L. DEWEY. Parent Report Compared to Direct Assessment of Symptoms of Autism Spectrum Disorders in Children with Primary Anxiety.

Objective: Children with anxiety disorders often experience social problems and differential diagnosis can be challenging. Previous studies have explored social difficulties in anxious children using either parent rating scales or direct assessment, (e.g. Pine et al. 2008; Sikora et al. 2008) but no study to date has compared parent report and direct assessment of social skills for anxious children. This has implications for differential diagnosis of children presenting with social problems, particularly when differentiating between an anxiety disorder and autism spectrum disorder (ASD). We sought to compare direct and indirect assessment of social problems in children with primary anxiety.

Participants and Methods: We evaluated 30 children aged 5 to 15 with primary anxiety. Children were diagnosed with an anxiety disorder based on DSM-IV-TR criteria, confirmed by clinically significant scores on the anxiety scale of the Behavior Assessment System for Children, Second Edition (BASC-2) and/or on the total anxiety scale of the Multidimensional Anxiety Scale for Children (MASC). We excluded children with a history of intellectual disability or language disorder. We administered the Lifetime form of the Social Communication Questionnaire (SCQ), a parent rating form, and Module 3 of the Autism Diagnostic Observation Schedule (ADOS), a direct measure of ASD symptoms.

Results: Using McNemar's test, the ADOS' ability to correctly differentiate ASD from no ASD was significantly greater than the SCQ's ability to correctly differentiate ASD from no ASD ($p < .01$). The SCQ classified 20 of 30 children as having a high probability of ASD, while only 1 of 30 children scored in the autism spectrum range on the ADOS.

Conclusions: Using parent report to evaluate symptoms of ASD in children with primary anxiety is not as useful as direct assessment. Parents rated their children as having many symptoms of ASD, due to the social problems in this population. For clinicians hoping to differentiate between ASD and anxiety, direct assessment is helpful.

Correspondence: *Alison Wilkinson-Smith, Ph.D., Children's Medical Center Dallas, 6300 Harry Hines, Suite 900, Dallas, TX 75235. E-mail: alison.wilkinson-smith@childrens.com*

C. YOUNG, S.D. MARION, K. DAVIDSON, R. GREEN, B. COLEMAN, J. TURNBULL & A. RIZZO. The Virtual Reality Classroom Stroop Task as a Measure of Executive Dysfunction.

Objective: Impairment in inhibitory control has been linked with ADHD and poor arithmetic and reading competency. Traditional tests of inhibitory control rarely resemble real-world situations, which contributes to their uncertainty as predictors of everyday functioning. The Virtual Classroom (VC) is an ecologically valid virtual reality system designed for assessment of attention and executive function. The VC Stroop is a task embedded within the classroom that measures inhibitory control found to yield the Stroop effect in university students. The objective of the current study is to validate this measure in children. It was hypothesized that performance on the VC Stroop would correlate with performance on the NEPSY-II Inhibition task.

Participants and Methods: Participants were 24 children (14 male; Age, $M = 8.75$, $SD = 2.43$; FSIQ, $M = 105.11$, $SD = 12.72$). Participants were administered the VC Stroop and NEPSY-II Inhibition. During the VC Stroop, color words flash on a whiteboard printed in congruent or incongruent ink. The examinee must press a key when the virtual teacher correctly names ink colors.

Results: Spearman correlations were conducted between completion times (CTs) on Inhibition trials and RTs on the VC Stroop. The correlation between RTs on VC Stroop congruent trials and Naming CTs trended toward significance ($r = .36$, $p = .09$). RTs on VC Stroop incongruent trials correlated with Inhibition CTs ($r = .45$, $p = .03$). Finally, overall RTs on the VC Stroop did not correlate with CTs on Switching.

Conclusions: The correlations between VC Stroop congruent trials and Inhibition-Naming, and between VC Stroop incongruent trials and Inhibition-Inhibition suggest that both measure rapid naming and inhibitory control. The moderate size of the correlations may be explained by the stronger ecological validity of the VC Stroop, which may be more sensitive to real-world ability.

Correspondence: *Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 180 N. Oakland Ave., Pasadena, CA 91101. E-mail: sdmarion@fuller.edu*

Imaging (Structural)

J. ANSADO, M. GARON, L. COLLINS, V. FONOV, S. KARAMA, A. EVANS & M. BEAUCHAMP. Validation of a New Template to Study Callosal Growth During Childhood and Adolescence.

Objective: The Corpus Callosum (CC) changes structurally throughout life, but most dramatically during childhood and adolescence. Previous magnetic resonance imaging (MRI) studies have used midsagittal cross-sectional areas (Giedd, 1996; Hasan et al., 2008) to measure the CC. However, the CC sectors have a unique three-dimensional pathway architecture that is currently best measured by developing a new template of the CC in three dimensions.

Participants and Methods: Participants were 370 children aged 4-18 years who underwent three sessions of testing at two year intervals. We studied callosal development elaborating a new template of the CC. Then, the CC was subdivided in the rostro-caudal direction as follows: rostrum, genu and anterior body (C1); mid body (C2); caudal body (C3); isthmus (C4); splenium and a decrease in the extension of the central regions (i.e., midsection, caudal part and isthmus) (C5).

Results: A weak correlation was found between the corpus callosum total volume (CC) and the participants' age, $r = .10$ $p = .053$. There were also moderate correlations between corpus callosum mid body volume (C2) and age, $r = .20$ $p < .05$ and between caudal body volume (C3) and age, $r = .21$ $p < .05$. Significant differences were found between age groups for the corpus callosum's mid body (C2), $F = 3.68$ $p < .05$, and for the caudal body (C3), $F = 3.72$ $p < .05$.

Conclusions: On the overall sample studied, a growth in volume in association with age was observed on the corpus callosum's mid body (C2), caudal body (C3) and on its total volume (CC). Moreover, a peak in size of C2 and C3 was observed for older participants (16-17-18 years old) in comparison with participants between 4 and 7 years and 10 and 11 years.

Correspondence: *Jennyfer Ansado, University of Montreal, 3175, Chemin de la Côte-Sainte-Catherine, Montréal, QC H3T 1C5, Canada. E-mail: jennyfer.ansado@umontreal.ca*

A. BARGHI, V.W. MARK, T. RICKARDS, C. STERLING, M. HADDAD, G. USWATTE & E. TAUB. Structural Brain Integrity Is Associated with Spontaneous Real-World Arm Use in Chronic Hemiparetic Multiple Sclerosis.

Objective: Previous research from this laboratory has shown that individuals with greater brain integrity after stroke have greater spontaneous use of the hemiparetic arm in the life situation. The present study evaluated whether a measure of cerebral integrity, the Brain Parenchymal Fraction (BPF), would similarly be associated with the extent of spontaneous hemiparetic arm use in multiple sclerosis (MS).

Participants and Methods: Eighteen adults with chronic hemiparetic MS (aged 49.9 ± 8.0 years) underwent T1 MRI scans at 3T before participating in experimental physical rehabilitation programs. The BPF was calculated as the ratio of the total parenchymal voxels (grey and

white matter) to the entire intracranial volume. Hemiparetic arm use was simultaneously measured with the Motor Activity Log (MAL). The MAL is a validated, structured interview on the amount and quality of spontaneous use of the more-impaired arm on 30 common real world activities involving the arms or hands. We then examined the correlation between the MAL and BPF.

Results: The BPF was positively correlated with the MAL ($r = 0.21$), but the relationship did not reach statistical significance.

Conclusions: Our preliminary finding of a positive correlation between BPF and MAL accord with our previous stroke research on brain integrity and spontaneous use of the hemiparetic arm in the life situation from a much larger patient sample. In addition, the BPF in MS has been previously positively correlated with lower extremity motor capacity measures. Our present findings suggest that brain atrophy fundamentally affects the behavioral inhibition of paretic upper extremity use in the life situation in MS. Further research is warranted to evaluate brain structure-motor behavior relationships in MS in larger clinical samples and their responses to physical rehabilitation.

Correspondence: *Ameen Barghi, Psychology, University of Alabama at Birmingham, 1604 wingfield dr, Birmingham, AL 35242-7812. E-mail: abarghi@uab.edu*

A. BENITEZ, J. HASSENSTAB & K.J. BANGEN. A Survey of Expert Neuropsychologist-Neuroimagers' Recommendations for Neuroimaging Training for Neuropsychologists.

Objective: Neuroimaging has gained widespread use in neuropsychological research and clinical practice. However, there are no established guidelines on how a neuropsychologist might be trained to become a competent researcher or consumer of neuroimaging data. As such, we surveyed expert neuropsychologist-neuroimagers (NP-NI) on their training experiences and recommendations for neuroimaging training for neuropsychologists.

Participants and Methods: 17 neuropsychologists were identified by the study investigators as expert NP-NI, all of whom were emailed letters that included the study rationale and a link to an anonymous online survey. 13 respondents provided complete data, which were summarized with non-parametric descriptive statistics.

Results: Respondents were mostly male (69.2%), white (92.3%), and received a PhD (92.3%) in Clinical Neuropsychology (46.2%) from an APA-accredited doctoral program (76.9%). Most respondents trained and currently have appointments in academic medical centers, and engage in research, administrative, and supervisory activities. Further details of their training and current appointments will be provided. The majority of NP-NI endorsed using MRI in their professional activities, and obtained their training through independent study (100%), individual mentoring (92.3%), attendance of brief workshops (69.2%) and clinical conferences (53.8%), formal coursework post-grad (38.5%), web tutorials (38.5%), lab assistantships (30.8%), and formal coursework in graduate school (7.7%). The content areas covered in their training, and the skills they deemed necessary to be a competent researcher or consumer of neuroimaging data, will be reported.

Conclusions: NP-NIs recommended independent study and working closely with an experienced mentor, as well as acquiring skills in computer programming and coursework in relevant topics such as MR physics. This initial effort will help guide students who aspire to develop competence in neuroimaging, and inform future formulations of neuropsychological training. Correspondence: *Andreana Benitez, PhD, Center for Biomedical Imaging, Medical University of South Carolina, 68 President St, MSC 120, Charleston, SC 29401. E-mail: benitez@muscd.edu*

D. DOVE, A. CAO, S.S. BURNS, N. DAVIS & L.E. CUTTING. White Matter Integrity in Young School-age Children Positively Correlates with Reading, Language, and Executive Function.

Objective: The white matter (WM) structure of young school-age children was studied with respect to reading, language, and executive functions (planning and inhibition).

Participants and Methods: Maps of fractional anisotropy (FA), which is an indicator of white matter integrity, were made with Diffusion Tensor Imaging (DTI) of 21 children in the first grade (ages 6:9 to 7:11 years). Voxel-wise statistical tests were performed on spatially normalized images of FA. Reading, language, planning, and inhibition scores were generated from factor analyses with varimax rotation of variables from neurobehavioral testing. Whole brain analyses were performed to correlate FA with behavioral factors. Statistical parametric maps were calculated at an uncorrected significance level of $p < 0.005$, excluding clusters less than 30 voxels.

Results: Reading, language, and planning positively correlated with FA. Reading positively correlated with FA within the left tempo-parietal, left middle frontal, and left inferior frontal WM. Language correlated positively with FA within the left and right middle temporal, and right and left parahippocampal WM. Planning correlated positively with FA within the left parahippocampal, right middle frontal, and right superior frontal WM. No significant correlation was identified between inhibition and FA. The clusters where reading, language, or planning positively correlated with FA did not overlap.

Conclusions: White matter integrity positively correlates with reading, language, and planning in first-grade children. The current study identifies these areas using behavioral correlations in a single group of children rather than from group contrasts (i.e. reading disorder vs. control). Applying this type of study design to young school-age populations has the potential to identify important neuroanatomical areas in reading disorders that are less severe, are late-emerging, or are associated with weaknesses in other skills (e.g. language or executive function).

Correspondence: *Dwayne Dove, MD/PhD, Vanderbilt University, 2200 Children's Way, 11101 DOT, Nashville, TN 37232-9003. E-mail: dwayne.dove@vanderbilt.edu*

J.A. EASTMAN, K.S. HWANG, A. LAZARIS, N. CHOW, L.M. RAMIREZ, E. WOO, S. BABAKCHANI, P.M. THOMPSON & L.G. APOSTOLOVA. 3D Mapping of Semantic Fluency in Clinical and Pre-Clinical Alzheimer's Disease.

Objective: While one hallmark of Alzheimer's disease (AD) is declarative memory loss, the loss of semantic fluency is also commonly observed in this population. We examined the relationship between semantic fluency and cortical atrophy in order to identify the specific cortical regions that play a role in semantic fluency.

Participants and Methods: Structural magnetic resonance imaging data (MRI) were collected from 9 Normal (NC), 40 Mild Cognitive Impairment (MCI), and 10 probable AD subjects as part of the Alzheimer's Disease Neuroimaging Initiative (ADNI). They all were administered the Category Fluency (CF) animals and vegetables tests within one month of their MRI. A computational anatomy-based cortical thickness technique was applied to the MRI scans, and linear regression models were applied to detect associations between performance on the semantic fluency tests and cortical atrophy in both the left and right cerebral hemispheres.

Results: In the CF animals and vegetables tests, poorer semantic fluency was associated with bilateral cortical atrophy of the inferior parietal lobule (Brodmann areas (BA) 39 and 40) and BA 4 and 6 in the frontal lobe. More diffuse frontal associations were seen in the left hemisphere, involving BA 9, 10, 32, 44, 45, and 46. Additional cortical atrophy was seen in the temporoparietal (BA 37) and the right peristriate (BA 19, 18) cortex. Associations were more diffuse in the vegetable category than the animal category. The permutation-corrected map-wise significance for CF animals was $p_{corrected} = 0.01$ for the left hemisphere, and $p_{corrected} = 0.06$ for the right hemisphere. The permutation-corrected map-wise significance for CF vegetables was $p_{corrected} = 0.009$ for the left hemisphere, and $p_{corrected} = 0.03$ for the right hemisphere.

Conclusions: These results demonstrate the profound effect of cortical atrophy on semantic fluency. Specifically, the frontal lobe is required for tapping semantic knowledge. In addition, the comprehension aspects of semantic fluency involve the temporoparietal region.

Correspondence: *Jennifer A. Eastman, MA, Neurology, University of California Los Angeles, 10911 Weyburn Ave Ste 200, Los Angeles, CA 90095. E-mail: jeastman@mednet.ucla.edu*

N. FANI, T.Z. KING, S. NORRHOLM & K.J. RESSLER. White Matter Integrity and Fear-potentiated Startle Response During Acquisition and Extinction of Conditioned Fear in Individuals With and Without PTSD.

Objective: The hippocampus and cingulate cortex have been implicated in extinction of conditioned fear, a process that is impaired in individuals with posttraumatic stress disorder (PTSD). We examined associations between the integrity of a white matter tract (measured by fractional anisotropy; FA) that connects these structures and fear-potentiated startle (FPS) response during acquisition and extinction of conditioned fear in a sample of highly-traumatized individuals with and without PTSD.

Participants and Methods: DTI was acquired on 51 African-American women aged 20-62 years who were recruited through an ongoing study of risk factors for PTSD. The PTSD Symptom Scale (PSS; Falsetti et al., 1993) was administered to determine presence and severity of PTSD; 26 traumatized controls without PTSD (TC) and 25 participants were classified as PTSD. FPS during fear acquisition and extinction was measured in a subset of these individuals (12 PTSD+, 13 TC), using a paradigm detailed previously (Jovanovic et al., 2005). We conducted FSL TBSS on fractional anisotropy (FA) maps using a threshold-free cluster enhancement approach (Smith & Nichols, 2009).

Results: Voxel-wide t-test results indicated significantly lower FA in bilateral posterior cingulum in participants with PTSD, compared to TCs (cluster size: left = 163mm³; right = 63 mm³; $p < .05$ uncorrected). FA values extracted from these regions were negatively correlated with FPS response during late phases of extinction in PTSD [$r(12) = -.59$, $p < .05$], but not TC [$r(13) = -.07$, $p = .82$] individuals. No significant associations between diagnosis and FPS during acquisition were observed.

Conclusions: These preliminary findings document an association between WMI and extinction in PTSD individuals. Specifically, reduced microstructural integrity within posterior cingulum is associated with greater FPS during extinction. We will discuss how this relationship informs our current understanding of PTSD pathophysiology and future directions. Correspondence: *Negar Fani, PhD, Psychiatry and Behavioral Sciences, Emory University, 101 Woodruff Circle, Suite 4304, Atlanta, GA 30322. E-mail: nfani@emory.edu*

M. GARON, J. ANSADO, L. COLLINS, V. FONOV, A. EVANS & M. BEAUCHAMP. A new template establishes a relationship between callosal volume and performance IQ.

Objective: The corpus callosum (CC) is the largest tract of white fibers in the brain, accounting for the majority of information exchange between left and right hemispheres. To date, studies linking the development of the CC and intelligence are inconsistent, mainly because of methodological factors. Until now, measurement of the CC has typically been obtained by using a sagittal cut and measuring callosal area without taking width into account. The objectives of this study were to determine the usefulness of a new brain template developed in our laboratory assessing CC growth and to determine if the volumes obtained could be linked to performance on neuropsychological tests.

Participants and Methods: A template was designed including six sections: rostrum, genu and anterior body (C1), mid body (C2), caudal body (C3), isthmus (C4); splenium (C5) and total volume (CC). Participants were 370 children aged 4-18 years who underwent three sessions of testing at two year intervals. Each session included an MRI scan followed by neuropsychological tests.

Results: For every session (T1, T2, T3), a positive correlation between total volume and Performance IQ (PIQ) on the WASI was found. PIQ also correlated with C1 for T1 and T2, with C4 for T1, and with C5 for every session. However, no relation was found between volume and verbal IQ. The Block Design subtest correlated with CC volume at T2 and T3, whereas the Matrix Reasoning subtest correlated with CC at T1.

Conclusions: The apparent contribution of CC to PIQ in opposition to VIQ may be attributable to the greater lateralisation of language and to the earlier pruning of associated regions, in comparison with the complex motor component (use of both hands) required for Block Design. These findings emphasize the need to consider callosal width in anatomical studies. They also suggest that the association of the posterior section (C5) of the CC and performance IQ may account for a large part of the link between CC and IQ.

Correspondence: *Mathieu Garon, B.Sc., Psychology, University of Montreal, 90 Vincent d'Indy, Montreal, QC H2V 2S9, Canada. E-mail: server345@hotmail.com*

K. GICAS, C.J. GIESBRECHT, H.A. BAITZ, W. PANENKA, F. VILARODRIGUEZ, D.J. LANG, W. MACEWAN, A.M. BARR, A.E. THORNTON & W.G. HONER. Neurocognitive Profiles and Structural Brain Differences in a Marginalized Population.

Objective: Individuals living in single-room occupancy hotels (SROs) represent a marginalized population with increased rates of substance dependence, viral infection, and psychiatric illness. The neurocognitive sequelae of these factors have been well documented. This study aims to characterize neurocognitive profiles and identify distinct structural brain differences in an SRO population.

Participants and Methods: Two-hundred and forty-nine (194 males, 55 females) SRO residents underwent a battery of cognitive tests and whole brain structural imaging. Test scores were subjected to a cluster analysis to identify subgroups with common profiles of neurocognitive functioning across six domains (premorbid IQ, verbal memory, attention, inhibition, mental flexibility, decision-making). A multivariate analysis of covariance was used to examine whether profiles meaningfully differed on cortical and sub-cortical brain volumes, and white matter lesion burden, while controlling for intracranial volume.

Results: Three distinct profiles emerged. Profile 1 ($n = 59$) exhibited overall higher functioning, while Profile 3 ($n = 37$) was lowest functioning with a relative strength in decision-making skills. In contrast, Profile 2 ($n = 103$) bisected the performance of the other clusters, displaying a relative weakness in decision-making skills. Overall, Profile 1 (higher functioning) had greater left temporal grey matter volumes (GMVs; $F = 4.03$, $p < .05$) relative to the other profiles. Additionally, Profile 2, with its more pronounced decision-making deficit, showed less right medial orbitofrontal GMVs ($F = 3.13$, $p < .05$) relative to Profile 1.

Conclusions: The observed structural brain differences are consistent with the derived neurocognitive profiles and the broader neuropsychological literature. Specifically, these profiles could stand as important markers for underlying brain pathology, and may be a useful tool for predicting clinical and functional outcomes.

Correspondence: *Kristina Gicas, M.A., Psychology, Simon Fraser University, 8888 University Dr, Burnaby, BC V5A 1S6, Canada. E-mail: kgicas@sfu.ca*

H.M. GIRARD, N.E. KUCUKBOYACI, N. KEMMOTSU, J.M. KUPERMAN, A.M. DALE & C.R. MCDONALD. Beginning to See Clearly: Application of Prospective Motion Correction (PROMO) MRI to Pediatric Epilepsy.

Objective: Quantitative MRI has become increasingly important for the early detection of brain lesions and monitoring of brain development in children with neurological disorders. Obtaining precise measurements requires that the child remain motionless in the scanner. Previous research has demonstrated the efficacy of a new on-line motion correction (PROMO) method for improving the accuracy of brain morphometry measures in typically developing children. We apply this new method to pediatric epilepsy—a population with a high prevalence of cognitive impairment that pose additional motion-related challenges to obtaining high-quality MRI.

Participants and Methods: Two 3T T1-weighted MRIs were collected, one with PROMO on and one with PROMO off, from a 13-year old child

with intractable epilepsy and a Full Scale IQ in the borderline range (FSIQ=72). Both scans were reviewed by a board-certified radiologist who judged their image quality. Subcortical volumes and cortical thickness estimates were obtained for both scans using FreeSurfer software. Percent difference was calculated for all structures between the scans. **Results:** The PROMO-off scan was judged to be lacking sufficient quality to observe the internal structure of the hippocampi, or detect possible malformations at the gray-white matter junction due to motion artifact, whereas the PROMO-on scan was judged to be of easily interpretable image quality. Quantitatively, volume and thickness estimates with PROMO-off deviated highly from those with PROMO-on, with percent disagreement ranging from 0.2-47.6% for volumes 0-37.4% for thickness. Additionally, the PROMO-off scan incorrectly classified regions gray matter as white matter hypointensities due to poor delineation of the gray-white boundaries secondary to the motion artifact in the image.

Conclusions: PROMO may provide clinicians and researchers with a means of gathering high-quality MRI data in children with epilepsy, improving qualitative review and quantitative estimates, while eliminating the need for sedation.

Correspondence: *Holly M. Girard, BA, Psychiatry, University of California, San Diego, 9500 Gilman Drive, 0841, La Jolla, CA 92093. E-mail: hgirard@ucsd.edu*

A. GONENC, M.K. DAHLGREN, K.A. SAGAR & S.A. GRUBER. Uncinate Fasciculus is Associated with Cognitive Function and Impulsivity in Bipolar Disorder: An Enhanced Tractography Analysis.

Objective: Traditional tractography methods have revealed alterations in patients with bipolar disorder (BD), however, they rely on averaging white matter (WM) along an entire fiber tract. It would be advantageous to be able to determine where along WM tracts differences occur. The aim of this study was to study the structural integrity of the uncinate fasciculus (UF) and its relation to cognition in patients with BD using an enhanced tractography method via length parameterizing. Based on previous work, we hypothesized that patients with BD would have deficits in WM integrity in this region as well as impairments in executive function and impulsivity.

Participants and Methods: 40 adults (17 healthy controls (HC), 23 with BD) underwent diffusion tensor imaging at 3T and cognitive assessment. Measures of executive function and impulsivity included the Trailmaking test (Trails B) and Barratt Impulsiveness Scale (BIS-11). The UF tract was segmented into different sub-regions (frontal and temporal) using a novel length parameterizing method and fractional anisotropy (FA) was examined between groups.

Results: FA was reduced in BD group compared to HCs and this difference was localized primarily to the frontal section of the tract rather than the temporal ($p=0.004$ for the frontal vs $p=0.067$ for the temporal). Patients with BD showed greater impairment on measures of executive functioning ($p=0.010$) and impulsivity ($p=0.002$) compared to HCs. FA in the frontal UF tract was negatively correlated with Trails B ($r=-0.424$, $p=0.031$) and positively correlated with BIS-11 ($r=0.364$, $p=0.057$) in the BD group. These correlations were not demonstrated in the HCs.

Conclusions: These findings suggest reduced FA in the frontal UF tract is associated with poorer executive function and higher impulsivity in BD. The length parameterized tractography technique is promising, and may provide a more sensitive approach to evaluating the integrity of WM tracts with additional localization details.

Correspondence: *Atilla Gonenc, MIC/JCCNC, Harvard Medical School, 115 Mill St, Belmont, MA 02478. E-mail: agonenc@partners.org*

A. GRABOWSKA, K. JEDNOROG, N. GAWRON & A. MARCHEWKA. Grey matter volume differences in cognitive subtypes of developmental dyslexia.

Objective: The variety of different causal theories together with inconsistencies about the brain makers emphasize the heterogeneity of de-

velopmental dyslexia. Attempts have been made to test on behavioral level the existence of subtypes of dyslexia showing distinguishable cognitive deficits. No research has been directly devoted to the investigation of structural brain correlates of these subtypes. We studied grey matter volume (GMV) differences in dyslexic children split into subtypes based on deficits in various cognitive domains. We hypothesized that dyslexic subtypes can be characterized by a specific pattern of grey matter volume.

Participants and Methods: A relatively large sample ($n=46$) of dyslexic children were tested. They were split into subtypes based on deficits in four cognitive domains: phonological awareness, rapid automatized naming, visual magnocellular-dorsal processing and auditory attention. Regional differences in GMV between controls and 3 dyslexic groups were analyzed.

Results: The VBM data revealed GMV clusters specific for each studied group. In addition, using discriminant analysis on GMV clusters, 79% of cross-validated cases were correctly classified into 4 groups (controls versus 3 subtypes).

Conclusions: The results indicate that dyslexia may result from distinct cognitive impairments characterized by distinguishable anatomical GMV markers.

Correspondence: *Anna Grabowska, PhD, Neurophysiology, Nencki Institute of Experimental Biology, 3 Pasteur St, Warsaw 02-093, Poland. E-mail: a.grabowska@nencki.gov.pl*

L. HAMPTON, J. JURANEK, J.H. HANNAY & J.M. FLETCHER. The Relation of Anomalous Heschl's Gyrus and Dichotic Listening in Spina Bifida.

Objective: The present study focused on the rate of anomalous (duplicated) Heschl's gyrus (HG) in individuals with spina bifida meningomyelocele (SBM) and the relation of anomalous HG to ear advantage on a dichotic listening measure.

Participants and Methods: Children (ages 8-17) and adults (ages 18-65) with SBM ($N=177$) were recruited from an existing cohort, along with typically developing (TD; $N=93$) participants. All participants completed both an MR imaging protocol and a battery of cognitive tests that assessed verbal and spatial intelligence, reading and math achievement, and dichotic listening. The structure status of the participants' HG (single, duplicate) was determined through qualitative coding of MRI scans.

Results: The results did not indicate a higher rate of anomalous HG in individuals with SBM (33 anomalous HG, 144 single HG) compared to TD individuals (17 anomalous HG, 76 single HG). There was no HG status x group interaction, but separate analysis of each HG status group suggested that age (child, adult) predicted ear advantage in the single HG status group, and that the duplicated HG group did not display an ear advantage.

Conclusions: The results indicate that the development of an anomalous HG does not relate to the pattern of congenital maldevelopment that occurs in SBM. The results also indicate that having anomalous HG status reduces performance on a dichotic listening task.

Correspondence: *Lyla Hampton, University of Houston, 2151 W. Holcombe Blvd, Suite 222, Houston, TX 77204. E-mail: lelmesst@gmail.com*

A.L. JEFFERSON, S. DAMON, W. CHAPMAN, K. GIFFORD, J. SPARLING, N. CANTWELL, V. DOBROMYSLIN & D. SALAT. Gray-White Matter Contrast Ratio Relates to Progression in Mild Cognitive Impairment.

Objective: Research suggests gray and white matter contrast ratio (GWR) seen on MRI is healthier in cognitively normal elders compared to individuals with Alzheimer's disease (AD) or mild cognitive impairment (MCI). We examined GWR and conversion status after a 3-year follow-up period in MCI.

Participants and Methods: Alzheimer's Disease Neuroimaging Initiative participants meeting the following criteria were included: (1) baseline MCI diagnosis; (2) 1.5T MRI acquisition on Siemens or GE scanner; (3) 36-month follow-up data. Participants, matched on age and

Mini-Mental State Examination, were categorized according to 36-month follow-up diagnoses: 1) non-converters ($n=69$, 75 ± 7 years, 26% female), and 2) converters with a dementia diagnosis at follow-up ($n=69$, 75 ± 7 years, 30% female). GWR was generated by FreeSurfer using T1 structural MR images.

Results: Using a general linear model ($p < 0.01$ threshold), adjusting for hippocampal volume, cortical thickness, systolic blood pressure, and APOE status, converters evidenced significantly lower GWR values than non-converters (i.e., more degradation in tissue contrast), especially in the left and right temporal lobes.

Conclusions: Results suggest GWR differences between MCI participants who convert to AD versus those MCI participants who remain diagnostically stable over a three-year period. Differences persisted even after statistically adjusting for neuroimaging markers of brain aging and AD pathology, blood pressure, and an AD genetic susceptibility risk factor. GWR may represent an early neuroimaging marker of abnormal brain aging that precedes AD pathology or a second pathway of injury independent of AD pathology.

Supported by: AG030962, AG034962, HL111516, HRC-08-88733, AG024904, American Federation for Aging Research

Correspondence: *Angela L. Jefferson, PhD, Vanderbilt University, 2525 West End Ave, 12-th Floor, Suite 1200, Nashville, TN 37203. E-mail: angela.jefferson@vanderbilt.edu*

S.M. DYER, S.E. LEE, J.M. KLAVER, L.A. BEYES, J.M. CONSTANCE, B.A. WEBSTER & M.Y. KIBBY. Are Teachers Better Raters Than Parents? Teacher-rated Hyperactivity and Attention Problems Predict Right Orbitofrontal Cortex Volume in Children.

Objective: When analyzing individuals with ADHD, studies have shown reduced orbitofrontal cortex (OFC) volume, as well as reduced activation of the OFC during sustained attention and inhibition tasks. Nonetheless, few studies have examined the relationship between the OFC and attention and activity level as measured by different raters. Thus, this study examined the relationship between OFC volume and childhood attention problems and hyperactivity, as rated by their parents and teachers.

Participants and Methods: As part of NIH/NICHHD funded projects (R03 HD048752, R15 HD065627), parents and teachers of 39 children (ages 8 to 12 years) with ADHD, reading disabilities, both disorders, and controls completed the Behavior Assessment System for Children (BASC). The OFC was manually traced in the coronal plane using the Analyze 10.0 Region of Interest module. Both inter-rater ($rs > .90$) and intra-rater reliability ($rs > .90$) of measurement were attained first.

Results: Hierarchical linear regressions were performed, controlling age and gender, first predicting right and then left OFC volume from the BASC scales (parent- and teacher-rated attention and hyperactivity). Neither of the parent-rated BASC scales predicted right or left OFC volume, $ps > .05$. Both teacher-rated hyperactivity, $b = -.335$, $t(36) = -2.189$, $p = .04$, and teacher-rated attention problems, $b = -.320$, $t(36) = -2.213$, $p = .03$, predicted right OFC volume, but not left OFC volume, $ps > .05$.

Conclusions: Higher levels of teacher-rated attention problems and hyperactivity were associated with reduced right OFC volume, while parent-ratings of these symptoms were not associated with OFC volume. The reason for this discrepancy may be that teachers are better raters of hyperactivity and attention problems because they have a greater number of reference points for typical behavior. In total these findings contribute to the growing body of evidence suggesting OFC's involvement in ADHD. Correspondence: *Sarah M. Dyer, M.S., Psychology, Southern Illinois University Carbondale, Life Science II, Room 281, Mail Code 6502, Carbondale, IL 62901. E-mail: sarahdyer@siu.edu*

S.E. LEE, J.M. KLAVER, S.M. DYER, L.A. BEYES, J.M. CONSTANCE, B.A. WEBSTER & M.Y. KIBBY. An Investigation of the Precentral Gyrus as a Neural Structure Underlying Rapid Automated Naming in a Mixed Childhood Sample.

Objective: Children with reading disabilities (RD) frequently are found to have poor rapid naming of stimuli, while there are inconsistent find-

ings regarding rapid naming performance in children with Attention-Deficit/Hyperactivity Disorder (ADHD). Furthermore, although fMRI studies indicate a possible dissociation between structures activated during letter and object naming tasks, there are limited quantitative MRI investigations on rapid automatized naming (RAN). Thus, we assessed the relationship between precentral gyrus volume and RAN performance in a mixed sample consisting of children with ADHD, RD, comorbid RD/ADHD and controls.

Participants and Methods: Forty children, ages 8 to 12 years, performed several measures as part of university based, NIH/NICHHD funded projects (R03 HD048752, R15 HD065627), including the Comprehensive Test of Phonological Processing (Rapid Letter Naming, Rapid Object Naming). T-1 weighted images were collected, and the precentral gyrus was manually traced in the sagittal plane using the Analyze 10.0 Region of Interest module after inter-rater ($rs > .90$) and intra-rater ($rs > .90$) reliability were attained.

Results: Two backward linear regressions predicting rapid letter naming and object naming were performed, using age, IQ, gender, and brain measurements as IVs. While age, IQ, and gender did not predict letter or object naming ($ps > .10$), left precentral volume significantly predicted rapid letter naming performance, $b = -.002$, $t(37) = -2.09$, $p = .04$. Neither left nor right precentral volumes significantly predicted rapid object naming performance, $ps > .05$.

Conclusions: Larger left precentral gyri volume is associated with worse rapid letter naming performance, suggesting a potential neural structure underlying the rapid letter naming deficit commonly seen in individuals with RD and less frequently in individuals with ADHD. Moreover, the finding is consistent with research suggesting some dissociation between the neural structures involved in letter versus object naming.

Correspondence: *Sylvia E. Lee, M.A., Southern Illinois University Carbondale, 1000 Brehm Lane Apt. E2, Carbondale, IL 62901. E-mail: sylvia.lee09@gmail.com*

S. VAN HUIDEN, A.K. LEE, J. RAO, S. CORREIA, J. O'MUIR-HEARTAIGH, A. CONGATANA, S. SALLOWAY, P. MALLOY & S. DEONI. Imaging Markers of Myelin in Alzheimer's Disease: Diffusion-Tensor Imaging and mcDESPOT.

Objective: White matter hyperintensities (WMH) are common in Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI). WMH reflect small vessel disease characterized pathologically by loss of myelin, axons, oligodendrocytes, and astrocytic gliosis. Radial diffusivity (RD), diffusion tensor imaging (DTI) metric quantifies diffusion perpendicular to axons. RD is commonly interpreted as a marker of myelin integrity but other factors (e.g., axon diameter) may impact RD values. A new MRI technique, multicomponent driven equilibrium single pulse observation of T1/T2 (mcDESPOT) quantifies myelin integrity expressed in a metric called myelin water fraction (MWF). Higher MWF values represent greater myelin integrity. The current study aims to examine the association between RD and MWF in both WMH and regions of normal-appearing white matter (NAWM) in AD and MCI, and determine whether RD are redundant markers of cerebral white matter myelin content.

Participants and Methods: Thirty-one patients with MCI ($n=16$) and AD ($n=15$), aged 50-90, received a series of MRI scans and a cognitive test battery. Masks for NAWM and WMH were created using an intensity-based algorithm. Diffusion values of MWF and RD in both masks were obtained for each participant.

Results: In the combined sample, MWF was significantly lower in WMH than in NAWM ($p < .001$), and RD was significantly higher in WMH than in NAWM ($p < .001$). MWF was significantly correlated with RD in NAWM ($p < .001$), but not in WMH. Group analyses showed neither RD nor MWF differed significantly between the MCI and AD groups in either WMH or NAWM. In the AD group only, diffusivity metrics in NAWM, including RD, were significantly correlated with the learning composite score.

Conclusions: In MCI and AD, RD is moderately correlated with MWF in NAWM but not in WMH. This may reflect the pathological underpinnings of WMH. It may be prudent for researchers to consider the relative volumes of WMH and NAWM when drawing conclusions about RD as a maker of myelin integrity in MCI and AD.

Correspondence: *Athene K. Lee, MA, MSSc, Psychology, Brown University, 345 Blackstone Boulevard, Providence, RI 2906. E-mail: athene_lee@brown.edu*

J. RAO, A.K. LEE, S. VAN HUIDEN, J. O'MUIRCHARTAIGH, S. CORREIA, S. SALLOWAY, P. MALLOY & S. DEONI. Myelin Integrity, ApoE Genotype, and Cognitive Function in MCI and AD.

Objective: Previous neuroimaging research has shown that apolipoprotein genotype may moderate an association between cognitive processing speed and myelin in late-myelinating white matter in healthy adults (Bartzokis et al., 2007). We sought to extend this work by examining the association between myelin integrity and cognitive function in normal-appearing white matter (NAWM) in patients with mild cognitive impairment (MCI) and Alzheimer's disease (AD). We used a recently developed imaging technique, multicomponent driven equilibrium single pulse observation of T1/T2 (mcDESPOT) that specifically quantifies myelin integrity expressed in a metric called myelin water fraction (MWF) - higher values represent greater myelin integrity.

Participants and Methods: ApoE status was obtained for 24 participants (aged 55-87) with either MCI or AD. Those with at least one E4 allele were included in the ApoE+ group (n = 12); those with no E4 alleles were included in the ApoE- group. Participants completed a cognitive test battery and a series of MRI scans including mcDESPOT. MWF in normal appearing white matter (NAWM) was measured for each participant.

Results: The ApoE+ group and the ApoE- group did not significantly differ in age, dementia severity, cognitive performance, grey matter volume, white matter hyperintensities, or MWF. In the ApoE+ group, MWF did not correlate with any volumetric or cognitive measures. For the ApoE- group, MWF correlated with volumetric and cognitive measures involving processing speed, executive functioning, and verbal learning.

Conclusions: We found myelin integrity in NAWM to be associated with cognitive function in patients with MCI and AD but only among those without an ApoE e4 allele. This extends prior work showing ApoE genotype moderates the association between myelin and cognitive function in AD.

Correspondence: *Athene K. Lee, MA, MSSc, Psychology, Brown University, 345 Blackstone Boulevard, Providence, RI 2906. E-mail: athene_lee@brown.edu*

A. PEREZ, J. ADLER, N. KULKARNI, J. STRAIN, K. WOMACK, R. DIAZ-ARRASTIA & C.D. MARQUEZ DE LA PLATA. DTI Correlates with Acute Injury Severity and Chronic Outcomes after TAI.

Objective: It is well understood that white matter compromise at the chronic phase of traumatic axonal injury (TAI) is associated with neurocognitive outcomes. This study examined white matter integrity from the acute to chronic phase to explore its relationship with acute injury severity and understand its association with information processing speed.

Participants and Methods: Participants included sixteen patients with moderate to severe TBI with predominant white matter damage consistent with TAI, and ten healthy age- and gender-matched controls. Diffusion tensor images (DTI) were collected from a single 3 Tesla scanner in a longitudinal fashion (acute, mean = 1 day post-injury; chronic, mean = 7 months post-injury). Conventional preprocessing was conducted using FSL software. Tract-Based Spatial Statistic (TBSS) analysis pipeline was utilized to examine global white matter fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD). Outcomes assessments were conducted on the day of the chronic scan. Associations between DTI metrics and (a) injury severity and (b) outcomes were assessed.

Results: Acute RD is positively correlated with days in the intensive care unit and in the hospital. Chronic DTI metrics were not associated with acute injury measures, but chronic FA was positively associated with processing speed. FA among patients was correlated with RD at both time points, but not AD. All p-values < 0.05, one-tailed.

Conclusions: Our results suggest RD in TAI may be a sign of acute injury severity, as higher values are associated with more severe injuries. Correlation analysis suggests that a lower FA at the chronic phase of TAI is more strongly related to the degree of diffusion perpendicular to tracts, suggesting axons may be demyelinating over time. Furthermore, chronic patients demonstrated slowed information processing speed that could be explained, at least partially, by decreased integrity along the length of axons.

Correspondence: *Carlos D. Marquez de la Plata, PhD, Center for Brain-Health, University of Texas at Dallas, 2200 West Mockingbird Ln., Dallas, TX 75235. E-mail: c.marquez@utdallas.edu*

N. KULKARNI, J. ADLER, A. PEREZ, J. STRAIN, K. WOMACK, R. DIAZ-ARRASTIA & C.D. MARQUEZ DE LA PLATA. Evolution of White Matter Damage after TAI.

Objective: Diffusion Tensor Imaging (DTI) has been useful in showing compromise after traumatic axonal injury (TAI) at the chronic stage; however, the evolution of white matter compromise from the acute stage of TAI to the chronic stage is not well understood. This study aims to examine changes in white matter integrity following a moderate to severe TAI by obtaining DTI within three days of injury and again approximately seven months post-injury.

Participants and Methods: Thirteen patients with moderate to severe TBI with predominant white matter damage consistent with TAI were recruited in the intensive care unit for this study. Ten healthy age- and gender-matched controls were recruited for a comparison group. DTI was collected from a single 3 Tesla scanner in a longitudinal fashion. Each patient was scanned twice, once at the very acute stage (within 3 days post-injury, mean = 1 day), and again at the chronic stage (approximately 7 months post-injury). Conventional preprocessing was conducted using FSL software. Tract-Based Spatial Statistic (TBSS) analysis pipeline was utilized to examine fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD).

Results: Spatial analysis shows a proportional global increase in AD and RD (p-value < 0.001) in acute patients compared to controls with no difference in FA. Chronic patients show greater AD (< 0.005) and RD (< 0.05) compared to controls, and a decrease in FA (< 0.005). Longitudinal analysis of white matter shows general reduction in FA and AD (< 0.01), but no change in RD.

Conclusions: Increased diffusion parallel and perpendicular to axons suggest significant edema occurs within hours of TAI. Over the course of the first seven months, AD decreases suggesting resolution of initial edema. The disproportional changes in AD and RD occurring over time result in a decrease in FA suggesting demyelination. Clinical interventions targeting acutely edematous white matter to prevent subsequent axonal compromise should be examined.

Correspondence: *Carlos D. Marquez de la Plata, PhD, Center for Brain-Health, University of Texas at Dallas, 2200 West Mockingbird Ln., Dallas, TX 75235. E-mail: c.marquez@utdallas.edu*

M. MATSUI, C. TANAKA, A. UEMATSU, M.M. TANAKA & S. UDA. Developmental Trajectories of the Fronto-Temporal Lobes from Infancy to Early Adulthood.

Objective: Some developmental studies have used magnetic resonance imaging (MRI) to examine infant brains, but it remains the case that relatively little is known about cortical brain development in the first few years of life. The purpose of this study was to examine developmental trajectories of whole brain, temporal, and frontal lobes from infancy to early adulthood in healthy individuals, considering sex and brain hemisphere differences.

Participants and Methods: We performed a cross-sectional, longitudinal morphometric MRI study of 114 healthy individuals (54 females and 60 males), aged 1 month to 25 years old (mean age \pm S.D.; 8.8 \pm 6.9). We measured whole brain, temporal, and frontal lobe gray matter (GM)/white matter (WM) volumes, following previously used protocols.

Results: There were significant non-linear age-related volume changes in all regions. Peak ages of whole brain, temporal lobe, and frontal lobe development occurred around preadolescence (9-12 years old). GM volume for both temporal and frontal lobes showed a greater increase in females until around 5-6 years old, at which point this tendency reversed (GM volume changes in males became greater), with male GM volume increasing for a longer time than that of females. WM volume growth changes were similar across regions, all increasing rapidly until early childhood but slowing down thereafter. Furthermore, the right temporal and frontal lobes showed a greater volumetric increase than the left for the first several years, with this tendency reversing at around 6 years old.

Conclusions: These findings indicated that brain developmental trajectories differ depending on brain region, sex, and brain hemisphere. Gender-related factors such as sex hormones and functional laterality may affect brain development.

Correspondence: *Mie Matsui, PhD, Department of Psychology, University of Toyama, 2630 Sugitani, Toyama 930-0194, Japan. E-mail: mmatsui@las.u-toyama.ac.jp*

H. PARK, D. KIM & M. PARK. Distribution Analysis of Cerebral Microbleeds in Cognitive Impairment and Stroke with Susceptibility Weighted Imaging.

Objective: Cerebral microbleeds (CMBs) is an important finding in cerebral amyloid angiopathy and hypertensive arteriopathy. Each of them has a major role in Alzheimer's disease and stroke. Several studies shown that these two disorders have different patterns in CMBs distribution on the brain. We sought to determine whether association of CMBs distribution with cognitive impairment and stroke by susceptibility weighted imaging (SWI) which is known to be a sensitive magnetic resonance technique in detecting microbleeds.

Participants and Methods: 51 patients presenting at our neurology department were included and 1.5T SWI was used to image. 31 patients were diagnosed with cognitive impairment and 30 had recent ischemic stroke. Microbleed Anatomical Rating Scale (MARS) was used to localize each CMB (deep versus lobar). Numbers of microbleeds in each anatomical division were counted and statistically compared. Correlation analysis on the relation between CMBs distribution and cognition were done.

Results: CMBs were revealed at various foci in the brain, with a preference for the deep and lobar regions. Microhemorrhage in patients with cognitive impairment had spatial distribution of lobar predominance while stroke patients showed significantly higher occurrence of CMBs in deep brain area. There was a significant association between the distribution of CMBs and subnormal cognition defined by mini mental state examination, clinical dementia rating scale and global deterioration scale.

Conclusions: These findings suggest there is significant difference in CMBs distribution between cognitive impairment and stroke patients. Enhanced detection and localization of CMBs through SWI can be a useful differential diagnosis tool for cerebrovascular and degenerative diseases.

Correspondence: *Hyunjung Park, Neurology, Yeungnam University Medical Center, College of Medicine, Yeungnam University, Daegu 705717, Republic of Korea. E-mail: kazeni11@hanmail.net*

M.W. REID, D.F. TATE, E.M. LANE, C.Y. ALMENDAREZ, C. VELEZ, M. NOWAK & R.H. PAUL. Impact of Social Engagement on Brain Volumetrics Among the Elderly.

Objective: Several studies have demonstrated the importance of the amygdala for various types of social behavior in numerous species, including humans. Recently, a positive association between amygdala vol-

ume and the size (and number) of an individual's social group(s) was demonstrated in healthy younger and middle-aged human beings. The current study complements this research and its findings by investigating subcortical brain structure volumes in a sample of elderly men and women that differ in the amount of time they spend with friends and family, rather than the size of their social circle.

Participants and Methods: All participants (N=64, Mean age=64yrs) underwent MRI examination and the T1 weighted anatomic images were processed using FreeSurfer suite of tools. The number of hours each individual spent with friends and family over the course of a typical week was self-reported and this information was dichotomized (median split) to form our comparison groups. Additionally, we collected measures of anxiety, depression and stress to determine whether structure and behavior would vary concomitantly.

Results: Our findings indicate that both left and right hemisphere hippocampi and amygdalae are larger in those that spend more time with family and friends. This group also reported significantly lower levels of anxiety. Age, years of education and gender were controlled for in all analyses and intracranial volume was used to correct for brain size in structural analyses. Measures of stress and depression did not significantly differ between groups.

Conclusions: These findings suggest that in addition to the size and overall number of social groups one occupies, that the amount of time spent in social interactions can influence amygdala and hippocampal volume in elderly populations and potentially confer a protective effect against anxiety.

Correspondence: *Matthew W. Reid, Ph.D., Henry M. Jackson Foundation, 6720A Rockledge Dr., Suite 100, Bethesda, MD 20817. E-mail: mttreid@yahoo.com*

K. RHOADS, J. GALBREATH, J. SIEGAL & N. ISENBERG. Relationships between volumetric MRI and neuropsychological assessment results in MCI and Alzheimer's disease.

Objective: Magnetic resonance imaging (MRI) with volumetric analysis may improve accuracy in detecting neurodegenerative disorders via assessing change in key cortical structures, including hippocampi and inferior lateral ventricle volumes. Few studies, however, have examined the relationship between volumetric analysis results and neurocognitive data in patients with Alzheimer's disease (AD) and mild cognitive impairment (MCI).

Participants and Methods: Seventy six older adults (mean age 74.7) with suspected AD or MCI participated in comprehensive clinical evaluations including neuropsychological assessment and MRI with volumetric analysis.

Results: Age was significantly related to total inferior lateral ventricle (ILV) volume ($r = .61, p < .01$) and overall hippocampal volume ($r = -.46, p < .01$), serving as a covariate on all analyses. Hippocampal and ILV volume differed significantly between the AD and MCI groups ($p < .01$). Delayed story recall was associated with increased left, but not right, hippocampal volume ($r = .53, p = .04$). Delayed visual recall, however, was associated with increased hippocampal volumes for the left and right hippocampus ($p = .01$ and $p < .01$, respectively). Left hippocampal volume was also associated with confrontational naming ability ($r = .39, p = .001$) and semantic, but not phonemic, verbal fluency ($r = .31, p < .01$). Right ILV volume was negatively associated with delayed visual memory ($r = -.30, p = .04$), but no other memory measures. Increased ILV volume to overall intracranial volume percentages were only associated with decreased performance on tests of confrontational naming ($r = -.23, p = .05$), and semantic verbal fluency ($r = -.38, p = .001$).

Conclusions: MRI with volumetric analysis findings are associated with cardinal neurocognitive changes in patients with AD and MCI. Larger hippocampal volumes appear more strongly related to memory and language, possibly yielding greater specificity and sensitivity in detecting neurodegenerative changes.

Correspondence: *Kristoffer Rhoads, PhD, Neurosciences, Virginia Mason Medical Center, 1100 Ninth Avenue, Seattle, WA 98101. E-mail: kristoffer.rhoads@vmc.org*

T. RICKARDS, C. STERLING, J. HICKS, A. BARGHI, G. USWATTE, V.W. MARK & E. TAUB. White Matter Hyperintensity Load In Adults With Chronic Stroke Relates To Initial Motor Function, Not Response To CI Therapy.

Objective: To elucidate the relationship between white matter (WM) hyperintensity load, motor ability and response to Constraint-Induced Movement (CI) Therapy in chronic stroke patients with upper-extremity hemiparesis.

Participants and Methods: Participants included eighteen individuals with chronic stroke (63.8±12.4 years) with mild/moderate motor impairment of their more-affected upper-extremity. Sixteen received CI therapy, an efficacious rehabilitation method for upper-extremity hemiparesis. Two patients were given a comparison therapy. MRI FLAIR sequences obtained prior to therapy were rated by two trained raters using the Fazekas Hyperintensity Scale on amount of Periventricular White Matter Hyperintensity (PVWMH) and Deep White Matter Hyperintensity (DWMH). Hemiparetic arm use and function were measured prior to and after therapy with the Motor Activity Log (MAL) and Wolf Motor Function Test (WMFT).

Results: At pretreatment, those with “low” PVWMH ratings had better performance than those with “high” PVWMH ratings on the WMFT ($p<.03$). No significant differences were found on the MAL. For DWMH, no differences were found on either measure between patients in the “low” and “high” groups. Patients’ motor ability improved similarly after CI therapy regardless of pretreatment hyperintensity rating.

Conclusions: Prior to treatment, stroke survivors with less PVWMHs have better motor function than those with a greater amount of PVWMH; amount of DWMH was unrelated to motor function. Neither type of hyperintensity at pretreatment prevents patients from benefiting from CI therapy. This is consistent with data from this laboratory showing that after stroke, neither amount of WM damage in general or amount of damage to the corticospinal tract relates to magnitude of treatment change after CI therapy. Following neurological damage, PVWMH has been related to balance, gait, and cognitive ability; results from the current project suggest that PVWMH may be an important component to examine in upper-extremity motor function, as well.

Correspondence: Tyler Rickards, B.S., University of Alabama-Birmingham, 606 Patton Chapel Trail, Hoover, PA 35226. E-mail: tyler.rickards@gmail.com

S. RYMAN, R.A. YEO, B. KOPALD, J.A. FRANTZ, A. VAKHTIN, S. SHAMILOGLU & R.E. JUNG. Subcortical Volumes Relate to Intelligence Measures.

Objective: Previous research has implicated subcortical structures to be related to intelligence scores, specifically the hippocampus (Andreasen et al., 1993). We hypothesized that hippocampal volume would be related to intelligence in healthy young controls, and that relationships between other subcortical regions that have not been investigated previously would predict performance on intelligence measures.

Participants and Methods: We obtained behavioral and neuroimaging data from 125 healthy participants (57 Female). Subjects did not differ significantly in terms of age (mean=21.7; SD:2.9) or intelligence (Full Scale Intelligence Quotient (FSIQ) =119.5, SD=13.1). FSIQ was assessed using the Wechsler Adult Intelligence Scale (WAIS-III). We utilized the technique developed by Fischl et al. (2002, 2004), implemented by FreeSurfer, for segmentation of subcortical white matter and deep gray matter volumetric structures, which included bilateral hippocampus, amygdala, caudate, putamen, globus pallidus, nucleus accumbens, and thalamus. These volumetric values were entered into a stepwise linear regression controlling for age, sex, and total intracranial volume.

Results: We found that larger volume in the right caudate was predictive of FSIQ ($F=4.2$, $p<0.003$, $R^2=0.12$). Post hoc analysis revealed that the Verbal Comprehension Index (VCI) was also predicted by right caudate volume ($F=3.6$, $p=.008$, $R^2=.11$), while the Perceptual Organization Index was predicted by a model that included the left amygdala, left nucleus accumbens, and right caudate ($F=4.1$, $p=.001$, $R^2=.17$).

Conclusions: This study did not replicate previous findings showing associations between hippocampal volumes and intelligence. Rather, caudate volumes were found to predict FSIQ and VCI across subjects, supporting the importance of fronto-subcortical networks described previously (Tekin & Cummings, 2002).

Correspondence: Saphira Ryman, University of New Mexico, 800 Madison St. NE, Albuquerque, NM 87110. E-mail: saphira.ryman@gmail.com

L.M. SQUEGLIA, J. JACOBUS, S.F. SORG, T.L. JERNIGAN & S.F. TAPERT. Does Cortical Thickness During Adolescence Predict Neuropsychological Functioning?

Objective: Adolescence is characterized by significant neuromaturation, including extensive cortical thinning, particularly in frontal regions. The goal of this study was to examine the behavioral correlates of this neurostructural development in early adolescence.

Participants and Methods: Participants were 153 healthy 12-14 year-olds (44% female) recruited from local schools. Participants completed a comprehensive neuropsychological test battery and MRI session. Cortical surface reconstruction and thickness estimates were performed via FreeSurfer.

Results: Age and cortical thickness were negatively correlated in 18 brain regions, with 14 of the 18 regions located in frontal areas ($r_s=-.16$ to $-.30$, $ps<.05$). Hierarchical regressions examined the influence of cortical thickness on attention/working memory, verbal and visual learning and memory, and spatial and executive functioning, controlling for age and intracranial volume. In 14 regions spanning frontal, parietal, and temporal lobes, thinner cortices predicted better performance on tests of attention/working memory, verbal and visual learning and memory, and spatial functioning ($\beta=-.16$ to $-.22$, $ps<.05$). In no areas were age or cognitive performance positively related to cortical thickness.

Conclusions: Significant cortical thinning occurs during early adolescence, particularly in frontal regions, which corresponds with improved cognitive functioning independent of the effect of age.

Correspondence: Lindsay M. Squeglia, Ph.D., University of California San Diego, 3350 La Jolla Village Drive, La Jolla, CA 92037. E-mail: lsquegli@ucsd.edu

C. STARK, D. HUFFMAN, S. STARK & M. YASSA. Medial temporal lobe cortical thickness measurement using diffeomorphic registration in aging and mild cognitive impairment.

Objective: Neurodegeneration in Alzheimer’s disease (AD) begins in layer II of the entorhinal cortex (EC). This structural lesion distinguishes AD from healthy aging in post-mortem studies. Our goal was to assess a diffeomorphic registration approach to measurement of cortical thickness (DiReCT) in healthy volunteers and aMCI patients and to assess the relationship between EC thickness and a delayed recall word list learning task.

Participants and Methods: We assessed EC cortical thickness in a sample of healthy volunteers ($N=100$, age 18-89) and a sample of MCI patients using a technique that uses diffeomorphic registration (DiReCT). This takes a different approach than FreeSurfer by warping each scan’s white matter/gray matter boundary to the corresponding gray matter/CSF boundary using anatomical constraints. The amount of deformation is used to calculate thickness. The approach prevents over-estimating thickness in regions with deep sulci or intersecting gray matter banks and corrects for any errors in segmentation. This enables it to be fully automatic without any adjustment in the segmentation process.

Results: Test-retest reliability (using two serial scans conducted within 1 month) compared favorably with FreeSurfer in both the aMCI volunteers and a set of older controls. Further, the technique is sensitive to a known decrease in EC thickness that is characteristic of MCI. Consistent with post-mortem data, across the healthy lifespan EC thickness shows robust resistance to change. Finally, we show an association between EC thickness in MCI patients and delayed recall on a word list learning list.

Conclusions: The DiReCT approach is a viable, fully-automated method for measurement of entorhinal cortical thickness. As in other studies, EC thickness did not change across the healthy lifespan but was reduced in aMCI. Further, the correlation with delayed recall suggests that EC thickness is a biomarker tied to memory function, and in particular for memory that is dependent on the medial temporal lobe.

Correspondence: *Craig Stark, Ph.D., Neurobiology and Behavior, UC Irvine, 213 Qureshey Research Lab, Irvine, CA 92697. E-mail: cestark@uci.edu*

D.F. TATE, C. FRANKLIN, C. VELEZ, P. KOCHUNOV, G. YORK, P. SHERMAN & S. MCCUIRE. Relationship between quantitative frontal white matter neuroimaging measures and global cognitive function in high altitude pilots.

Objective: Recently, there have been a number of high-altitude pilots who experienced clinical neurologic decompression syndrome (NDCS) symptoms (i.e., disorientation, cognitive dysfunction) while flying. In addition, they appear to be at increased risk for developing white matter injury (i.e., white matter hyperintensities (WMH)), though the exact pathologic etiology is unknown. In this study, we examined the relationship between MRI measures of white matter integrity (WMH volume, fractional anisotropy (FA)) and cognitive function to determine what the relationship between white matter injury and cognitive function would be in this unique clinical population.

Participants and Methods: MRI and cognitive testing results for 84 active duty U2 Air Force pilots (68 Non-NDCS, 16 NDCS) were examined for differences between groups and for relationships between imaging and cognitive variables. WMH volumes for the frontal and temporal lobes were quantified from FLAIR images, FA was quantified for major frontal and temporal tracts, while the Multidimensional Aptitude Battery (MAB) and MicroCog were used to examine cognitive performance.

Results: WMH volumes were non-significantly increased in the frontal and temporal lobes for NDCS pilots. The FA values for the left anterior corona radiata (L-ACR) were significantly decreased in NDCS pilots but not for other frontal or temporal tracts. Only MicroCog attention and processing speed performance was marginally worse in NDCS pilots. WMH volume was not related to MAB/MicroCog performance though significant relationships were noted between FA values in the ACR and posterior corona radiata (PCR) and PIQ, spatial processing, attention, and processing speed. The magnitude of these relationships was noted to be much larger in NDCS compared to non-NDCS pilots.

Conclusions: Important relationships between measures of white matter integrity (especially FA) and cognitive function were noted in this unique population that require additional investigation.

Correspondence: *David F. Tate, Ph.D., Neurology, DVBIC, SAMMC, San Antonio, TX 78234. E-mail: dftatephd@mac.com*

S. TREMBLAY. Long-term impact of sport concussion on primary motor cortex thickness and metabolism in asymptomatic athletes.

Objective: Even if a concussed athlete generally shows full recovery within the first 10 days, recent studies have shown metabolism disruption in the primary motor cortex (M1) in the acute phase and 6 months after concussion. However, whether or not these neurochemical alterations are persistent and linked to cortical thickness of M1 is still unknown.

Participants and Methods: The effects of sport concussions on M1 metabolic activity and cortical thickness were assessed in a group of 16 active American football players who sustained their last concussive event, on average, three years prior to testing and a control group of 14 active American football players who never sustained a concussion. The protocol consisted of a single session of proton magnetic resonance spectroscopy (1H-MRS) acquired during the off-season using a 3T Siemens MRI system. To localize the primary motor cortex (M1), a T1-

weighted MPRAGE sequence was used. 1H-MRS data were acquired using a MEGA-PRESS sequence allowing concentrations of the following metabolites to be measured: GABA, Glutamate+Glutamine, N-acetylaspartate, creatine + phosphocreatine, myo-inositol. Whole-brain cortical thickness analysis was used to verify possible differences between groups. The MACCAC (Mapping Anatomical Correlation Across Cerebral Cortex) method was used in order to evaluate differences between slopes of correlations between M1 and other brain regions. Finally, M1 thickness was correlated with metabolic concentrations.

Results: No significant group differences were observed for metabolic concentrations, cortical thickness, correlation maps of M1 thickness, and correlation between M1 thickness and metabolic concentrations.

Conclusions: Taken together, these data suggest a complete recovery of metabolic disruption and no impact on whole brain cortical thickness 3 years following the last concussion in active university-level football players.

Correspondence: *Sara Tremblay, Psychology, University of Montreal, 4367 des Érables, Montreal, QC H2H 2C7, Canada. E-mail: saratremblay1@gmail.com*

J.R. WIENER, J. CHONG, A. SMITH, J. BREFCZYNSKI-LEWIS, B. HOU, D. KERR, D. MCLAREN & M.W. HAUT. Grey Matter Changes Following Attention Training.

Objective: There is evidence that acquisition of new skills in adults results in changes in brain structure as measured by MRI. We examined the effect of 10 days of attention training on brain structure (grey matter) in healthy young adults.

Participants and Methods: Nine healthy adults received attention training involving 20 minutes per day of training on n-back tasks over two weeks. They were compared to 8 healthy controls. Both groups received pre and post-training cognitive assessments and pre and post-training high resolution structural MRI. Only 6 controls received MRI. Groups did not differ significantly ($p > .05$) by age, years of education, or estimated IQ. Tensor Based Morphometry (TBM) and High Dimensional Warping (HDW) implemented in SPM8, were used to analyze change in grey matter volume over time. We set $p < .001$, uncorrected, with a minimum of 50 contiguous voxels for the extent threshold for significance.

Results: Significant group x time interactions were observed on the n-back task [$F(1,15)=33.9$, $p < .05$], a self-ordered pointing task [$F(1,15)=9.2$, $p < .05$], and Digit Span [$F(1,15)=5.8$, $p < .05$]. In each case, the intervention group improved over time, while the control group did not. We also identified increases in grey matter volume in response to attention training in cortical areas, including the left inferior middle frontal gyrus [$x = -46$, $y = 34$, $z = -2$, z -score = 3.6, voxels = 50] and the left parahippocampal gyrus [$x = -20$, $y = -54$, $z = -2$, z -score = 3.8, voxels = 60]. Change in grey matter volume correlated with the change in working memory performance [$r = 0.69$, $p < .05$ left frontal; $r = 0.54$, $p < .05$ left parahippocampus].

Conclusions: We observed a change in brain function on working memory tasks and an increase in grey matter volume in structures associated with new learning and working memory. These changes were present after 10 days (200 minutes) of training. This increased brain volume was related to improved brain function.

Correspondence: *Jennifer R. Wiener, Psy.D., Behavioral Medicine and Psychiatry, West Virginia University School of Medicine, 930 Chestnut Ridge Road, Morgantown, WV 26505. E-mail: jwiener@hsc.wvu.edu*

V.J. WILLIAMS, J. JURANEK, M. DENNIS & J. FLETCHER. Examination of Frontal and Parietal Tectocortical Attention Pathways in Spina Bifida Meningomyelocele Using Probabilistic Diffusion Tractography.

Objective: The tectum is a critical component of attention orienting and selection, with bi-directional connections between frontal and parietal attention networks. Beaking of the midbrain tectum is a hallmark neurodevelopmental malformation in Spina Bifida Meningomyelocele

(SBM), and has been linked to neuropsychological deficits in attention orienting. Conversely, sustained attention dependent on frontal attention networks is relatively intact within this population. The degree to which variations in tectum structure influences white matter (WM) connectivity to cortical regions implicated in attention processes is unknown.

Participants and Methods: To assess the relationship between tectal structure and its connectivity to frontal and parietal cortical regions, probabilistic diffusion tractography was performed on 106 individuals (81 SBM, 25 typically developing (TD)), using FSL's *probtracX* to isolate anterior versus posterior tectocortical WM pathways. Hand-drawn labels of the tectum served as tractography seed points, with FreeSurfer frontal and parietal cortex parcellations as endpoints.

Results: Results reveal those with SBM exhibit significantly reduced tectal volume, along with decreased fractional anisotropy (FA) in posterior but not anterior tectocortical WM pathways when compared to TD individuals, controlling for age. The SBM group also showed a greater within-subject discrepancy between frontal and parietal WM integrity compared to the TD group. Of those with SBM, qualitative classification of tectal beaking was associated with increased axial diffusivity across both anterior and posterior tectocortical pathways, relative to SBM individuals with a normal appearing tectum.

Conclusions: Results of the current study support previous findings of selective insult to posterior versus anterior structures in SBM, and quantifiably relate for the first time tectal volume, tectocortical WM integrity, and tectal malformation in this population.

Correspondence: *Victoria J. Williams, University of Houston, 4907 Louisiana, #4, Houston, TX 77006. E-mail: toriS5@gmail.com*

T.C. WU, E.A. WILDE, S.R. MCCAULEY, A. BARNES, G. HANTEN, Z.D. CHU, J.V. HUNTER & H. LEVIN. Diffusion Tensor Imaging Findings in Mild Traumatic Brain Injury and Orthopedic Injury.

Objective: Advanced neuroimaging techniques have enabled us to detect microstructural changes in the brain following mild traumatic brain injury (mTBI). In this study, we examined microscopic changes in the frontal and callosal regions, between patients who sustained mTBI or orthopedic injury (OI) and typically-developing (TD) individuals using diffusion tensor imaging (DTI).

Participants and Methods: Eighty-three patients with mTBI, 60 patients with OI, and 37 TD controls were examined. MTBI was classified as an initial Glasgow Coma Scale score of 13-15, and all participants had no findings on CT. Both mTBI and OI participants underwent MRI scan on a 3-Tesla scanner within 96 hours of injury. Two DTI metrics, fractional anisotropy (FA) and apparent diffusion coefficient (ADC), were quantified using Philips PRIDE tractography software.

Results: MTBI, OI and TD did not differ significantly on age at injury, gender, race and socioeconomic status. The TBI and OI groups did not differ significantly for FA or ADC in the genu, body, splenium or total corpus callosum and frontal regions bilaterally (FA: p values ranged from 0.64-0.97, d ranged from 0.01-0.08; ADC: p values ranged from 0.46-0.97, d ranged from 0.01-0.13). Compared to the TD group, the TBI group demonstrated significantly higher ADC in the genu ($p=0.04$, $d=0.42$), splenium ($p=0.04$, $d=0.41$) and total of the corpus callosum ($p=0.03$, $d=0.43$) and the right frontal region ($p=0.03$, $d=0.43$). A marginal difference was found in the left frontal area ($p=0.08$, $d=0.35$). FA between TBI and TD groups did not differ significantly in genu, body, splenium or total of the corpus callosum and frontal regions bilaterally (p values ranged from 0.13-0.87, d ranged from 0.05-0.34).

Conclusions: The use of OI versus TD control groups may account for some of the conflicting results in DTI studies of mTBI. Possible reasons for the failure to detect differences in mTBI versus OI participants may relate to premorbid characteristics, systemic response to injury, or co-occurring occult head trauma.

Correspondence: *Trevor C. Wu, Ph.D., Baylor College of Medicine, One Baylor Plaza, Houston, TX 77030. E-mail: ctwu@bcm.edu*

Dementia (Subcortical, Specific Disorders, MCI, etc.)

K. PARK, H. JIN, S. KIM, S. LEE, Y. KIM, G. KIM, S. KIM, Y. KIM, S. CHA & S. YIM. Randomized, Double-Blind, Placebo-Controlled Clinical Trial of Korean Ginseng as a Functional Food in Healthy Volunteers with Mild Cogni.

Objective: Ginseng has been used as a functional food worldwide. There are many evidences to support ginseng has a cognition enhancing function. But there is a few clinical studies to test cognitive effect of ginseng. To address the cognitive enhancing function of Korean ginseng as a functional food, a randomized, double-blind, placebo-controlled clinical trial of Korean ginseng was conducted.

Participants and Methods: A total of 90 healthy Korean volunteers with mild cognitive impairment participated in this study. All subjects was allocated randomly into 'Ginseng' group and 'Placebo' group. All subject administered 3g of Korean Ginseng powder or placebo for 6 month. Korean version of the Mini-Mental Status Examination (K-MMSE), Korean version of Instrumental Activities of Daily Living (K-IADL), and Seoul Neuropsychological Screening Battery (SNSB) were used to assess the change in cognitive function at the end of the 6 month study period.

Results: The subjects of 'Ginseng' group showed significant improvement on the visual learning ($p=0.0407$ and $p=0.0342$ in PP and ITT analysis, respectively) and visual recall ($p=0.0396$ and $p=0.0355$ in PP and ITT analysis, respectively) after 6 month of Korean ginseng treatment when compared with 'placebo' group. There were no serious adverse events.

Conclusions: These results suggest that Korean ginseng has cognition enhancing effect.

Correspondence: *Key-Chung Park, Kyung Hee Medical Center, #1 Hoegidong, Dongdaemoon-gu, Seoul 130-702, Republic of Korea. E-mail: kcpark67@medimail.co.kr*

Dementia (Alzheimers)

R. MITSUTO, K. FUJI, T. MUNESAWA, K. SAWADA, Y. HASHIMOTO, K. KONDO & K. TATSUKAWA. Evaluation of the patients with Alzheimer's disease and mild cognitive impairment -Utility of discriminant-analysis in the substests of Rivermead Behavioral Memory Test-

Objective: Although it is important for Alzheimer's disease (AD) to make a diagnosis in early stage because the early intervention slows the dementia, it is difficult to detect early symptoms by using screening tests. Present study focuses on the identification of those individuals with AD and mild cognitive impairment (MCI) by using Rivermead Behavioral Memory Test (RBMT). Previous study reported that total screening score and profile score of RBMT could be a useful tool for the evaluation of AD and MCI. Since the subtest of RBMT can evaluate different kinds of memory, in this study, the statistical differences in all subtest scores of RBMT were analyzed. The primary objective of this study was to examine the usefulness of the substests of RBMT for diagnosis of AD, MCI and age-matched healthy normal controls (NC). The secondary objective of it was to comprehend the characteristics of memory function in AD, MCI and NC.

Participants and Methods: The participants consisted of forty adults with AD ($n = 11$), MCI ($n = 13$) and NC ($n = 16$). We used the RBMT to evaluate their memory abilities. Their features were investigated by coefficients of the discriminant-analysis.

Results: The discriminant-analysis was able to correctly classify 92.3% of AD, 100% of MCI and 93.8% of NC. These results demonstrated that the discriminant-analysis distinguished among the types of three diagnoses. The substests of RBMT characterizing NC were "Delayed recall of a short story", "Immediate recall of a message" and "Immediate recall of new route". The substests of RBMT characterizing AD were "Immediate recall of new route", "Belonging" and "Immediate recall of a short story".

Conclusions: These findings suggest that the subtests of RBMT could become a useful test for the diagnosis of AD, MCI and NC, and that NC maintained significantly higher levels of verbal memory, prospective memory and spatial memory than other groups. On the other hand, AD of verbal comprehension, prospective memory and spatial memory were significantly lower than other groups.

Correspondence: *Rina Mitsuto, Hiroshima Higher Brain Function Center, Higashikawaguchichou, 4-2-9, Hukuyama Hiroshima 720-0821, Japan. E-mail: rinamitsuto@yahoo.co.jp*

Electrophysiology/EEG/ERP

C. STEFANIDOU, R. CEPONIENE & J.P. MCCLEERY. **Neural Time-Course of Mechanisms for the Processing of Human Action Sounds in Toddlers.**

Objective: Extensive research has uncovered evidence for specialist neural mechanisms for the visual processing of the actions of others in infants and adults. Similar specialist neural mechanisms have recently been identified for the processing of the sounds produced by the actions of others. Here, we employ a novel event-related potentials (ERP) paradigm to investigate the nature and time-course of neural mechanisms associated with human and non-human action sound processing in toddlers.

Participants and Methods: Participants were twenty-one 2-year-olds. The auditory-auditory Repetition Suppression (RS) ERP paradigm involved human action sounds (hands clapping, hands ripping paper) and non-human action sounds (ocean waves, helicopter blades spinning). Four trial types were presented, which involved the immediate repetition or non-repetition of human and non-human action sounds. Differences in neural activity elicited by repeated (suppression of brain mechanisms) and non-repeated (release of brain mechanisms) stimuli were examined.

Results: Repeated measures ANOVAs including Stimulus Type (Human, Non-Human) and Hemisphere (Left, Right) as within-subjects factors were conducted on RS difference wave components recorded over central and frontal cortex. Human and non-human action sounds elicited differential activity within a latency range associated with perceptual processing (250-450ms). Specifically, human action sound processing elicited right-lateralised RS effects recorded from electrodes over central/motor cortex, whereas non-human action sound processing elicited RS effects bilaterally in electrodes over frontal cortex.

Conclusions: These findings further our understanding of the nature and time-course of neural activity associated with human action sound processing in toddlers, and contribute to a growing body of evidence for the existence of specialist neural mechanisms for the processing of other people and their actions early in human development. This study was funded by Autistica.

Correspondence: *Chrysi Stefanidou, School of Psychology, University of Birmingham, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom. E-mail: cxs811@bham.ac.uk*

ADHD/Attentional Functions

D. SHAPERO, J. CROSBIE & R. SCHACHAR. **Working Memory Deficits in ADHD and ODD: Shared or Unique?**

Objective: Verbal and Spatial Working Memory (WM) deficits have been observed in individuals with Attention Deficit/Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD), and individuals presenting with both ADHD+ODD. Although recent research has begun to explicate whether the observed impairments in WM result from the presence of ADHD, ODD, or comorbid ADHD+ODD, relatively little research has been conducted to differentiate the disorders in terms of specific deficits in working memory. The objective of the current research was to explore whether the observed WM deficits in individuals with ADHD and ODD are shared, or if the deficits are unique to either disorder.

Participants and Methods: Children ranging from 5 to 16 years of age completed a range of verbal and spatial span and WM tasks. The group included individuals with (a) ADHD only (N = 579); (b) ADHD+ODD (N = 420); (c) ODD only (N = 86); and Normal Controls (NC; N = 62). All participants were free of stimulant medication for at least 48 hours.

Results: Group differences indicated that individuals with ADHD and ADHD+ODD had significant deficits across all WM and span tasks when compared to NCs. The ODD group had significantly worse performance than the NC group on Digit Span (forward and backward) and the Spatial N-back, though had significantly better performance than the ADHD group on the Digit Span backwards. Regression modeling was used to further explore the relative variance accounted for by ADHD and ODD. Results demonstrated that the presence of ADHD accounted for significant variance associated with both verbal and spatial WM performance. The presence of ODD did not account for any additional or unique variance.

Conclusions: Results add to previous findings, noting deficits in ADHD on span and WM tasks. This study did not find evidence of an independent deficit of WM in ODD, suggesting that WM deficits associated with ODD likely result from the high rate of comorbidity with ADHD within the population.

Correspondence: *Dana Shapero, MA, The Hospital for Sick Children, 555 University Avenue, Toronto, ON M5G1X5, Canada. E-mail: dana.shapero@sickkids.ca*

Invited Symposium: Progression of Non-Amnesic Dementias: Measurement and Intervention

Chair: **Emily Rogalski**

3:15–4:45 p.m.

E. ROGALSKI. **Invited Symposium: Progression of Non-Amnesic Dementias: Measurement and Intervention.**

Symposium Description: Neurodegenerative diseases can be classified by the molecular nature of the proteinopathy, the cellular aspects of the pathology, the anatomical distribution of the neurosynaptic loss, or the clinical features of the resultant phenotype. The relationship between structural neuroanatomy and clinical features is relatively consistent; however, the relationship of the clinical picture to the underlying disease process in neurodegenerative dementia is more complex. For example, the clinical syndrome primary progressive aphasia (PPA) can be caused by the neuropathology of either Alzheimer's disease (AD) or frontotemporal lobar degeneration (FTLD). This demonstrates that there is no one to one relationship between clinical phenotype and underlying pathology. Disease progression in dementia syndromes is also variable and incompletely understood, with some patients declining more rapidly than others. This symposium will introduce approaches directed at establishing markers of etiology and progression of dementia syndromes. We will also highlight the potential use of these approaches in clinical trials and providing disease-staging expectations for patients and families.

Learning Objectives:

- (1) characterize clinical and neuroanatomic features of nonamnesic neurodegenerative dementias such as primary progressive aphasia
- (2) describe approaches directed at establishing potential markers of neurodegenerative disease
- (3) explain the importance of relationships between clinical phenotype and neuropathology in neurodegenerative dementias

Correspondence: *Emily Rogalski, Cognitive Neurology and Alzheimer's Disease Center (CNADC), Northwestern University, 320 E Superior Street, Searle Building 11-569, Chicago, IL 60611. E-mail: erogalski@gmail.com*

T.W. CHOW. Update on Concepts of Progression and Caregiver Interventions.

Predicting the progression of dementia is a clinical challenge, yet it remains a patient and family FAQ. A 4-stage model of dementia can be helpful in educating caregivers and preparing them for what lies ahead. In a prior publication, we demonstrated preliminary evidence that the behavioral variant of frontotemporal dementia (bvFTD) may be characterized by an inflection point in Neuropsychiatric Inventory scores between stage 2 (progressively severe behavioral aberration) and stage 3 (increasing apathy and remission of behavior problems) that occurs at approximately year 6 of illness. In Alzheimer's disease, there was no inflection point. In this presentation, we will present the results of re-testing the model with a different dataset and inventories added to the Neuropsychiatric Inventory.

<<>>

Regardless of disease stage, support for informal caregivers is crucial to patient and family well-being. Needs assessments of children caring for early-onset dementia show that they had felt isolated and under-informed during their experience. Young carers saw caring as positive overall but identified opportunities for professionals to assist them in overcoming stigma and the challenge of balancing childhood and adolescent development within this context. Specific commentary and the resulting online resources for these caregivers will be presented, as well as plans for expanding this work to grandchildren of Alzheimer's patients. Correspondence: *Tiffany W. Chow, Baycrest Brain Health Complex, 3560 Bathurst St., Toronto, ON M6A 2E1, Canada. E-mail: tchow@research.baycrest.org*

B. DICKERSON. Monitoring Progression of PPA and bvFTD: Toward Measures Useful for Clinical Trials.

Primary progressive aphasia (PPA) and behavioral variant frontotemporal dementia (bvFTD) have characteristic clinical phenotypes arising from multiple underlying neurodegenerative pathologies. Although both of these syndromes ultimately lead to non-amnesic dementias, they are recognizable in the prodromal clinical phase. This, along with deepening insights into potential markers of progression and their underlying neurodegenerative pathophysiology, offer the hope of meaningful intervention. To move toward this goal, we need robust measures for confident early diagnosis, subtyping, and monitoring of symptoms. Recent data on these measures will be reviewed—including new clinical scales and multi-center MRI data—which support the concept that the field is mature enough to embark on a new wave of clinical trials of both symptomatic and disease-modifying interventions.

Correspondence: *Brad Dickerson, 149 13th St., Suite 2691, Charlestown, MA 02129. E-mail: bradd@nmr.mgh.harvard.edu*

Symposium 3: The Reserve Construct: How Homogeneous is it?

Chair: Eli Vakil

Discussant: Yaakov Stern

3:15–4:45 p.m.

E. VAKIL, Y. STERN, E.D. BIGLER, E. VAKIL, Y. RASSOVSKY & Y. STERN. The Reserve Construct: How Homogeneous is it?

Symposium Description: Symposium Description: The 'reserve' concept was introduced in an attempt to explain repeated findings that similar brain pathologies have resulted in different clinical outcomes. Based on studies conducted subsequent to the introduction of the reserve concept, it became more evident that a person's premorbid cognitive abilities (e.g., intelligence) as well as brain reserve capacity (e.g., total intracranial volume) provide a differential reserve against age-related

changes or brain injury. In this symposium, based on cutting-edge research, new empirical findings will be presented that highlight the complexity of cognitive as well as brain aspects of the reserve concept. In his talk, Dr. Stern will review some representative studies from his group that exemplify possibilities for the neural substrate of cognitive reserve. Dr. Bigler will discuss the literature on brain reserve capacity and cognitive reserve in Traumatic Brain Injury (TBI) outcome, along with findings from the Social Outcomes of Brain Injury in Kids (SOBIK), a multisite pediatric TBI study. Dr. Vakil will present empirical data attempting to identify key variables that constitute the "cognitive reserve" construct in the context of TBI. In addition the contribution of pre-morbid variables and acute injury indices to long-term functioning following TBI will be reported. Finally, Dr. Rassoovsky will introduce a novel construct, Emotional Reserve, which received support from a recently collected data in explaining significant variance in TBI outcome. Dr. Stern will provide commentary on the symposium as a discussant.

Correspondence: *Eli Vakil, PhD, Psychology, Bar Ilan University, Bar Ilan University Ramat Gan, Ramat Gan 52900, Israel. E-mail: vakile@mail.biu.ac.il*

Y. STERN. Imaging Cognitive Reserve.

The concept of reserve arose from the mismatch between the extent of brain changes or pathology and the clinical manifestations of these brain changes. The cognitive reserve hypothesis posits that individual differences in the flexibility and adaptability of brain networks underlying cognitive function may allow some people to cope better with brain changes than others. Although there is ample epidemiologic evidence for cognitive reserve, the neural substrate of reserve is still a topic of ongoing research. We introduced two possible neural implementations of cognitive reserve. Neural reserve refers to the natural variability in the efficiency or capacity of existing brain networks. Neural compensation refers to the process by which individuals suffering from brain pathology use brain structures or networks (and thus cognitive strategies) not normally used by individuals with intact brains in order to compensate for brain damage. We also consider the possibility that there are generalized cognitive reserve networks that do not rely on task-related activation. Our strategy for studying the neural substrates of reserve in the context of aging is to quantify brain changes potentially associated with cognitive change, and couple these with fMRI activation studies and clinical evaluations. This combination of data allows multivariate analyses that can explore the effect of brain changes on cognitive networks. We can then explore whether cognitive reserve is mediated by aspects of task-related activation or moderates the effects of physical brain changes or brain network changes on cognition. In this presentation we will review some representative studies from our group that exemplify possibilities for the neural substrate of cognitive reserve. Correspondence: *Yaakov Stern, 630 W 168th St, P&S Box 16, New York, NY 10032. E-mail: ys11@columbia.edu*

E.D. BIGLER. Brain and Cognitive Reserve in Traumatic brain injury.

The idea of reserve against brain damage stems from the repeated observation that there is not a strict linear relationship between the degree of brain pathology or brain damage and the clinical manifestation of that damage. Factors associated with both brain and cognitive reserve likely influence outcome from traumatic brain injury (TBI), but brain reserve capacity (BRC) and cognitive reserve (CR) have received only minimal attention in TBI research involving neuropsychological outcome. From a BRC perspective, optimal brain size and the size of key brain structures prior to injury likely bestow some level of reserve in response to injury. The key element for the influence of BRC may be how much structural atrophy results from the injury and how these pathological influences alter the brain's underlying neural networks that relate to particular functions. From the CR perspective, higher levels of pre-morbid cognitive ability are associated with better recovery. Higher pre-morbid ability level likely is associated with efficient neural systems

that capitalize on maximal neural connectivity within some optimal brain size or given structure, like the hippocampus. The literature on BRC and CR in TBI outcome will be reviewed along with the findings from the Social Outcomes of Brain Injury in Kids (SOBIK), a multisite pediatric TBI study where total intracranial volume (TICV) is used to estimate pre-injury brain volume. Since in the pediatric brain, brain growth drives intracranial size but reaches its asymptote at the end of the latency period of childhood, TICV represents an excellent estimate of total brain volume (TBV) prior to injury. Furthermore, since there is an overall positive relationship between the size of subcortical structures and TBV, the TICV estimate of TBV can also be used to estimate pre-injury subcortical size. Neuropsychological outcome in pediatric TBI will be discussed from the influence that BRC and CR may have on outcome.

Correspondence: *Erin D. Bigler, 1001 Kimball Tower, BYU, Provo, UT UT. E-mail: erin_bigler@byu.edu*

E. VAKIL, Y. LEVI, E. AGRANOV, M. SELA-KAUFMAN & Y. RASSOVSKY. Predicting Long-term Outcome Following Traumatic Brain Injury (TBI): Three-factor Cognitive Reserve Structure.

Although numerous studies have employed various measures thought to reflect the Cognitive Reserve (CR) concept, empirical evidence for its construct validity is lacking. The aims of this study were two-fold. First, to identify key variables that constitute this construct in the context of Traumatic Brain Injury (TBI). Second, based on the CR factors that were identified, to evaluate the contribution of pre-morbid variables and acute injury indices to long-term functioning following TBI. Eighty-nine participants with moderate-to-severe TBI were evaluated at an average of 14.2 years post-injury. Pre-morbid variables typically used in literature as reserve indices were assessed by medical examinations, neuropsychological evaluations, clinical interviews, and questionnaires. Using factor analysis, we found a content-based, three-factor CR structure, consisting of pre-morbid intellectual functioning (measured according to “hold” principle), leisure activity, and socioeconomic status. Subsequent analyses suggested two separate factor structures: one for CR and the other for neurological history and head circumference, commonly used as Brain Reserve indices. Based on these findings the predictive value of these three identified factors for long-term outcome following TBI was evaluated. The results showed that TBI severity predicted cognitive, social, and daily functioning outcomes. Among the CR factors (after controlling for injury severity), pre-injury intellectual functioning predicted cognitive, occupational, social, emotional and daily functioning. Pre-injury leisure activity predicted cognitive, emotional and daily functioning, while socioeconomic status failed to predict any of these variables. Findings suggest that CR construct explains significant variance in TBI outcome, over and above the variance explained by injury severity. Findings provide empirical support for the notion of CR and suggest a coherent framework for further investigation.

Correspondence: *Eli Vakil, Department of Psychology, Bar-Ilan University, Ramat-Gan 52900, Israel. E-mail: vakile@mail.biu.ac.il*

Y. RASSOVSKY, M. SELA-KAUFMAN, Y. LEVI, E. AGRANOV & E. VAKIL. Emotional Reserve in Traumatic Brain Injury: Evaluating Construct Validity of Emotional Reserve and its Relationship to Functional Outcome.

Traumatic brain injury (TBI) often results in long-term physical and mental disability. While injury severity accounts for a large portion of the variability in functional impairment, numerous clinical reports describe cases with similar brain insults, yet distinct clinical expression. The concept of “reserve” against brain damage has been proposed to account for this mismatch between brain pathology and its clinical expression. In this sense, the concept of “reserve” is applied as a potential buffer between brain pathology and clinical outcome. Prior efforts to characterize this concept focused mostly on anatomical or physiological measures (“Brain Reserve”), as well as mental abilities (“Cognitive Reserve”). However, no studies have examined in this context the emotional or personality components that are potentially related to TBI out-

come. The present study attempted to evaluate this additional component of reserve, termed “Emotional Reserve.” Our objective was to examine its construct validity and its relationship with real-world functional outcome. We collected pre-morbid, injury severity, and personality data on 61 individuals who sustained moderate-to-severe TBI. Data was collected from medical records, questionnaires filled by family members regarding pre-morbid personality, questionnaires assessing mental and functional status, and neurobehavioral assessment performed by a clinician. Using factor analysis and structural equation modeling approaches, we found a content-based, three-factor personality structure. Among the three factors identified, one pre-morbid personality factor, Neurotic Personality, was found to significantly predict post-injury mental status, social functioning, and occupational level, after controlling for the effects of injury severity. Findings suggest that Emotional Reserve is an important construct, predicting significance variance in TBI outcome, and could contribute to a more complete understanding of the concept of “reserve.”

Correspondence: *Yuri Rassovsky, UCLA Semel Institute for Neuroscience and Human Behavior, 760 Westwood Plaza (CS-746), Los Angeles, CA 90095. E-mail: yurir@ucla.edu*

**Symposium 4:
The Pediatric Imaging, Neurocognition and Genetics (PING) Study: Focus on Assessment Core Phenotypes**

Chair: Terry Jernigan

3:15–4:45 p.m.

T.L. JERNIGAN, N. AKSHOOMOFF, L. CHANG, E. NEWMAN & V. DOUET. The Pediatric Imaging, Neurocognition and Genetics (PING) Study: Focus on Assessment Core Phenotypes.

Symposium Description: In this symposium we describe PING, a large multisite study of well over 1000 young, typically-developing participants (aged 3 to 20 years) recruited at 10 sites throughout the US. The goal of the study was to create a pediatric imaging-genomics data resource to be shared with the developmental community. PING phenotypes were derived from developmental history, family history, and neuromedical history questionnaires, neuropsychological testing, and a standardized, multimodality imaging protocol. DNA was extracted from saliva samples and genome-wide genotyping was performed on the extracted DNA using the Illumina Human660W-Quad BeadChip. Here we present the structure of the study and of the resulting data resource, focusing on the Assessment Core phenotypes. Dr. Natacha Akshoomoff will highlight the neuropsychological data in the PING resource, and will describe effects of age and gender on NIH Cognition Toolbox performance. Dr. Linda Chang will highlight PING neuromedical data, and will present comparisons of matched groups of PING participants with and without prenatal nicotine exposure. These comparisons reveal effects on multimodal imaging phenotypes associated with nicotine exposure. Dr. Erik Newman will highlight auxiliary PING phenotypes collected through the NHGRI PhenX RISING project, and will present new findings linking levels of childhood anxiety with a developmental cortical surface area phenotype. Dr. Vanessa Douet will highlight the genetic resources in PING by describing effects of a functional variant in the neuregulin 1 gene on gray and white matter development. PING infrastructure for interactive data exploration and visualization will also be highlighted in the symposium.

Correspondence: *Terry L. Jernigan, Ph.D., Center for Human Development, UC San Diego, 9500 Gilman Dr., M/C: 0115, La Jolla, CA 92093-0115. E-mail: tjernigan@ucsd.edu*

N. AKSHOOMOFF. The NIH Toolbox Cognition Battery: Results from a Large Normative Developmental Sample (PING).

This presentation describes the age-related changes in performance on the NIH Toolbox Cognition Battery from a large subset of the PING sample. Participants were 1020 individuals, ages 3-20 years. Potential participants with a history of major developmental, psychiatric, or neurological disorders, brain injury, premature birth, or other medical conditions that affect development, or contraindications for MRI were excluded. The influence of demographic factors, specifically sex, SES, and race/ethnicity (using a genetic ancestry factor (GAF)) were examined. Toolbox scores reflecting distinctive cognitive sub-domains included cognitive flexibility, inhibitory control, sustained attention, visual episodic memory, working memory, receptive vocabulary, reading recognition, and visual processing speed. Three nested Generalized Additive Models were computed for each Toolbox score. The base model modeled the score as a function of the smooth of age, a linear term for sex, and a smooth of the interaction between sex and age. The second model included the SES variables in addition to the base model. The third model added GAF in addition to the SES and base variables. As expected, there were large and highly significant increases across all 8 Toolbox scores with age across the entire sample. When adjusted for age, there were significant but relatively small effects of sex in the cognitive flexibility, working memory, and visual processing speed Toolbox scores. The SES and the GAF terms were significant for all of 8 Toolbox scores, with SES explaining between 1 to 6% of the variation and GAF explaining an additional .4 to 2%. These results demonstrate the dramatic age-related changes in these cognitive domains, the utility of the Toolbox Cognition Battery in pediatric studies, and the rich data resource available from PING. The statistical results indicate the importance of including SES and race/ethnicity in neuropsychological studies.

Correspondence: *Natacha Akshoomoff, Department of Psychiatry and Center for Human Development, University of California, San Diego, La Jolla, CA 92093-0115. E-mail: nakshoomoff@ucsd.edu*

L. CHANG, A. PRITCHETT, C. JIANG, B. KEATING, T. ERNST & P. CONSORTIUM. Prenatal Tobacco Smoke Exposure on Brain Morphometry and Diffusivity.

Objective: Tobacco cigarette smoking is still common in pregnant women despite the decline over the past decade (18% to 16.3%) (SAMHSA, 2011). Individuals with prenatal nicotine exposure (PNE) were found to have thinner frontal and parahippocampal cortices, smaller corpus callosum and cerebellum, and increased fractional anisotropy (FA) in frontal cortical white matter. We further investigated possible structural brain abnormalities in PNE children across the ages 3-20 years. Participants and Methods: 55 PNE children and 104 age-sex and socioeconomic status matched controls from the Pediatric Imaging Neurocognitive Genetic (PING) study were evaluated. A structured interview assessed exposure to nicotine or other drugs/medications in utero. MR scans included T1 and T2-weighted images and DTI. Principal components (PC) analysis reduced the dimensionality of MRI data. PNE effects and interactions with age and sex were assessed with ANCOVAs; Bonferroni corrected p-values are noted with asterisks. Results: Apparent diffusion (ADC) was higher in amygdala PC ($p=0.01^*$) of PNE, and in cerebellar WM PC of female PNE only (interaction- $p=0.01^*$). PNE had greater FA in cingulum cingulate gyrus fiber PC ($p=0.04$) and trends for lower FA in longitudinal fasciculus PC ($p=0.08$). PNE also showed trends for frontal thickening ($p=0.07$) but lateral frontal thinning ($p=0.06$). Female PNE had larger volume while male PNE had smaller volume in the cerebral cortex and WM PC (interaction $p=0.04$). No age-by-nicotine interactions were seen. Conclusion: Children with PNE showed persistent microscopic structural abnormalities in amygdala, and the girls additionally showed abnormalities in their cerebellum. Sex differences on the effect of PNE in brain development parallel those reported in preclinical studies. These brain abnormalities may impact emotion and motor coordination in children with PNE. Grant Support: RC2-DA29475; 2K24-DA016170; U54-NS56883; P20-RR011091

Correspondence: *Linda Chang, University of Hawaii Neuroscience and MR Research Group, 1356 Lusitana St 7th fl, Honolulu, HI 96813. E-mail: lchang@hawaii.edu*

E. NEWMAN, C.J. MCCABE, C. CHEN, A.M. DALE & T.L. JERNIGAN. Age-Dependent Relationship between Childhood Anxiety and Regionalization of the Ventromedial Prefrontal Cortex.

This presentation describes the PhenX measures available through the PING data resource, including the revised version of the Screen for Child Anxiety Related Emotional Disorders (SCARED-R), which we use to investigate the relationship between the ventromedial prefrontal cortex (VMPFC) and childhood anxiety. Previous functional and structural imaging studies have linked the VMPFC to negative affectivity and neuroticism. We recently presented results linking cortical regionalization in the VMPFC to anxiety in a smaller sample from PING using the SCARED-R. Here we expand upon these findings by using a novel parcellation scheme and investigating the age-dependence of this relationship in a larger sample. Participants were 203 individuals, ages 9-20 years. The VMPFC was defined using results from a recent genetic parcellation of the cortex (Chen et al., 2012), and the size of this ROI relative to total cortical surface area was used as the primary independent variable. Variation in Total Anxiety was modeled using this ROI, age, and gender, as well as interaction terms. Results demonstrate significant main effects of gender ($p=.004$) and the VMPFC ($p=.002$), such that being female and having lower relative surface area in the VMPFC were associated with higher anxiety. In addition, a significant VMPFC by age interaction ($p=.01$) was found. Secondary analyses showed that anxiety-related differences in the VMPFC were larger in the younger than in the older children. This pattern was consistent across most anxiety subdomains, although the relationship was strongest for the Generalized Anxiety Disorder scale. One interpretation of these results is that children with delayed development of the VMPFC may be at higher risk for anxiety. Further evidence for this hypothesis will require longitudinal data; however, these results highlight the ways in which the PING data resource can be used to generate developmental hypotheses.

Correspondence: *Erik Newman, 9500 Gilman Drive, La Jolla, CA 92093-0115. E-mail: enewman@ucsd.edu*

V. DOUET, L. CHANG, C. JIANG, A. PRITCHETT, T. ERNST, T. JERNIGAN, A. DALE, S. MURRAY & P. CONSORTIUM. Relationship of a Functional Variant in the Neuregulin 1 Gene to White Matter Microstructure in Children of the Pediatric Imaging Neurocognitive Genetic (PING) Study.

Objective: The neuregulin-1 (NRG-1) gene is involved in neural development, and is a susceptibility gene for schizophrenia and psychosis. In healthy adults, the T-risk allele of rs6994992 NRG-1 variant is associated with changes in white matter integrity and density in brain regions affected by psychosis. However, when these changes occur in the brain and whether their relationship to psychosis is still unclear. We hypothesize that the TT-carriers of rs6994992 would be associated with white matter abnormalities.

Methods: Group differences in rs6994992 genotype of 760 healthy children (ages 3-20 years; 265 CC, 381 TC, 114 TT) were evaluated on fractional anisotropy (FA) and apparent diffusion (ADC) using diffusion tensor imaging (DTI). Principal components (PC) analysis reduced the dimensionality of DTI data. Genotype effects and interactions with age and sex were assessed with ANCOVAs, covarying for device. Bonferroni corrected p-values are noted with asterisks.

Results: ADC in pallidum/putamen PC showed steeper decline with age in TC ($r=-0.59$, $p<0.001$, slope=-.13) and TT ($r=-0.58$, $p<0.001$, slope=-.12) than CC ($r=-0.43$, $p<0.001$, slope=-.08; interaction- $p=0.002^*$). FA in the superior longitudinal fasciculus (SLF) PC showed age-by-sex-by-genotype interaction ($p=0.008^*$); male TT showed age-related increase ($r=0.56$, $p<0.001$) while female TT showed no change in FA with age. Age-by-sex-by-genotype interactions in FA were also seen in thalamus PC (interaction- $p=0.04$) and amygdala PC (interaction- $p=0.02$).

Conclusion: Children with the T-risk allele showed steeper decline in diffusion, which suggest a possible altered or aberrant myelination pattern in the striatal regions. Furthermore, girls with TT allele did not show age-appropriate increases in FA in the SLF. How these changes in brain diffusion are related to cognitive performance or other risk factors for psychosis will be further explored in the rich PING database. Grant Support: RC2-DA29475, 2K24-DA016170.

Correspondence: *Vanessa Douet, University of Hawaii Neuroscience and MR Research Group, 1356 Lusitana St 7th fl, Honolulu, HI 96813. E-mail: vdouet@hawaii.edu*

Poster Symposium: Depression after TBI: Empirically-based Interventions

3:30–4:30 p.m.

TBI (Adult)

T. ASHMAN, T. TSAOUSIDES & E. D'ANTONIO. Depression after TBI: Empirically-based Interventions.

Symposium Description: Interventions targeting depression in the general population abound; however, the literature is scarce on the treatment of post-TBI depression. The few published intervention either lack methodological rigor or the primary treatment target was not depression despite the high prevalence and negative impact of post-TBI depression. The purpose of this symposium is to describe a recently completed randomized controlled trial comparing the efficacy of two treatment approaches to post-TBI depression. The first part will describe the state of evidence regarding prevalence, assessment, and interventions for post-TBI depression, including the benefits of using a cognitive-behavior therapy (CBT) approach. The rationale for the development and implementation of a clinical trial on the efficacy of CBT for post-TBI depression will be presented. The second part will describe the first RCT to date to target post-TBI depression directly using individual psychotherapy. Participants included individuals with TBI with a DSM-IV-TR diagnosis of depression who were randomized to receive 16 individual sessions of either CBT or supportive psychotherapy (SPT). Mood and psychosocial functioning were assessed at four time points (pre-, mid- and, post-treatment, 6-month follow-up). Forty-one participants completed treatment and follow-up assessments. Rate of remission were greater for the CBT group, though both groups benefited from treatment. Approximately 57% of CBT group and 35% of SPT group no longer met criteria for depression. The third part has a session-by-session analyses of mood assessments conducted at the beginning and end of each session, using visual analog scales VAS. Analyses of VAS data showed a within session treatment effect (pre-session vs. post-session VAS) for sessions 1 and 16 for the CBT group ($t_1 = 5.36$, $p < .001$, $t_{16} = 2.4$, $p < .05$); and for session 1 but not session 16 for the SPT group, ($t_1 = 2.27$, $p < .05$; $t_{16} = 1.1$, ns).

Correspondence: *Teresa Ashman, PhD, Rehabilitation Medicine, NYU Langone Medical Center, 222 East 80th Street, 9B, New York, NY 10075. E-mail: teresa.ashman@nyumc.org*

T. TSAOUSIDES. Depression After TBI.

Reported rates of depression following traumatic brain injury (TBI) range from 14% to 77%. Despite the variability of these rates, even by conservative estimates, post-TBI depression is higher than population base rates. The high prevalence and negative impact of post-TBI depression on psychosocial functioning necessitate developing interven-

tions to facilitate treatment. The purpose of this presentation is to review the state of the science regarding treatments for depression for individuals with TBI and to describe the rationale and development of two theory-based types of psychotherapy for post-TBI depression. A review of the existing literature on interventions for post-TBI depression was conducted. Rationale for the development of a cognitive-behavioral therapy (CBT) protocol was sought in the literature. A CBT manual was developed based on existing manuals and guidelines. A supportive psychotherapy (SPT) manual was developed by combining common factors from different models of psychotherapy as a comparison treatment. Both manuals were adapted for use with individuals with TBI and included interventions and compensatory strategies to maximize benefits in individuals with TBI-related cognitive impairments. A range of pharmacological, other biomedical, and behavioral intervention (including individual psychotherapy) studies exist that have addressed post-TBI depressive symptoms directly or indirectly. Studies vary considerably in terms of inclusion criteria, sampling, and outcome measurement. Although widely recommended and applied, limited empirical evidence exists for the effectiveness of individual psychotherapy for post-TBI depression. The development and application of the psychotherapy interventions (CBT and SPT) is described. Challenges unique to this population in terms of implementing a manualized psychotherapy intervention are discussed and case studies are presented.

Correspondence: *Theodore Tsaousides, 1 Gustave Lery Place, New York, NY 10029. E-mail: theodore.tsaousides@mountsinai.org*

T. ASHMAN. Randomized Clinical Trial for Treatment of Depression After TBI.

Given the high prevalence and negative impact of post-TBI depression, developing appropriate behavioral interventions is imperative. Cognitive-behavioral therapy (CBT) is a well-established treatment for depression in the general population. The structure and frame of CBT render it a suitable treatment for individuals with TBI-related cognitive challenges. However, the efficacy of CBT in post-TBI depression has not been investigated. The purpose of Part 2 of this two-part presentation is to describe the outcomes of a recently completed randomized controlled trial of the efficacy of psychotherapy for post-TBI depression. A study was designed to compare the efficacy of CBT and supportive psychotherapy (SPT) in treating depression following TBI. Participants included individuals with TBI who met DSM-IV-TR criteria for depressive disorder. They were randomly assigned to either CBT or SPT and received 16 psychotherapy sessions. Participants' mood (diagnosis and symptom severity) and psychosocial functioning were assessed at four time points (pre-treatment, post-session 9, post-treatment, 6-month follow-up). Forty-one participants completed treatment and follow-up assessments (CBT=21, SPT=20). Approximately 57% of the CBT and 35% of the SPT group no longer had a DSM-IV-TR depressive disorder diagnosis, representing significant change for both groups ($p = .00004$ and $p = .003$, respectively). Rate of remission did not differ significantly between groups ($p = .134$). The study provides evidence that individual psychotherapy is an effective treatment for post-TBI depression. The structure and techniques provided by CBT render it a preferred treatment when working with individuals with cognitive impairments. Implications of these findings for practice and research are discussed.

Correspondence: *Teresa Ashman, 240 East 38th St, 17 floor, New York, NY 10016. E-mail: teresa.ashman@nyumc.org*

E. D'ANTONIO. Session by Session Data for a RCT Treating Depression After TBI.

To examine the differential treatment effects of cognitive behavioral therapy (CBT) and supportive psychotherapy (SPT) in individuals with TBI who sought treatment for depressive disorder and to provide symptom-by-symptom and session-by-session analysis. Forty-four individuals with TBI and depression who received CBT or SPT (mean age 48.8 yrs; 57.1% female; 57.5% Caucasian, 20% Hispanic, 15% African-

American). Outcome measures included the BDI-II and mood assessments for depression and anxiety conducted at the beginning and end of each session, using visual analog scales (VAS). Mean total BDI-II scores did not differ significantly between treatment groups at either baseline ($t(42)=.98, ns$) or end of treatment ($t(42)=.09, ns$). 50% of CBT and 31.9% of SPT participants improved by at least 2 points on two or more BDI items, while 33.3% of CBT participants improved on 3 or more items. CBT participants reported significant improvement in sadness ($t(21)=2.34, p=.03$), loss of interest ($t(21)=2.94, p=.01$), and loss of interest in sex ($t(21)=2.34, p=.03$). SPT participants reported significant improvement in agitation ($t(21)=2.65, p=.02$), and irritability ($t(21)=4.17, p<.001$). There was no overlap in individual symptom improvement between groups. Analyses of the depression VAS showed a within session treatment effect (pre-session vs. post-session VAS) for sessions 1 and 16 for the CBT group ($t1 = 5.36, p<.001, t16 = 2.4, p<.05$); and for session 1 but not session 16 for the SPT group, ($t1 = 2.27, p<.05; t16 = 1.1, ns$). In addition, the CBT group demonstrated a difference between sessions 1 and 16 pre-session VAS ($t = 3.11, p<.01$) but no difference between sessions 1 and 16 post-session VAS. CBT demonstrated a broader treatment effect, decreasing more symptoms in more participants. SPT may target symptoms of behavioral disinhibition, while CBT may target mood symptoms. Participants overall reported better mood at the end of each session.

Correspondence: *Emily D'Antonio, 1 Gustave Levy Place, New York, NY 10029. E-mail: emily.dantonio@mountsinai.org*

Poster Session 4: Aging/Assessment (Adult)/TBI

3:30–4:30 p.m.

Aging

A.M. AKERSTEDT & R.E. READY. **Nightly Awakenings In Persons With Alzheimer's Disease And Its Implications For Family Caregiver Daily Emotional Functioning.**

Objective: The present study is the first to examine the impact of nightly sleep in persons with Alzheimer's disease (AD) on their caregiver's emotional functioning using a daily diary method. Nighttime awakenings in persons with AD have been found to be particularly relevant for caregiver mood in retrospective studies (e.g., McCurry & Teri, 1995). It was thus hypothesized that caregivers who were awakened by the person with AD would report higher daily negative affect (NA) and lower positive affect (PA) on the PANAS.

Participants and Methods: The current data is from a larger study that examined sleep and mood in caregivers of persons with AD. Forty family caregivers of persons with AD were interviewed about sleep and mood across eight days. Sleep data was collected via a sleep diary filled out in the morning and positive and negative mood ratings on the PANAS were obtained in the evening.

Results: The results demonstrated a direct link between poor sleep in persons with AD and caregiver negative affect (NA), but not positive affect (PA). Specifically, the number of times the person with AD left the bed during nighttime was significantly associated with lesser daily caregiver NA. The results suggest that addressing AD person and caregiver sleep, may improve caregiver emotional functioning.

Conclusions: As approximately 70 percent of persons with AD are being cared for at home (Alzheimer's Association, 2011), it is particularly relevant to target interventions to ultimately alleviate the caregiving process. Improving AD person sleep and caregiver emotional functioning has important implications that may enhance quality of care and prolong the time until institutionalization.

Correspondence: *Anna M. Akerstedt, Ph.D., Psychology, University of Massachusetts Amherst, 135 Hicks Way, Amherst, MA 01003. E-mail: anna.akerstedt@gmail.com*

S. BELLEVILLE, ÉMILIE. LEPAGE, S. MELLAH, C. BOCTI, F. MASSOUD & S. GAUTHIER. **Working Memory and Control of Attention in mild cognitive impairment: relation to white-matter hyperintensities and disease progression.**

Objective: There is increasing evidence for impaired control of attention in persons with mild cognitive impairment (MCI), a preclinical phase of Alzheimer's disease. However, MCI is a heterogeneous condition and some of these persons suffer from comorbid vascular diseases, which may contribute to their cognitive deficits. This study measures working memory and control of attention in persons with MCI and examines the impact of vascular brain burden on the nature and extent of their deficit.

Participants and Methods: Tasks were used to measure on-line manipulation, divided attention, inhibition, impulsivity, planning and switching. Furthermore, patients received an MRI examination and were identified as vascular or non-vascular MCI based on the presence and severity of white-matter hyperintensities on the MRI. An 18-month follow-up was used to distinguish those who later progressed to dementia from those who remained stable.

Results: Results indicated impairment in persons with MCI for switching, inhibition, impulsivity and divided attention but not for planning and manipulation. At baseline, inhibition and switching were more impaired in persons progressing to dementia 18 months later than in those remaining stable. In contrast, MCI persons with vascular burden were more impaired than those without vascular brain burden on impulsivity and on divided attention.

Conclusions: This study confirms that an impaired working memory and attentional control is present very early in the course of Alzheimer's disease. It also shows that impaired performance on some of these tasks is indicative of future progression to dementia whereas impairment on some other tasks is indicative of a vascular brain burden. The finding that different tasks are sensitive to progression vs vascular burden suggests that they might reflect different neuropathological mechanisms in those individuals.

Correspondence: *Sylvie Belleville, Ph.D., CRIUGM, 4565 Queen Mary, Montreal, QC H3W-1W5, Canada. E-mail: sylvie.belleville@umontreal.ca*

C. BURNS & S. ROGERS. **Importance of Personal Wellness: How Exercise and Leisure Activities Relate to Memory.**

Objective: Studies have shown that pursuits toward personal wellness in later life may impact memory functioning, but much of this research has focused on exercise to the exclusion of leisure activities. In the present study, the authors examined the way participation in exercise and leisure activities is related to older adults' memory.

Participants and Methods: Fifty-four older adults (44 women, M age = 76.65, M education = 15.61) indicated their weekly participation in exercise and leisure. They also completed the WMS-III, CVLT-II, and Rey-O 3' & 30' delays.

Results: On average, participants engaged in exercise 4.49 times and leisure activities 5.39 times per week. Amount of weekly exercise was significantly positively associated with CVLT-II Long Delay Free Recall, $p < .04$, and Rey-O 30' delay, $p < .03$. The number of leisure activities was positively correlated with WMS-III Visual Reproduction I, $p < .01$, and II, $p < .04$. Moreover, the combined amount of exercise and leisure was significantly positively associated with scores on WMS-III Logical Memory II, $p < .02$, CVLT Total Trials 1-5, $p < .01$, CVLT-II Long Delay Free Recall, $p < .01$, Rey-O 3' delay, $p < .03$, Rey-O 30' delay, $p < .01$, and WMS-III Visual Reproduction I, $p < .02$, and II, $p < .03$.

Conclusions: Results show a significant relationship between personal wellness and memory in later life. Among older adults, exercise seems to affect those bilateral neurological areas and mechanisms responsible for delayed recall, such as hippocampal regions. Leisure activities seem to benefit nonverbal rather than verbal learning and memory, suggesting a differential impact on the right relative to left hemisphere, as well

as both prefrontal and temporal regions. These findings provide support for the customization of personal wellness programs toward individual memory difficulties and syndromes with particular memory profiles.

Correspondence: *Cory Burns, Psychology, Westmont College, 955 La Paz Road, Santa Barbara, CA 93108. E-mail: cburns@westmont.edu*

S. CHI, L. RABIN, S.J. KANN & A. KAPOOR. Differentiation of Prospective and Retrospective Components of Prospective Memory Performance in Older Adults using a Computerized Event-Based Task.

Objective: PM involves both retrospective and prospective components, with the latter relying on executive control functions. Due to this complex reliance on executive functions, PM may be more vulnerable than retrospective memory to early cognitive changes associated with neurodegeneration. We explored this premise in line with the Multiprocess Theory of PM (McDaniel & Einstein, 2000), which contends that levels of executive control demand may be determined by whether intention retrieval relies on strategic monitoring (supported by executive processes/prefrontal cortex) or spontaneous retrieval (supported by the reflective-associative MTL system).

Participants and Methods: 200 non-demented older adults with varying levels of cognitive complaints and deficits recruited from the Bronx, N.Y. took a computerized event-based PM test (Foster et al., 2009) comprised of low and high executive demand conditions. Both conditions contained an on-going word-categorization task embedded with PM cues. On each trial, participants indicated whether a word belonged to the category on screen; they pressed a different key each time a PM cue appeared. The focal PM cue was “tulip” and nonfocal cue was “rad”. We anticipated that if the ongoing activity simplified processing of the PM cue then intention retrieval would depend on spontaneous processes (focal condition); conversely, if the ongoing activity did not focus attention on the PM cue then intention retrieval would rely on strategic monitoring (nonfocal condition).

Results: We measured PM performance by the sum of correct PM cue responses. There was a significant effect of test condition, $t(199)=5.65$, $p<0.001$, with higher scores in the focal than nonfocal condition.

Conclusions: The PM task differentiated prospective/executive control and retrospective components of performance scores. We will present findings related to group differences in the nonfocal scores, which may reflect the sensitivity of the executive control component in PM to detection of very early cognitive decline.

Correspondence: *Laura Rabin, Brooklyn College/CUNY, 2900 Bedford Ave, Brooklyn, NY 11210. E-mail: lrabin@brooklyn.cuny.edu*

L. RABIN, A. ARONOV, S.Y. CHI, J. FOGEL, M.M. CHARCAPE, M.J. BORGOS & A.J. SAYKIN. The Test of Practical Judgment (TOP-J): Updated Normative Data and Validation in a Demographically Diverse Group of Older Adults.

Objective: The Test of Practical Judgment (TOP-J) is an objective, open-ended measure for evaluating judgment related to safety, medical, social/ethical, and financial issues. Initially validated within an older adult, rural Caucasian sample, it has been shown to be clinically useful in assessing judgment in outpatients with mild cognitive impairment (MCI) and Alzheimer’s disease (Rabin et al., 2007), in younger mixed neuropsychiatric samples (Borgos et al., 2006), and in geriatric veterans (Baughman et al., 2011). In a structural neuroimaging study (Rabin et al., 2009), TOP-J scores correlated with gray matter density in prefrontal regions (left inferior and superior frontal gyri). In the present study we re-evaluated the factor structure and validity of the TOP-J in a sample of non-demented older adults with different demographic characteristics than the initial normative sample.

Participants and Methods: Non-demented older adults ($n=210$) recruited from the Bronx, NY community (mean age= 81.9, $SD=5.2$; 64.8% female; 62.4% Caucasian, 30.5% African American). Participants completed the TOP-J in addition to a comprehensive neuropsychological test battery.

Results: A principal components analysis with varimax rotation identified 6 components, which accounted for 55.9% of the variance (all factor loadings > 0.42 ; only components with eigenvalues > 1 were retained.). All 15 TOP-J items loaded appropriately. In addition to discussing the TOP-J’s component structure, we provide updated norms for older adults with MCI, significant cognitive complaints despite normal cognition, and healthy elderly controls along with evidence for convergent and discriminant validity.

Conclusions: Since its introduction in 2005, the TOP-J has found widespread use in clinical and research settings in the U.S. and abroad, although the initial validation sample was demographically homogenous. For those utilizing the TOP-J with demographically diverse individuals, these data will provide a more appropriate normative comparison.

Correspondence: *Laura Rabin, Brooklyn College/CUNY, 2900 Bedford Ave, Brooklyn, NY 11210. E-mail: lrabin@brooklyn.cuny.edu*

S. CONNELL & K. KILBORN. Presence of Alzheimer’s Disease and Changes in Normal Ageing Are Reflected in the Patterns of Early and Late ERP Components.

Objective: Changes in memory function occur as a result of the healthy ageing process and also the onset of Alzheimer’s disease. However, difficulty can arise in separating out the changes that can be attributed to the normal ageing process and those which may indicate the presence of disease. Using an episodic memory task we investigate ERP components that differ between patients and their healthy counterparts but also between healthy individuals of different ages.

Participants and Methods: Participants comprised 4 groups; healthy young (18-24yrs, $N=15$), healthy mid-age (50-65 yrs, $N=49$), healthy older (66-85yrs, $N=39$), and Alzheimer’s disease patients (65+ yrs, $N=65$). Participants engaged in an associative memory task comprising an image and a spoken word presented simultaneously. If the stimulus pair was seen for the first time the participants pressed the ‘new’ button or if they had been presented previously participants indicated this by pressing the ‘old’ button. 128-channel EEG was recorded continuously. **Results:** N2 group analysis revealed differences in the latency and amplitude between the groups ($p<.05$). N2 of young adults peaked earlier than mid-adults, older adults and AD patients ($p<.05$). AD patients showed a significantly lower N2 compared to the other groups ($p<.05$). P6 group analysis revealed differences in amplitude between all groups ($p<.05$).

Conclusions: N2 reflects early executive control functions, while P6 indexes aspects of episodic retrieval. The N2 was attenuated for the AD patients compared the healthy groups, with younger adults showing this component slightly earlier. The P6 amplitude showed differences with both age and disease. Taken together, these results suggest that, when looking at amplitude, differential processing in AD patients can be captured as early as 200ms, whereas differences in age do not emerge until later in the processing sequence. We suggest that ERPs may provide clinically useful functional markers that differentiate between changes in cognition due to age and to AD.

Correspondence: *Stephanie Connell, University of Glasgow, 58 Hillhead Street, Glasgow G12 8BQ, United Kingdom. E-mail: stephanie.connell@btinternet.com*

A.R. CURIEL, G.J. LEE, K.J. MILLER & G.W. SMALL. Hormone Replacement Therapy and Language Functioning.

Objective: Estrogen has been proposed to have an important role in several physiological and neurological mechanisms associated with cognitive functioning, and the estrogen deficiency related to menopause may play a role in cognitive declines experienced by postmenopausal women. Thus, hormone replacement therapy (HRT) may protect postmenopausal women from cognitive decline. The current study was designed to investigate the longitudinal effects of HRT use on the relative decline in language abilities in healthy, non-demented postmenopausal women.

Participants and Methods: A total of 100 participants (33 HRT users, 15 HRT non-users, and 52 males; $M\ age=61.90$ years, $SD=9.97$) completed neuropsychological evaluations at baseline and follow-up, ap-

proximately 2.6 years later ($SD=1.67$). A composite Language score was calculated for each participant by averaging the age- and education-normed z-scores of individuals' performances on the Boston Naming Test (BNT) and the Controlled Oral Word Association Test (FAS, Animals). **Results:** A repeated measures ANOVA of the baseline and follow-up Language scores revealed a significant difference between the groups, $F(2,97)=3.28$, $p=.04$. Specifically, post-hoc Bonferroni tests revealed that HRT users (Mean change= 0.24 , $SD=.55$) demonstrated more improvement in Language scores from baseline to follow-up than men (Mean change= -0.03 , $SD=0.53$), $p=.04$, who demonstrated relatively little change across time. HRT non-users (Mean change= -0.08 , $SD=0.45$) had a mean difference score similar to the men, but the difference between the HRT users and non-users did not reach statistical significance. **Conclusions:** These results suggest a possible benefit of HRT in improving the language functioning of postmenopausal women over time. Limitations and implications are discussed.

Correspondence: *Ashley R. Curiel, MA, Pepperdine University, 12026 Hoffman Street #305, Studio City, CA 91604. E-mail: ashleycuriel@gmail.com*

S. ENGLAND, J. VERGHESE, J. MAHONEY, N. BHULANI & R. HOLTZER. Subjective Perception and Objective Assessment of Turns While Walking.

Objective: Difficulties while turning are common in PD and linked to increased disease severity, and falls. However, research concerning turns in non-demented older adults is scarce. Furthermore whether individuals are able to accurately determine when they enter and exit a turn has not been examined. Here we empirically investigated the accuracy of participants' versus rater's objective assessment in determining the entry and exit of turns.

Participants and Methods: Non-demented older adults ($N=20$; $M=75.40 \pm 5.52$ years of age; 50% female), participated in the current study. Turns were defined as a change in direction while walking. Participants were instructed to walk three loops on an instrumented walkway and indicate when they entered and exited each turn by pressing a button on a time-stamp device linked to the instrumented walkway. Independent and blind to the participants' responses a designated clinician marked the entry and exit of turns for each participant with a second time-stamp device.

Results: The entry, $t(19) = -1.73$, $p = .10$, $r = 0.37$, and duration, $t(19) = -1.26$, $p = .22$, $r = 0.28$, of turns were comparable between participants and the rater. However, participants determined that they exited the turn significantly earlier than the rater $t(19) = -2.74$, $p = .013$, $r = 0.53$. Only in females increased differences between participants and rater in determining entry to turns were negatively correlated with ratings of confidence in performing the task $r(10) = -.59$, $p < .04$, $R^2 = 0.34$, and positively correlated with ratings of task-related stress $r(10) = .62$, $p < .03$, $R^2 = 0.39$.

Conclusions: The determinations of entry and duration of turns were consistent between the participants and rater. Exits from turns were identified earlier by participants compared to the rater. Finally, increased differences between the participants and rater in determining entry to turns were correlated with lower confidence and higher stress in females. Correspondence: *Sarah England, Ferkauf Graduate School of Psychology, Yeshiva University, 26 Newell Street, Apt 3L, Brooklyn, NY 11222. E-mail: sarahe.english@gmail.com*

S.J. FOX & S. ROGERS. A Look at the Effects of Marital Status on Global Cognitive Functioning in a Non-Clinical Sample of Elderly Adults.

Objective: The mood and memory of elderly adults has been shown to vary with marital status, with married participants usually outperforming single, divorced, and widowed participants. However, there is a paucity of research exploring the effect of marital status on other cognitive domains. The current study examines if cognitive performance in multiple domains varies with marital status.

Participants and Methods: A total of 209 older adults (156 women, M age = 78.22) reported their marital status and completed a battery

of tests that included the CVLT-II, WMS-III, select WAIS-III subtests, Rey-O, select DKEFS subtests, Trailmaking, BNT, and COWAT.

Results: MANOVAs revealed that the set of visuospatial, language, and memory variables each significantly varied with marital status, $ps < .02$. Subsequent bivariate ANOVAs showed that those who were married showed significantly higher scores on (a) CVLT-II Trial 5 than those who were single, divorced, or widowed; (b) CVLT-II Long Delay Free Recall and BNT compared to those who were widowed; (c) Rey 3' Delay and WAIS-III Block Design relative to those who were single or widowed; (d) Rey-O Copy than those who were single or divorced; (e) Animals compared to those who were divorced; and (f) WMS-III VR I & II and WAIS-III. Picture Completion relative to those who were divorced or widowed. All $ps < .04$.

Conclusions: These findings confirm prior research on memory and suggest that marriage is also beneficial for the memory, visuospatial functioning, and semantic language skills of older adults, but not their attention, processing speed, or executive functions. Singlehood seems to only differentially affect visuospatial functions relative to marriage, whereas divorce and widowhood seem to impact multiple domains (memory, semantic language, visuospatial). Clinicians working with geriatric populations should consider marital status when evaluating, treating, and attempting to protect against changes in, cognitive functioning.

Correspondence: *Spencer J. Fox, Westmont College, 66 Ocean View Ave., Apartment 64, Santa Barbara, CA 93103. E-mail: sfox@westmont.edu*

T. GEFEN, E. SHAW, J. STRATTON, K. WHITNEY, S. WEINTRAUB, M. MESULAM & E. ROGALSKI. Neuropsychological Performance of Cognitive SuperAgers: Preliminary Findings from a Longitudinal Study of Extraordinary Seniors.

Objective: The elderly frequently complain of declining episodic memory. Such complaints are so widespread that they have led to the belief that a gradual loss of cognition is part of normal aging. Recent data from the Northwestern University SuperAging study, suggests it is possible for some individuals to maintain memory at the level of individuals 20-30 years their junior. SuperAgers are defined as individuals over age 80 with memory scores at least average according to 50-65 year-old normative scores, and whose scores in other cognitive domains are at least normal for their age. This study examined longitudinal neuropsychological data from SuperAgers at baseline (T1) and at 1.5 year follow-up (T2) to determine whether memory and other cognitive domains remain stable or decline over time.

Participants and Methods: To date, of 27 total SuperAgers studied at T1, 18 had neuropsychological data available from T1 and T2. Scores from SuperAgers were compared to well-established demographically adjusted 50-65 year-old norms to determine SuperAgers' longitudinal performance on tests of memory and cognition relative to that of individuals 20-30 years their junior.

Results: Of 18 SuperAgers (Age Range: 80-88), 16 maintained memory scores at least average for 50-65 year-old norms at T2. Furthermore, when compared to 50-65 year-old norms, the vast majority (at least 66.7%) of SuperAgers remained within the average to superior range over the 1.5 year interval on tests of attention, executive function, and language.

Conclusions: Such high cognitive performance by a majority of SuperAgers is impressive given the high prevalence of Alzheimer's dementia over age 80, and provides further support that a unique trajectory of cognitive aging is possible. Although their preservation of cognitive performance over 1.5 years is intriguing, it must be evaluated relative to the rate of decline in elderly persons cognitively normal for age tested over the same time interval.

Correspondence: *Tamar Gefen, MS, Cognitive Neurology and Alzheimer's Disease Center, Northwestern University, Feinberg School of Medicine, 320 East Superior St., Searle, 11-447, Chicago, IL 60611. E-mail: tamar.gefen5@gmail.com*

J.L. HAMILTON, A.M. BRICKMAN, R. LANG-WALKER, G. BYRD, J. HAINES, R. MAYEUX, M. PERICAK-VANCE & J. MANLY. Depressive Symptoms Effect Different Domains Of Cognition In Older, Non-Demented African Americans.

Objective: The influence of depressive symptoms on cognitive functioning has been tested primarily in small, clinic-based samples comprising predominantly Caucasians. Previous literature suggests that manifestation of depression among African Americans (AAs) may be distinct from other racial/ethnic groups, which could result in differential relationships to cognition. We sought to determine whether depressive symptoms are related to specific domains of cognition among a cohort of older, non-demented, community-based AAs.

Participants and Methods: Participants ($n = 854$; age=70.49 SD 9.11; education=13.21 SD 3.56; 76% women) were recruited around four different US cities, including New York City, Greensboro NC, Miami, and Nashville. Summary scores for Memory, Executive Functioning, Processing Speed, Language, and Attention were derived based on factor analysis of a comprehensive neuropsychological battery. Depressive symptomatology was measured with the 15-item version of the Geriatric Depression Scale (GDS). Controlling for age, number of years of education, sex, and recruitment site, we used multiple regression analysis to examine the relationship between depression symptoms and cognition.

Results: Higher GDS scores (i.e., more depression symptomatology) were associated with lower memory ($\beta = -0.048$, $p = 0.005$) and language ($\beta = -0.054$, $p < 0.001$) scores and weakly associated with attention ($\beta = 0.036$, $p = 0.028$), but not with executive functioning ($\beta = 0.022$, $p = 0.165$) or processing speed ($\beta = 0.025$, $p = 0.181$). Increased education and female sex were generally related to better performance.

Conclusions: Depressive symptomatology is related to poorer memory, language, and attention, but not to executive functioning, among older non-demented AAs. Discrepancies with reported studies may be attributed to either our community-based participant recruitment source or to different underlying causes of the link between depression and cognition among AAs.

Correspondence: *Jamie L. Hamilton, PhD, College of Physicians and Surgeons, Columbia University-Medical Center, 622 W 168th St Rm 19-321, New York, NY 10032. E-mail: jh3344@columbia.edu*

C.C. KANDAH, C.D. KAY, M. SEIDENBERG & J.L. WOODARD. Recent and Remote Recognition: Brand Names, Famous Names and Television Shows.

Objective: Studies comparing memory for recent and remote material often focus on neurologic groups. However, much less is known about normal age-related differences. In addition, most studies of healthy individuals examine only a single measure. The purpose of the study was to create a continuum of inanimate to animate memory tasks: Brand Names (BN), Television Shows (TS), and Famous Names (FN) to investigate the temporal gradient (TG) in healthy adults.

Participants and Methods: Older participants ($n = 19$, Mage = 72) and Younger participants ($n = 19$, Mage = 23) were evaluated on BN, FN, and TS recognition. Stimulus names were selected on the basis of a normative study using an independent sample of older and younger adults in order to ensure adequate recognition performance of remote and recent names. For BN and FN, twenty recent names, twenty remote names, and sixty fictitious names were used. TS that were aired from 1950 to 2000 were contrasted with fictitious TS. Participants were asked to indicate via button press whether the presented name was real or fictitious. Response accuracy and reaction time were collected.

Results: A 2x2x2 mixed design ANOVA indicated that older adults recognized more remote FN and BN ($p < .01$) than recent names, while the young group showed the opposite pattern ($p < .05$). Regarding TS accuracy, older adults recognized remote TS more accurately than recent TS ($p < .05$), and young adults recognized recent TS more accurately than remote TS ($p < .05$). A comparable pattern was evident for reaction time. A 2x3 RMANOVA resulted in a main effect of epoch across type of measure in the older adults.

Conclusions: TGs are evident within healthy older adults across a spectrum of inanimate and animate memory tasks, whereas young adults exhibit a reversed pattern. In terms of FN and BN, memory age or age of acquisition does not appear to adequately explain the findings for the younger group. Alternative explanations such as extent of knowledge should be considered. Correspondence: *Cassandra C. Kandah, B.S., Psychology, Rosalind Franklin University of Medicine and Science, 3333 Green Bay Road, North Chicago, IL 60064. E-mail: Cassandra.Kandah@my.RFUMS.org*

D.A. KAUFMAN & W.M. PERLSTEIN. Apathy, Anxiety, and Executive Functioning in Healthy Aging.

Objective: Affective states such as apathy have been associated with declines in cognitive function in various forms of pathological aging. However, it is not known whether affective states are associated with age-related cognitive decline in healthy individuals. This project examined the relationships between executive functioning and affective symptoms in healthy samples of young and older adults.

Participants and Methods: Thirty-four young and 20 healthy older adults completed a brief assessment of executive functioning (Trails, Stroop, Verbal Fluency, Wisconsin) and self-reported affective functioning (depression, apathy, anxiety). Independent t-tests were used to compare young and older adults on cognitive and affective measures. Hierarchical regression models used the three affective variables as predictors for performance on each of the cognitive tests.

Results: Relative to young adults, older adults exhibited poorer executive functioning and less trait anxiety. Among older adults, affective variables significantly predicted performance on Trails A and B, along with the Color Word Naming condition of the Stroop test. More specifically, apathy had a strong association with decreased performance on Trails A and B, while trait anxiety was associated with decreased performance on the Stroop test. No affective variables significantly predicted cognitive performance in young adults.

Conclusions: Apathy and anxiety both predicted compromised cognition in this sample of healthy older adults. Although all of these subjects were neurologically normal at the time of testing, some may eventually go on to develop dementia or other neurological conditions. Longitudinal follow-up is needed to determine whether apathy and anxiety in this type of sample have the power to predict subsequent cognitive impairments associated with pathological aging.

Correspondence: *David A. Kaufman, PhD, Psychology, Saint Louis University, 221 N Grand Blvd, Shannon Hall, Room 216, St. Louis, MO 63103. E-mail: dkaufma3@slu.edu*

L. KRASEAN & A.D. BAIRD. Does Occupational Complexity Impact Knowledge of Personal Health and Safety and Money Management?

Objective: A history of employment in more complex work has been associated with a reduced risk of dementia. However, there is a dearth of research investigating how occupational complexity is related to ability on performance-based instruments such as the Independent Living Scales (ILS). Therefore, in this study we aimed to advance understanding of the effect that previous work history has on financial or health-related skills and knowledge in individuals experiencing memory or other cognitive problems.

Participants and Methods: We studied 111 African American and European Americans aged 65 and above in an urban, outpatient clinical setting. IVs were occupational complexity (high or low), ethnicity, and gender. DVs were ILS Money Management (MM) and Health and Safety (HS) raw scores.

Results: Two 2x2x2 ANOVAs revealed a modest but significant effect of work history on the MM score but not on the HS score. Once age, years of education, reading score, and overall cognitive status were entered as covariates, there was no longer a significant effect of job complexity on the MM score.

Conclusions: While individuals with higher past work complexity performed better on a money management measure, this effect was no longer present after controlling for age, years of formal education, reading level, and overall cognitive status. Analyses also demonstrated that those with more complex past employment had less cognitive impairment, more years of formal education, and higher reading scores.

Correspondence: *Laura Krasean, M.A., Psychology, University of Windsor, 401 Sunset Ave, Windsor, ON N9B 3P4, Canada. E-mail: krasean@uwindsor.ca*

L. KRASEAN & A.D. BAIRD. Word Reading Ability, Occupational Complexity, and Neuropsychological Functioning in a Clinical Older Adult Population.

Objective: Higher levels of past mental stimulation, as indexed by proxy measures like occupational complexity (OC) and word reading, have been shown to increase cognitive reserve (CR) levels. The study purpose was to assess the unique contribution of OC and word reading on measures of fluid (Gf) and crystallized (Gc) intelligence and episodic (EM) and semantic memory (SM). This contribution was hypothesized to exist over and above the influence of age, formal education years, ethnicity, gender and overall cognitive status.

Participants and Methods: We studied 218 African American and European American aged 65+ seen in an urban outpatient clinic for suspected cognitive impairment. DVs were WASI Vocabulary (Voc) and Matrix Reasoning (MR) subtests, Boston Naming Test (BNT) and WMS-R Logical Memory (LM) I subtest raw scores. OC was classified as high or low, and word reading and cognitive status were measured by the WRAT-3 Reading subtest and Dementia Rating Scale, respectively.

Results: For all DVs except the BNT score there were significant missing data, which were not at random, nor ignorable. Multiple hierarchical regressions were run, with the Heckman two-step model included to assess the effect of missing data as necessary. OC accounted for a significant amount of variance in Voc, MR and LM scores beyond age, formal education, ethnicity, gender and current overall cognitive status. Oral word reading ability accounted for a significant amount of variance in Voc, MR and BNT scores beyond the same background variables.

Conclusions: OC was a significant predictor of performance on Gf and Gc and EM measures. Word reading was a significant predictor of Gf and Gc and SM scores. The contribution of these predictors was in addition to expected impact of background variables. Proxy measures of CR, such as OC and word reading, should be considered when examining neuropsychological test performance. This study also highlights the importance of adequately assessing and addressing missing data.

Correspondence: *Laura Krasean, M.A., Psychology, University of Windsor, 401 Sunset Ave, Windsor, ON N9B 3P4, Canada. E-mail: krasean@uwindsor.ca*

B. LAZOR & S. ROGERS. Does Depression Affect Attention and Processing Speed in Older Adults? Bethany T.S. Lazor and Steven A. Rogers.

Objective: Depression seems to have an impact on the executive function of older adults, but less is known about its particular effect on attention and information processing speed. This study examined the relationship between depressive symptomatology and older adults' performance on tasks of attention and processing speed.

Participants and Methods: A total of 207 older adults (154 women, M age = 78.32) completed the Geriatric Depression Scale (GDS) and measures of attention and processing speed (WAIS-III Digit Symbol, Digit Span; Trails A; DKEFS Color Naming & Word Reading). GDS symptoms were also grouped into Adams' (2001) five subscales (Dysphoria 1, Withdrawal-Apathy, Anxiety, Mental Impairment, Dysphoria 2).

Results: Total GDS score was significantly negatively associated with all measures of attention and processing speed, $ps < .02$. The Dysphoria 1 subscale was significantly negatively correlated with all tests of attention and processing speed, $ps < .02$. Those who scored higher on the Mental Impairment and Dysphoria 2 subscales performed significantly worse on Digit Symbol, Trails A, Color Naming, and Word Reading, $ps < .03$. Negative correlations were found between the Anxiety subscale and both Digit Symbol, $p < .04$, and Trails A, $p < .02$, as well as between the Withdrawal-Apathy subscale and Digit Symbol, $p < .03$.

Conclusions: Depression seems to be negatively associated with older adults' simple attention and processing speed, although this association

varies with the features of depression. Both attention and processing speed were adversely related to a negative affect. Slower verbal and visual processing speed, but not attention, was found among those with greater mental impairment and hopelessness. Visual processing speed also seemed to be negatively related to withdrawal/apathy and anxiety. These findings may help clinicians understand how particular profiles of depression influence older adults' attention and cognitive speed.

Correspondence: *Beth Lazor, B.A. Psychology, Westmont College, 1310 Heulu Street, Apt. 1001, Honolulu, HI 96822. E-mail: blazor@westmont.edu*

S.W. MACDONALD, J. LOVE, D. HALLIDAY, S. HUNDZA, P. BREWSTER, C. DECARLO & R.A. DIXON. Gait and Interletter Variability Under Cognitive Load Are Associated With 25-Year Cognitive Decline.

Objective: Emerging evidence suggests that indicators of biological and sensorimotor function (gait velocity, stride-time and heart-rate variability) are linked to age-related changes in neural and cognitive function, morbidity, and mortality. Similarly, increased intraindividual variability (IIV) across reaction time (RT) trials of cognitive tasks shares systematic links to aging processes (cognitive and physiological deficits), neurodegenerative pathology (Alzheimer's disease), and brain injury. In the present study, we employ data from the Victoria Longitudinal Study (VLS) to examine links between 25-year change in cognitive function and IIV in gait as well as response latency trials for each letter of a 7-letter word spelled backward (Lezak, 1995) while performing a gait task.

Participants and Methods: The sample was comprised of returning VLS participants ($n=32$; age range=83-94 years) from Sample 1 Wave 8 (mean follow-up=25.09 years). Using a 16' GAITrite computerized walkway, participants completed 4 passes of the mat under two conditions: walk only and walk while spelling words backwards. Sensorimotor indicators included markers of gait pace (velocity) and variability (stride-time IIV). Cognitive constructs included episodic memory, perceptual speed, incidental recall, and crystallized ability. An index of IIV, the intraindividual standard deviation (ISD), was computed across RT trials for relevant tasks.

Results: Results from linear mixed models indicated that concurrent S1W8 gait status and increasing IIV in the production of letters while spelling backwards were associated with age-related cognitive decline over the preceding 25 years.

Conclusions: These findings are consistent with claims that various gait characteristics provide a snapshot of an individual's overall health useful for detecting those at risk of cognitive change, and that detection of such change can be further improved by indexing IIV for cognitive tasks completed simultaneously with gait assessment due to cross-domain resource competition.

Correspondence: *Stuart W. MacDonald, Ph.D., Psychology, University of Victoria, PO Box 3050 STN CSC, Victoria, BC V8W 3P5, Canada. E-mail: smacd@uvic.ca*

A. MARTYR & L. CLARE. Executive Function And Activities Of Daily Living In Older Adults.

Objective: The population is ageing and people over 60 form an increasingly large segment of society. Understanding the cognitive and behavioural changes that develop as people get older is important if we are to help older people to maintain independence. Ageing is associated with a decline in executive function (EF) and in performance of instrumental activities of daily living (iADL). A decline in both EF and iADL may form part of the profile of early stage dementia. A better understanding of the relationship between performance of iADL and EF is needed. The aim of this study was to investigate the associations between tests of EF and iADL.

Participants and Methods: Fifty-nine older people (mean age 72; range 63-94) completed seven tests of EF and attention and a performance-based test of iADL; participants also provided self-ratings on an iADL questionnaire.

Results: After applying Holm-Bonferroni correction, results of partial correlations, controlling for age, show that only the performance-based test of iADL was correlated with EF test scores. The five tests that were significantly correlated with the performance-based test of iADL were included in a regression. The model significantly predicted 53% of the variance. Following Holm-Bonferroni correction, only the D-KEFS Trail Making Test 4, which investigates switching ability, was found to individually predict iADL performance ($\beta = -.469$, $p < .001$).

Conclusions: The findings therefore suggest that this cognitively complex subcomponent of the Trail Making Test is useful in predicting functional status in older adults.

Correspondence: *Anthony Martyr, School of Psychology, Bangor University, Brigantia Building, Bangor LL57 2AS, United Kingdom. E-mail: a.martyr@bangor.ac.uk*

K. MCCULLOCH & R.L. COLLINS. Sensitivity and Specificity of the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) in Screening for Mild and Severe Cognitive Impairment Related to Dementia.

Objective: The MMSE, developed by Folstein, Folstein, and McHugh (1975), is a frequently utilized cognitive screening measure for detecting Alzheimer's disease and related dementias (ADRD). The MoCA was developed in an attempt to increase detection of milder stages of ADRD (Nasreddine et al., 2005). The MMSE is often conceptualized as having better specificity, whereas the MoCA has improved sensitivity for detecting impairment. The goal of the present study was to determine which cognitive screener has greater clinical utility in a sample of Veterans referred by neurological services.

Participants and Methods: 167 Veterans completed an MMSE and MoCA. Sensitivity (SE), specificity (SP), positive predictive value (PPV), and negative predictive values (NPV) were calculated at each level of screener cut-off. Neuropsychological testing was set to classify mild impairment, -1.5 standard deviations (SD) below the mean on at least two cognitive domains, as well as severe impairment, -2.5 SD below the mean on at least two cognitive domains.

Results: Nasreddine et al. (2005) reported an optimal cut-off of below 26 on the MoCA and the MMSE to detect cognitive impairment. However, the optimal cut-off in this sample based on Youden's Index, for the MMSE was below 28 for mild (SE=0.68, SP=0.58, PPV=0.53, NPV=0.72) and below 26 for severe impairment (SE=0.71, SP=0.80, PPV=0.17, NPV=0.98). For the MoCA, the optimal cut-off was below 22 for mild (SE=0.60, SP=0.80, PPV=0.68, NPV=0.74) and below 21 for severe impairment (SE=1.00, SP=0.72, PPV=0.17, NPV=1.00).

Conclusions: At optimal cut-offs, the MMSE's specificity increases and the MoCA's sensitivity increases when detecting more severe cognitive impairment. The optimal cut-off for each cognitive screener is dependent on the severity of cognitive impairment being screened for.

Correspondence: *Katie McCulloch, M.A., Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204. E-mail: katiemccull@gmail.com*

K. MCCULLOCH & R.L. COLLINS. How to Select Between the Mini-Mental State Examination (MMSE) or Montreal Cognitive Assessment (MoCA) When Accounting for the Base Rate of the Sample and the Level of Severity Being Screened For.

Objective: The MMSE it is one of the most utilized cognitive screeners for detecting dementia (Folstein et al., 1975). Recently, the MoCA was developed by Nasreddine, et al. (2005) to screen for earlier stages of dementia. The MMSE is often conceptualized as having better specificity, whereas the MoCA has improved sensitivity for detecting impairment. However, clinical utility, in the form of positive predictive value (PPV) and negative predictive value (NPV), of each screener is influenced by the dementia base rate of the sample. Undocumented dementia ranges from approximately 3.2 to 12% in primary care settings, whereas the prevalence of dementia in memory clinics is estimated to

be 59.7% (Boustani, et al, 2003; Mitchell, 2009). In a meta-analysis, the MMSE was found to have better PPV in specialist settings, with higher base rates of dementia, and better NPV in non-specialist settings (Mitchell, 2009). As of yet, the MoCA has not been evaluated across different settings or base rates of dementia.

Participants and Methods: In the present study, sensitivity, specificity, PPV, and NPV were calculated for each screener at specified base rates using a sample of Veterans referred from Neurological services. 167 Veterans completed an MMSE and MoCA. Analyses were repeated at two levels of impairment, -1.5 or -2.5 standard deviations below the mean on two or more cognitive domains on neuropsychological testing.

Results: When detecting mild impairment, the MMSE and MoCA have similar optimal PPV and NPV values at low base rates, but at high base rates the MMSE has greater PPV and the MoCA has greater NPV. When detecting severe impairment, the MoCA has greater PPV at low base rates and NPV at high base rates, in comparison to the MMSE.

Conclusions: These tables allow clinicians to select the most appropriate measure for their sample.

Correspondence: *Katie McCulloch, M.A., Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204. E-mail: katiemccull@gmail.com*

K. MCCULLOCH, J.M. STINSON & R.L. COLLINS. Predicting Caregiver Burden from Patient Functional Ability and Mood.

Objective: There is a tenuous relationship between a patient's functional ability and their caregiver's level of burden. Burden is strongly associated with caregiver report of functional ability, but there does not appear to be a perfect relationship between the two factors. Additional factors, such as caregiver mood, have been shown to further explain the relationship (Razani et al., 2007). In the present study, patient mood was predicted to explain additional variance in the relationship between caregiver burden and patient functioning.

Participants and Methods: In a sample of 142 Veterans referred by Neurological services, each patient completed the Beck Depression Inventory-II (BDI-II) and the Beck Anxiety Inventory (BAI), if indicated during the clinical interview. Each patient's caregiver completed the Zarit Burden Inventory (ZBI) and the Dementia Severity Rating Scale (DSRS).

Results: In a multiple regression analysis, the DSRS, BDI-II, and BAI significantly predicted ZBI scores ($p < .01$) and accounted for 25.9% of the variance, although depression ($p > .05$) and anxiety ($p > .05$) did not have significant main effects on burden. Inclusion of interactions among the DSRS and each mood factor continued to produce a significant model ($p < .01$) and accounted for 27.4% of the variance, although the DSRS ($p < .01$) continued to be the only significant predictor of burden.

Conclusions: In this sample, patient mood does not appear to have a notable effect on caregiver burden, above and beyond what may be accounted for within caregiver report of functional ability. Caregiver report on the DSRS may account for functional changes secondary to dementia as well as affective symptoms.

Correspondence: *Katie McCulloch, M.A., Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204. E-mail: katiemccull@gmail.com*

L.D. MEDINA, E. GRACIAN, E. PIROGOVSKY, G. BRUSATI, S. GLUHM, B. BLOOM, S.P. WOODS, V. FILOTEO & P.E. GILBERT. Prospective Memory Relates to Everyday Functioning in Older Adults but not in Younger Adults.

Objective: Prospective memory (PM), or "remembering to remember," declines with age and is associated with self-reported everyday functioning among older adults. However, the relationship between PM and performance-based measures of everyday functioning has not been adequately examined.

Participants and Methods: The current study sought to examine relationships between performance-based and self-report measures of PM

and everyday functioning in 30 Younger Adults (YA; Mean age=19.5, SD=1.48) and 26 Older Adults (OA; Mean age=69.8, SD=6.84). Participants were administered performance-based and self-report measures of PM and everyday functioning, including financial and medication management.

Results: Linear regression revealed that total scores on performance-based PM in OA predicted scores on performance-based measures of financial, $R^2=.33$, $F(2, 23)=5.55$, $p=.011$, and medication management, $R^2=.36$, $F(2, 23)=6.43$, $p=.006$. Specifically, lower time-based PM was associated with worse financial management performance, $R^2=.29$, $F(1, 24)=9.93$, $p=.004$, while event-based PM was related to medication management performance, $R^2=.27$, $F(1, 24)=8.81$, $p=.007$. This relationship was not observed in YA ($p>.05$). Self-report measures of PM did not predict performance-based measures of PM, financial, or medication management in either group ($p>.05$).

Conclusions: These results suggest that older adults with deficits in PM may be at greater risk of functional decline in their daily lives. Consistent with research in clinical samples, findings indicate a possible interplay between variability in the strategic demands of the PM cue (i.e., time- vs. event-based PM) and success in specific everyday functioning outcome. Given the small sample size, future studies are needed to further examine incremental value of PM in predicting functional outcomes. Nonetheless, our findings provide preliminary evidence that PM ability may play a significant role in everyday functioning in older adults.

Correspondence: *Luis D. Medina, MS, Clinical Psychology, SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 6363 Alvarado Court, Suite 103, San Diego, CA 92120. E-mail: medinal@rohan.sdsu.edu*

B.P. MULLIGAN, C.M. SMART, S.S. MACDONALD & S.J. SEGALOWITZ. Utility of Neural and Behavioral Markers of Intra-Individual Variability in the Discrimination of Healthy Older Adults from Those with Subjective Cognitive Impairment.

Objective: Older adults with subjective cognitive impairment (SCI) are those who, despite significant, informant-corroborated complaints, appear normal on standard neuropsychometric testing. Previously dismissed as the “worried well”, longitudinal research suggests that a proportion of individuals with SCI progress to mild cognitive impairment and eventual dementia. Furthermore, studies employing measures of intra-individual variability in task performance show sensitivity to predicting such future decline, although such measures are not routinely employed by clinical neuropsychologists.

Participants and Methods: We assessed a sample of neurocognitively normal older adults ($N = 35$, ages 65-77) with SCI using a battery of common neuropsychological tests, focusing on statistical measures of profile dispersion (intra-individual standard deviation) rather than absolute test performance. We also examined trial-by-trial reaction time (RT) inconsistency on a visual Go/NoGo task, while concomitantly recording event-related potentials (ERP). Specifically, we examined the amplitude of the late positive potential (LPP), due to its putative association with neural activity related to stimulus processing/response selection, and its known decrement in older relative to younger adults.

Results: Compared to a control group ($n = 20$) that did not differ in age, level of education, or depression scores, the self-identified SCI group ($n = 15$) had an attenuated LPP amplitude on Go trials only ($F(1,33) = 4.31$, $P < 0.05$). However, there were no group differences in levels of neuropsychological dispersion, RT variability, mean RT, or response accuracy (all $F < 2.4$, $P > 0.05$). Zero-order and unique associations indicated that both RT inconsistency and self-identified SCI, but not neuropsychological dispersion, were important predictors of Go LPP amplitude.

Conclusions: Results suggest neurophysiologic measures could be more sensitive markers of individuals who may be at risk for future cognitive decline than absolute test scores.

Correspondence: *Bryce P. Mulligan, M.Sc., Psychology, University of Victoria, P.O. Box 3050, University of Victoria, Victoria, BC V8W 3P5, Canada. E-mail: bpm@uwic.ca*

T.S. PATERSON, S.E. YEUNG & W.J. THORNTON. Depressive Symptoms Predict Practical, Not Social, Everyday Problem Solving Ability in Older Adults.

Objective: Increased symptom endorsement on the Centre for Epidemiologic Studies Depression (CES-D) Scale has been associated with reduced everyday problem solving (EPS) ability in older age (Yen et al., 2011). Our Laboratory has also shown that Positive Affect measured by the CES-D is specifically related to EPS. It remains unclear whether this relationship applies to both social and practical everyday problems. To address this, we examined CES-D total and factor scores as predictors of social and practical EPS problems, in a sample of older adults.

Participants and Methods: Older adults ($n=103$; age: 51-91) were administered the CES-D to measure depressive symptomatology; EPS ability was determined by the number of safe/effective solutions generated for 16 real-world scenarios (8 socially based, and 8 practically based).

Results: Regression analyses revealed that beyond age, sex, and education, overall depressive symptoms were predictive of practical EPS ability, though CES-D total score was not predictive of social EPS ability ($\Delta R^2 = .044$, $F = 6.37$, $p < .01$). By contrast, the Positive Affect factor of the CES-D was significantly related to not only total EPS ($\Delta R^2 = .05$, $F = 7.20$, $p < .01$) and practical EPS performance ($\Delta R^2 = .04$, $F = 6.12$, $p < .05$), but also to Social EPS performance ($\Delta R^2 = .03$, $F = 4.83$, $p < .05$).

Conclusions: The current results extend previous findings that the relationship between depressive symptomatology and EPS ability in older age may be driven by decreased positive affect, by demonstrating that this relationship may more strongly effect practical, as opposed to social problem-solving abilities. This may have implications for intervention program planning for older adults exhibiting problem-solving difficulties.

Correspondence: *Theone S. Paterson, M.A., Psychology, Simon Fraser University, 580 Oxford St. East, London, ON N5Y 3J1, Canada. E-mail: theonep@sfu.ca*

R. PAUL, J. HEAPS, J. HOFFMAN, E. LANE, J. BOLZENIUS, D. LAIDLAW, R. CABEEN, T. CONTURO, S. CORREIA & D. TATE. Relationship between white matter hyperintensities and subcortical fiber lengths among healthy older adults.

Objective: Previous studies have demonstrated a high prevalence of subcortical vascular disease identified as subcortical white matter hyperintensities (SH) and frontal cortical atrophy in the brains of older adults. In addition, animal and autopsy studies have revealed that advanced age is associated with reductions in white matter fiber lengths. However, no study has determined if SH damage represents a potential mechanism of fiber length reduction in the white matter.

Participants and Methods: In the present study we investigated this relationship among 54 healthy adults over the age of 50 who had completed diffusion tensor imaging and volumetric magnetic resonance imaging to quantify SH volume. Quantitative tractography was utilized to define average white matter fiber lengths in each lobe as well as total brain fiber length.

Results: Results revealed that older age was significantly related to reduced fiber lengths in the frontal and temporal lobe but not the parietal or occipital lobes. Further, older age was significantly related to increased burden of SH. Mean fiber length was related to SH burden in the parietal lobe but not any other brain region.

Conclusions: These results suggest that age is significantly related to both increased SH volume and decreased frontal white matter fiber lengths, but the two imaging markers of aging are largely influenced by independent mechanisms of brain aging.

Correspondence: *Robert Paul, PhD, University of Missouri, St. Louis, 1 University Blvd, Stadler 412, St. Louis, MO 63141. E-mail: paulro@umsl.edu*

D. PAULSON, B.C. SCHNEIDER, M.A. SUGARMAN, E.M. HOLCOMB & P.A. LICHTENBERG. Prediction of IADL disability using executive functioning in older African-Americans.

Objective: The goal of this study was to evaluate the utility of an idiographic deficit model for executive functioning in predicting IADL disabilities.

Participants and Methods: The sample included 120 community-dwelling, African American adults over the age of 65 from a mid-western urban area. WRAT-3 Reading was used to estimate pre-morbid intellectual functioning. Four measures of executive functioning were administered: Trail Making Test, Stroop Color-Word Test, Lexical Fluency (Animals) and COWAT tests. IADLs were evaluated using the Lawton-Brody IADL Scale. MOAANS scores were used to score all executive functioning measures. Executive functioning deficits were identified based on presence of a discrepancy of more than 1 SD between WRAT-3 Reading score and executive functioning measure. A Generalized Linear Model (GLM) was used to test the hypothesis that, after controlling for age, gender and education, incidence of executive functioning deficit would predict IADL disability. Two post-hoc analyses were based on adjustments to the model.

Results: Results of the hypothesized model indicate that greater disability (lower IADL Scale scores) are predicted by less education and idiographic deficits on Trails-B. A second model including an interaction term between education and Trails-B deficits. The third model excluded non-significant predicts, and included only Trails-B, education and the Trails-B*education interaction term, whereby less education predicted more IADL disability among respondents with idiographic Trails-B deficits.

Conclusions: Education can serve as a protective factor against IADL deficits in the face of idiographic Trails-B deficits. These findings support the use of idiographic-deficit identification strategies, particularly with Trails-B. The emergence of Trails-B as a predictor of IADL deficits suggests that cognitive flexibility underlies development of IADL impairment.

Correspondence: *Daniel Paulson, MA, Department of Psychology and Institute of Gerontology, Wayne State University, 57 E Ferry St, 226 Knapp Building, Detroit, MI 48202. E-mail: paulson@wayne.edu*

N. PERSSON & ÅKE. WAHLIN. Change and Variability in Body Mass Index & Cognitive Performance in the Adult Life Span.

Objective: Weight problems are associated to both dementia and cognitive decline. Most studies have focused on whether overweight in mid-life predicts cognitive performance later on in life. Also underweight has been associated to cognitive decline. The associations of change in body mass index (BMI) with cognitive change is less well documented. We wanted to examine if time-varying BMI could predict cognitive performance change over 15 years.

Participants and Methods: We used a random sample of 897 participants from the Betula study in Sweden (35-80 years at baseline). Participants diagnosed with dementia at the fourth measurement occasion were omitted from the analyses (N = 103). Time varying predictors contain both between person- and within person sources of variation. Between persons sources of variation refers here to how individual differences in BMI are associated with individual differences in cognition. Within person associations is exemplified by time specific changes in BMI, within the individual, as predictors of cognitive performance change across time. Linear growth models were fitted to our data.

Results: We found non-linear between person effects of BMI and cognitive performance, such that high and low BMI were both associated with decline in episodic memory, phonemic fluency, and vocabulary, even after controlling for demographic factors (age, sex and education), stroke, heart disease and diabetes. Furthermore, increase within the individual in BMI was associated to decrease in cognitive performance across all these tasks. Semantic fluency and visuospatial ability were not affected by changing BMI.

Conclusions: Both within and between person sources of variation in BMI and non-linearity should be taken into consideration in prediction of cognitive decline. Both high and low BMI are associated with poor cognitive performance. Weight increase causes cognitive decline across the lifespan in non-demented adults.

Correspondence: *Persson Ninni, MSc, department of psychology stockholm university, 57 East Ferry Street, 226 Knapp Building, Detroit, MI 48202, Å. E-mail: ninni.persson@gmail.com*

E. RHODES, R. CHARLTON, O. AJILORE, A. KUMAR, J. GADELKARIM, S. YANG & M. LAMAR. Exploratory Analysis of Graph Theory in Neuroimaging as a Marker of Cognitive Reserve in Aging and Late-Life Depression.

Objective: Research on the neural basis of cognitive reserve (CR) has identified neural efficiency as a potential neuroanatomical measure of CR in healthy aging (HA) and dementia. Little is known about these relationships in late-life depression (LLD) or whether novel brain network analyses may clarify the relationship between neuroanatomy, CR and cognition in aging and LLD.

Participants and Methods: CR (education and IQ), cognitive performance and diffusion tensor imaging (DTI) were collected in 93 adults over 60 (53 HA, 40 LLD). Graph theory was used to construct connectivity matrices defined by fiber tract number on eddy-current corrected DTI data in conjunction with whole-brain gray matter parcellated into 87 regions-of-interest. Global network efficiency and path length were calculated.

Results: Whole-sample and individual group correlations (controlling for age and sex) were not significant between network analysis variables and measures of CR, ending attempts at mediation analyses with CR and cognition. Despite this, path length showed a positive association with age ($p=.043$) and Digit-Symbol Coding ($p=.013$) in HA. In LLD, path length correlated positively with age ($p=.009$) and stroke risk ($p=.007$), and negatively with Similarities ($p=.018$) and Matrix Reasoning ($p=.018$), while global efficiency showed a significant negative association with stroke risk ($p=.027$) and positive associations with Similarities ($p=.019$) and Matrix Reasoning ($p=.005$).

Conclusions: This exploratory study suggests that network efficiency measures are not suitable as a neural marker of CR in the HA or LLD. Instead, network alterations may negatively impact verbal reasoning and executive functioning in LLD, as well as vascular risk and information processing speed in HA.

Correspondence: *Emma Rhodes, MA, Psychiatry, University of Illinois Chicago, 1601 W Taylor St., MC 912 - Psychiatric Institute, Chicago, IL 60612. E-mail: erhodes@psych.uic.edu*

C. RODRIGUEZ-ARANDA & M. ERIKSEN. Addressing the Link Between Age-related Cognitive Decline and Fine Motor Dexterity in Healthy Elderly Adults.

Objective: Slowing of processing speed and motor functions are characteristic features of normal aging. Still, the relationship between these two age-related changes is not well understood. The importance of better understanding this issue has clinical implications. In fact, it is suggested that changes in fine motor functions could be employed as differentiators of normal aging and dementia. Because neuropsychological research usually measures motor functions with simple speed measures the present study aims to employ a new approach by combining kinematic and cognitive data in the study of hand dexterity in healthy elderly adults.

Participants and Methods: Thirty right-handed adults divided in two groups (15 young, 15 elderly) participated in the study. The MMSE, Stroop, Vocabulary, TMT, Dynamometer and Digits Span were used for cognitive evaluation. Also, all subjects performed two tasks (inserting pins and assembly) of the Purdue pegboard test with reflective markers on their hands. Markers were placed on four specific anatomical points (index, thumb and wrist). Performance was video recorded and analyzed with the Peak Motus motion system. Motion analyses were done by blocks of 10 and 15 minutes.

Results: Angular positions and velocity trajectories were correlated to cognitive performance. Variability of movement was also calculated and correlated with cognitive data. Preliminary results showed that healthy elderly are slower to assemble pegs and pins during the entire task, while the slowing was more accentuated in the starting phase of the inserting task. For the easiest task (inserting) the slowing seems to be merely associated with sensorimotor changes, while the slowing in assembly was correlated with tests relying on visuo-spatial coordination and attentional control.

Conclusions: A decline in dexterity in healthy elderly is to a limited extent related to higher cognitive functions. The present approach could have fruitful applications for the analysis of psychomotor functions in various aging populations.

Correspondence: *Claudia Rodriguez-Aranda, Department of Psychology, University of Tromsø, Tromsø 9037, Norway. E-mail: claudia.rodriguez-aranda@uit.no*

E.A. SCHARAGA & R. HOLTZER. Psychometric Properties of the BRIEF: An Efficient Assessment of Instrumental Activities of Daily Living Performance.

Objective: Decline in Instrumental Activities of Daily Living (IADL) is required for the diagnosis of dementia. IADL is typically assessed by questionnaires. While objective measures of IADL exist, lengthy administration time and cost have limited their use in cohort studies and clinical practice. Therefore, we developed and administered the Brief Report of Instrumental Everyday Functioning (BRIEF), a short performance measure of IADL, to a sample of community-dwelling older adults.

Participants and Methods: We administered the BRIEF to 116 older adults, deemed non-demented through consensus diagnostic procedures ($M = 76.89 \pm 7.36$ years of age; female $N = 61$). Administration time for the BRIEF requires up to five minutes and contains two IADL domains: finance, composed of computation and money handling, and medication management. A subsample ($N = 87$) completed retest administration 5 to 36 days apart ($M = 10.54 \pm 6.11$ days). Participants completed a self-report IADL questionnaire and comprehensive neuropsychological and motor functioning evaluations.

Results: Completion times in seconds were short for: finance computation ($M = 11.07 \pm 7.16$), handling money ($M = 28.05 \pm 11.97$), and medication management ($M = 64.33 \pm 28.24$). Retest reliability for the time to complete each component of the BRIEF was significant, although moderate ($p < .01$). Logistic regressions showed that accuracy in day 1 significantly predicted day 2 accuracy for finance computation $b = 1.55$, $t(85) = 5.60$, $p < .05$, $OR = 4.73$, money handling $b = 1.74$, $t(85) = 8.20$, $p < .01$, $OR = 5.71$, and medication management $b = 2.03$, $t(85) = 8.20$, $p < .01$, $OR = 7.57$. Time to complete the combined finance and medication management tasks correlated in the expected directions with measures of executive functions and processing speed ($p < .01$).

Conclusions: Objective assessment of medication and finance management, two critical components of IADL, can be accomplished within a 5-minute time interval. Future research should determine the diagnostic utility of the BRIEF.

Correspondence: *Elyssa A. Scharaga, B.A., Clinical Psychology, Yeshiva University, 138 Altessa Blvd., Melville, NY 11747. E-mail: Scharaga@gmail.com*

E. SHERMAN, C. ROSENBLATT, P. HOUSE, T. SZABO, M. KOEHLER, B. SAFFER & D. COPEMAN. Neuropsychology in the Primary Care Setting: Overview and Experiences from a Brain Health Program.

Objective: Contact with a family physician is by far the most common access point for people concerned about their brain health. Despite this, neuropsychological assessment and intervention are virtually absent from primary medical care in most countries. We describe a novel brain health program created for primary care, based on: 1) prevention and early detection, 2) neuropsychological principles of brain health, 3) evidence-based assessment.

Participants and Methods: A Brain Health service centered on neuropsychological principles of care was created for a primary care setting to provide cognitive assessments, consultation, and intervention in a family practice model aimed at prevention. Cognitive assessment were specifically geared towards 1) brevity, 2) repeatability (i.e., employing empirically-based reliable change and base rate data), 3) com-

prehensiveness (covering core cognitive domains and psychological screening), and 4) flexibility (i.e., appropriate for both healthy aging and dementia). Patients received graphical or table-based results, general and personalized information on brain health protective factors, recommendations to address brain health risk factors, and intervention such as cognitive training, cognitive-physical exercise programs, and rehabilitation.

Results: Over 300 patients have been seen to date in two centres. Core elements of the service are direct consultation with primary care physicians and education on neuropsychology and brain health, and a proactive health approach, which is reflected in the high number of self-referrals for brain health services (50 to 80% of patients). Physicians and patients report high satisfaction with the model thus far.

Conclusions: Because access to early assessment and treatment is key to preventing and mitigating the impact of conditions associated with aging, including dementia, neuropsychological services operating within a primary care model such as that described here may be of increasing utility in community settings.

Correspondence: *Elisabeth Sherman, PhD, Copeman Healthcare Centre, 400-628 12th Ave SW, Calgary, AB T2N 0B4, Canada. E-mail: esherman@copemanhealthcare.com*

J. STRATTON, E. SHAW, T. GEFEN, K. WHITNEY, S. WEINTRAUB, M. MESULAM & E. ROGALSKI. Super-Memory-Agers or Super-Cognitive-Agers: Are they one and the same?

Objective: Understanding the neurobiologic processes of those who seem resistant to “normal” age-related memory decline may influence the development of strategies for avoiding disease and disability in old age. A group of such individuals, with memory scores at least as good as individuals 20-30 years their junior, has been identified by Northwestern University’s SuperAging program. While SuperAgers are selected for outstanding memory scores, the goal of this study was to determine if they also have above average performance in other cognitive domains.

Participants and Methods: SuperAgers were community dwellers over age 80 whose memory scores were equal to or exceeded norms for 50-65-year-olds and whose scores in language, attention, and executive functions were at least average for age. Baseline neuropsychological data from 27 SuperAgers were examined to compare test scores in non-memory cognitive domains to well-established demographically adjusted 50-65-year-old norms.

Results: The vast majority ($\geq 81\%$) of SuperAgers scored within the average range or above using the 50-65 year-old norms on measures of executive function, language, and attention. Three SuperAgers consistently preformed in the high average range of the middle-aged norms (scaled score ≥ 12) in the domains of attention and executive functioning. Similarly, 85% of the SuperAgers achieved high average scores on at least one non-memory cognitive test.

Conclusions: In addition to having remarkable memory, the majority of SuperAgers performed at an average level or better in multiple cognitive domains compared to middle-aged norms, suggesting a high level of performance across cognitive domains is possible in old age. These individuals may provide a novel approach to the study of age-related cognitive change.

Correspondence: *John Stratton, M.A., Psychiatry and Behavioral Science, Feinberg School of Medicine, Northwestern University, 2300 Lincoln Park West, Apt 425, Chicago, IL 60614. E-mail: johumbstratton@gmail.com*

K. THOMAS, S.D. MARION, M. GOMEZ, K. MILLER, W. BROWN & M. HARRINGTON. Cerebrospinal Fluid and Plasma apolipoprotein A-1 Predicts Performance on Verbal Episodic Memory Measures.

Objective: Apolipoprotein A-1 (ApoA-1), a lipid-protein molecule providing numerous functions in the blood and brain, merits consideration as a key biomarker for detecting early AD as well as understanding the pathological characteristics of prodromal cognitive change in those at

risk for AD. Research on the association of plasma and CSF ApoA-1 to cognition and dementia has yielded conflicting results. Given that early episodic memory deficits characterize the AD process, this study sought to explore the association of CSF and plasma ApoA-1 levels on verbal memory performance.

Participants and Methods: Participants ($N = 130$) ages 47-97 ($M = 77.96$, $SD = 7.56$) were administered the California Verbal Learning Test-II (CVLT-II) as a measure of list-learning and the Wechsler Memory Scales-III, Logical Memory (WMS-III LM). CSF and plasma ApoA-1 assays were obtained using isoelectric focusing and immunoblotting.

Results: Results of this study revealed that CSF ApoA-1 significantly predicted list-learning (CVLT recognition discriminability, $p < .05$) and both immediate ($p < .001$) and delayed ($p < .01$) narrative memory (WMS-III LM). Interestingly, a gender effect was seen in that the association between list-learning and ApoA-1 was found only in men. CSF ApoA-1 also significantly predicted performance on. Higher CSF ApoA-1 values associated with lower recognition discriminability in both cognitively healthy ($p < .05$) and impaired ($p < .01$) subgroups.

Conclusions: Results from this study indicate that ApoA-1 plays an important, albeit not fully elucidated role in the AD cascade. This study confirms and extends prior findings that poorer memory functioning is associated with higher levels of ApoA-1 in the CSF and lower ApoA-1 in the plasma. Advantages of this study are the inclusion of a relatively large sample of comprehensively assessed (i.e., medical and cognitive) older adults. This study also highlights the sensitivity of verbal memory, recognition discriminability in specific, to this important biomarker. Correspondence: Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 150 N. Oakland Ave., Pasadena, CA 91101. E-mail: [sdmarion@fuller.edu](mailto:sdm Marion@fuller.edu)

A.L. WONG, J. BUCKWALTER, S.D. MARION, S.S. AMANO & T.E. SEEMAN. Triglyceride Levels as a Predictor of Cognitive Performance in Healthy Aging Adults.

Objective: Hypertriglyceridemia is one of the many risk factors associated with cardiovascular disease. It has been suggested that high triglyceride levels can affect cognitive impairment by inducing leptin resistance at the blood brain barrier, particularly in those who are obese and/or have diabetes. However, little is known about the effects that triglyceride levels have on cognitive functioning in healthy aging adults. The aim of this study was to determine if triglyceride levels would be a predictor of cognitive performance in this population.

Participants and Methods: The sample consisted of 1003 participants (553 females) aged 34 to 84 years old ($M = 55.39$, $SD = 11.82$) with education levels ranging from elementary to graduate school. Various biomarker data and health-related information were collected from each participant. In addition, each participant completed a brief assessment protocol of cognitive functioning, called the Brief Test of Adult Cognition by Telephone, which consisted of tests of processing speed, verbal memory, and executive functioning.

Results: After controlling for age, gender, education level, waist-to-hip ratio (used as a measurement of obesity), and diabetes diagnosis, hierarchical regression analyses showed that triglyceride levels significantly predicted processing speed, $F(1, 998) = 10.81$, $B = -2.14$, $SE B = .65$, $R^2 = .20$, $p = .001$, and executive functioning, $F(1, 993) = 5.96$, $B = -0.13$, $SE B = .06$, $R^2 = .24$, $p = .02$. However, triglyceride levels were not shown to be predictive of verbal memory performance, $F(1, 990) = 0.03$, $B = 0.01$, $SE B = .06$, $R^2 = .21$, $p = .85$.

Conclusions: There is evidence from this current study that suggests triglyceride levels can have a remarkable effect on cognitive functioning in healthy aging adults, particularly in executive functioning and processing speed. These findings suggest that high triglyceride levels may need to be monitored as they could potentially increase one's risk for significant cognitive decline later in life.

Correspondence: Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 150 N. Oakland Ave., Pasadena, CA 91101. E-mail: [sdmarion@fuller.edu](mailto:sdm Marion@fuller.edu)

S. TOMASZEWSKI FARIAS, L. QUITANIA PARK, O. CARMICHAEL & D. MUNGAS. Relationships between everyday cognition, neuropsychological function and structural brain imaging vary by diagnosis.

Objective: The aim of the present study was to examine how the association between everyday function and both neuropsychological abilities and structural brain volumes vary as a function of diagnostic syndrome (e.g. normal vs. impaired).

Participants and Methods: Participants included 474 older adults (244 normals, 142 with MCI, 88 with dementia). Participants were considered impaired if they had MCI or dementia. Everyday function was measured using the ECog, an informant-rated questionnaire measuring multiple cognitively-relevant functional domains. Neuropsychological function was captured using psychometrically matched composites of episodic memory and executive functions. Region-specific brain MRI volumes included: hippocampus and dorso-lateral prefrontal cortex (DLPFC). Tobit regression models were used to examine the neuropsychological and imaging predictors of the ECog domains, with an interaction term included to examine diagnosis effects.

Results: There were fewer associations between episodic memory and the ECog domains in normals, whereas in the impaired group, episodic memory was associated with all ECog domains. Alternatively, the pattern of associations between executive function and the ECog domains was the same across groups. Similarly, there were fewer associations between the hippocampus and ECog domains in the normal group as compared to the impaired group, whereas the associations between the DLPFC and the ECog domains were the same across groups.

Conclusions: Episodic memory and hippocampal volume are more consistently predictive of everyday function in those with MCI or dementia as compared to normal elderly. In contrast, executive function and prefrontal cortex have more consistent relationships with everyday function regardless of diagnosis in older adults.

Correspondence: Sarah Tomaszewski Farias, Ph.D., Neurology, UC Davis, 4860 Y Street 1, Sacramento, CA 95817. E-mail: sarah.farias@ucdmc.ucdavis.edu

M.A. TRIVEDI, V.T. DINH, B. RYPMA, R.C. SHAH, J.D. GABRIELI, S.W. GABRIELI & C.T. STEBBINS. The neural correlates of symbol digit modalities test (SDMT) performance across the lifespan.

Objective: Normal aging is associated with a decline in cognitive efficiency. The present study used fMRI, functional connectivity analysis, and diffusion tensor imaging fiber tractography to better understand the neural basis of age-related changes in cognitive efficiency.

Participants and Methods: We used an fMRI-modified version of the symbol digit modalities test (SDMT) to investigate age effects on the neural correlates of cognitive efficiency in 47 adults, while DTI fiber tracking of white matter was examined in a sample of 111 adults (age range: 18-87 years). During the SDMT task, participants decided whether a target symbol-digit pair matched one of the symbol-digit pairs in a corresponding table. Regression analysis was used to examine age effects on the neural correlates of cognitive efficiency. fMRI data processing and statistical analyses were conducted with SPM8, while mrDiffusion was used for to process and analyze the DTI fiber tracking data.

Results: Increasing age was associated with reduced fMRI activation in right inferior occipital cortex and increased activation in right globus pallidus, orbitofrontal, inferior parietal, and lateral temporal cortices and left putamen ($p = 0.001$, uncorrected, $k = 50$). Increasing age was also associated with greater functional connectivity between right globus pallidus and bilateral superior temporal cortices and right caudate nucleus and right superior temporal cortex, whereas reduced connectivity was observed between right globus pallidus and right prefrontal cortex and right caudate nucleus and right superior frontal cortex ($p = 0.001$, uncorrected, $k = 50$). Reduced white matter integrity along fiber tracts between left striatum and hippocampus ($r = -0.25$, $p = 0.02$) and left striatum and orbitofrontal cortex ($r = -0.35$, $p = 0.001$) was also associated with increasing age.

Conclusions: This study demonstrates that increasing age is associated with alterations in fMRI activation and functional/structural connectivity in brain regions critical for SDMT performance.

Correspondence: *Mehul A. Trivedi, Ph.D., Neurological Sciences, Rush University Medical Center, 1725 W. Harrison Street, Suite # 1101, Chicago, IL 60612. E-mail: mehul_trivedi@rush.edu*

S.A. WOOD, P. LIU, S. WILLIAMS & A. MIDDEN. Neurocognitive Risk Factors for Elder Financial Exploitation.

Objective: Elder Financial Exploitation (FE) has been defined as the illegal or improper use of vulnerable adults' funds or property for another person's profit or advantage (AARP, 2006; NCEA 1998). Common types of exploitation include transfer of real property, estate changes, unauthorized ATM charges, overcharging for services, forged checks, and "gifts". Basic research into the understanding of FE has been lacking until recently, in part because of difficulties in accurately defining and measuring FE, which can be challenging (Conrad et al, 2010). The current study examines neuropsychological correlates of actual real world incidence of FE in a community sample.

Participants and Methods: A sample of 100 community dwelling older adults were recruited for this project. The participants were administered a 3 hour test battery as well as the Older Adult Financial Exploitation Measure, a 79-item self report measure (OAFEM; Conrad et al., 2010).

Results: Preliminary analyses revealed that measures of executive functioning (Trails, Stroop), WRAT Calculation, IADLS, and numeracy (financial literacy) were significantly correlated with risk of FE (all p s < .05). Older adults who performed worse on the above measures reported higher frequency of fraudulent events. However, in a regression analyses, only numeracy remained significant after demographics, cognition, and health are controlled for (p < .05).

Conclusions: These results are consistent with work on financial capacity (Marson, 2007) and the growing literature on the importance of numeracy in decision-making (Wood et al., 2010).

Correspondence: *Stacey A. Wood, PhD, Psychology, Scripps, 1030 Columbia Ave, Claremont, CA 91711. E-mail: swood@scrippscollege.edu*

D.A. WORTHY. Older Adults Show a Heightened Behavioral Response to Negative Prediction Errors During Decision-Making: A Proposed Effect of Dopaminergic Decline.

Objective: The dopamine hypothesis of cognitive aging holds that normal aging is associated with a monotonic decline in dopamine levels. One possible byproduct of this decline is a reduced responsiveness to positive outcomes and a heightened responsiveness to negative outcomes. Recent work supports this view in that older adults show a bias to learn from negative feedback as opposed to positive feedback (e.g. Frank & Kong, 2008). Here we tested whether older adults would show a heightened behavioral response to negative errors of prediction, where the reward received was less than what was previously given, relative to younger adults.

Participants and Methods: Healthy older ($N=23$) and younger ($N=23$) adults performed 100 trials of a decision-making task where they repeatedly chose from two options and received continuously valued rewards, with the goal of maximizing their cumulative reward over the course of the task. One option provided a higher mean reward, on average, but there was a large degree of variance in the reward given on each trial.

Results: Older and younger adults selected the option with the higher average payoff equally often. Despite equivalent evidence of learning in the tasks, an analysis of the average prediction errors that preceded trials in which participants switched to the other option showed that older adults had significantly lower negative prediction errors than younger adults on the trials preceding a switch. Thus, older adults were more likely to switch following trials in which they received a significantly lower payoff than they had expected, suggesting an age-related increase in responsiveness to negative information.

Conclusions: These results are consistent with the dopamine hypothesis of aging and suggest that older adults may be particularly sensitive to decision-making outcomes that are worse than what they expected.

Correspondence: *Darrell A. Worthy, PhD., Texas A&M University, 4235 TAMU, College Station, TX 77843-4235. E-mail: worthyda@tamu.edu*

M. FANNING, M. ACKER, T. GIOVANNETTI, A.C. LYON, S. HEVERLY-FITT, B. CIAUDELLI, S. WELDEN & T.F. FLOYD. Verbal Fluency Output over Time: Relation to Executive Dysfunction and Vascular Risk Factors.

Objective: A steep decline in verbal fluency output over time has been associated with cerebrovascular disease and executive deficits in MCI and dementia, suggesting verbal fluency slopes may be a sensitive measure of executive dysfunction associated with cerebrovascular disease. We examined this notion in older adults without MCI/dementia but with chronic cardiac disease, which is associated with cerebrovascular compromise and executive dysfunction. We predicted steeper verbal fluency slopes would be associated with vascular risk factors (VRFs) and executive impairment.

Participants and Methods: 230 participants (age ≥ 65) with aortic stenosis and/or coronary artery disease and no diagnosis of MCI or dementia were recruited. Verbal fluency slopes were calculated from the percentage of responses across 4 15-second time intervals. Means were compared to those of healthy controls (HC) and participants with dMCI or mixed MCI (mxMCI) reported in Libon et al (2010). Background neuropsychological measures and 9 VRFs also were collected.

Results: This sample showed a significantly steeper mean slope on the verbal fluency task ($M=-8.34$ $SD = 3.68$) than HC ($M=-6.37$, $p<0.01$) but a significantly flatter slope than mxMCI ($M=-9.17$) or dMCI ($M=-12.51$, $p<.01$ for both). Correlation analyses showed verbal fluency slope was unrelated to the number of VRFs ($r = .05$) but significantly related to multiple neuropsychological variables. A hierarchical linear regression showed executive measures accounted for a significant portion of the variance in slope (Non-Automatized Mental Control $\beta=.19$, $p<.01$; Digit Span $\beta=.17$, $p=.02$); the additional variance explained by other measures was not significant.

Conclusions: Verbal fluency slopes are steeper in people with cardiac disease relative to healthy controls. Although unrelated to the number of VRFs, fluency slope in those with cardiac disease was significantly associated with executive dysfunction. Fluency slope is an easily obtained measure that reflects executive function in older adults.

Correspondence: *Tania Giovannetti, PhD, Psychology, Temple University, Weiss Hall, 6th floor, 1701 N 13th Street, Philadelphia, PA 19122. E-mail: tgio@temple.edu*

Assessment/Psychometrics/Methods (Adult)

D. OTTEMILLER, C. SETER & T. GIOVANNETTI. Creativity and Everyday Action.

Objective: Performance-based measures of everyday action are becoming increasingly popular in the literature. Identifying errors on everyday tasks is challenging, as it can be hard to distinguish a true error from a creative or idiosyncratic action. We examined the relation between creativity and everyday action and hypothesized that creative people would make more errors reflecting atypical or off-task actions on a test of everyday action.

Participants and Methods: 30 participants (73% men, $Age=22.16$) completed the Alternate Uses Task (AUT), a measure of creativity, and the 2x3 Multi-Level Action Test (MLAT), a performance-based test of everyday action. The AUT was scored for fluency (total plausible uses) and errors (total implausible uses). The MLAT was scored for omissions (failure to perform a step), commissions (performing a step incorrectly) and additions (off-task step is performed).

Results: On average, participants generated 32.60 plausible and .53 implausible uses on the AUT. On the MLAT participants made an average of 2.03 omissions, 6.90 commissions, and .73 additions. Spearman rank order correlations between AUT variables and MLAT errors showed a meaningful negative relation between fluency and commissions ($r_s = -.35$, $p = .06$), but relations with other MLAT errors were weak ($r < .18$ for both). AUT errors were significantly positively correlated with MLAT additions ($r_s = .42$, $p < .05$) but not with commissions or omissions ($r < .06$ for both).

Conclusions: Contrary to our prediction, creative individuals were less likely to make errors while performing everyday tasks. Thus, it is possible to distinguish true errors on performance-based measures of everyday action, even among highly creative individuals. Individuals who demonstrated overinclusive thinking on the AUT were more likely to demonstrate overinclusive everyday action errors, suggesting that difficulties in filtering superfluous actions or responses may be observed across a range of tasks. Correspondence: *Tania Giovannetti, PhD, Psychology, Temple University, Weiss Hall, 6th floor, 1701 N 13th Street, Philadelphia, PA 19122. E-mail: tgio@temple.edu*

A. BOETTCHER, B. HILL, M. WOMBLE, J. KLINE, E.R. CORLEY & M. ROHLING. Association Between Experimental Measures of Working Memory Ability and Concussion Vital Signs Domains.

Objective: While computerized cognitive assessment batteries have become widely utilized in the assessment of concussion, there is limited research examining the cognitive constructs assessed by these batteries. This study explored potential similarities and differences between experimental working memory criterion tasks and cognitive domains on a computerized cognitive assessment battery.

Participants and Methods: The following measures were used: Automatic Operation Span (OSpan) task, Reading Span (RSpan) task, and Concussion Vital Signs (CVS). Forty seven undergraduate college students were recruited from a southeastern university (mean age=20.96, SD=6.47).

Results: The two experimental working memory tasks correlated at $r = .66$ ($p < .001$). The mean CVS Neurocognitive Index score, a measure of overall cognitive performance, was 90.02, SD=20.30. Correlations with OSpan (r_1) and RSpan (r_2) performance, respectively, with CVS domains were as follows: Neurocognitive Index ($r_1 = .11$, $r_2 = .04$), Psychomotor Speed ($r_1 = .23$, $r_2 = .19$), Reaction Time ($r_1 = -.05$, $r_2 = .04$), Complex Attention ($r_1 = -.02$, $r_2 = -.02$), Cognitive Flexibility ($r_1 = .28$, $r_2 = .13$), Processing Speed ($r_1 = .12$, $r_2 = -.09$), Executive Functioning ($r_1 = .28$, $r_2 = .12$), Verbal Memory ($r_1 = .25$, $r_2 = .37$), Visual Memory ($r_1 = .24$, $r_2 = .41$), and Memory Domain ($r_1 = .29$, $r_2 = .46$).

Conclusions: Results showed a strong significant correlation between the two working memory criterion tasks, demonstrating convergent validity. Comparing performance on the two experimental working memory tasks to CVS performance, the strongest associations were noted for Cognitive Flexibility, Executive Functioning, and all of the Memory indexes suggesting that working memory ability is contributing to performance on these CVS domains. Further discussion of the results will be presented.

Correspondence: *Benjamin Hill, PhD, Psychology, University of South Alabama, 2000 UCOMM, CCP Program, Mobile, AL 36688. E-mail: bdhill@usouthal.edu*

J. BOLZENIUS, P. ROSKOS, J. STOUT, P. ZHANG, J. GFELLER & R. BUCHOLZ. Construct Validity of the N-Back Task as an Attention and Working Memory Paradigm in Individuals with Traumatic Brain Injury.

Objective: The n-back task is a measure of working memory and attention that has been used in many experimental cognitive and neuroimaging procedures. Literature has shown that accuracy (AC) and reaction time (RT) from the n-back task relate modestly to other measures of attention and working memory, as well as other cognitive domains. The present study further examined the construct validity of the n-back task in a sample of individuals with traumatic brain injury (TBI; $N = 71$) and a sample of age- and gender-matched healthy controls (HC; $N = 31$).

Participants and Methods: Participants completed a battery of neuropsychological tests (e.g. WAIS-III, CVLT-II, and Trail Making Test) designed to assess a range of cognitive functioning as part of a larger, on-going neuroimaging study. The n-back task was used as a stimulus paradigm during a magnetoencephalography procedure and AC and RT variables were calculated for 4 conditions (0-, 1-, 2-, and 3-back). Univariate statistics were calculated to determine if differences existed between groups (TBI vs. HC) on n-back AC and RT variables. Additionally, Pearson 2-tailed correlations were calculated to examine relationships between n-back variables and neuropsychological test scores.

Results: ANOVA results revealed reduced AC scores in the TBI group for 2- and 3-back conditions. No differences were observed in AC in 0- or 1-back conditions or in RT between groups. Correlational analyses showed low-moderate magnitude (0.2-0.5) statistically significant ($p < .05$) relationships between n-back scores and measures of attention, working memory, processing speed, and executive function.

Conclusions: Findings suggest that the n-back task taps into multiple cognitive constructs, including, but not limited to, working memory and attention. Our study also suggests that more difficult n-back conditions (2- or 3-back), requiring increased cognitive load and additional executive processes, may result in lower AC performance in neurologically impaired participants, such as individuals with TBI.

Correspondence: *Jacob Bolzenius, University of Missouri-St. Louis, One University Boulevard, 443 Stadler, Saint Louis, MO 63121. E-mail: jdbd@mail.umsl.edu*

S. CHEN, L. BOXLEY, A. KRAAL & L. BIELIAUSKAS. Does MOCA Performance Vary By IQ?

Objective: Intelligence testing provides the context within which an individual's strengths and weaknesses may be evaluated. Prior studies have demonstrated that cognitive screening performance on the Mini Mental Status Exam (MMSE) is significantly related to estimated intelligence (Bieliauskas et al., 2000). The goal of the current study was to perform a parallel investigation of the potential relationship between estimated intelligence and another brief screening measure, the Montreal Cognitive Assessment (MOCA).

Participants and Methods: A neuropsychological battery was administered to 128 consecutively recruited veterans referred to a VA polytrauma clinic. Among other neuropsychological tests, patients were given the MOCA, Peabody Picture Vocabulary Test (PPVT-IV), and the Wechsler Adult Intelligence Scale (WAIS-IV) – Digit Span subtest. In an effort to control for adequate effort, individuals who obtained a score of ≤ 11 on Reliable Digits were excluded from the analysis ($N = 30$). Using ANOVA, PPVT performance was stratified by 1 standard deviation intervals from the mean.

Results: Individuals with IQ scores less than 85 produced lower average MOCA scores ($M = 21.13$, $SD = 5.38$) than those with IQ scores between 85 and 99 ($M = 24.00$, $SD = 2.48$), and those with IQ scores between 100 and 115 ($M = 25.91$, $SD = 2.21$; $F(3, 97) = 4.32$, $p = .007$). Scores higher than 115 did not follow the same pattern, likely due to the small number of individuals in this same that fell in that range ($n = 8$).

Conclusions: As was seen with the MMSE in previous studies, MOCA performance appears to vary by estimated IQ. This finding underlines the continuing importance of considering premorbid ability in the assessment of current cognitive functioning.

Correspondence: *Laura Boxley, PhD, VHA Ann Arbor, 2215 Fuller Road, Ann Arbor, MI 48103. E-mail: lauraboxley@gmail.com*

C.Z. BURTON, E. BENGOTXEA, B.T. MAUSBACH, J. BUCARDO, T.L. PATTERSON & E.W. TWAMLEY. Cognition and Functional Capacity Assessment in English Speakers and Monolingual Spanish Speakers with Schizophrenia.

Objective: Cognition and everyday functioning are highly related in schizophrenia, but little is known about the effects of language on functional capacity assessment in this population. This study aimed to evaluate performance on a cognitive battery as well as various functional capacity measures among English speakers and monolingual Spanish speakers diagnosed with schizophrenia-spectrum disorders.

Participants and Methods: 210 English speakers and 29 monolingual Spanish speakers completed the Mattis Dementia Rating Scale (DRS) and three performance-based functional capacity measures: the UCSD Performance-Based Skills Assessment (UPSA), the Social Skills Performance Assessment (SSPA), and the Medication Management Ability Assessment (MMAA). The UPSA evaluates skills in general organization, finance, communication, transportation, and household chores. The SSPA assesses social skills in two role-play scenarios, and the MMAA involves planning how to take a complex regimen of medications. The groups were compared on various demographic, cognitive, and functional capacity variables.

Results: Although both groups performed in the impaired range on the DRS (English $M=126$; $SD=14$; Spanish $M=119$; $SD=13$), Spanish speakers performed significantly worse ($t=2.77$; $df=233$; $p=.006$). Education level ($p<.001$) but not language ($p=.905$) significantly predicted DRS score ($R^2=.16$). The Spanish speakers performed worse on the UPSA but better on the MMAA; the groups performed comparably on the SSPA. Both DRS score ($p<.001$) and language ($p=.008$) predicted UPSA performance ($R^2=.55$).

Conclusions: Language of test administration may not affect the measurement of cognition in schizophrenia. Measurement of functional skills, however, may be strongly affected by cognitive ability and language of test administration. Language is not a unitary construct, though; literacy, education, and acculturation may also play a critical role in the assessment of functional outcome in schizophrenia.

Correspondence: *Cynthia Z. Burton, SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 140 Arbor Drive, San Diego, CA 92103. E-mail: czburton@ucsd.edu*

M. BUSSE, D. WHITESIDE, D. WATERS & J. HELTINGS. Reliability of the PAI in a Neuropsychological Population.

Objective: Studies have suggested that the generalizability of an assessment tool cannot be assumed to extend to individuals defined by specific or unique characteristics (Schinka, 1995). As a result, when using an assessment tool with a population that differs from the standardization sample, it is important to first establish generalizability (Messick, 1989). Given the need for additional research investigating the Personality Assessment Inventory's (PAI) psychometric properties when used with specialized populations (Kurtz & Blais, 2007), the current study examined the reliability of the PAI in a mixed neuropsychological population.

Participants and Methods: Participants consisted of 506 consecutive neuropsychological referrals who completed the PAI. To analyze reliability, Cronbach's alpha and mean inter-item correlation coefficients were calculated for all full scales and subscales.

Results: As hypothesized, all full scale and subscale alpha coefficients were acceptable and comparable to what Morey (1991) reported for the standardization sample. Full scale coefficients ranged from .72 to .94, with a mean alpha value of .83. Subscale coefficients ranged from .60 to .90, with a mean alpha value of .78.

Conclusions: Results lend support for the reliability of the PAI when used with a neuropsychological sample and suggest that the PAI performs similarly in this special population.

Correspondence: *Michelle Busse, M.A., Washington School of Professional Psychology, 1900 Alaskan Way, #409, Seattle, WA 98101. E-mail: michelle.busse@hotmail.com*

G.J. CHELUNE, J.R. CRAWFORD, J. SHEEHAN, K. DUFF, J. HOLDNACK & O. PEDRAZA. Assessing Reliable Cognitive Decline in Older Adults: Part I — Efficacy of Multivariable Regression Equations Derived from Summary Data.

Objective: Regression-based equations form the basis of the predicted-difference method of assessing individual reliable change in retest situations. In the absence of observed data, methods for generating multivariable prediction equations based on simple summary data have been developed (Crawford et al., 2012). The comparability of derived prediction equations and those using observed data is evaluated for several widely used clinical tests.

Participants and Methods: Baseline and follow-up retest data for Mayo's Older American Normative Studies were available for Dementia Rating Scale ($n=1030$), Boston Naming Test ($n=1155$), Controlled Oral Word Association ($n=582$), semantic fluency ($n=359$) and Trails A & B ($n=329$). Using summary data (N , Means, SDs, and zero-order correlations), derived equations and scores (DER) were compared to those generated from the observed (OBS) data. Specifically, 1) DER Multiple Rs were compared to zero-order r 's between OBS Time 2 (T2) scores and DER predicted T2 scores; 2) DER equations were applied to OBS data and the Means and SDs of the predicted-difference z -scores were examined; 3) beta weights for the DER and OBS equations were compared; and 4) the predicted T2 scores from the DER and OBS equations were correlated.

Results: DER Multiple Rs were comparable with the zero-order r 's between OBS T2 scores and DER predicted T2 scores. The Mean and SD of the predicted-difference z -scores were nearly 0.0 and 1.0 respectively. Beta weights for baseline scores, age, and education were virtually identical for the DER and OBS equations. The r between predicted T2 scores from the DER and OBS equations approached 1.0 in all cases.

Conclusions: DER equations and scores were highly comparable to the OBS data across multiple dimensions. In the absence of access to observed raw data, multivariable prediction equations derived from summary data provide a satisfactory means for performing predicted-difference analyses to evaluate individual cognitive change.

Correspondence: *Gordon Chelune, Ph.D., ABPP(CN), Neurology, University of Utah, Ctr. for Alzheimer's Care, Imaging & Research, 650 Kommas Dr., Ste 106A, Salt Lake City, UT 84108. E-mail: gordon.chelune@hsc.utah.edu*

G.J. CHELUNE, O. PEDRAZA, J. SHEEHAN, K. DUFF, J. HOLDNACK & J.R. CRAWFORD. Assessing Reliable Cognitive Decline in Older Adults: Part II — Base Rates of Decline in a Clinical Sample at Two Levels of Impairment.

Objective: To examine whether baseline level of cognitive impairment influences subsequent rate and frequency of cognitive decline.

Participants and Methods: Of 3673 patients seen at a cognitive disorders clinic, 1581 had neuropsychological exams, and serial assessments were done in 402 cases. To avoid retest floor effects, 383 cases were selected with MMSE >17 and divided into those with mild (18-23; $n=98$) vs. normal (24-30; $n=285$) baseline cognition (Tombaugh & McIntyre, 1992). The groups were comparable on education, sex, handedness, and retest interval; the mild impairment group was significantly older (74.3 vs. 71.7 yrs). Predicted-difference z -scores were computed using regression equations built from summary retest data from Mayo's Older American Normative Studies for the Dementia Rating Scale (DRS), Boston Naming Test, Controlled Oral Word Association, semantic fluency, and Trails A & B (see Part I).

Results: The mild impairment group showed significantly greater discrepancies between observed and predicted retest scores on all variables except Trails B, indicating an accelerated rate of decline compared to the normal cognition group. A reliable change cut score of <-1.645 was used to establish base rates of reliable decline. The mildly impaired group showed significantly greater base rates of decline on all variables except Trails B and semantic fluency. Odds ratios ranged from 7.0 (DRS) to 0.6 (Trails B), and likelihood ratios ranged from 4.8 (DRS) to 0.7 (Trails B), indicating that patients who experienced decrements in performance over the retest interval were more likely impaired at baseline.

Conclusions: Patients who already manifest cognitive impairment at baseline are older and at higher risk for accelerated cognitive decline over the retest interval. These results suggest that such patients may have already reached their inflection point and will continue to show a rapid rate of cognitive decline.

Correspondence: *Gordon Chelune, Ph.D., ABPP(CN), Neurology, University of Utah, Ctr. for Alzheimer's Care, Imaging & Research, 650 Kommas Dr., Ste 106A, Salt Lake City, UT 84108. E-mail: gordon.chelune@hsc.utah.edu*

M.S. EDMUNDSON, A.L. SHANDERA-OCHSNER, J.P. HARP, L.S. BROSTER, S. JENKINS, M. HEFLIN, Y. JIANG, D. POWELL, R.E. SCHLEENBAKER & W.M. HIGH. Methodological considerations for research in mild traumatic brain injury (mTBI) and post-traumatic stress disorder (PTSD) in combat veterans: Information from a preliminary study.

Objective: To examine the usefulness of a research methodology involving a 2 x 2 group design (PTSD vs. no PTSD by mTBI vs. no mTBI), EEG and functional MRI and using a delayed match-to-sample test, and comprehensive neuropsychological evaluation.

Participants and Methods: This study included 21 age-matched combat veterans (5 combat control, 6 mTBI only, 4 PTSD only, 6 PTSD and mTBI ["combo"]) drawn from a larger study in which participants completed a neuropsychological battery involving structured interview for PTSD and TBI, and tests of malingering, attention, memory, executive functioning, pre-injury IQ, and processing speed. In the present study, participants studied 80 line drawing pictures until they reached 90% accuracy, then were tested using a delayed match-to-sample task. There were two study-test variants (A or B). Testing of variants A or B was completed in a 3T MRI scanner or while connected to EEG (counterbalanced).

Results: Disturbance in functioning was noted in the PTSD, mTBI, and combo groups compared to control on fMRI, EEG, and neuropsychological measures. For some measures the PTSD and mTBI groups' functioning were statistically the same and both groups differed from the combo group (e.g., anterior cingulate cortex [ACC]: PTSD = mTBI > combo). For some measures the mTBI and combo groups' functioning were statistically the same and both groups differed from the PTSD group (e.g., amygdala: PTSD > mTBI = combo; P300: mTBI = combo > PTSD).

Conclusions: This study illustrates the methodological need to include a PTSD only group when examining the effects of mTBI in veterans because it allows one to see that the effects of PTSD can mimic mTBI in some areas (ACC), differentiates from mTBI in some areas (amygdala), and has effects on electrophysiological correlates (P300). Other strengths of this methodology (e.g., use of malingering testing, delayed match-to-sample, and combat controls) are discussed.

Correspondence: *Maryanne S. Edmundson, MS, Psychology, University of Kentucky, 464 N Martin Luther King Jr Blvd, Apt 2, Lexington, KY 40508. E-mail: m.s.edmundson@gmail.com*

A.I. FORD, T. FORD & B. GIORDANI. Construct Validity and Reliability of Repeated Telephone-based Cognitive Screening Measures for Dementia.

Objective: The ability to efficiently screen older adults for potential cognitive impairment is a primary need of researchers and clinicians. The Telephone Interview for Cognitive Status (TICS; Brandt, Spencer, & Folstein, 1988) and cognitive questionnaire from the AHEAD study (Ofstedal, Fisher, & Herzog) are two existing, easily-administered instruments. They have been used in various studies as a repeated screening instrument, which raises questions about individual performance change over time. However, to our knowledge, their reliability as repeated measures has not been investigated.

Participants and Methods: To establish construct validity, we conducted latent variable analyses using Rasch measurement techniques. Our sample included 175 older adults who completed a combined TICS and AHEAD screener annually for 9 years. A Rasch partial credit measurement model was fit to the 29 ordered, polytomous items. The procedure was repeated using items from the TICS alone and the AHEAD alone (there is item overlap between the two instruments).

Results: This analysis yielded four important findings. First, the items which comprise both the combined instrument and the AHEAD alone constitute valid measurement models, based on Rasch infit and outfit thresholds of 1.4. Further, the models were stable over time, without item anchoring. Second, model reliability was high and stable over time, ranging from 0.7 to 0.8 for both instruments. Third, the TICS alone was not stable, with model reliability below 0.6. Fi-

nally, analysis of item difficulties revealed that these too were stable over time; the most difficult items were immediate and delayed recall, vocabulary, and serial subtraction. This may explain the instability of the TICS, which does not include delayed recall or vocabulary sections.

Conclusions: These results help establish the validity and reliability of the AHEAD and combined instrument for longitudinal use. Future reports from our sample will detail the score trajectories of participants later diagnosed with dementia.

Correspondence: *Alicia I. Ford, Psychology & Behavioral Sciences, Louisiana Tech University, PO Box 3163, Ruston, LA 71272. E-mail: aford@latech.edu*

C.M. FUNES, J. BURCIAGA ROSALES, M. MADORE & J. RAZANI. The Impact of Education within the U.S. on List Learning in Ethnically Diverse Groups.

Objective: Memory and learning measures are sensitive to many demographic factors, such as education, immigration history and acculturation level. While a positive relationship has been identified between years of education and the CVLT-II (Norman, Evans, Miller, & Heaton, 2000), little is known about whether the amount of educated outside of the US impacts performance. In the current study, we examined whether there are differences on CVLT-II performance in a group of ethnically diverse individuals who had varied levels of education outside of the US.

Participants and Methods: 126 healthy participants, encompassing an ethnically diverse group of Asian, Latino or Middle Eastern descent, were recruited from the Los Angeles area to participate in this study. Two distinct groups were created: 62 participants who completed the majority of their education within the United States, and 64 participants who were educated mostly outside of US. Groups were matched for overall level of education. All participants were fluently conversant in English and were administered the CVLT-II in English.

Results: Two one-way ANCOVAs, covaried for age, were utilized to observe performance differences across the education groups on total learning and semantic clustering. The analyses revealed significant differences for total learning ($P < .05$) and semantic clustering ($p < .05$), such that participants who had been educated mostly in the US demonstrated greater learning and utilized more effective learning strategies than those educated mostly abroad.

Conclusions: These data suggest that qualitative factors related to being educated within the US positively impact both overall learning during list learning neuropsychological measures but also impact the use of effective strategies during these tasks, which will be further discussed. Correspondence: *Cynthia M. Funes, Georgia State University, 140 Decatur St, Atlanta, GA 30303. E-mail: cfunes1@student.gsu.edu*

C. GOPIN, Y. CUKIER & S. SCHAFFER. The Neuropsychological Assessment Battery-Naming Subtest: Convergent Validity in a Clinical Sample.

Objective: The convergent/divergent validity of the Neuropsychological Assessment Battery-naming subtest (NAB-n) has previously been demonstrated in healthy older adults and in a sample of patients with aphasia, but the construct validity of this measure has yet to be assessed in other patients who present with language difficulties (i.e., probable Alzheimer's disease, epilepsy with left-hemisphere seizure onset).

Participants and Methods: The correlation between the NAB-n and other language measures (i.e., BNT, Wechsler Vocabulary, and category fluency) was investigated in a sample of 45 patients [mean (SD) = 52.8(20.2)]. Additionally, the relationship between the NAB-n and various demographic variables (i.e., age, sex, education, and gender) was assessed; results were compared to the correlations between those variables and the BNT.

Results: The BNT and NAB-n were highly correlated with one another ($r = 0.74$) and with other language measures (range = 0.66-0.72). Both

measures were also strongly correlated with IQ (r with NAB-n=0.64, with BNT=0.57). The correlation between NAB-n and years of education was weak and not significant ($r=0.27$), whereas the BNT was moderately correlated with educational background ($r=0.36$, $p < .05$). Neither measure was significantly correlated with age or sex.

Conclusions: Findings support the use of the NAB-n with clinical populations and suggest that it may be the preferred measure when evaluating patients with limited educational background.

Correspondence: *Chaya Gopin, Ph.D., Weill Cornell Medical Center, 525 East 68th Street, New York, NY 10065. E-mail: cbg9005@med.cornell.edu*

M.C. GROSCHE & C. CULLUM. A new measure of processing speed in cancer survivors.

Objective: Neuropsychological coding tasks are some of the most sensitive measures of cognitive functioning. Popular coding tests require 90-120 seconds and entail an expense to users. We developed the Texas Assessment of Processing Speed (TAPS) that entails number-symbol pairings, is free and quick to administer (60 seconds), and has shown a strong correlation (>0.80) with the Coding subtest of the WAIS-IV in a preliminary mixed elderly sample. Here we examined the relationship between the TAPS and Coding in cancer survivors.

Participants and Methods: The TAPS and WAIS-IV Coding were administered as part of a larger investigation to 67 female breast cancer survivors who had completed chemotherapy an average of 11 months prior. Mean age of the sample was 56.5 years (range 40-70), mean education was 15.3 years (range 11-20), and mean WTAR standard score was 109.3 (range 86-126).

Results: TAPS scores were highly correlated with Coding ($r=0.74$, $p<0.001$). The mean TAPS score (max possible=75) was 38.4 (range: 21-57) and mean Coding raw score was 71.9 (range: 39-104; mean scaled score=12.3; scaled score range=). TAPS scores showed slightly weaker associations with education ($r=0.29$, $p=0.02$) and WTAR standard scores ($r=0.26$, $p=0.04$) than Coding ($r=0.40$, $p=0.001$; $r=0.41$, $p=0.001$), and both measures were similarly associated with age ($p<0.001$).

Conclusions: The TAPS is a brief, easily administered, cost-effective measure that correlates well with WAIS-IV Coding. Preliminary data support the validity of the TAPS in different clinical groups, although further investigation is needed in other populations and against other well-validated tests.

Correspondence: *Maria C. Grosch, Ph.D., Baylor College of Medicine/Texas Children's Hospital, 7300 Brompton St, Apt 4232, Houston, TX 77030. E-mail: maria.grosch@utsouthwestern.edu*

R.P. KESSELS, B. MONTAGNE, A.W. HENDRIKS, D.I. PERRETT & E.H. DE HAAN. Perception of Morphed Facial Expressions: Norms for the Emotion Recognition Task (ERT) for Ages 8-75.

Objective: The ability to recognize emotional facial expressions is an important aspect of social cognition, but existing paradigms to examine this ability present only static facial expressions, suffer from ceiling effects or have limited or no norms. Here, we present normative data for a newly developed computerized test, the Emotion Recognition Task (ERT).

Participants and Methods: The ERT is a test in which emotional facial expressions are presented as morphs, gradually expressing one of the six basic emotions from neutral to four levels of intensity (40%, 60%, 80% and 100%; administration duration approx. 10 minutes). The test was administered in 373 healthy participants aged 8-75 (186 men, IQ range 73-135). Number correct per emotion as well as a total score were computed. Effects of sex, age and IQ/education level were examined, as well as the presence of ceiling effects, and regression-based normative data were computed.

Results: In children aged 8-17, only small age effects were found for anger and happiness, in contrast to adults who showed age-related decline on most emotions ($p<0.01$). Sex differences were present predominantly in the adults, with women performing better than men on

anger, fear, sadness and the total score ($p<0.05$). IQ was positively correlated with perception of disgust in children ($p<0.0005$), while years of education were correlated with all emotions but surprise and disgust in adults ($p<0.0005$). Ceiling effects for happiness were present in 45.8% of the participants, but infrequent for the other emotions. Age- and IQ/education-adjusted norms are presented for clinical use.

Conclusions: Our findings indicate that the ERT is a feasible and easy-to-administer computerized task to assess the perception of morphed facial expressions. With its norms for ages 8-75, it adds to existing paradigms and its validity has been previously established in a wide range of psychiatric, neurologic or neurodegenerative patient groups, showing selective deficits in many.

Correspondence: *Roy P. Kessels, PhD, Radboud University Nijmegen, PO Box 9104, Nijmegen 6500 HE, Netherlands. E-mail: r.kessels@donders.ru.nl*

G. MACDONALD, N. AWAD SHIMMOON, F. SARAZIN, L. SWEET, L. MORRISON & M. BREAU. Clinical Utility of the Montreal Cognitive Assessment (MoCA) in an Acute Care Setting: Association of MoCA Total and Subtest Scores with Standardized Neuropsychological Test Performance.

Objective: The MoCA has gained tremendous popularity in its use to assess cognitive dysfunction in numerous patient populations. However, validation studies to date are limited, particularly those relating the MoCA subtests to standardized neuropsychological measures. This is the first study to determine the convergent and discriminant validity of the MoCA subtests in acute care patients.

Participants and Methods: Fifty-eight patients in the acute care setting who were referred for suspected cognitive dysfunction underwent a standardized neuropsychological assessment including the MoCA. Validity of the MoCA total, domain, and individual subtests was determined by reviewing correlations with standardized neuropsychological tests.

Results: As expected, the results revealed that MoCA total was strongly related to a measure of dementia (DRS-2), as well as tests of working memory, naming, and visuospatial function; however, the MoCA total did not appear related to memory measures. The MoCA Visuospatial/Executive, Attention, and Language domains appear related to multiple cognitive functions and thus may not be discriminatory. Alternatively, examiners may rely on MoCA Naming, Abstraction, and Orientation domains as well as individual subtests including the MoCA clock, serial 7s and fluency to predict test performance on similar neuropsychological measures. Surprisingly, the results suggest that performance on MoCA Trails B, Digit Span, and Delayed Recall individual subtests cannot be used to predict performance on the Trail Making Test-B, Digit Span (WAIS), or common memory measures, respectively.

Conclusions: For patients with moderate to severe cognitive impairment, the MoCA appears to be a useful indicator of global cognitive function. However, clinicians are cautioned not to rely on the face validity of some of the MoCA subtests as they appear to be poor predictors of performance on similar neuropsychological measures, including Trails B, Digit Span, and common memory measures.

Correspondence: *Gillian Macdonald, Psychology, University of Windsor, 345 Berkley Ave, Ottawa, ON K2A 2G9, Canada. E-mail: macdon_gill@hotmail.com*

S.A. MACKALA, J.M. KOZICKY, L.N. YATHAM & I.J. TORRES. Test-retest Reliability of Global Rating Measures of Metacognition in Healthy Volunteers.

Objective: Global self-ratings of cognitive ability or performance are commonly used in clinical research studies on metacognition, but psychometric data such as reliability are lacking for these tasks. This study assessed the test-retest reliability of several measures derived from global metacognitive ratings in healthy volunteers.

Participants and Methods: Healthy subjects (age $M=23.3$, $SD=5.0$) self-rated their cognitive functioning (general rating; GR) before performing a cognitive battery, and provided a postdiction rating (PR) of

their perceived memory performance after completing the CVLT-II. Testing was done at baseline ($n=37$), 6 months ($n=33$), and 1 year ($n=32$), using the CVLT-II (alternate form at 6 months). Test-retest reliability coefficients and mean score changes across time were determined for GR and PR ratings, difference scores (DS) between self-ratings and memory performance, and for the absolute value of difference scores (AS) that measure the relative divergence from “perfect” awareness.

Results: Memory performance improved at 1 year ($F=7.2$, $p<.01$), likely due to practice effects at 1 year. Stability across time was noted for most, but not all metacognitive measures. Test-retest reliabilities were highest for the GR (range .78-.89), and marginal for the PR (range .37-.72) and for all the DS (range .43-.68). The lowest reliabilities were observed for the AS (range -.02-.51).

Conclusions: The GR showed the most consistency and highest reliabilities across time, likely because subjects make judgments about their perceived stable cognitive ability prior to task performance. The PR and DS showed somewhat lower reliabilities, at least partly due to their sensitivity to change in memory performance across time. AS showed the poorest reliabilities likely due to the truncation of range in these measures. Overall, these global metacognitive rating measures showed adequate reliability in most instances. These findings should be considered in the design and interpretation of clinical metacognitive studies.

Correspondence: *Ivan Torres, PhD, University of British Columbia, 2C7-2255 Wesbrook Mall, Vancouver, BC V6T 2A1, Canada. E-mail: Ivan.torres@ubc.ca*

S.A. MACKALA, S.W. FLYNN, H. BAITZ, W.L. THORNTON & A.E. THORNTON. Understanding the Underlying Relationship Between Traditional Cognition and Functional Abilities in Hospitalized Patients with Severe Mental Illness.

Objective: To identify the extent to which everyday cognitive (EC) skills mediate the relationship between traditional cognition (TC) and skill-based functional abilities.

Participants and Methods: Twenty tertiary inpatients with schizophrenia ($N=8$), schizoaffective disorder ($N=9$), and bipolar disorder ($N=3$) were evaluated prior to discharge. Select established measures of traditional novel problem-solving/fluid abilities (N/FA) as well as crystallized abilities (CA) were administered. Additionally, the Everyday Problems Test (EPT) and the Everyday Cognition Battery Knowledge Questionnaire (ECB) assessed EC in a paper and pencil format. Functional abilities were evaluated by using the University of California-San Diego Performance-Based Skills Assessment-II (UPSA). Mediation analyses were conducted using the bootstrapping procedure (5000 samples; $p<.05$ two-tailed) of Hayes (2009).

Results: The first analysis evaluated the extent to which both EC measures mediate the relationship between CA and UPSA. The total effect of CA ($B=.74$) was significant. The direct effect of CA on UPSA ($B=.08$) was not significant after partialling out the total indirect effect of both EC measures ($B=.66$). EPT showed a significant mediating effect (point estimate=.87; CI: 0.29, 1.35), but not ECB. The second analysis evaluated the extent to which both EC measures mediate the relationship between N/FA and UPSA. The total effect of N/FA ($B=.65$) was significant. The direct effect of N/FA on UPSA ($B=.07$) was not significant after partialling out the total indirect effect of both EC measures ($B=.58$). EPT showed a significant mediating effect (point estimate=.68; CI: 0.29, 1.14), but not ECB.

Conclusions: Greater novel/fluid problem-solving and crystallized abilities lead to better functional proxy skills. These relationships were mediated selectively by everyday problem-solving abilities, but not by everyday knowledge. Everyday problem-solving appears to explain the relationship between traditional cognition and skill-based functional abilities.

Correspondence: *Sylvia Mackala, BA Honours, Psychology, Simon Fraser University, 8888 University Drive, Burnaby, BC V5A 1S6, Canada. E-mail: sam28@sfu.ca*

S.M. MCCLINTOCK, M. CULLUM, I. BERNSTEIN, M. CHANSARD, T. MELTON, P. MOORE, H. TERRACE, S.H. LISANBY & M.M. HUSAIN. Test-Retest Psychometrics of Translational Neurocognitive Measures Specific for Electroconvulsive Therapy.

Objective: Presently, there exist no widely accepted, systematic neurocognitive measures to assess the effects of electroconvulsive therapy (ECT). We previously reported our translation of a preclinical neurocognitive battery of short-and long-term memory, working memory, and metacognition measures to address this issue. The purpose of this study was to evaluate the test-retest reliability of those translated neurocognitive measures.

Participants and Methods: 89 healthy participants (age: $M=39.1$, $SD=14.0$; education: $M=16.0$, $SD=2.5$; estimated IQ: $M=107.0$, $SD=7.7$) completed the adapted neurocognitive battery (Target Identification, Target Sequencing, Spatial Configuration, Serial Target Recognition, and MetaCognition measures) at two time points separated by 1-month. Pearson correlation coefficients and paired t -tests were used to examine test-retest psychometric properties of the battery.

Results: With one exception, test-retest reliability coefficients (range: $r=0.33$ to 0.98) for the adapted neurocognitive battery were statistically significant (range: $p=0.002$ to <0.0001). The exception was a null correlation ($r=0.08$, $p=0.47$) for the short-term memory task. Performance on most measures showed no practice effects from baseline to 1-month testing. However, there were modest practice effects on the short-term ($t(77)=-2.3$, $p=0.02$) and 4-item long-term ($t(77)=-2.7$, $p=0.008$) memory measures.

Conclusions: Overall, most of the adapted neurocognitive measures demonstrated temporal stability across two testing time points. Moreover, practice effects were negligible on most measures, suggesting that accuracy may not be artificially inflated during repeated testing session. Collectively, these results are encouraging and support the continued development of this translated neurocognitive battery designed to be specific and sensitive to the cognitive effects of ECT.

Correspondence: *Shawn M. McClintock, PhD, MSCS, UT Southwestern Medical Center, 5323 Harry Hines, Dallas, TX 75390-8898. E-mail: shawn.mcclintock@utsouthwestern.edu*

A. ODLAND, L. BERTHELSON, V. SHARMA, P. MARTIN & W. MITTENBERG. Rates of Elevated Scores on the MMPI-2-RF in the Normal Population.

Objective: Rates of significant MMPI-2-RF scores in the normal population are as of yet unavailable in the instance of multiple scale interpretation. In an effort to further refine interpretive practices this study aims to provide such data.

Participants and Methods: Monte Carlo Simulations using normative interscale correlation matrices were utilized to compute base rates for individual scale families, as well as for all scales combined. Interest scales were excluded from the largest analysis as they do not measure psychopathology per se.

Results: Resultant base rates indicated that a significant number of adults score beyond commonly accepted cut-scores. When considering 40 MMPI-2-RF scales (excludes Validity and Interest scales) simultaneously at a cut score of 65T, almost 70% of normal adults exhibited one or more deviant scores, with 35% elevating at least three clinically significant scores. Consideration of individual scale groups also yielded a high frequency of adults with elevated scores. For example, on the Restructured Clinical scales approximately 34% and 14% of the normal population can be expected to have one and two or more elevated scores respectively. Almost one in four elevate at least one score on the Somatic/Cognitive scales. If more conservative criteria for abnormality on the Internalizing scales are applied (from 65 to 70T) the potential risk for false positive interpretation drops from approximately 35% to 15%. In this latter case the cut score of 70T more closely approximates rates obtained by referencing the theoretical normal distribution (i.e., the percentage expected to score 1.5 SDs beyond the mean).

Conclusions: Consistent with previous research documenting the impact of multiple test scores on base rates of apparently significant abnormality, this study highlights the potential for misinterpreting commonly occurring rates of score elevation as indicative of significant psychopathology.

Correspondence: *Anthony Odland, M.S., Emory University, 1659 Briarcliff Rd Apt. 1419, Atlanta, GA 30306. E-mail: apodland@gmail.com*

S. OKAHASHI, K. SEKI, A. NAGANO, Z. LUO, M. KOJIMA & T. FU-TAKI. Development of a Virtual Shopping Test (VST) for Assessment of Cognitive Function: Parallel form Reliability and Effect of Age.

Objective: In order to assess the cognitive function of patients with brain damage in real daily life, we have developed the Virtual Shopping Test (VST) using virtual reality technology. We have reported that VST was able to assess the ability of attention and everyday memory in patients with brain damage by correlating its scores to the performance on several neuropsychological tests (Okahashi et al., 2012, in Japanese). The aim of the present study was to validate two parallel forms of VST and to examine the basic age difference in VST performance.

Participants and Methods: On VST, the visual environment modeling a Japanese shopping mall comprised of 20 shops was provided. By touching the bottom of the screen, participants could move in the virtual shopping mall, enter a shop and buy items. They were instructed to buy four specific items in the mall quickly in a rational way. The scores for assessment included the number of items bought correctly, the times to refer to the hints (e.g. list and bag), the numbers of movements between shops, and the total time to complete the shopping. VST consisted of two parallel forms (VST-1, VST-2) which had different contents with the same quality. Participants were 10 healthy elderly adults aged 64-76 ($M = 68.9$, $SD = 3.9$) and 10 healthy young adults aged 20-29 ($M = 25.2$, $SD = 3.0$). The elderly completed VST-1 and VST-2 in random order at 2 weeks intervals, while the young completed only VST-1.

Results: There was no statistically significant difference between the median value of each basic score of two parallel forms. The total time spent on VST was significantly longer for the elderly than for the young ($p < .01$).

Conclusions: The two parallel forms of VST appeared to be equivalent measures of cognitive function. The total time spent on VST represented the basic difference of cognitive function between the elderly and the young.

Correspondence: *Sayaka Okahashi, Department of Human Health Sciences, Graduate School of Medicine, Kyoto University, 53 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan. E-mail: saya@hs.med.kyoto-u.ac.jp*

R.V. PARISH, K.L. WAGERS, A.R. KATSCHKE, R.L. COLDREN & L.R. BROUILLARD. Initial Premorbid Army GT Scores Are Strongly Related to Subsequent WTAR-Demographics Predicted WAIS-III FSIQ Scores in Patients Presenting for Neurocognitive Testing in a Military Medical Setting.

Objective: The current study seeks to evaluate the validity of the Army General Technical (GT) score as found on the Armed Forces Vocational Aptitude Battery (ASVAB) as a measure of premorbid intellectual function, by comparing the initially obtained Army GT scores of patients presenting for neurocognitive testing to the patients' subsequently obtained Wechsler Test of Adult Reading (WTAR)-Demographics Predicted WAIS-III FSIQ scores. The relationship of the scores is evaluated to determine the robustness of the correlations with and without history of TBI and other situational factors. It is hypothesized that the relationship of the measures will be strong and that TBI history and other variables will not have a significant impact on that relationship.

Participants and Methods: The premorbid cognitive function of 53 patients (ages 19-44) presenting at a military medical center for neurocognitive testing was evaluated using the WTAR. The subjects' WTAR scores were then compared to their initially achieved Army GT scores. The majority of subjects were active duty Army ($n=42$); 31 of the subjects had a history of TBI. Other demographic, symptom, and effort related information was obtained.

Results: Statistical analyses were performed using Pearson's R and linear regression. Army GT score was found to correlate strongly with WTAR score ($R^2 = .4195$; p -value < 0.05) even when controlling for other factors, such as TBI or pain. Other correlations that showed significance included ethnicity, education, and effort. Ethnicity did not correlate strongly after controlling for other factors.

Conclusions: These findings provide evidence of the construct validity of the Army GT score as an estimate of premorbid intellectual function, as well as the convergent validity of the Army GT score and WTAR score. The findings suggest the usefulness of the WTAR/Army GT scores in predicting premorbid function in neuropsychological patients despite factors that might be expected to affect performance on neurocognitive testing, including history of TBI.

Correspondence: *Robert V. Parish, Ph.D., Landstuhl Regional Medical Center, CMR 402 Box 2095, Apo, AE, NY 09180. E-mail: rparish@yahoo.com*

J. PARKER, D. BARRY, L. REINHARDT, D. MIROCHNITCHENKO, G. ZECKLER, A. LANDENBURGER, D. GIRARD & M. ETTENHOFER. Convergent Validity Of Bethesda Eye & Attention Measure (BEAM) Saccadic Inhibition Errors With Measures Of Executive Functioning: A Preliminary Study.

Objective: To assess the convergent validity of Bethesda Eye & Attention Measure (BEAM) saccadic inhibition errors with other measures of executive functioning (EF).

Participants and Methods: This cross-sectional, observational pilot study included 48 participants aged 18-65: 27 males and 21 females. Mean education was 16.35 years ($SD=2.44$). Nineteen had a positive TBI history. Following a semi-structured interview, participants completed the BEAM, a 15 minute measure of multiple cognitive processes using saccadic and manual reaction times and errors to directional cues. Participants then completed a 90-minute battery of conventional neuropsychological tests, including measures of executive functioning. Standardized scores from Trail Making Test B (TMT B total time), Conner's CPT-II (commission errors and Hit SE), D-KEFS Color Word Interference Test (Conditions 3&4 total time), and WAIS-IV Digit Span Backward were aggregated into a single EF domain score. Convergent validity of BEAM saccadic inhibition errors was evaluated using partial correlations with the EF domain score and individual EF tests, controlling for age and education.

Results: BEAM saccadic inhibition errors were associated with overall EF (EF domain score, $r_p = -.36$, $p < .05$) and decreased working memory (Digit Span Backwards, $r_p = -.34$, $p < .05$). Additionally, preliminary analysis found saccadic inhibition errors were associated with increased errors on visual processing and cognitive flexibility measures (TMT A & B errors, $r_p = .39$, $p < .01$).

Conclusions: The neurocognitive processes and pathways underlying effective inhibition of saccadic eye movements appear to be linked to general executive performance. The BEAM, an oculomotor assessment tool, demonstrates potential as a measure of EF. Preliminary findings revealing the BEAM's convergent validity with associated neuropsychological measures support further investigation with larger samples. Funding: Support provided by Uniformed Services University Grant # R072LP.

Correspondence: *Jessica Parker, Psy.D., Neuropsychology Services, Walter Reed National Military Medical Center, 8901 Rockville Pike, Bethesda, MD 20889. E-mail: jessica.parker@med.navy.mil*

J.C. PIERCY, D. LEITNER, H.B. MILLER & M. REYNOLDS. Papillary Tumor of the Pineal Region: A Twin Case Study.

Objective: The study evaluated the neuropsychological assessment of identical twins; one of whom suffers from a rare brain tumor: a papillary tumor of the pineal region. Using the unaffected twin as a genetic control, a comparison of cognitive domains was analyzed. This case addresses the neuropsychological effects of the pineal tumor with the unique opportunity to examine the impact by comparing the findings to a natural control and normative data. Further, the sensitivity of normative data to individual differences was considered.

Participants and Methods: The neuropsychological assessment records of the female monozygotic twins, and normative data were considered. Neuropsychological test performance assessing domains of cognitive ability (attention, memory, working memory, visuospatial skills, and executive function) was compared to each other and to normative data.

Results: The twins demonstrated similar, and at times identical, performance on many cognitive domains (working memory, verbal comprehension, perceptual reasoning), within the normal range when compared to normative data. However, there were occasions where both twins' performance deviated significantly from the norms but not from each other, with performance moderately impaired compared to norms (i.e., processing speed). The affected twin presented as impaired on attention, executive function, and measures of learning and memory, compared to both the norms and the unaffected twin.

Conclusions: The study calls attention to the potential shortcomings of reliance on normative data when assessing cognitive abilities, as pre-existing individual differences may lead to inaccurate interpretation based on norms alone. Additionally, the study will allow for longitudinal collection of information regarding the neuropsychological performance and recovery over time. While providing an appreciation of the potential pitfalls of a non-critical use of normative data the study will generate information on the recovery trajectory and management following pineal tumor resection.

Correspondence: *Jamie C. Piercy, Interior Health Authority, 2268 Pandosy Street, Kelowna, BC V1Y1T2, Canada. E-mail: jamiepiercy@live.ca*

D.M. RANSOM & M. FRANZEN. Detection of Symptom Exaggeration using the Personality Assessment Inventory (PAI) and the Structured Inventory of Malingered Symptomatology (SIMS).

Objective: This study sought to expand the knowledge base surrounding the efficacy and utility of the PAI in neuropsychological settings by comparing performance on its validity scales to results of the SIMS. It was hypothesized that the PAI Negative Impression Management, Malingering Index, and Rogers Discriminant Function would significantly predict performance on the total score and substantive scales of the SIMS.

Participants and Methods: Participants in this sample were 31 English-speaking adults over the age of 18 ($M = 42.32$, $SD = 11.16$) who presented with actual cognitive complaints and were administered both the PAI and the SIMS as part of a larger clinical evaluation. Demographic information was gleaned from a record review and included age, gender, etiology of complaint, and highest education level attained.

Results: Chi squared tests of independence were employed to determine the relationships among the PAI and SIMS scales along with the Kappa coefficient to determine the strength of agreement. Hierarchical linear regression analyses were also conducted to evaluate the incremental validity of the NIM index, Malingering index, and RDF in predicting the total score of the SIMS scales. Significant differences were observed based on pass/fail classification status on the SIMS for the Negative Impression Management Scale, the Malingering Index, and the Positive Impression Management scale of the PAI. Those participants who failed the SIMS tended to produce elevated results on the over-reporting scales of the PAI. Incremental validity analyses demonstrated the superiority of the Malingering Index in predicting performance on the SIMS.

Conclusions: Findings from this study provide support for the use of embedded validity indicators of the PAI as critical additions in the assessment of symptom validity during neuropsychological assessments, especially the Malingering Index.

Correspondence: *Danielle M. Ransom, Psy.D., Division of Neuropsychology, Children's National Medical Center, 1209 McKinley Street, Annapolis, MD MD. E-mail: daniellemransom@gmail.com*

R. READY & H.B. VEAGUE. Training in Psychological Assessment: Current Practices of Clinical Psychology Programs.

Objective: Training in psychological assessment has been studied since 1960. On the one hand, several problems emerge. The same psychological tests have been the most popular instruments for

decades. There are discrepancies between what is taught in graduate programs and the skills needed for internship and evidence-based practice. Training in performance-based personality measures is a persistent controversy. On the other hand, assessment competencies are valued and highly regarded by the profession. This project updated current assessment training practices in clinical psychology programs.

Participants and Methods: All APA-accredited programs in clinical psychology were invited to respond to an anonymous on-line survey about program characteristics, assessment training, assessment faculty, courses, practicum experiences, and training hours; response rate was 33%.

Results: Assessment training over the past decade was stable or increasing. Training in neuropsychological assessment and in the assessment of treatment effectiveness had substantially more emphasis. PsyD programs provided more training than PhD programs in performance-based tests of personality, consultation, clinical assessment, neuropsychological assessment, and therapeutic assessment. The most popular instruments were the Wechsler Adult Intelligence Scale – IV, Wechsler Intelligence Scale for Children – IV, Minnesota Multiphasic Personality Inventory – II, the Beck Depression Inventory – II, and the Woodcock-Johnson III Tests of Achievement. Training in evidence-based practice, ethics, and multicultural issues needs more emphasis to support the development of core competencies in future generations of clinical psychologists.

Conclusions: Graduate programs in clinical psychology are attending to the importance of high quality training in assessment. Assessment training was generally stable or increasing. There are clear areas in which more training emphases are needed. Results of this project can guide curriculum development in training programs.

Correspondence: *Rebecca Ready, Ph.D., Psychology and Neuroscience, Univ of MA, 135 Hicks Way, Tobin Hall, Amherst, MA 01003. E-mail: ready@psych.umass.edu*

J.J. RYAN, J.S. SEELEY & A.M. PAOLO. Base Rates of Temporal Disorientation in Alzheimer's Disease and Parkinson's Disease.

Objective: Intact time orientation is a feature of competent everyday functioning, whereas disorientation in time suggests adaptive impairment. It is known that temporal disorientation occurs frequently in dementia syndromes regardless of etiology. However, no study has reported base rates of impaired temporal orientation separately for patients with Alzheimer's disease (AD) or Parkinson's disease (PD). We provide base rates in rigorously diagnosed patient and control samples and test the hypothesis that temporal disorientation will be higher in ADs compared to PDs and healthy controls.

Participants and Methods: Participants were 210 elderly controls, 112 individuals with AD, and 189 individuals with PD. Each completed the Temporal Orientation Scale (TOS, Benton et al., 1994) and was classified as either impaired (≥ 4 errors) or normal (≤ 3 errors).

Results: Impaired TOS rates for controls, ADs, and PDs were .01%, 72.3%, and 22.7%. Disorientation occurred at a significantly higher rate among ADs than controls ($p < .0001$), among ADs than PDs ($p < .0001$), and among PDs than controls ($p < .0001$). Comparing ADs to controls, the TOS identified AD with sensitivity (Sn) of .72, specificity (Sp) of .99, positive predictive value (PPV) of .98, and negative predictive value (NPV) of .87. For the combined controls and PDs ($n = 399$), disorientation identified AD with Sn of .72, Sp of .89, PPV of .64, and NPV of .92. Comparing PDs with controls, disorientation identified PD with Sn of .23, Sp of .99, PPV of .96, and NPV of .59.

Conclusions: The study hypothesis was supported as ADs produced a significantly higher base rate of disorientation than either PDs or controls. These findings reinforce the diagnostic utility of the TOS as a screening device among elderly persons with possible dementia.

Correspondence: *Joseph J. Ryan, PhD, Psychological Science, University of Central Missouri, Lovinger Building, Warrensburg, MO 64093. E-mail: ryan@ucmo.edu*

S. STERN, S. PENNA & R.D. MORRIS. Psychometric Properties of the Saint Louis Mental Status Exam (SLUMS) for the Identification of Mild Cognitive Impairment (MCI) in a Veteran Sample.

Objective: Mild cognitive impairment (MCI) is the early stage of neurocognitive disease in which cognitive changes are observed, but daily functioning is not significantly impacted. There is only one brief cognitive screening measure that purports to accurately identify individuals with MCI in a veteran sample, the St. Louis University Mental Status Exam (SLUMS). However, the psychometric properties have not been rigorously evaluated. Convergent and divergent validity of the SLUMS are assessed in the current study.

Participants and Methods: The sample includes 95 subjects with a mean age of 67.8 (SD = 7.95, range = 55-88) and a mean education of 13.4 years (SD = 2.73, range = 5-20). Seventy percent of the sample is Caucasian and 30% are African American. Sixty-two percent of the sample is diagnosed with MCI, 18% with major depressive disorder, 10.5% with dementia, and 8.5% with Cognitive Disorder NOS. The SLUMS total score is correlated with another cognitive screener, neuropsychological measures assessing various cognitive domains, and two measures of depressive symptoms.

Results: The SLUMS total score is significantly positively correlated with the other cognitive screening measure and every neuropsychological measure, except for one psychomotor processing speed measure and an executive functioning measure. These include measures of attention, processing speed, abstract reasoning, confrontation naming, verbal fluencies, memory, and abstract reasoning. The SLUMS was not significantly correlated with measures of depressive symptoms.

Conclusions: Convergent and divergent validity of the SLUMS are demonstrated in the current study. There is potential that the SLUMS could be an effective cognitive screening measure, but more research is needed.

Correspondence: *Susan Stern, MA, Georgia State University, 375 Highland Ave NE, Unit 103, Atlanta, GA 30312. E-mail: susan.k.stern@gmail.com*

L. SUN, J.N. RUST & A. BATEMAN. The Underlying Structure of the Ekman 60 Faces Test and Adaptive Testing.

Objective: The Ekman 60 Faces Test makes use of the Ekman and Friesen (1976) Series of Pictures of Facial Affect to assess the ability to recognize facial expressions of emotion. The objective of this study was to investigate the underlying structure of the Ekman 60 Faces Test using Confirmatory Factor Analysis (CFA) and to explore the potential of applying Computerized Adaptive Testing techniques to individual emotion scales.

Participants and Methods: 194 brain injury patients (62 female and 132 male; age: M=35.34 years, SD=11.45 years; 138 TBI patients and 40 non-TBI patients, 16 not recorded) were administered the Ekman 60 Faces Test after they were admitted into the Oliver Zangwill Centre for Neuropsychological Rehabilitation. 194 normal controls from the UK and Ireland (117 female and 77 male; age: M=26.30 years, SD=10.15 years) took part in the test online. CFA was carried out using Mplus, and the R packages "ltm" and "catR" were employed to estimate item parameters and implement adaptive testing.

Results: The unidimensionality of the whole test was examined with CFA, which revealed a poor model fit (CFI: 0.78). A number of alternative models were proposed and a bifactor approach presented the best model fit (CFI: 0.92). Using half of the sample, item parameters were estimated for each scale based on the Rasch Model, and the results applied to the other half of the sample to simulate adaptive testing. Adaptive tests with 5 items per scale were capable of generating highly consistent ability estimates when compared with the full-length ten-item scales (all $r_s > 0.89$, $p < .001$). The correlation coefficients remained above 0.75 ($p < .001$) with only 3 items per scale.

Conclusions: The CFA Bifactor results suggested the existence of one general emotion recognition ability and six distinctive factors corresponding to the basic emotions. With adaptive testing techniques, short forms of the test can be developed, which will substantially reduce the administration time while maintaining high accuracy.

Correspondence: *Luning Sun, Department of Psychology, University of Cambridge, The Psychometrics Centre, The Mond Building, New Museum Site, Free School Lane, Cambridge CB2 3RQ, United Kingdom. E-mail: ls223@cam.ac.uk*

D. WALD, D. WHITESIDE, D. WALKER & L. KEARNS. Preliminary Psychometric Data for the Wechsler Memory Scale-Fourth Edition Designs and Spatial Addition Subtests in a Sample of Older Adults.

Objective: The Wechsler Memory Scale-Fourth Edition (WMS-IV) is a well validated assessment of memory (Pearson, 2009). Preliminary research and validation trials found unacceptably low reliability and validity coefficients for two subtests, Designs (DES) and Spatial Addition (SA), among older adults. These subtests were not included in the older adult battery as a result (Pearson). The current study sought to further examine the validity of DES and SA in a sample of older adults.

Participants and Methods: Participants (n=41) included consecutive neuropsychological referrals age 65 and older. Convergent validity was measured using the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) Digit Span (DS), Continuous Performance Test-Second Edition (CPT-II), Judgment of Line Orientation (JLO), and the Rey Complex Figure Test (RCFT). Divergent validity was measured using the WAIS-IV Processing Speed Index (PSI), Trial Making Test-A (TMT-A), Boston Naming Test (BNT), and the Wisconsin Card Sorting Test (WCST).

Results: Spearman's rho indicated significant correlations between DES immediate recall (IR) and WAIS-IV DS ($p=.49$), CPT-II ($p=-.54$), and RCFT delayed recall (DR; $p=.41$). DES DR was significantly correlated with WAIS-IV DS ($p=.32$), CPT-II ($p=-.38$), JLO ($p=.38$), and RCFT DR ($p=.43$). Most measures hypothesized to be orthogonal to DES and SA were not significantly correlated; however, contrary to the hypothesis DES IR was significantly correlated with WCST perseverative errors ($p=-.50$) and perseverative responses ($p=-.53$); DES DR was significantly correlated with WCST perseverative errors ($p=-.50$) and perseverative responses ($p=-.53$); SA was significantly correlated with WCST perseverative errors ($p=-.15$) and perseverative responses ($p=-.16$).

Conclusions: Findings of the current study generally contribute preliminary data on the validity of DES and SA in a sample of older adults. Results suggest DES and SA in combination with other cognitive measures and patient history may help with differential diagnosis.

Correspondence: *Danielle Wald, M.A., Kansas University School of Medicine-Wichita, 8510 E 29th St N apt #605, Wichita, KS 67226. E-mail: d_wald593@hotmail.com*

A.L. WONG, A.M. MEIER, K. BARRERA, A. GHELANI, C. MOORE & S.K. PATEL. Evaluating Alternate Form Use in Neurocognitive Research.

Objective: Serial neurocognitive assessments in longitudinal research are associated with practice effects due to repeated exposure to test stimuli. Researchers are encouraged to administer alternate forms of the same test to minimize practice effects. This methodology assumes that subjects will perform equally on psychometrically similar forms of the same test. Using data from an ongoing, larger study we evaluated the hypotheses of comparable performance on alternate test versions.

Participants and Methods: The current sample consists of 91 healthy female controls who were administered two similar forms of batteries (Forms A and B) across two time points (T1 and T2). Approximately 50% of the women were administered Form A at T1 and then Form B at T2. The other group was administered forms in the reverse order. Form A consisted of one version of the WRAT-4 Reading subtest and one version of the D-KEFS Verbal Fluency subtest, whereas Form B consisted of the alternate versions. The alternate versions of these subtests are widely believed to be comparable to their original forms.

Results: In these analyses, we controlled for age and education. Repeated measures ANCOVAs showed significant differences between the two versions of the WRAT-4 with better performance on the blue form, $F(1, 61) = 4.96, p = .03$. In regards to the D-KEFS, significant differences emerged between the two versions of the letter fluency task with better performance on FAS, $F(1, 60) = 3.18, p = .05$, and the two versions of the category fluency task with better performance on naming items of clothing/girls' names, $F(1, 61) = 18.91, p < .001$. No significant differences were found on the switching fluency task.

Conclusions: We found significant effects associated with alternate form use and that patients perform differently on these alternate forms. This variability in performance may adversely impact research results and should be considered in designing longitudinal studies. Further research is warranted to evaluate the pros and cons of alternate forms.

Correspondence: *Andrew L. Wong, M.A., Clinical Psychology, Fuller Theological Seminary, 1501 S. Fifth Avenue, Arcadia, CA 91006. E-mail: alwong83@gmail.com*

A. YAMAMOTO. Development and Evaluation of New RBANS Story and Figure Recognition Memory Items.

Objective: The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a commonly used brief neuropsychological battery with a list recognition memory (RM) task but no RM items for story or figure memory items. RM testing provides important diagnostic and functional information as it can distinguish between individuals with encoding or retrieval difficulties. This study will evaluate the concurrent validity of newly developed RBANS story and figure RM and establish clinical norms.

Participants and Methods: Participants were 276 clinical referrals (57% male, age 18-93, education 5-22) with RBANS RM testing; 73 also completed the Brief Visuospatial Memory Test-Revised (BVMT-R). Correlations with established RM items were used to evaluate the concurrent validity of new RM items. A subgroup of 121 participants scoring within age-corrected RBANS list RM Z-scores <1.3 standard deviations (SD) from the mean were used to establish clinical norms for new RM items.

Results: Story and figure RM were significantly correlated with BVMT-R RM ($r=.54$ and $.61$, respectively, $p<.001$) and list RM ($r=.49$ and $.55$, respectively, $p<.001$). Correlations remained significant after controlling for age and education ($r=.40$ to $.60, p<.005$). For the normative sample, means (SD) were 10.0 (1.9) for story RM and 5.9 (1.9) for figure RM. RM results did not differ between education groups. Age groups differed for both RM items (for story and figure: ages 18-39 and 40-59 vs. 80+; for story: ages 60-69 vs. 80+; for figure: ages 40-59 vs. 70-79; $t=2.2$ to $3.8, p<.05$). Given these results and sample size considerations, clinical norms were established for two age groups: 18-69 ($n=78$) and 70+ ($n=43$). Means (SD) for story RM were 10.3 (1.9) and 9.4 (1.9), respectively, and for figure RM were 6.2 (1.9) and 5.3 (1.7), respectively.

Conclusions: The new story and figure RM items have concurrent validity and norms were established for clinical use. Future research is required to verify these findings.

Correspondence: *Aiko Yamamoto, Ph.D., Mental Health, Providence Health Care, 1081 Burrard Street, Vancouver, BC V6B 1E6, Canada. E-mail: ayamamoto@providencehealth.bc.ca*

T. YOSHIMURA, S. MAESHIMA, A. OSAWA & M. OSAKA. Working memory and digit span in dementia.

Objective: The forward digit span task requires subjects to recall the digit strings in a forward order as were presented, reflecting the function of verbal short-term memory (STM). In the backward digit span task, subjects are required to transform the stimuli in a reverse order, reflecting the function of working memory (WM). Rosen and Engle (1997) reported these two digit span tasks would require a similar level of complexity, although Gathercole et al. (2004) concluded the backward recall would be a task of measuring WM. St. Clair-Thompson

(2010) pointed out that these contradictory results occurred because the subjects' age group was different. It is highly expected to obtain a different pattern of results from individuals with different backgrounds. This study investigated how the individuals with dementia would perform on digit span tasks from perspectives of STM and WM.

Participants and Methods: Subjects were 33 patients having amnesia as a complaint including 10 Alzheimer's disease (AD), 16 frontotemporal dementia (FTD), 3 vascular dementia (VD), 2 dementia with Lewy bodies (DLB), and 2 mild cognitive impairment (MCI). We discussed the difference of scores in different types of dementia. Their ages varied from 65 to 85 years old (73.0 ± 5.2 years old), and average years of education was 10.1 ± 2.7 years.

Reading Span Test (RST) for Japanese in elderly population (Osaka, 2002) was conducted in order to measure WM, in addition to the digit span task. Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) was also conducted.

Results: Results showed that the backward digit recall significantly correlated with RST, but the forward digit recall did not correlate with RST. The backward digit recall did not correlate with the forward digit recall. These results of correlation were shown regardless of the severity or type of dementia.

Conclusions: We discussed the relationship between WM and digit span in dementia and the appropriateness of using the digit span task as measuring WM in the clinical situation.

Correspondence: *Takako Yoshimura, Ph. D, Speech Therapy, Osaka College of Medical Technology, 2-1-30, Higashi-temma, Kita-ku, Osaka 5300044, Japan. E-mail: t-yoshimura@ocmt.ac.jp*

TBI (Adult)

E. BALLANTYNE, D. WHITESIDE, J. GRIECO & J. CARSWELL. The Role of Obsessive-compulsive Traits in Chronic Cognitive Complaints: A Comparison Between Individuals With Mild Traumatic Brain Injury and Somatization Disorders.

Objective: Although people usually recover cognitively following a mild traumatic brain injury (mTBI) in a few days to weeks, a minority report chronic cognitive sequelae. Controversy exists about the factors that lead to prolonged cognitive complaints in mTBI (McCrae, 2007). An obsessive-compulsive style may result in ongoing cognitive complaints due to perfectionism or hyperattentiveness (Turk, Heimberg, & Hope, 2001). Similarly, this style may also exacerbate somatization symptoms (Nakao, Shinozaki, Ahern, & Barsky, 2011).

Participants and Methods: To investigate the relationship among obsessive-compulsive traits, somatization, and cognitive complaints, a group of individuals at least three months post-mTBI ($N=38$) were compared to non-mTBI individuals with a somatization diagnosis (SD; $N=30$) on the SOM and ARD-O scales of the Personality Assessment Inventory (PAI). It was hypothesized that the ARD-O scale would predict severity of cognitive complaints as measured by the SCZ-T subscale of the PAI in both groups.

Results: The mTBI group reported significantly more cognitive complaints than the SD group, $t(66)=7.27, p<.01$. Separate correlational and regression analyses were conducted on both groups. SOM, ARD-O, litigation status and cognitive effort as measured by pass/fail on the Test of Malinger Measure were entered into a hierarchical regression based on the magnitude of the bivariate correlations with SCZ-T. For the mTBI group, ARD-O and SOM together accounted for 44% of the variance, $F_{1, 29}=12.86, p<.01$, but ARD-O did not independently predict SCZ-T. Litigation status and effort did not account for a significant amount of the variance. For the SD group, none of the variables correlated with SCZ-T.

Conclusions: The results suggest that obsessive traits and somatization in combination predicted higher levels of cognitive complaints after mTBI. Clinicians may consider obsessive-compulsive traits as a risk factor for prolonged cognitive complaints following mTBI particularly when somatization symptoms are also present.

Correspondence: *Elena Ballantyne, BA, Adler School of Professional Psychology, 26 Thorndale Avenue, St. Catharines, ON L2R6A7, Canada. E-mail: eballantyne@my.adler.edu*

S. BOWN, J.N. BECKSTRAND, R. FROST, T.J. FARRER & D.W. HEDGES. The Prevalence Of Traumatic Brain Injury In Adult Female Victims Of Interpersonal Violence: A Meta-Analysis.

Objective: Every year several million people sustain physical injuries due to interpersonal violence (IPV). Most of these victims are women. The head, neck, and face tend to be the most frequent site of IPV injury. The most common mechanisms of injury place the victim at risk for brain injury (e.g., strangulation, blunt-force injuries). To test the hypothesis that adult, female victims of IPV are more likely to have suffered a traumatic brain injury (TBI) than adult females in the general population, we performed a meta-analysis of peer-reviewed studies reporting data on the prevalence of TBI in female victims of IPV.

Participants and Methods: We searched PubMed, PsychInfo, and Google Scholar to identify articles that reported TBI prevalence in IPV populations, with TBI being defined as having sustained a head injury with associated loss of consciousness (LOC). Six studies met inclusion criteria (Total N of IPV=721; n of TBI=79). From these studies, the mean proportion of IPV victims who suffered a TBI was calculated and compared to the mean proportion of adult females in the general population who suffered a TBI (Total N=12,605; n of TBI=1,078). The latter data was extracted from a meta-analysis of TBI in the general population.

Results: An independent-samples t-test did not show a statistically reliable difference between the proportion of adult, female IPV victims with TBI ($M = 0.16$; $s = 0.13$) and the proportion of adult females in the general population with TBI ($M = 0.15$; $s = 0.01$), $t(16) = 0.141$, $p > .05$, $\alpha = .05$.

Conclusions: We found no significant difference in TBI prevalence between adult, female IPV victims and the general, adult female population. There could be several reasons for the apparent similarities in these groups. For example, it may be that many female TBI victims in the general population are also victims of IPV. Further, social factors, such as underreporting of IPV or injury severity, may also be present. Implications and suggestions for reexamining this question are discussed.

Correspondence: *Stephanie Bown, B.A., Brigham Young University, 1001 SWKT, Provo, UT 84602. E-mail: bown.stevie@gmail.com*

C. ESOPENKO, P.K. KUMAR, C. ALAIN, T.W. CHOW, A.R. MCINTOSH, S. STROTHER & B. LEVINE. The Interaction between Traumatic Brain Injury and Aging: Evidence from NHL Alumni.

Objective: Unhealthy brain aging and traumatic brain injury (TBI) have been associated with neurodegenerative changes that cause a great deal of human suffering and distress. Previous research has shown that aging and TBI are independently associated with neurocognitive changes that can result in cognitive impairment; however, whether they interact to accelerate such impairments is unknown. Concussions, or mild TBIs in sport, especially when repeated, have been linked to cognitive impairments in aging (such as Alzheimer's disease and memory impairments), and have been associated with an earlier onset of cognitive impairments compared to individuals who have not experienced a concussion. Given that the National Hockey League (NHL) alumni comprise a large sample of individuals across a wide age range who were subjected to high speed collisions with concussion during their careers, these athletes provide an excellent model for research examining the interaction between TBI and aging.

Participants and Methods: NHL and control participants' cognitive abilities were assessed using a variety of neuropsychological tests, while working memory and attention abilities were assessed using functional magnetic resonance imaging (fMRI) and electroencephalography during a series of n-back tasks.

Results: The neuropsychological tests revealed better performance among controls on measures of executive function, verbal memory and

speed of processing. Behaviourally, differences in accuracy between the NHL alumni and controls were only seen on the more complex 2-back task, while NHL alumni were slower on the 0- and 1-back, but not on the 2-back task. The neuroimaging measures demonstrated differences in frontal, parietal, and occipital brain activation, as well as differences in P300 latency and amplitude in the frontal, parietal, and occipital cortices, between the NHL alumni and controls during the n-back tasks.

Conclusions: Together, these results suggest that repetitive mild TBIs have long-term implications on neurocognitive functioning.

Correspondence: *Carrie Esopenko, PhD Psychology, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2X5, Canada. E-mail: cesopenko@research.baycrest.org*

T.J. FARRER, R. FROST, D.W. HEDGES & M. PRIMOSCH. Prevalence of Traumatic Brain Injury in the General Population: A Meta-Analysis.

Objective: Traumatic Brain Injury (TBI) is a significant public health concern. Understanding the impact of TBI requires sound estimates of TBI prevalence in the general population, which is difficult considering published studies range from 5.7% to 60%. To better understand the prevalence of TBI, we performed a meta-analysis of published studies that reported TBI prevalence in the general population.

Participants and Methods: Multiple data bases were searched using standard search terms. Article selection was limited to TBI cases with loss of consciousness (LOC) in an attempt to minimize heterogeneity across operational definitions of TBI. A weighted grand average was calculated to determine the overall frequency of TBI across all source studies. To calculate odds ratios of TBI by sex, we tabulated the prevalence rates for males and females. Next, we pooled the odds ratios by study into a summary odds ratio using a random-effects model. Potential publication bias was examined with the Classic and Orwin's Fail-Safe test, and the Trim-and-Fill test.

Results: Fifteen source studies were identified that met inclusion criteria. The total sample consisted of 25,134 individuals, of whom 3,044 had a lifetime history of TBI (12.1%). Several studies reported prevalence rates by sex. The total male sample (14 studies) consisted of 10,176 individuals with 1,697 (16.68%) reporting a lifetime history TBI. For females (12 studies), 1,078 individuals out of 12,605 reported a TBI (8.55%). For males compared to females, the summary odds ratio was 2.22 ($p \leq 0.001$), indicating that the odds of sustaining a TBI are 2.22 times higher in men than women. No publication biases were identified.

Conclusions: Our meta-analysis suggests that the general population prevalence of TBI with LOC is approximately 12 percent (16% in males and 8% in females). Our study supports literature that TBI is common in otherwise healthy groups and represents a significant public health concern.

Correspondence: *Thomas J. Farrer, M.S., Psychology, BYU, 346 W. 400 N #3, Provo, UT 84601. E-mail: thomasfarrer@yahoo.com*

E. GARDIZI & R.A. HANKS. Does Medical Comorbidity Predict Depression 1-year After Traumatic Brain Injury?

Objective: The prevalence of depression following traumatic brain injury (TBI) can range from 6 to 77% (Seel et al., 2004). Research has demonstrated that demographic variables such as age, education, and employment status may be more predictive of depression following TBI relative to injury related variables such as GCS and PTA (Malec et al., 2010). On the other hand, few studies have examined the effects of medical comorbidities which are hypothesized to contribute to the development of depression above and beyond well established variables.

Participants and Methods: Hierarchical regression was used to examine the relationship between medical comorbidity and depression in 40 persons (80% male) with moderate to severe TBI 1-year post injury. Mean age of the sample was 38 while the mean GCS score on admission was 9.26. The Modified Cumulative Rating Scale (MCIRS) was used to measure medical comorbidity whereas depression was measured using the Brief Symptom Inventory (BSI-18) depression subscale.

Results: Age and medical comorbidity were significant predictors of depression; however, education and employment status were not. Specifically, individuals who were younger and reported more medical complications were more likely to be depressed. The greatest amount of variance in depression scores was accounted for by medical comorbidities. Analysis of the MCIRS subscales showed that hypertension (HTN) and EENT (eyes, ears, nose, and throat) symptoms were the most frequently reported complications following TBI; although neither of them was predictive of depression individually.

Conclusions: The findings demonstrate the utility of the MCIRS as a general measure of medical burden. Focusing on medical comorbidities early on, particularly HTN and EENT can improve quality of life and reduce healthcare cost in the long run for this population.

Correspondence: *Elmar Gardizi, M.A., Psychology, University of Windsor, 401 Sunset Ave., Windsor, ON N9B3P4, Canada. E-mail: gardizi@uwindsor.ca*

J. GRIECO, D. WHITESIDE, E. BALLANTYNE & J. CARSWELL. Comparison Study of Predictors of Aggression in Individuals with Mild Traumatic Brain Injury and Individuals with Somatization Disorder.

Objective: The purpose of the study was to explore predictors of aggression in individuals with mild traumatic brain injury (mTBI) and somatization. Understanding predictors of aggression between groups will provide more thorough understanding of personality functioning in the context of neurocognitive functioning, yielding improved diagnosis, treatment, and quality of life. It is hypothesized that different predictors will exist between groups and pursuit of litigation will predict aggression.

Participants and Methods: Data was collected from adult outpatients referred for neuropsychological assessment diagnosed with mTBI (n=81) or somatization disorder (n=30). Assessments included the Personality Assessment Inventory (PAI) and the Test of Memory Malinger (TOMM). Potential predictors examined included depression (PAI-DEP), subjective cognitive complaints (PAI-SCZ-T), effort (TOMM Trial 2), and litigation status. Statistical analysis included ANOVA, correlation analyses, and hierarchical multiple regression.

Results: The amount of aggression reported in the somatization group was significantly higher than in the mTBI group (PAI AGG [t(109)= -7.19; p<0.001]). Hierarchical multiple regression analysis indicated that in the somatization group, litigation status significantly predicted aggression (R²=0.30, p=0.028); but depression, effort, and subjective cognitive complaints did not. In the mTBI group, regression analysis indicated that subjective complaints of cognitive dysfunction and depression together significantly predicted aggression (R²=0.53, p=0.001); however litigation status and effort did not.

Conclusions: Findings suggest that cognitive dysfunction and depression significantly predict aggression in individuals with mTBI; whereas individuals pursuing litigation significantly predicts aggression in individuals with somatization. Clinically, individuals with mTBI reporting symptoms of depression and cognitive dysfunction should be closely assessed to reduce potential for acting upon feelings of aggression.

Correspondence: *Julie Grieco, M.A., The University of Wisconsin Madison & The Adler School of Professional Psychology, 2970 N. Sheridan Rd., Apt. 827, Chicago, IL 60657. E-mail: jgrieco@my.adler.edu*

C.S. HALLER. Validation of the Langer Mindfulness Scale among severe TBI patients, and their significant others in German.

Objective: Mindfulness may have an impact on the recovery process among severe traumatic brain injury (TBI) patients. Measuring such mindfulness has previously been successfully done with Langer Mindfulness scale (LMS). In order to increase its availability in the clinical community, a short, easy usable scale, and a cross-cultural adaptation is required.

Participants and Methods: The present investigation is part of a Prospective cohort study of severe TBI patients. Test-retest interviews

were held at six-month intervals. 225 individuals (113 severe TBI patients and 112 healthy controls) responded to the first survey and 230 completed the retest. The measures included the Langer Mindfulness Scale (LMS), self-report questions on personality, openness, and attention. Items' characteristics were studied (missing answers, floor or ceiling effects), number of underlying dimensions was using principal component and exploratory factor analysis, reliability using Cronbach's alpha, and test-retest validity using weighted kappa for single items and intraclass correlation for the total score.

Results: Factor-, and item response analyses revealed a 6-item scale with a high reliability (alpha=0.82). External validity was confirmed in the whole sample.

Conclusions: The German short-form of the original LMS is a valid and reliable measure of mindfulness for severe TBI patients and their relatives.

Correspondence: *Chiara S. Haller, PhD, Harvard University, 2 Gree-nough Ave #5, Cambridge, MA 02139. E-mail: chiara_haller@gmail.com*

W. HUANG, J. BATCHELOR, A.J. WALKER, S. MEARES & A.J. TAYLOR. Impact of Pre-injury Factors on Neuropsychological Outcome in Adults with Severe Traumatic Brain Injury: A Cognitive Reserve Perspective.

Objective: To demonstrate that Cognitive Reserve (CR) is multi-faceted by testing a CR model based on a lifespan approach, and examine the clinical utility of applying the CR concept in predicting outcome following adult traumatic brain injury (TBI).

Participants and Methods: The lifespan CR model used composed of pre-injury variables proposed to enhance CR (i.e. CR+), including higher education, more complex occupation and mentally stimulating leisure activities, and pre-injury variables hypothesized to diminish CR (i.e. CR-), including substance abuse, alcoholism and history of conduct disorder or oppositional defiance disorder. Other predictors of interest were Premorbid IQ and injury severity. Retrospective data of 161 community clients, aged 17-77 years, of a TBI rehabilitation service were analysed. Neuropsychological outcome was assessed by scores on tests of speed of information processing, attention and concentration, learning and memory, and executive function. Factors that potentially moderate the effects of CR (e.g. age, gender, emotional and psychological distress) were controlled.

Results: Multivariate ANOVA was used. Premorbid IQ was a significant predictor on all cognitive domains. CR+ significantly predicted neuropsychological outcome across all cognitive domains, but only significantly accounted for variance over and above premorbid IQ for speed of information processing. CR- significantly predicted scores on attention and concentration, and executive function; CR- also significantly contributed to outcome prediction on top of premorbid IQ in these two domains. No interaction between CR and injury severity was found. Only age showed significant covariate effects.

Conclusions: This study found support for a multi-faceted CR. Concluded that effects of CR differ across cognitive domains. CR+ exerted neuroprotective effects on speed of information processing, and CR- posed vulnerability on attention and concentration and executive functioning. Applying the CR concept to adult TBI improves outcome prediction.

Correspondence: *Wanping Huang, Psychology, Institute of Mental Health, 10 Buangkok View, Singapore 539747, Singapore. E-mail: wanping81@gmail.com*

R. KRISHNA M.D., V. CHANDRA, M. GRINN MPH & K. ROY. Diffusion Tensor Imaging in the care of a Moderate Traumatic Brain Injury Patient.

Objective: To evaluate the diagnostic capacity of Diffusion Tensor Imaging (DTI), for a patient with Moderate Traumatic Brain Injury (MTBI).

Participants and Methods: A 23-year-old, previously healthy educated female was involved in a motor vehicle accident (MVA). The patient had persistent neurological signs and symptoms associated with TBI 9-months post MVA. Subsequently a neuropsychological consultation and DTI was obtained. The study was done in a clinical setting.

Results: The patient lost consciousness for 5 hours post MVA, and presented with persistent cognitive deficits, headaches and nosebleeds. A neuropsychological consultation was done 1-month post injury and revealed the following. Beck Depression Inventory II revealed scores in the severe range. Beck Anxiety Inventory revealed scores in the severe range. Pain Experience Scale revealed feelings of frustration, irritability and depression as a result of pain. A final diagnosis of Post Traumatic Stress Disorder, Post Concussion Syndrome, and Pain Disorder was given.

A DTI was conducted 9 months post MVA, revealing findings suggestive of TBI to the genu of the corpus callosum. DTI demonstrated a mild decrease in the fractional anisotropy (FA) in the region of the genu of the corpus callosum bilaterally, with extension into the subcortical white matter of both frontal lobes, consistent with trauma. These findings correlate to the diagnosis by neuropsychological evaluation.

Conclusions: This case report highlights the sensitivity and utility of DTI for a patient with clinical symptoms of mTBI that had persistent complaints after a clinical diagnosis. Recent evidence indicates that abnormalities in the genu of the corpus callosum showing diffuse axonal injury (DAI) correlates strongly with future disability in TBI patients (Matsukawa et al.). DTI has been highlighted as a powerful diagnostic tool for a clinical practice, which is not widely utilized in a clinical setting. Further studies are needed.

Correspondence: *Ranga Krishna M.D., MD, Methodist Hospital, 1513 Voorhies avenue, Brooklyn, NY 11235. E-mail: rkrishna@pol.net*

M. LEE & H. KIM. Discriminant variables of cognitive-pragmatic language abilities in traumatic brain injury.

Objective: Cognitive-pragmatic language disorders after traumatic brain injury (TBI) are different from those of other neurological disorders such as stroke and degenerative diseases. Evaluation domains of cognitive-pragmatic language may include attention, orientation, memory, organization, reasoning, and pragmatic language. The aim of this study is to investigate discriminant variables among several domains of cognitive-pragmatic language abilities which may aid in differentiating between TBI patients and the normals.

Participants and Methods: We evaluated cognitive-pragmatic language ability of 62 TBI patients and 226 normal adults. The newly developed protocol consisted of 33 items and 9 domains (i.e., attention, orientation, visuoperception, memory, organization, reasoning, problem-solving, executive function, pragmatic language). We used the discriminant analysis to identify discriminant variables.

Results: Discriminant analysis provided the predicative extent and variables. The protocol could discriminate between the patient and normal groups accurately by 92.4%. All 9 domains were found to be significant variables to discriminate the two groups. The most powerful variable was executive function, and memory, organization, pragmatic language, problem-solving, attention, orientation, reasoning, and visuoperception were in order.

Conclusions: Upon evaluating and identifying cognitive-pragmatic language disorders in TBI patients, incorporating multiple domains is essential even though some domains are more important than others.

Correspondence: *Mi Sook Lee, Yonsei Univ., Yonsei University College of Medicine, Seoul 120-752, Republic of Korea. E-mail: camusms@hanmail.net*

D. MILLER, J.P. HAYES, G. LAFLECHE, D. SALAT & M. VERFAELLIE. Spatially Variable White Matter Disruptions in Blast-Induced Mild Traumatic Brain Injury.

Objective: Blast-induced mild traumatic brain injury (mTBI) has been a pervasive problem for soldiers serving in Operation Enduring Freedom/ Operation Iraqi Freedom (OEF/OIF). Although the effect of mTBI on white matter integrity has been reported in the civilian literature, less is known about the effect of blast mTBI, in part because previous studies have yielded conflicting results. This study aimed to reconcile such inconsistencies with an approach that accounts for both the severity and heterogeneity of injury.

Participants and Methods: Seventy-nine OEF/OIF Veterans underwent diffusion tensor imaging. Veterans were assigned to one of four groups based on clinical interview: no blast-exposure/no TBI (n = 9), blast-exposure/no TBI (n = 28), blast-exposure/mTBI without loss of consciousness (LOC) (n = 22), and blast-exposure/mTBI with LOC (n = 20). Group comparisons focused on (1) mean fractional anisotropy (FA) in individual regions-of-interest (ROIs) comprising long fiber tracts previously found to be susceptible to mTBI; (2) white matter load, defined as the number of ROIs with reduced mean FA relative to the no blast/no TBI group. Additionally, analyses considered the effect on FA of posttraumatic stress disorder (PTSD), as measured by CAPS scores.

Results: Individual ROI analyses revealed no significant group differences after correcting for multiple comparisons. However, logistic regression analysis revealed that mTBI, but not PTSD, predicted white matter load. In particular, the mTBI with LOC group demonstrated an elevated odds ratio (OR) for global reductions in FA (OR = 11.37, p < 0.03).

Conclusions: Blast-induced mTBI with LOC is associated with global reductions in white matter integrity. Furthermore, white matter load is a more sensitive measure than FA in select ROIs for detecting blast-related mTBI structural brain changes. These findings suggest that damage to white matter pathways is spatially variable in individuals with blast-induced mTBI.

Correspondence: *Danielle Miller, Boston University, 150 South Huntington Ave, 151-A, Boston, MA 02130. E-mail: dmiller3@bu.edu*

M. NAESER, R. ZAFONTE, M.H. KRENGEL, P.I. MARTIN, J.A. FRAZIER, M.R. HAMBLIN, J. KNIGHT & E.H. BAKER. Improved Executive Function in Chronic, mild TBI after Treatment with Scalp Application of Red/Near-infrared, Light-emitting Diodes (LEDs): Open-Protocol Study.

Objective: Investigate if scalp application of red and near-infrared (NIR) light-emitting diodes (LED) can improve cognition in chronic, mild traumatic brain injury (mTBI). Rationale: TBI has no consensus treatment. Intra-cellular, mitochondrial dysfunction is present in TBI. Application of light in red and NIR wavelengths improves mitochondrial function (especially in hypoxic/compromised cells), promoting increased production of adenosine tri-phosphate (ATP) important for basic cellular metabolism, respiration, and oxygenation. Also, nitric oxide is released locally, increasing regional CBF.

Participants and Methods: 8 chronic mTBI cases (26-62 Yr, 5F) with persistent cognitive dysfunction, were treated starting at 1-7 Yr post-mTBI (MVA, Sports-related, IED blast injury). LED therapy is inexpensive, non-invasive, painless, and non-thermal (500mW LED device, MedX Health, Toronto); FDA-cleared, non-significant risk. Each LED cluster head had a 2" diameter, with power density=22.2 mW/cm² applied for 10 min to each of 11 scalp placements (13 J/cm² at scalp; estimated 0.4 J/cm² at cortex). LEDs placed front-to-back hairline along vertex/mid-sagittal suture line; and bilateral dorso-lateral prefrontal, temporal, parietal, occipital areas (5-6 LEDs used simultaneously). 18 LED Tx.'s (MWF, 6 Wks) as outpatients, Spaulding Rehabilitation Hospital, Boston. Neuropsych. Testing: Pre-LED; and Post- LED at 1 Wk post- 18th Tx., and at 1 and 2 Mo.

Results: Safe, no adverse effects. Raw Neuropsych. scores converted to age/education-matched standard scores for Pre/Post comparison (percentiles, z-scores). At 1 Wk Post-18th Tx. there was significant improvement on Executive Function, Stroop Trial 4, Inhibition Accuracy (t=3.864, p<.006, two-tail); and Verbal Memory, California Verbal Learning Test II, Total Trials 1-5 (t=2.892, p<.02, two-tail). Patients and family reported clear improvement in capacities to perform social, interpersonal and occupational functions.

Conclusions: These open-protocol data suggest controlled studies are warranted.

Correspondence: *Margaret Naeser, PhD, Harold Goodglass BU Aphasia Research Center, VA Boston Healthcare System, JP, VA Boston Healthcare System, JP Campus, 150 So. Huntington Ave., Boston, MA 02130. E-mail: mnaeser@bu.edu*

L. RIEGLER & J. NEILS-STRUNJAS. **Telehealth Intervention Results in Treatment Adherence and Improved Performance.**

Objective: We investigated whether provision of telehealth services can increase adherence to cognitive therapy and result in similar outcomes as clinic-based treatment in veterans with mild traumatic brain injury (TBI).

Participants and Methods: Veterans who were initially non-adherent to clinic-based cognitive therapy were offered a newly developed treatment- Military On-Line Problem Solving Videophone Intervention (MOPS-VI) designed to address the issues facing veterans with mTBI via online modules and videophone support. The control participants were selected from patient records of veterans who had completed cognitive treatment and were matched to MOPS-VI participants on the basis of age, marital or relationship status, and composite memory index score. Baseline and post-treatment cognitive functioning as assessed by the Test of Memory and Learning 2nd Edition (TOMAL-2) was obtained for all participants.

Results: Sixty-seven percent of veterans (6/9) (who were assigned to the MOPS-VI treatment group because they were initially non-adherent with the clinic-based treatment) completed the MOPS-VI telemedicine treatment. Results of a two way analysis of Variance (ANOVA) comparing baseline and follow-up scores on the TOMAL-2 in the MOPS-VI and control groups revealed there was a significant pre-post assessment effect, $F(1, 10) = 50.38, p < .001$, indicating that participant's memory and learning improved after treatment for both MOPS-VI and standard treatment groups. There was no significant difference between clinic-based treatment and MOPS-VI therapy ($F(1, 10) = 0.39, p = .55$). **Conclusions:** The results support the feasibility of an online program with videophone support for veterans with mild TBI. Preliminary evidence supports the efficacy of the treatment, defined as increased compliance in completing the treatment program and improvements in standardized memory and learning test results comparable to those following clinic-based treatment.

Correspondence: *Jean Neils-Strunjas, PhD, Rehabilitation Sciences, Armstrong Atlantic State University, 216 Coffee Pointe Circle, Savannah, GA 31419. E-mail: jean.neilsstrunjas@armstrong.edu*

K.M. O'DELL, R.P. VANDERPLOEG, D.M. RAMANATHAN, A.J. DONNELL & S. GROER. **Anger and Guilt in US Veterans with Traumatic Brain Injury: Who is Vulnerable and what are the Relationships with Subjective Psychological Functioning and General Well Being?**

Objective: Feelings of anger and guilt are common emotional sequelae of traumatic brain injury (TBI). However, little research has examined anger and guilt following TBI in the context of a veteran population. The purpose of this study is twofold: to examine 1) demographic, deployment, and injury characteristics associated with increased anger and guilt in a sample of US veterans with a history of TBI, and 2) how anger and guilt relate to subjective ratings of psychological functioning and general well being within this population.

Participants and Methods: Participants were 485 veterans who reported sustaining a TBI. Participants completed a TBI-related quality of life survey which included self-report measures of anger, guilt, anxiety, depression, health, and satisfaction with life (SWL). Demographic characteristics, number of deployments, and injury severity variables were also collected as part of the survey.

Results: One-way ANOVA indicated that younger age, less education, and ethnic minority status were associated with higher anger scores, while more severe injury, less education, and ethnic minority status were associated with higher guilt scores. Two linear regression models indicated that, collectively, anxiety, depression, health, and SWL scores accounted for 57.7% of the variance in anger scores and 49.7% of the variance in guilt scores. Variance partitioning analyses revealed that anxiety scores accounted for the highest amount of unique variance in both anger and guilt scores (11.8% and 3.6%, respectively). Most of the predictive variance was shared among the variables.

Conclusions: Veterans with certain demographic and injury characteristics are more likely to experience feelings of anger and guilt fol-

lowing TBI. Anger and guilt are highly related to subjective ratings of psychological functioning and general well being. In particular, anxiety is uniquely related to both anger and guilt. Thus, interventions targeting anger and guilt following TBI may have positive implications on outcomes for veterans.

Correspondence: *Keira M. O'Dell, MA, James A. Haley VA, 10420 N McKinley Dr, Apt S113, Tampa, FL 33612. E-mail: keira.o'dell@va.gov*

D.M. RAMANATHAN, R.P. VANDERPLOEG, K.M. O'DELL, A.J. DONNELL & S. GROER. **Factors Associated with Resiliency Following TBI in a Military Population.**

Objective: Military personnel sustaining traumatic brain injury (TBI) cope with multiple cognitive, psychosocial, and behavioral difficulties associated with their injury, along with the consequences of deployment and combat exposure. Therefore, it is imperative to examine factors that buffer these detrimental outcomes. One factor that has been associated with beneficial outcomes following trauma is resiliency, which involves positive coping and adjustment to trauma. This study examined how demographic and injury variables, psychological factors, and vocational status relate to resiliency following TBI in a military sample.

Participants and Methods: This study included 455 veterans who reported sustaining TBI. Participants completed self-report measures of resiliency, anxiety, and depression from the TBI-QOL and NeuroQOL scales. Variance partitioning analyses were used to determine unique and shared variance for variables associated with post-TBI resiliency. Variables considered were demographics (race, age, gender, education), psychological factors, injury severity, presence of comorbid spinal cord injury, and vocational status.

Results: Demographics, injury variables, psychological factors, and vocational status collectively accounted for 33% of the variance in resiliency. Psychological variables accounted for the most unique variance in resiliency collectively (24.6%), with depression (5.4%) having a stronger association than anxiety (0.5%). Demographic variables together accounted for 1.7%, injury severity 0.5%, and vocational status only 0.2% unique variance in resiliency.

Conclusions: Psychological factors, especially depression, are uniquely associated with TBI resiliency. However, the majority of variance in resiliency was not accounted for by the current variables. Thus, continued work should examine additional factors associated with resiliency. An improved understanding of methods that enhance resiliency and minimize adverse consequences following TBI will aid in optimizing outcomes for veterans.

Correspondence: *Deepa Ramanathan, M.S., James A. Haley Veterans' Hospital, 13000 Bruce B. Downs Blvd, Tampa, FL 33612. E-mail: deepa.ramanathan@va.gov*

E. ROMERO, C. DODSON, F. MARTINEZ, J. GIBSON, L. MAES, M. HABIB, D.J. HARDY, E. WOO, D.L. MCARTHUR, D.A. HOVDA, P. VESPA & M.J. WRIGHT. **Cognitive Reserve Enhances Functional Recovery from Traumatic Brain Injury.**

Objective: Cognitive reserve (CR), which is attained via mentally enriching activities, has been shown to reduce the neuropsychological impact of neurological insult. That said, CR is also likely related to functional outcomes following brain injury.

Objective: To determine if CR is predictive of functional recovery rates in participants with moderate to severe traumatic brain injury (TBI). We hypothesize that greater CR would predict improved rates of functional recovery between three and 12 months post-injury.

Participants and Methods: Thirty-five participants with moderate to severe TBI took part in this study. All participants were administered the Glasgow Coma Scale (GCS) multiple times during their acute care, the Glasgow Outcome Scale-Extended (GOSE) at three and 12 months post-injury, and a brief interview. These data were collected as part of a larger project administered through the Brain Injury Research Center at the University of California, Los Angeles. The rate of functional recovery was assessed by the difference between the three and 12 month GOSE scores and CR was indexed by years of education.

Results: Hierarchical regression was utilized to determine if CR (as indexed by years of education) was predictive of functional recovery (as indexed by GOSE difference scores) above and beyond age at the time of injury. We found that age at injury was not a significant predictor of rate of functional recovery, while CR was. CR accounted for 18.2% of the variance.

Conclusions: Overall, functional recovery appears to be related to CR. Thus, those with greater CR are likely to show more rapid recovery from TBI and may benefit from earlier rehabilitation efforts.

Correspondence: *Elizabeth Romero, Masters of Clinical Psychology, Department of Psychiatry and Biobehavioral Sciences, UCLA, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center., 1124 W. Carson St.B-4 South, Torrance, CA 90502 . E-mail: elizabeth.romero@pepperdine.edu*

N.D. SILVERBERG, D.L. SNELL, R.J. SIEGERT, J. HAY-SMITH & L. SURGENOR. Illness Perceptions in the Prediction of Outcome from Mild Traumatic Brain Injury: A Cross-Validation.

Objective: Early identification of cases at risk for poor outcome after mild traumatic brain injury (MTBI) can help triage clinical services. Whittaker et al. (2007) developed a multivariate model for predicting MTBI outcome. We aimed to cross-validate this model in an independent sample.

Participants and Methods: Of 147 participants with MTBI recruited from an emergency department and concussion clinic, $n = 125$ completed questionnaires at study entry (6.0 +/- 3.5 weeks post-injury) and again at follow-up three months later. The assessment battery included the Rivermead Post Concussion Symptoms Questionnaire (RPQ) and sub-scales of the Illness Perception Questionnaire-Revised (IPQ-R) that measure negative expectations for recovery and perceptions of significant injury consequences. Diagnosis of Postconcussional Disorder (PCD) at follow-up was derived from the RPQ and self-ratings of functional disability.

Results: A logistic regression model with the RPQ and two sub-scales of the IPQ-R (Timeline, Consequences) as predictors and PCD (diagnosed in 27% of the sample) as the dichotomous outcome was significant, $\chi^2(3) = 27.87, p < .001$. RPQ and IPQ-R Timeline scores uniquely contributed to the model and were weighted similarly to the development study. Unlike the development study, IPQ-R Consequences explained no unique variance ($p = .93$). Overall classification accuracy was 81% and the area under the Receiver Operating Characteristic curve was .79 (95% Confidence Interval = .69, .87). Adding time since injury at initial assessment in a subsequent step of regression did not improve model fit.

Conclusions: The original model held up well to cross-validation despite one of the predictors (IPQ-R Consequences) not contributing to group discrimination. Initial post-concussion symptom severity and expectations of a protracted recovery predicted PCD status at follow-up in our sample. The Whittaker et al. model is especially encouraging because it contains modifiable risk factors.

Correspondence: *Noah D. Silverberg, University of British Columbia, Rehab Research Lab, 4255 Laurel St, Vancouver, BC V5Z 4R2, Canada. E-mail: noah.silverberg@rvch.ca*

A.J. SZABO, L.S. KAKOS & J. GUNSTAD. Perceived Risk for Concussions in College Football Players.

Objective: Almost half of athletes who have concussion symptoms fail to report them. Research has shown that individuals who do not perceive themselves at risk do not take appropriate protective actions (i.e. using condoms). Athletes who do not perceive themselves at risk for concussion may not attend to potential symptoms of a concussion after they experience a hit to the head, so they do not report these symptoms. This study examined potential factors related to risk perception for concussions, such as concussion knowledge, personal experience, emotional health and executive functioning.

Participants and Methods: 81 Division I collegiate football players (average age 19.9 ± 3.38 years) completed a computerized cognitive test

battery and a questionnaire about their perceived risk for concussion. To assess risk perception, individuals were asked about both their own and others' risk of concussion on a scale of 0 to 10. Analyses were conducted using individuals' ratings of their own risk, as well as a comparison variable comprised of perceived risk for others minus perceived risk for self.

Results: Paired t-tests revealed that football players believe themselves to be at lower risk for concussion than others [$t(79) = 8.61, p < 0.001$; $M = 4.13, SD = 2.30$ for self; $M = 6.18, SD = 2.32$ for others]. Individual ratings of perceived risk was significantly correlated with their estimates of teammates' concussions ($r = 0.23, p = 0.04$) and worry about concussions ($r = 0.58, p = 0.00$). The comparison variable of own versus others' risk was significantly correlated with worry about concussions ($r = -0.27, p = 0.02$) and total correct on a measure of executive functioning ($r = -0.29, p = 0.01$).

Conclusions: College football players' perceived concussion risk is related to their teammates' experiences, worry about concussions, and executive functioning. These factors may be targets for future interventions to improve risk perception for concussions and reporting of concussions in college football players.

Correspondence: *Ashley J. Szabo, M.A., Kent State University, PO Box 5190, Kent, TX 44240. E-mail: aszabo6@kent.edu*

S. UZZAMAN, M.A. SCHMUCKLER & K.K. ZAKZANIS. On the Nature of Prospection and its Relationship to Instrumental Activities of Daily Living in Patients with Mild Traumatic Brain Injury.

Objective: Prospection is the ability to plan ahead by creating a series of intentions and sequential steps to achieve a particular goal. The current project examined whether prospection was reduced in a set of patients who had incurred a mild Traumatic Brain Injury (mTBI), and who described disabling cognitive impairment characterized by an inability to achieve goals (e.g., return to work).

Participants and Methods: The Tower of London (TOL) was used to measure prospection abilities in 77 patients who incurred a mTBI. We divided this group into cognitively impaired and disabled groups in terms of their real world functioning defined by their ability (or inability) to engage in instrumental activities of daily living (IADLs).

Results: Comparing groups of mTBI patients who were or were not disabled in their real world functioning (as defined by their IADLs) revealed that TOL could reliably discriminate between these two groups. In subsequent structural equation modeling, TOL scores were used to create a prospection model that was able to predict IADLs functioning.

Conclusions: This study demonstrates that prospection is a critical component of one's ability to function independently following the onset of a mTBI, and that clinicians should routinely investigate prospection in those patients who have incurred a mTBI.

Correspondence: *Sarah Uzzaman, MA, Psychology, University of Toronto, 1265 Military Trail, Toronto, ON M1C 1A4, Canada. E-mail: sarah.uzzaman@utoronto.ca*

M.W. WILLIAMS, L.J. RAPPORT, R.A. HANKS & S.R. MILLIS. Life Satisfaction, Community Integration, and Emotional Distress after Traumatic Brain Injury.

Objective: Adverse consequences of traumatic brain injury (TBI) frequently include emotional distress, poor community integration and low life satisfaction. These outcomes are key components of well-being after TBI, yet research examining reciprocal relationships among them and to the overarching concept of psychosocial functioning is sparse.

Participants and Methods: This was an archival study of a prospective data registry. Participants were 253 adults with moderate to severe TBI who were 1 to 15 years post injury. Outcome measures included the Satisfaction With Life Scale; Positive Affectivity (PA) and Negative Affectivity (NA) scales of the Positive Affective and Negative Affect Schedule; Mobility, Occupation, and Social Integration scales of the Craig Hospital Assessment and Reporting Technique; Community Integration Measure; and Somatization, Depression, and Anxiety scales of the Brief Symptom Inventory-18.

Results: The three-factor structural equation model fit the data adequately; a higher-order model did not necessarily improve model fit, yet revealed significant relationships with first-order constructs and one second-order construct. The hierarchical solution indicated two distinct subjective factors (life satisfaction and emotional distress) dissociated from an objective factor (community integration); yet, all three factors were related to the second-order construct.

Conclusions: Life satisfaction, community integration, and emotional distress are related yet unique concepts in persons with TBI. Life satisfaction and community integration show positive relation to each other and both are inversely associated to emotional distress; in turn these concepts are related to a higher-order concept that reflects psychosocial status. The presence of a higher-order construct that is equally influenced by subjective and objective aspects of outcome has implications for multidimensional interventions in rehabilitation after TBI.

Correspondence: *Michael W. Williams, M.A., Psychology, Wayne State University, 5057 Woodward Ave., 7th Flr, Detroit, MI 48202. E-mail: MWwilliams@wayne.edu*

Correspondence: *Michael W. Williams, M.A., Psychology, Wayne State University, 5057 Woodward Ave., 7th Flr, Detroit, MI 48202. E-mail: MWwilliams@wayne.edu*

FRIDAY MORNING, FEBRUARY 8, 2013

CE Workshop 7: Decision-Making in Neuropsychological Syndromes and Implications for Neuropsychiatric Disorders

Presenter: Antoine Bechara

7:20–8:50 a.m.

A. BECHARA. CE Workshop 7: Decision-Making in Neuropsychological Syndromes and Implications for Neuropsychiatric Disorders.

I will review neuropsychological evidence implicating three key neural systems in complex decision-making: (1) An impulsive, amygdala-striatum-dependent, system for signaling immediate prospects and mediating automatic and habit behaviors, and (2) A reflective, prefrontal cortex-dependent, system for signaling future prospects and for exerting control over the impulsive system. However, the dynamics of these two neural systems can be altered significantly under the influence of homeostatic perturbations brought about by conditions such as deprivation, craving, or even stress, depression, and anxiety. One key neural structure that mediates these homeostatic signals is the insula, where bottom-up (body) signals sensitize the impulsive system, and even “hijack” the top-down cognitive resources needed for the normal function of the reflective system, such as when exercising willpower to resist the temptation to smoke or to use drugs in addicted individuals. I will review the evidence showing that lesions of the insula wipe out smoking addiction. Learning Objectives:

- (1) Explain the neural basis of decision-making and impulse control, based on work in patients with focal brain damage
- (2) Understand how different neural regions are linked to different mechanisms of decision-making and impulse control
- (3) Apply various neuropsychological tests to assess different mechanisms of decision-making and impulse control.

Correspondence: *Antoine Bechara, Brain and Creativity Institute, University of Southern California, x, Los Angeles, CA x. E-mail: bechara@usc.edu*

CE Workshop 8: Correcting IQ and Neuropsychological Scores in High Stakes Decision-making: An Ethical Issue?

Presenter: Jack Fletcher

7:20–8:50 a.m.

J. FLETCHER. CE Workshop 8: Correcting IQ and Neuropsychological Scores in High Stakes Decision-making: An Ethical Issue?

Neuropsychologists are often asked to testify in judicial and related proceedings involving high stakes decision-making, including social security administration hearings, eligibility for school services, and “Atkins”

cases involving commutability of the death penalty for death row inmates because of an intellectual disability. Using this last high stakes decision as an example, this course addresses some of the ethical and technical issues that emerge in determining intellectual disability. Ethical issues involve the use of translators, scoring criteria, and the interpretation of guidelines for appropriate assessment and diagnosis of intellectual disability. Two prominent technical issues involve the assessment of adaptive behavior and the need to correct IQ test scores for norms obsolescence.

Learning Objectives:

- 1) make correct decisions about how to assess intellectual disabilities
- 2) apply appropriate methods for assessing adaptive behavior and correcting for the Flynn Effect
- 3) apply and transfer this information to other tests and high stakes decisions.

Correspondence: *Jack Fletcher, Department of Psychology, University of Houston Texas Medical Center, 2151 W Holcombe Blvd, Suite 222, Houston, TX 77204-5355. E-mail: jackfletcher@uh.edu*

Symposium 5: Interventions for Enhancing Behavioral and Neural Plasticity in Older Adults

Chair: Ruchika Prakash

9:00–10:00 a.m.

R.S. PRAKASH, Y. STERN, T. LIU-AMBROSE, R.S. PRAKASH & D.C. PARK. Interventions for Enhancing Behavioral and Neural Plasticity in Older Adults.

Symposium Description: In the U.S., the aging of the baby boomer generation has already instigated an increase in the resources and services devoted to older people, much of this concerned with cognitive and physical decline. Despite our field’s more sophisticated understanding of the neurocognitive mechanisms involved in aging, our capacity to apply and translate these findings into pragmatic, efficacious remediation methods has been more limited. While research shows that the aging brain has considerable capacity for cognitive flexibility and neural reorganization, the predominant lack of transfer effects in the existing training paradigms suggests that standard models of cognitive training have limited efficacy in actually improving the functional status of older adults. This impasse in the field of aging research signals the need to explore alternative, more multi-modal strategies to remediating age-related cognitive decline and enhancing neuronal plasticity. In this symposium, we discuss the current state of the literature on cognitive rehabilitation in the elderly, presenting both the advances and limitations of the traditional laboratory-based training approaches. We follow this with a series of four presentations on novel rehabilitation techniques, each of which capitalizes on the fundamentals of learning and memory to yield both near and far transfer effects. Ruchika Prakash will present data demonstrating the efficacy of mindfulness training to benefit the inter-related control processes of emotion and cognition in

the elderly. Yaakov Stern will provide evidence for the use of adaptive learning strategies in the context of a multi-domain and complex task, the videogame Space Fortress to improve cognitive functioning in the elderly. Teresa Liu-Ambrose will provide evidence for the benefits of exercise training in improving cognitive faculties in the elderly.

Correspondence: *Ruchika S. Prakash, Ph.D., Psychology, Ohio State University, 1835 Neil Avenue, Columbus, OH 43220. E-mail: prakash.30@osu.edu*

Y. STERN. Space Fortress Game Training and Executive Control in Older Adults.

Epidemiologic evidence suggests that a set of lifetime exposures are associated with more preserved cognitive and day-to-day function in aging. However, the specific set of activities that can maintain or improve function in late life has not yet been defined. Our interest in cognitive reserve encouraged us to explore enhancing executive control processes because they are ubiquitous and thus can be key to understanding individual differences in susceptibility to age-related neural changes across a wide range of tasks and functional activities. We chose a complex game, "Space Fortress," that was designed by human operations psychologists as a test bed for training approaches to teach young adults complex tasks. In the SF game, the player is required to shoot missiles and destroy a space fortress while protecting their spaceship against damage. An emphasis change (EC) training regimen has been shown to enhance performance and transfer of training. Ninety cognitively healthy elderly individuals were divided into 3 groups: non-gameplay, gameplay without EC training, and gameplay with EC training. The two gameplay groups played the game three times a week for 12 weeks. We hypothesized that SF game play, particularly when played in the EC condition, would provide a specific benefit to the executive control tasks. Elders in the pure gameplay condition were not as focused on the key goals of the game as the emphasis change group; they were more likely to respond to signals for bonus points as opposed to attempt to destroy the space fortress. In contrast, the elders in the emphasis change condition were more likely to focus on features central to the game. One of the 5 primary executive control outcome measures showed greater improvement from pre- to post-testing in the emphasis change than in the other two groups. We consider this a promising finding, and are currently conducting a study which combines space fortress game play with aerobic exercise.

Correspondence: *Yaakov Stern, 630 W 168th St, P&S Box 16, New York, NY 10032. E-mail: ys11@columbia.edu*

T. LIU-AMBROSE, L.S. NAGAMATSU, T.C. HANDY, M.W. VOSS, P. GRAF & B. BEATTIE. Resistance Training to Promote Cognitive Function in Older Women.

BACKGROUND: Cognitive decline is a pressing health care issue. Exercise may combat cognitive decline. We compared the effect of once-weekly and twice-weekly resistance training with twice-weekly balance and tone exercise training on the performance of executive cognitive functions and functional plasticity in senior women.

METHODS: In this single-blinded randomised trial, 155 community-dwelling women aged 65 to 75 years old living were randomly allocated to once-weekly resistance training (n=54), twice-weekly resistance training (n=52), or to twice-weekly balance and tone training (i.e., control group) (n=49). Primary outcome measure was performance on the Stroop Test, an executive cognitive test of selective attention and conflict resolution. Secondary outcomes of executive cognitive functions included set shifting as measured by the Trail Making Tests (Part A & B) and working memory as assessed by verbal digits forward and backward tests. Gait speed, muscular function, and functional magnetic resonance imaging (fMRI with flanker task) were also secondary outcome measures.

RESULTS: Both resistance training groups significantly improved their performance on the Stroop Test compared with those in the balance and tone group ($p < 0.03$). Enhanced selective attention and conflict resolu-

tion was significantly associated with increased gait speed. Twice-weekly resistance training also led to functional changes in two regions of cortex previously associated with response inhibition processes — the anterior portion of the left middle temporal gyrus and the left anterior insula extending into lateral orbital frontal cortex. These hemodynamic effects co-occurred with improved task performance.

CONCLUSIONS: Twelve months of once-weekly or twice-weekly resistance training benefited the executive cognitive function of selective attention and conflict resolution among senior women. Furthermore, twice-weekly resistance training can positively impact functional plasticity.

Correspondence: *Teresa Liu-Ambrose, 212-2177 Wesbrook Mall, Vancouver, BC V6T 1Z3, Canada. E-mail: tlambrose@exchange.ubc.ca*

R.S. PRAKASH, M. KLATT & W. MALARKEY. Mindfulness Training and Neural Indices of Emotional and Cognitive Control.

Mindfulness training (MT) reflects a paradigm shift in our conceptualization of cognitive training interventions in its unique targeting of cognitive control in the relational framework of affective regulation, two domains which research has traditionally evinced to be inextricable but yet continues to treat independently. In this study, we examined changes in cortical recruitment during a task of cognitive control and a task of emotional control in older adults, following a MT program. 25 older adults were recruited for the current study, and were randomized into either a MT group or a lifestyle education class. Neuroimaging data was collected while the participants performed the Eriksen flanker task and an affective localizer task, designed to elicit cortical response from the fronto-limbic circuitry involved in emotional processing. Viewing affective faces, relative to neutral, older adults demonstrated activation in amygdalae and lateral and prefrontal cortices prior to training. Post-intervention, the MT group, relative to the control group demonstrated a greater recruitment of the right posterior insular cortex, thalamus, and the inferior temporal gyrus, representing a shift in activation from emotional reactivity of the amygdalae to an up-regulation of interoceptive and sensory awareness regions of the brain. Further, performance on the Eriksen Flanker task improved marginally post-training (partial eta squared = .10) in the MT group, relative to the control group. This increased performance was coupled with an increased recruitment of the lateral prefrontal regions, and the insular cortices, demonstrating a greater increase in top-down cognitive control post MT. Targeting both attention regulation and emotional awareness, MT thus has the critical capacity to also improve aspects of emotional and cognitive control, and the corresponding neural circuitry involved in these inter-related processes.

Correspondence: *Ruchika S. Prakash, 1835 Neil Avenue, Columbus, OH 43220. E-mail: prakash.30@osu.edu*

Paper Session 4: ADHD/LD

Moderator: Janet Sherman

9:00–10:00 a.m.

S. BRAGER, A. THOMAS, M. COIRO & R. GROVER. Teachers' Perceptions of the Implementability of Assessment Recommendations Given in the Treatment of Attention-Deficit/Hyperactivity Disorder.

Objective: Children diagnosed with ADHD display behaviors that can significantly interfere with academic activities and put them at risk for poor scholastic outcomes. In order for the recommendations that neuropsychologists offer to be useful in the school setting, teachers must effectively implement these recommendations.

Participants and Methods: This study examined associations between teachers' ($N = 82$) perceptions of the implementability of assessment recommendations and recommendation-related variables, including the

amount of time the recommendation takes to implement, the specificity of the recommendation, the focus of the recommendation, and the teachers' role in the assessment process. Since this area has received little empirical attention, a measure was designed for the present study to allow teachers to rate 12 recommendations commonly offered following assessment of youth with ADHD.

Results: Results suggested that when the clinician writing the assessment recommendations consulted with teachers prior to writing the report, teachers were more likely to implement the recommendations than when they had not been consulted, $t(81) = 8.82, p < .001, r = .48$. Teachers also rated the recommendations that took the least time to implement as the recommendations that they were most likely to carry out, $F(2, 80) = 6.40, p = .003, \eta_p^2 = .138$. Finally, when recommendations were primarily academic in nature, it did not matter to teachers how specific they were. However, when the recommendations were primarily behavioral in nature, teachers rated more specific recommendations as being more likely to be implemented, $F(2, 79) = 3.97, p = .023, \eta_p^2 = .091$.

Conclusions: This interdisciplinary research provides a preliminary step from which to base not only future studies but also clinical judgment when writing school based recommendations for children with ADHD. Correspondence: Sarah Brager, M.S., Loyola University Maryland, 4501 N. Charles St, Baltimore, MD 21210. E-mail: srbrager@loyola.edu

J.B. HALE, H.A. KUBAS, K.R. FITZER, E.M. BACKENSON, J.A. CARMICHAEL, G.L. HARRISON & S.J. MACOUN. Operationalizing a Neuropsychological Process Approach for Specific Learning Disabilities Identification.

Objective: Specific learning disabilities (SLD) identification and intervention remains controversial. A neuropsychological processing strengths and weaknesses approach makes heuristic and clinical sense given statutory, regulatory, and legal precedents.

Participants and Methods: Children referred for comprehensive evaluations were examined for Concordance-Discordance Model (C-DM) SLD eligibility, which was contrasted with ability-achievement discrepancy (AAD) and school district multidisciplinary SLD criteria. Forced-entry multiple regression with WISC-IV cognitive predictors of WJ-III achievement subtests were computed for the sample ($N = 144$). Results were contrasted with separate regression equations for those who did not meet C-DM criteria, and C-DM determined SLD subtypes who had working memory (WM), processing speed (PS), or executive (EX) deficits explaining their reading and math SLDs.

Results: Crosstab comparisons for C-DM groups, AAD, and district criteria for reading and math revealed greater agreement for C-DM and district criteria than other comparisons. Regression analyses for the heterogeneous total sample revealed significant cognitive predictors of reading and math achievement (F range 2.32 to 5.52; p range $< .001$ to $.015$, R^2 range .156 to .315), but achievement variance accounted for was much greater when No C-DM (R^2 range .315 to .590), and WM (R^2 range .439 to .917), PS (R^2 range .274 to .676), and EX (R^2 range .234 to .709) C-DM groups were examined separately. Further, standardized beta weights were different for SLD subtypes in the prediction of different reading and math subtests.

Conclusions: WISC-IV predictive validity for WJ-III achievement improves when homogenous SLD subtypes are identified according to a neuropsychological processing approach using C-DM criteria. Differences in beta weights suggests different neuropsychological processes are relevant for SLD subtypes, which could lead to individualized intervention for children with C-DM determined SLD.

Correspondence: James B. Hale, University of Calgary, 106 Royal Elm Way, Calgary, AB T3G5P7, Canada. E-mail: halejb@ucalgary.ca

S. GRUBER, K. SAGAR, M. DAHLGREN, M. RACINE, A. GONENC & S. LUKAS. Gone to Pot? Early marijuana use and impulsivity predict neurocognitive impairment and alterations in brain structure.

Objective: Despite reports of the negative impact of chronic marijuana (MJ) use, perceived risk of MJ use continues to decline, spurring an in-

crease in MJ use in emerging adults. The current study aimed to assess the impact of early MJ use and impulsivity on neurocognitive performance and white matter microstructure, and to determine if early MJ onset and impulsivity scores could predict performance and structural brain alterations.

Participants and Methods: 46 chronic MJ smokers and 31 non-MJ smoking controls completed diffusion tensor imaging (DTI) and measures of executive function and impulsivity, including the Trail-Making Test, Stroop Color Word Test and the Barratt Impulsiveness Scale (BIS).

Results: Overall, MJ smokers performed significantly worse on measures of executive function, and had lower levels of fractional anisotropy (FA) in the left and right genu relative to controls. Regression analyses revealed that earlier age of MJ onset predicted poorer cognitive performance and altered white matter: earlier MJ onset predicted longer completion times on Trails A ($\beta = .304, p = .05$) and increased errors on Trails B ($\beta = -.302, p = .05$), as well as lower FA in the left and right genu ($\beta = .344, p = .09$; $\beta = .358, p = .08$). Notably, earlier MJ onset also predicted higher frequency ($\beta = -.346, p = .01$) and magnitude of MJ use ($\beta = .375, p = .01$).

MJ smokers also had significantly higher levels of impulsivity on the BIS, which predicted increased errors on Trails B ($\beta = .353, p = .03$), longer derived Trails interference (B-A) time ($\beta = .401, p = .01$), and lower performance accuracy on the Stroop interference condition ($\beta = .274, p = .09$). BIS scores also predicted lower FA in the right genu ($\beta = -.393, p = .05$) in MJ smokers, but not control subjects.

Conclusions: These findings underscore the importance of identification and prevention of early MJ use, as MJ exposure during a period of developmental vulnerability appears to result in neurophysiologic changes, greater MJ use, and is related to higher impulsivity, which may have long-term implications.

Correspondence: Staci Gruber, Ph.D., Cognitive and Clinical Neuroimaging Core, McLean Hospital/Harvard Medical School, Brain Imaging Center, 115 Mill Street C 14S, Belmont, MA 02478. E-mail: gruber@mclean.harvard.edu

E.D. BIGLER, T.J. ABILDSKOV, T.J. FARRER, C.S. FINUF, M. DENNIS, H.G. TAYLOR, K.H. RUBIN, C.A. GERHARDT, T.T. STANCIN, K. VANNATTA & K.O. YEATES. Voxel-Based Morphometry of Gray and White Matter Correlates of WASI IQ and WISC-III Processing Speed Index in Pediatric Traumatic Brain Injury and Orthopedic Injury.

Objective: MRI-based neural correlates of cognitive impairments in traumatic brain injury (TBI) may be examined using voxel-based morphometry (VBM). In a pediatric sample, the Social Outcomes of Brain Injury in Kids (SOBIK), the current investigation examined VBM correlates of performance on the WASI Vocabulary (V) and Matrix Reasoning (MR) subtests as well as IQ along with the Processing Speed Index (PSI) from the WISC-III. VBM findings were also compared to clinical rating and region of interest (ROI) volumetric analyses.

Participants and Methods: Children eight to 13 years of age with either TBI (mild complicated to severe, $n = 57$) or orthopedic injury (OI, $n = 47$) underwent MRI and neuropsychological assessment at least one year post injury. Gray and white matter correlates of neuropsychological outcome were assessed using SPM VBM image analysis tools. Volumetric findings were based on analyses performed in FreeSurfer.

Results: Children with TBI performed more poorly than controls on WASI subtests and WISC-III PSI, most significantly in those with severe TBI. Mild TBI and OI subjects did not differ on any cognitive measure. As expected VBM, volumetric and clinical MRI ratings resulted in differing relationships depending on the neuropsychological measure. With VBM analyses, WASI IQ and V and MR subtests were more prominently related to gray matter within the right parietal and temporal regions than with white matter. PSI was related to white matter in the left middle frontal gyrus and right frontal and temporal regions with few gray matter correlates.

Conclusions: VBM white matter PSI findings likely reflect disrupted networks necessary for fast processing in TBI. Interestingly, gray matter integrity appeared more important for correlates with IQ. Results are discussed in terms of known neuropathological consequences of TBI, how these injuries may impair cognitive functioning and the most sensitive MRI methods of analysis that relate to neuropsychological outcome.

Correspondence: *Erin D. Bigler, Ph.D., Psychology, Brigham Young University, 1001 Kimball Tower, Provo, UT 84602. E-mail: erin_bigler@byu.edu*

Paper Session 5: Aging in Alcoholism/ AD Signature

Moderator: **Emily Trittschuh**

9:00–10:00 a.m.

S.M. RUIZ, K.S. SAWYER, Z. GRAVITZ, G.J. HARRIS & M. OSCAR-BERMAN. Premature Aging in Alcoholism: Influences of Gender and Recovery.

Objective: Long-term alcoholism and normal aging are associated with similar patterns of cognitive deficits and brain atrophy. Neuropsychological and morphometric studies support the premature aging hypothesis, which suggests that older adults are particularly vulnerable to alcohol-related brain damage. How gender influences this increased susceptibility to aging remains unclear. Alcoholics (ALC) show restoration of both neuropsychological functioning and brain volumes with abstinence, but the influence of aging on this recovery is not well understood. This study examined the influence of gender on premature aging in ALC, and whether recovery effects remain stable throughout the life span.

Participants and Methods: Neurocognitive measures and structural MRI scans were collected for 42 abstinent ALC and 42 nonalcoholic controls, split evenly by gender. Multiple linear regression was used to examine interactions among age, gender, and alcoholism effects on cognitive performance and brain volumes, as well as to assess how these are affected by sobriety duration.

Results: Evidence for premature aging in alcoholism was observed in the memory domain functionally, particularly among men, and in the ventricles structurally, particularly among women. Younger ALC showed greater evidence for recovery of memory and executive functioning with abstinence than did older ALC, particularly among men. Recovery of brain volume with sustained abstinence varied by age, with older ALC showing less evidence of tissue recovery, particularly in subcortical gray matter.

Conclusions: Results support the premature aging hypothesis of alcoholism, and provide evidence that the vulnerability to aging varies by gender. The data further suggest that the typically observed recovery effects on brain function and structure do not remain stable through the life span. Understanding the unique profiles of impairment and recovery across genders and age groups is essential for tailoring effective treatment programs.

Correspondence: *Susan M. Ruiz, Ph.D., Boston University School of Medicine, 72 East Concord Street, L-815, Boston, MA 02118. E-mail: smosher@bu.edu*

N.H. STRICKER, T.A. ZINK, D.H. SALAT, J.M. FOLEY, I.L. KELLISON, C.P. MCFARLAND, L.J. GRANDE, R.E. MCGLINCHEY, W.P. MILBERG & E.C. LERITZ. Decreased AD-signature Cortical Thickness and White Matter Integrity in Neuropsychologically-defined Mild Cognitive Impairment.

Objective: The aim of the current study was to determine whether changes in cortical thickness and white matter integrity could be detected in a group of healthy adults with a high rate of family history of Alzheimer's disease (AD) through application of neuropsychological criteria for Mild Cognitive Impairment (MCI).

Participants and Methods: We applied comprehensive MCI criteria based on neuropsychological performance (Jak et al., 2009) to a sample of normally aging older adults: 32 participants met criteria for MCI and 81 participants were classified as normal control (NC) subjects. Whole-head high resolution T1 and DTI scans (Siemens; 1.5 Tesla Sonata System) were completed. DTI data were prepared for statistical analyses using Tract-Based Spatial Statistics and a priori selected ROIs were extracted from T1-based white matter parcellations created during the FreeSurfer processing stream. Hippocampal volume and average AD-signature cortical thickness (Dickerson et al., 2009) were also derived. Age, education and mean arterial blood pressure were used as covariates in all analyses.

Results: The MCI group demonstrated significantly lower hippocampal volume, AD-signature cortical thickness, and lower average fractional anisotropy (FA) than the NC group. Controlling for AD-signature cortical thickness, the MCI group showed decreased FA in parietal white matter and in white matter underlying the entorhinal cortex. Both hippocampal volume and average AD-signature cortical thickness were significantly related to memory and executive functioning. Controlling for AD-signature cortical thickness, medial temporal FA was significantly related to memory and parietal FA was significantly related to executive functioning.

Conclusions: Overall, results demonstrate that group differences in hippocampal volume, AD-signature cortical thickness and white matter integrity can be detected in neuropsychologically-defined MCI, and that some differences in white matter integrity are independent of cortical thinning.

Correspondence: *Nikki H. Stricker, Ph.D., VA Boston Healthcare System, 150 S. Huntington Ave (116B), Boston, MA 02130. E-mail: Nikki.Stricker@va.gov*

M.J. LARSON, P.E. CLAYSON, D.W. HEDGES, V.R. CALL & B.L. NIELSEN. Cognitive Control and Conflict Adaptation in Healthy Older Adults: An Electrophysiology Study.

Objective: Previous research suggests that older adults may display alterations in electrophysiological activation in brain regions putatively involved in conflict processing and cognitive control. We examined the influence of these potential difficulties on behavioral [response times (RTs), error rates] and event-related potential (ERP; N2 and P3 component amplitudes) indices of conflict adaptation, a cognitive control process wherein previous-trial congruency modulates current-trial performance, in healthy older adults compared to healthy young adults.

Participants and Methods: High-density electroencephalogram (EEG) was recorded while 65 healthy older adults ages 55 to 85 (34 female) and 94 healthy young adults ages 18 to 30 (49 female) completed a modified version of the Eriksen Flanker Task. Sex distribution did not differ between groups. Data were analyzed using separate 2-Group (old, young) x 2-Previous-trial Congruency (congruent, incongruent) x 2-Current-trial Congruency (congruent, incongruent) ANOVAs.

Results: Older adults showed significantly longer RTs and committed more errors than young adults. Both older and young adults showed significant Previous-trial Congruency x Current-trial Congruency interactions, but there was no interaction with group. Electrophysiological data indicated N2 amplitudes were similar between groups, whereas there was a significant Group x Previous-trial x Current-trial interaction for P3 amplitudes—suggesting some differences in neural processes underlying conflict adaptation between groups.

Conclusions: Despite increased overall error rates and RTs, older adults showed generally intact behavioral manifestations of conflict adaptation. Significantly different neural processes between the young and older adults on the P3 component of the ERP suggest different neural processes were needed for similar overall performance. Future research examining the specific neural components and genetic underpinnings is warranted.

Correspondence: *Michael J. Larson, Ph.D., Department of Psychology, Brigham Young University, 244 TLRB, Provo, UT 84602. E-mail: michael_larson@byu.edu*

A.J. JAK, K. SPOON, M. PANIZZON, C. FRANZ, W. THOMPSON, K. JACOBSEN, H. XIAN, M. GRANT, R. TOOMEY, M. LYONS & W. KREMEN. Hippocampal Atrophy Varies by Neuropsychological Definition of Mild Cognitive Impairment in Men in Their 50s.

Objective: It is of great interest to determine how early MCI may be reliably determined. Prior research has focused largely on adults over 65, but subtle changes precede decline by many years, warranting examination of younger cohorts. Operational definitions of cognitive impairment in MCI vary widely and it is not clear which approaches best identify early MCI. Prior work has categorized the sample into 5 definitions for MCI. Here, we examine hippocampal volumes to explore neuroanatomical support for the different operational definitions of MCI in men in their 50's.

Participants and Methods: 460 twins ages 51-59 enrolled in the MRI arm of the Vietnam Era Twin Study of Aging underwent extensive neuropsychological testing and an MRI. MCI was defined according to 5 criteria sets using different impairment cutoffs to classify individuals into subtypes including amnesic, non-amnesic, single-domain, and multiple-domain MCI. Hippocampal (HC) volume and calculation of HC atrophy (HC volume/HC volume + temporal horn) was completed with FreeSurfer. Statistical analyses were non-genetic mixed models that account for the non-independence of the observations via a random effect.

Results: MCI diagnostic approaches that required one impaired (>1.5SD) cognitive measure in a domain or two impaired (>1.0 SD) cognitive measures within a domain corresponded to differences in HC atrophy between normal cognitive functioning, amnesic, and non-amnesic MCI ($F's > 3.7$, $p's < .02$). However, there were no differences in HC volumes or HC atrophy between any of the groups when diagnoses were arrived at using more conservative or most composite score diagnostic approaches (all $p's > .05$).

Conclusions: Results provide empirical support for the ability to detect MCI in men as young as their 50's. The convergence of neuropsychological and neuropathological data, particularly data that captures HC atrophy as opposed to standard cross-sectional volume, supports early identification of MCI.

Correspondence: Amy J. Jak, Ph.D., VA Healthcare System, San Diego/UCSD, 3350 La Jolla Village Dr., 151B, San Diego, CA 92161. E-mail: ajak@ucsd.edu

**Poster Session 5:
Assessment (Adult)/Cognitive
Intervention/Cognitive Neuroscience/Memory**

9:00–10:00 a.m.

**Assessment/Psychometrics/Methods
(Adult)**

P.M. BEESON, K. RISING, M.L. HENRY, E.S. KIM & S.Z. RAPCSAK. The Arizona Semantic Test: A Picture-Based Test of Conceptual Knowledge.

Objective: In the assessment of individuals with aphasia, it is important to evaluate semantic knowledge in a manner that reduces reliance on spoken or written word processing. The Arizona Semantic Test (AST) was developed to assess semantic knowledge using a picture-pointing paradigm. The test was patterned after Pyramids and Palm Trees Test picture version (PPT; Howard & Patterson, 1992), a useful measure that has limitations for some American participants unfamiliar with some of the depicted relations. The purpose of this study was to examine the value of the AST as an alternative to the PPT.

Participants and Methods: The Arizona Semantic Test requires matching a target picture (e.g., candle) to a semantically related picture (e.g., a light bulb), from a set of 4 items (as opposed to the forced choice between 2 items on the PPT). The test was administered to 162 individ-

uals: 68 controls, 61 individuals with aphasia due to middle cerebral artery stroke, 19 individuals with primary progressive aphasia, and 14 individuals with damage due to posterior cerebral artery stroke. All participants received the AST, PPT, and the Raven's Coloured Progressive Matrices (RCPM).

Results: The AST and PPT were significantly correlated for the group as a whole ($r = .75$, $p < .0001$), and for those with brain damage ($r = .81$, $p < .0001$). The semantic tests were also significantly correlated with the RCPM ($r = .46$ and $.45$, $p < .0001$), suggesting a common problem-solving component of the tests. Results indicated strong internal consistency for both semantic tests (Cronbach's alphas between .85 and .90). Whereas both tests detected significant group differences between controls and groups with brain damage, the AST was more sensitive to differences between diagnostic subgroups.

Conclusions: Overall, the AST showed strong psychometric properties, and overcomes weaknesses of the PPT that arise with some participants. In sum, the AST offers good promise as a quick and valid assessment of semantic knowledge in individuals with language impairment.

Correspondence: *Pelagie M. Beeson, Ph.D., Speech & Hearing Sciences, University of Arizona, PO Box 210071, Tucson, AZ 85721-0071. E-mail: pelagie@u.arizona.edu*

K.I. IP, L. BOXLEY & L. BIELIAUSKAS. Assessing Delirium and Cognitive Impairment among Veterans through Behavioral Observations.

Objective: Delirium is a relatively common condition among elderly inpatients. Yet, given that delirium is frequently comorbid with other illness and has a multifactorial etiological nature, previous research has found that delirium is often misdiagnosed or under-diagnosed by clinicians (Han et al., 2009). Moreover, few studies have attempted to analyze the observable clinical characteristics that may distinguish delirious patients from patients with other impairments. Here we investigated the use of behavioral observations to identify both the common and unique traits associated with delirium and other cognitive impairments.

Participants and Methods: A neuropsychological test battery was administered to 257 consecutively assessed veterans [age 66.4 (11.2)] in an inpatient VA rehabilitation unit, in which, the Memorial Delirium Assessment Scale (MDAS) and the Mini-Mental State Examination (MMSE) were used to assess delirium and cognitive functioning respectively. Trained staff then characterized veteran behavior using 23 behavioral descriptors.

Results: Higher MDAS scores (worse performance) were uniquely associated with greater likelihood of being described as not alert and unpleasant, while lower MMSE scores (worse performance) were uniquely associated with being described as impulsive. Moreover, although both higher MADS scores and lower MMSE scores were associated with poor communication, higher MADS scores were significantly associated with greater likelihood of being described as slow and lacking in goal-directed behavior. MDAS scores were also significantly associated with greater likelihood having poor comprehension, word-finding difficulties, and prolonged speech latency.

Conclusions: Structured behavioral observations can be a useful tool to enhance the characterization of delirium.

Correspondence: *Laura Boxley, Ph.D, VHA Ann Arbor, 2215 Fuller Road, Ann Arbor, MI 48103. E-mail: lauraboxley@gmail.com*

L. BOXLEY, K.I. IP, R. KANSER, P. STAROSTKA & L. BIELIAUSKAS. An Investigation of MMSE Items Associated with Insufficient Task Engagement.

Objective: In the context of brief cognitive screens such as the Mini Mental Status Exam (MMSE), assessing task engagement currently requires the use of additional measures such as the Rey 15-Item Memory Test (RMT). In the absence of embedded measures, it is often difficult to assess the likelihood of authentic responses, particularly when time is limited. The purpose of the current study was to identify possible MMSE items that may suggest suboptimal effort.

Participants and Methods: A neuropsychological test battery was administered to 179 male veterans [age 65.8 (11.8)] in an inpatient VA

rehabilitation unit. Measures given included the MMSE, RMT, and the Memorial Delirium Assessment Scale (MDAS). Individuals who screened positive for delirium were excluded from the analysis ($n=23$). Insufficient task engagement was characterized as an RMT score <9 . Phi coefficients were calculated between MMSE item performance and RMT scores <9 .

Results: Mean MMSE total scores among those giving sufficient effort was 27.1 ($SD=3.8$). Mean MMSE total scores among those giving suboptimal effort was 23.7 ($SD=4.7$). Individuals giving suboptimal effort were likely to answer incorrectly when asked the current month ($r\phi=-.262$, $p=.001$), the name of the hospital ($r\phi=-.235$, $p=.003$), and what floor that they were on ($r\phi=-.193$, $p=.016$). They were also likely to miss the 1st ($r\phi=.225$, $p=.005$), and 3rd ($r\phi=.243$, $p=.002$), calculations on Serial 7s. Modest relationships were observed between poor effort and incorrect responses on repetition ($r\phi=-.163$, $p=.042$) and pentagons ($r\phi=.169$, $p=.039$).

Conclusions: There may be a relationship between individual item responses on the MMSE and suboptimal task engagement. Further investigation of possible response patterns consistent with insufficient effort is needed.

Correspondence: *Laura Boxley, Ph.D., VHA Ann Arbor, 2215 Fuller Road, Ann Arbor, MI 48103. E-mail: lauraboxley@gmail.com*

L. BOXLEY, K. IP, P. STAROSTKA, R. KANSER & L. BIELI-AUSKAS. Discerning Insufficient Task Engagement From Mild to Moderate Delirium Among Inpatient Veterans.

Objective: Among inpatient veterans, insufficient task engagement can be difficult to discern from mild to moderate delirium on neuropsychological measures. As such, having population and diagnosis-specific reference norms can provide clinicians with an additional tool for estimating patient performance. The purpose of the current study was to explore effort testing as a strategy for disambiguating the relationship between delirium and insufficient task engagement using the Rey 15-Item Memory Test (RMT) and the Memorial Delirium Assessment Scale (MDAS).

Participants and Methods: A neuropsychological test battery was administered to 179 male veterans [age 65.8 (11.8)] in an inpatient VA rehabilitation unit. Individuals with MDAS scores ≥ 7 were categorized as being at risk for delirium, while MDAS scores < 7 were categorized as having a negative screen for delirium. Among these two groups, normative RMT performance was evaluated. RMT scores <9 were considered a test failure.

Results: Of those assessed, 23 were identified as being at risk for delirium. When the mean performance between those who were suspected to have delirium and those who did not were compared, individuals with possible delirium performed worse on the RMT ($t(177) = 5.22$, $p < .000$). Overall, 56% of those with possible delirium failed the RMT, with a mean performance of 6.7 ($SD=3.9$). Among those who screened negative for delirium, 21% failed effort, with a mean RMT performance of 10.9 ($SD=3.5$). Follow-up analysis revealed that the individuals who were identified as having possible delirium were significantly older than those without suspected delirium ($t(177) = 2.98$, $p = .003$), though they did not differ by education ($t(173) = 0.79$, $p = .43$).

Conclusions: In an inpatient veteran setting, individuals at risk for delirium tend to be older and often fail effort testing by a wide margin. Additionally compelling was the finding that just under half of individuals with suspected mild to moderate delirium passed the RMT.

Correspondence: *Laura Boxley, Ph.D., VHA Ann Arbor, 2215 Fuller Road, Ann Arbor, MI 48103. E-mail: lauraboxley@gmail.com*

M. FEIGON, M.A. VERNALE, L.E. PIPER, A.M. POPA, J.N. WEIR & D.L. NYENHUIS. Use of the NINDS-CSN VCI Neuropsychological Protocols in a Sample of African-American Normal Healthy Controls.

Objective: The NINDS-CSN VCI Protocols have previously been validated in a sample of primarily Caucasian participants (Lobaugh et al.,

2011). Research suggests that cognitively normal African-Americans are more likely to be misdiagnosed as having cognitive impairment on neuropsychological tests as compared to Caucasians. Manly et al. (1998) found that 21% of older African-Americans (diagnosed by a neurologist as nondemented) met criteria for cognitive impairment sufficient for a diagnosis of dementia. We examine the percentage of non-demented, working African-American adults classified as impaired ($z < -1.5$) on the 60, 30, and 5 Minute Protocols.

Participants and Methods: African-American normal controls ($n = 28$) were housekeeping/maintenance staff recruited from local skilled care facilities compared against Caucasian controls ($n = 38$) recruited from several major urban universities. Samples differed significantly on age, education, and number of depressive symptoms ($p < .001$). African-American participants were younger ($m = 53.0$), with fewer years of education ($m = 12.45$), and higher levels of depressive symptoms ($m = 17.90$). All subjects were between the ages of 45 to 65. There were no differences between the two groups for gender. Subjects completed the 60, 30, and 5 Minute Protocols from the Harmonization Protocols as well as the MMSE and the Montreal Cognitive Assessment (MOCA). ANCOVA was used to account for the differences in depressive symptoms, education, and age.

Results: All three protocols demonstrated a significant effect size. Test performance differed between groups on both the 30 and 60 Minute protocols ($p < .01$), but not the 5 Minute protocol. Approximately 11% of the African-American normal controls were classified as impaired ($z < -1.5$) on the 5 Minute, 18% on the 30 Minute, and 36% on the 60 Minute protocol. By comparison, 25% were misclassified on the MOCA and 21% on the MMSE.

Conclusions: The use of separate norms for African-Americans and Caucasians for the VCI Protocols, is recommended.

Correspondence: *Maia Feigon, M.A., Illinois Institute of Technology, 1922 W. Bradley Pl., Chicago, IL 60613. E-mail: mfeigon@iit.edu*

A. HAHN-KETTER, L.A. WARDIN, J. KOGAN & D.M. WHITESIDE. Analysis of Performance on Effort Testing in a Dementia Population.

Objective: Previous studies examining the performance of individuals with dementia on effort testing have provided variable results and recommendations regarding the efficacy measures such as the Test of Memory Malingering (TOMM) (Teichner & Wagner, 2004). The current study furthers previous research on the psychometric validation of the TOMM (Tombaugh, 1996) among participants with dementia.

Participants and Methods: Participants were 30 individuals with dementia diagnoses who underwent neuropsychological evaluation. Participants were outpatients seen for comprehensive neuropsychological assessment, with a mean age of 68.3 ($SD=13.3$) and a mean education level of 14.1 years ($SD=2.9$). All 30 participants completed trials 1 and 2 of the TOMM, 21 of whom also completed the retention trial.

Results: Results of trials 1 and 2 as well as the retention trial of the TOMM were compared to normative data for two clinical samples of no cognitive impairment and cognitive impairment. We found that the dementia population performed significantly worse on the retention trial compared to the no cognitive impairment population ($t=2.87$; $p < .01$) and the cognitive impairment population ($t=4.49$; $p < .01$). However, scores were statistically similar on trials 1 and 2 for the dementia and cognitive impairment groups ($t=1.13$ & 1.31 ; $p=n.s.$).

Conclusions: This outcome differs from those of previous research using similar comparison populations. Additionally, it contraindicates the efficacy of the TOMM as a measure of effort among individuals with dementia.

Correspondence: *Amanda Hahn-Ketter, Adler School of Professional Psychology, 2504 N Orchard, Apt 3, Chicago, IL 60614. E-mail: ahahn-ketter@my.adler.edu*

D.B. HAMMERS, C.F. JOLLEY, S. CARD, K. DUFF, G.J. CHELUNE, M. STEARN & N.L. FOSTER. Converting Montreal Cognitive Assessment to Mini-Mental Status Examination Scores and Vice Versa in a Clinical Sample.

Objective: Transitioning from the Mini-Mental Status Examination (MMSE) to the Montreal Cognitive Assessment (MoCA) as a cognitive

screening tool has been a trend in recent years due to criticisms associated with the MMSE's susceptibility to demographic factors, its lower sensitivity for detecting mild cognitive decline, and changes in open-access use. Despite this increase in MoCA use, limited research exists to easily compare MMSE and MoCA performance. This study examines the conversion between MoCA and MMSE test scores.

Participants and Methods: We identified 101 clinical cases where both the MMSE and MoCA were administered either through the University of Utah (UU) or a VA-sponsored joint UU-St. John's Medical Center project. The sample was mostly elderly ($M=66.6$ years, $SD=12.6$), educated ($M=14.4$ years, $SD=2.8$), male (82.2%), and Caucasian. Reading ability ($SS=99.4$, $SD=13.1$) and raw performance on the Dementia Rating Scale ($M=130.3$, $SD=12.0$) suggested only a mildly impaired clinical sample. Linear regression analyses were run using MMSE scores, standard educationally-adjusted MoCA scores, and patient age and education.

Results: Linear regression analyses indicated that a MMSE equivalent score can be obtained in this sample using education-adjusted MoCA performance and patient age (Multiple $r=0.82$, $F(2)=98.42$, $p<.001$, $MMSE_{pred}=0.536MOCA-0.036AGE+16.776$ [$SE_{est}=2.00$]). Patient education did not appreciably add to the model. Conversely, an education-adjusted MoCA equivalent score can be obtained using MMSE performance (Multiple $r=0.81$, $F(2)=91.53$, $p<.001$, $MoCA_{pred}=1.15MMSE-7.774$ [$SE_{est}=2.93$]), with neither patient age or education adding to this model.

Conclusions: Equivalence-calculations can be obtained for the MMSE and education-adjusted MoCA using regression equations and demographic variables. In circumstances where the MoCA has replaced the MMSE in repeat clinical evaluations or research protocols, use of this conversion can allow comparisons for tracking purposes or statistical analyses.

Correspondence: *Dustin B. Hammers, PhD, Neurology, University of Utah, 650 Komar Dr., #106-A, Salt Lake City, UT 84106. E-mail: dustin.hammers@hsc.utah.edu*

J.P. HARP, A.L. SHANDERA-OCHSNER, M.S. EDMUNDSON, D.T. BERRY, T.L. PAPE, J.L. BABCOCK-PARZIALE, R.E. SCHLEENBAKER & W.M. HIGH. Symptom Validity Effects in Neuropsychological Evaluation of Veterans.

Objective: To determine the association between standalone symptom validity testing and embedded self-report validity indices, and to describe their effects on neuropsychological test performance and their association with diagnostic classification of TBI and PTSD.

Participants and Methods: OIF/OEF combat veterans ($N=438$) were recruited by telephone, mailer, and clinical contact at VA medical centers to complete structured interviews for TBI (SITDOV) and PTSD (CAPS) and neuropsychological testing. Testing included measures of psychiatric symptoms (MMPI-2-RF), attention (CPT-II), verbal memory (CVLT-II), processing speed (WAIS-IV PSI), and executive functions (D-KEFS Trail Making, Verbal Fluency; WCST). Symptom validity was assessed using the standalone Letter Memory Test (LMT) and embedded validity indices (VRIN-r, TRIN-r, F-r, and Fp-r) from the MMPI-2-RF.

Results: LMT failure was modestly but significantly associated with MMPI-2-RF symptom exaggeration ($\phi-sq = .04$, $\chi-sq(1) = 63.50$, $p < .001$) but not with content non-responsive invalidity (VRIN-r and TRIN-r). Failure of any validity indicator predicted worse performance on cognitive testing, with large (DKEFS trail making), medium (category fluency, CVLT-II, CPT), and small effects (WCST, letter fluency) across domains ($F(1,437)$, $p < .01$). Validity indicator failure was modestly associated with diagnosis of TBI ($\phi-sq = .04$, $\chi-sq(1) = 17.37$, $p < .001$) and PTSD ($\phi-sq = .13$, $\chi-sq(1) = 45.91$, $p < .001$).

Conclusions: While performance-based symptom validity was related to self-report validity, the two modalities were largely independent and may not measure a unitary construct in this population. Symptom invalidity indicated in either modality predicted worse performance on neuropsychological tests, often reaching clinical significance. Symptom invalidity was also related to diagnoses of TBI and PTSD. These findings suggest that symptom validity testing may provide incremental validity to objective neuropsychological testing and structured diagnostic interviews.

Correspondence: *Jordan P. Harp, M.S., Psychology, University of Kentucky, 111-C Kastle Hall, University of Kentucky, Lexington, KY 40508. E-mail: jordanharp@gmail.com*

K.M. HARRELL, S.S. WILKINS & J. CHODOSH. Comparing Clinical Video Telehealth and Face-to-Face Administrations of Neuropsychological Measures in a Patient with Multiple Sclerosis: A Case Study.

Objective: Clinical Video Telehealth (CVT) provides a conduit for real-time audio and visual clinical assessment for those who otherwise have limited access to care. How neuropsychological (NP) assessment can be best applied to this medium is not well understood. The following is a case study presenting test re-test data for a patient first seen for NP testing via CVT, followed by face-to-face testing 22 days later.

Participants and Methods: The participant was a 63 year-old male with a 39 year history of progressive multiple sclerosis. He had no cognitive diagnosis at the time of referral. A repeat comprehensive NP assessment was administered to enhance clinical understanding following non-standardized initial CVT assessment. The Reliable Change Index controlling for practice effects (RCI_{PE}), was employed to analyze performance from Time 1 (CVT: between Cisco EX90 devices) and Time 2 (face-to-face) to determine if clinically meaningful change occurred (Chelune, 1993; Iverson, 2001). Administrator and administration order were identical across assessments. No significant changes in health status, medication, or mood occurred during the interval between administrations.

Results: Of the 15 measures, 5 demonstrated reliable change using a cut off of ± 1.645 . The direction of change was variable, with 3 measures demonstrating improvement and 2 measures indicating decline. There was no discernible pattern across cognitive domains. Clinically, changes between assessments did not represent a change in diagnosis or overall impression.

Conclusions: Acknowledging the limitations of a single subject case study, there is insufficient data to attribute all reliable change to variation in medium. However, this case highlights both the potential to expand the reach of neuropsychology through CVT and the need for further investigation to determine if normative data and clinical profiles developed under standard administration procedures can be generalized to assessment via CVT.

Correspondence: *Kathryn M. Harrell, Ph.D., VA Greater Los Angeles, 11301 Wilshire Blvd., Los Angeles, CA 90073. E-mail: kathryn.harrell@va.gov*

M. HENRY, L. JACOB, J. LACOURSIERE-GIRARD, C.C. JOYAL & P. NOLIN. Discriminant and construct validation of a new impulsivity measure: the Virtual Reality Stroop Task.

Objective: It has been established that the VR-Stroop is a short task capable of assessing state impulsivity (both motor and cognitive) and sustained attention (Henry, Joyal, & Nolin, 2012). The main goal of this study was to test both construct validity and discriminant validity of this task.

Participants and Methods: A total of 52 volunteers were recruited among the general population (39♀ and 13♂, mean age: 26.92 ± 10.63 , 20-63). Four tasks were generated via computer on a 52" TV monitor in counterbalanced order: 1) simple visual presentation of 2D color boxes; 2) bimodal (audio-visual) VR-Stroop; 3) the Balloon Analogue Task (BART), a risk-taking task involving gains and losses of real money; and 4) the Barratt Impulsive Scale (BIS-11), assessing trait impulsivity. Eye tracking data (FaceLAB- Seeing Machines) and skin conductance (Thought Technology Ltd, Montreal) were also recorded during these tasks.

Results: As expected, analyses of the VR-Stroop indicate that it was not associated ($p > 0.05$) with traditional variables from both the BART and the BIS-11. Furthermore, skin conductance differed between each task in incremental order: Color boxes (2.79 ± 3.21) < Balloon (3.22 ± 4.20) < VR-Stroop (3.82 ± 4.44).

Conclusions: These results suggest that even though the VR-Stroop assesses different types of impulsivity, it does not evaluate risk-taking tendencies or impulsivity trait (discriminant validity). The VR-Stroop was associated with a greater physiological activation (e.g. skin conductance) than simple passive visual task or the BART. The VR-Stroop is a valid and discriminant tool, further applications in particular in clinical research seem promising.

Henry, M., Joyal, C. C., Nolin, P. (2012) Development and initial assessment of a new paradigm for assessing cognitive and motor inhibition: The Bimodal Virtual-Reality Stroop. *Journal of Neuroscience Methods*. 125-131.

Correspondence: *Mylène Henry, UQTR, 1020 avenue Côte, Champlain, QC G0X 1C0, Canada. E-mail: henry.mylene@gmail.com*

B. HILL, A. BOETTCHER, B. CARY, J. KLINE, M. WOMBLE & M. ROHLING. Much Ado About Norming: A Comparison of the Heaton Demographically Adjusted Norms and Mitrushina Meta-Norms.

Objective: This study compared the demographically adjusted Heaton norms (Heaton et al., 2004) and the meta-norms compiled by Mitrushina et al. (2005) to determine whether these two normative approaches produce significantly different results.

Participants and Methods: Data from 564 clinical cases were utilized. Participants ranged in age from 20 to 85 years (mean 45.4, SD 12.2), had at least 7 years of education (mean 14, SD 2.9), and was 57% female (89.7% Caucasian, 3% African American, 3.7% Hispanic). The following tests were utilized: Trail Making Test (TMT parts A and B), Controlled Oral Word Association Test (COWAT), Animal Naming, Grooved Pegboard Test (GPB), Finger Tapping Test (FTT), and Grip Strength Test (GST). The Heaton norms corrected all data for age, education, gender, and ethnicity. For the meta-norms, age was corrected for on all tests, education on TMT parts A and B and COWAT, and gender on FTT and GST.

Results: Matched t-tests comparing raw data normed using both the Heaton norms and meta-norms revealed the following were significantly different (all $p < .005$): TMT B, GPB non-dominant hand, FTT dominant and non-dominant hands, GST dominant and non-dominant hands, and Animal Naming. Individual regressions comparing Heaton norms to meta-norms yielded the following: TMT A ($r = .919$, slope = 10.083), TMT B ($r = .892$, slope = 15.120), GPB dominant ($r = .841$, slope = 14.273) and non-dominant hands ($r = .878$, slope = 14.988), FTT dominant ($r = .931$, slope = 14.557) and non-dominant hands ($r = .901$, slope = 14.049), GST dominant ($r = .952$, slope = -1.137) and non-dominant hands ($r = .968$, slope = 5.597), COWAT ($r = .962$, slope = 2.175), and Animal Naming ($r = .924$, slope = 1.005). Overall, mean $r = .917$ and mean slope = 9.071.

Conclusions: Results suggest that the Heaton norms and Mitrushina meta-norms produce results that are very similar in a general clinical sample, though small significant differences were noted on some tests. Future research should examine these different normative approaches in specific minority samples and for extreme performances.

Correspondence: *Benjamin Hill, PhD, Psychology, University of South Alabama, 2000 UCOMM, CCP Program, Mobile, AL 36688. E-mail: bdhill@usouthal.edu*

R. KANE, J. WILKEN, C. SULLIVAN & P. SHORT. Reliability of Selected Tests From The Automated Neuropsychological Assessment Metrics (ANAM) Test System For Pharmaceutical Research.

Objective: A putative advantage of computerized test batteries for pharmaceutical research is their ability to generate alternate forms. While practice effects are noted with alternate forms, changing items and item combinations can help attenuate these effects. The goal of this study was to assess the measurement stability obtained when different forms of select tests from the Automated Neuropsychological Assessment Metrics (ANAM) test system were given over six trials with relatively brief inter-test intervals as occurs in pharmaceutical or intervention studies.

Participants and Methods: Participants were healthy individuals taking various ANAM measures in preparation for participating in a

medication side effect study. Data for the analysis were from 6 initial baseline trials that were administered prior to subjects entering the active phase of the study. Participants ranged in age from 17 to 60 (mean = 32.4 ± 11.4). The sample included slightly more females ($n = 190$) than males ($n = 155$) but a one-way analysis of variance (ANOVA) indicated the groups did not differ significantly by age, $F(1,343) = 2.58$, ns. Reliability for each ANAM task was calculated in three ways: 1) Pearson r correlations were calculated between consecutive pairs of trials, 2) the mean correlation of each form with the other five was obtained, 3) intraclass ICC values were calculated using a two-way random effects ANOVA model with absolute agreement serving as a measure of agreement among parallel measures. These analyses were performed for accuracy, response time, and throughput scores.

Results: ANOVAs for all models were significant. Measures of reliability varied by type of measure, test, and test score. Strictly parallel forms ICCs were generally high especially for throughput (.93-.94) and response time (.92-.95). Pearson correlations varied by test, score, and particular time comparison with a low of .67 and high of .91.

Conclusions: Data support the stability of these metrics for use in clinical trials to assess alterations in cognition.

Correspondence: *Robert Kane, Ph.D., TATRC, 3604 Whitehaven Pkwy NW, Washington, DC 20007. E-mail: robert.kane@hotmail.com*

B. KNEZEVIC, A. WHITE, M. NIEMASIK, S.R. MILLER & C.J. MILLER. A Multidimensional Model of Impulsivity: Can Impulsivity be Modeled as a Macroconstruct?

Objective: Although personality (Whiteside & Lynam, 2001), experimental (Shuster & Toplak, 2009), and cognitive (White et al., 1994) research studies identified impulsivity as multidimensional, the underlying factor structure of the impulsivity construct across various research areas remains hazy. Therefore, the aim of the present multimethod, multi-source study was to identify a measurement model of impulsivity by combining clinical, personality, behavioural, and cognitive measures of impulsivity.

Participants and Methods: 175 full- and part-time students at the University of Windsor were surveyed using a computerized administration of questionnaires and performance tasks. The following questionnaires and tasks were presented in randomized order: (1) Adult ADHD questionnaire, (2) Risk-Taking Behavior questionnaire, (3) On Time, Organization, and Planning questionnaire (ON-TOP), (4), Wisconsin Personality Disorders Inventory (WISPI-IV), (5) UPPS-P Impulsive Behavior Scale, (6) Barratt Impulsiveness Scale (BIS), (7) The Big Five Inventory (BFI), (8) a Delay Discounting questionnaire, (9) a Delay Discounting task, and (10) a Go/No Go task.

Results: Exploratory factor analysis yielded a multifactorial model of impulsivity including four separate, yet related factors: (1) an impulsive personality style, (2) poor-planning/disorganization, (3) disinhibition, and (4) risk-taking/neuroticism. Evidence of the derived factors' internal consistency is reported. Overall, the obtained measurement model of impulsivity supported the notion of a multifactorial nature of impulsivity employing a range of measures across research areas.

Conclusions: Impulsivity represents a core neurocognitive characteristic with diverse clinical manifestations. Consequently, a multimethod assessment of impulsivity in clinical settings is essential to clearly delineate the nature of impulsive tendencies among a particular group of patients.

Correspondence: *Bojana Knezevic, M.A., Psychology - Graduate Studies, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada. E-mail: knezevib@uwindsor.ca*

K. KANE & J. KULAS. Exploration of the Association between Premorbid Learning Difficulties and Verbal Fluency Measures in a Veteran Clinical Population.

Objective: This study investigated the potential relationship between measures of verbal fluency and potential premorbid learning disability.

At least one-fifth of American adults have a learning disorder and of those, four-fifths have one associated with reading difficulties. The presence of a learning disability can impact cognitive processing and subsequent testing performance; however, it does not inoculate individuals from the effects of neurological injury or disease. As such, it is important to understand the direct effects that these developmental issues can have on test performance in related functional areas, as it may affect clinical interpretation. Developmental issues can affect reading decoding, which is often assessed by the Wechsler Test of Adult Reading (WTAR). Although it has been hypothesized that reduced performance on the WTAR will lead to lowered performance on a wide range of language-based tasks, including phonemic and semantic verbal fluencies, there has been little independent scientific exploration of this potential relationship.

Participants and Methods: Participants included 84 Veterans from a clinically-referred population, who were administered the WTAR, phonemic and semantic verbal fluencies, and other language-based measures (e.g., CVLT-2, BNT).

Results: An overall correlation pattern found strong, positive associations among WTAR raw scores with raw scores of both phonemic ($r = .30$; $.27$, $p < .01$, respectively) and semantic verbal fluencies raw scores ($r = .34$; $.36$, $p < .01$, respectively), and other language-based measures. The WTAR raw scores and FSIQ estimations were not correlated with scaled scores of phonemic and semantic fluencies corrected for education (Heaton Normative Data, 2008).

Conclusions: This study provides empirical evidence for the hypothesized relationship between reading decoding performance and performance on other language-based measures, but suggests its impact is likely moderated when educational attainment is used for normative comparisons.

Correspondence: *Katherine Kane, Ph.D., VAHCS, 950 Campbell Ave, West Haven, CT 06516. E-mail: kdkane@gmail.com*

E. LOGUE, J. MARCEAUX, K.J. MCCOY, C.M. CULLUM, N. YEHYAWI & R.C. HILSABECK. The Everyday Cognition (ECog) Scale: Further Evidence for Construct Validity.

Objective: In its initial validation study, the ECog demonstrated utility as an informant-report measure of cognitively mediated everyday functioning. The purpose of the current study was to provide additional evidence for the ECog's utility by examining its ability to predict performance on an objective measure of instrumental activities of daily living, the Texas Functional Living Scale (TFLS).

Participants and Methods: 87 patients (92% men) were administered the ECog and the TFLS as part of a comprehensive neuropsychological assessment. The average age of the sample was 60.1 years ($SD = 10.1$), and average education was 13.1 years ($SD = 2.9$). 52% identified as Caucasian, 40% as Hispanic/Latino, and 8% as African American.

Results: The ECog general factor and subscales correlated weakly to moderately with the TFLS total scale and subscales (spearman's $\rho = -.06 - .46$). Results of a multiple linear regression indicated that ECog subscales predicted TFLS total score ($F = 3.52$, $p = .004$). Binary logistic regression was used to predict performance at or below the 9th percentile on TFLS subscales using ECog subscales. The ECog Organization subscale predicted performance on the TFLS Money and Calculation subscale ($Wald = 12.36$, $p = .004$), and the ECog Language subscale predicted performance on the TFLS Communication subscale ($Wald = 4.17$, $p = .041$). Whereas the ECog Planning subscale showed a trend toward predicting the TFLS Communication subscale ($Wald = 3.14$, $p = .076$), the ECog Memory subscale did not predict performance on the TFLS Memory subscale ($p = .808$).

Conclusions: In conclusion, the ECog continues to show promise as an informant-report measure of cognitively mediated everyday functioning by demonstrating utility in predicting functional performance.

Correspondence: *Erin Logue, Psychology Service, South Texas VA, 7400 Merton Minter, 116B, San Antonio, TX 78229. E-mail: Erin.Logue@va.gov*

E. LOGUE, J. MARCEAUX, K.J. MCCOY, N. YEHYAWI & R.C. HILSABECK. Further Validation of the ECog Using a Diverse Clinical Sample.

Objective: The ECog is an informant-based questionnaire designed to assess everyday cognitive functioning. It has shown promising results within a geriatric sample, including healthy elderly and those diagnosed with mild cognitive impairment, but few additional validity studies exist. The purpose of the current study was to examine the ECog's ability to differentiate among patients with no cognitive impairment (NCI), Cognitive Disorder NOS (COG), and dementia (DEM) in a diverse clinical sample.

Participants and Methods: 196 patients (91% men) were administered the ECog as part of a neuropsychological assessment. Average age of the sample was 57.6 years ($SD = 12.2$), and average education was 13.2 years ($SD = 2.8$). 50% identified as Caucasian, 41% as Hispanic/Latino, and 8% as African American.

Results: Kruskal Wallis tests showed significant group differences in the overall ECog score ($p = .02$) and the Memory ($p = .01$), Language ($p = .05$), Visuospatial ($p = .001$), and Divided Attention ($p = .02$) subscales. Follow-up Mann Whitney U tests revealed significant differences between NCI and DEM groups in all these scores and between the COG and DEM groups in all of these scores except Language. The only scale that differed between the NCI and COG groups was Visuospatial ($p = .03$). To further examine the ECog's ability to differentiate among diagnostic groups, subscale scores were categorized as impaired/not impaired using a median split and entered into a multinomial logistic regression. Memory ($Wald = 6.75$, $p < .01$), Divided Attention ($Wald = 7.45$, $p < .01$), and Planning ($Wald = 9.63$, $p < .01$) differentiated between COG and DEM. The Visuospatial ($Wald = 8.74$, $p < .01$) and Planning ($Wald = 4.10$, $p < .01$) subscales differentiated between NCI and DEM, and the Visuospatial ($Wald = 13.93$, $p < .001$) subscale differentiated between NCI and COG. However, only 52.5% of the cases were correctly classified.

Conclusions: Findings provide further support for the validity of the ECog and insights into its clinical utility.

Correspondence: *Erin Logue, Psychology Service, South Texas VA, 7400 Merton Minter, 116B, San Antonio, TX 78229. E-mail: Erin.Logue@va.gov*

D.A. LOWE, S. BALSIS, T. MILLER, J.F. BENGE & R.S. DOODY. Improving Predictive Validity of the Clinical Dementia Rating Scale for Functional Outcomes.

Objective: Determining dementia severity is critical for Alzheimer's disease research and clinical care. Dementia severity can be staged using the Clinical Dementia Rating scale (CDR), which consists of 6 cognitive and behavioral domains rated on a 0 to 3 Likert-type scale where 0 = no impairment and 3 = severe impairment. The CDR scoring algorithm places individuals into 1 of 5 coarse stages (from no dementia to severe dementia), with no ability to indicate different degrees of dementia severity within each stage. Scoring based on item response theory (IRT) reveals variations of dementia severity within these 5 stages, bringing much needed precision to this dementia severity estimation. The current study examines whether this added precision improves prediction of important functional outcomes, such as ability to complete activities of daily living (ADLs); the CDR cannot predict functional outcomes within each dementia stage.

Participants and Methods: 1,181 individuals from Baylor College of Medicine Alzheimer's Disease and Memory Disorders Clinic completed comprehensive evaluations. Clinicians rated patients' dementia severity using the CDR. Patients were rated on an ADL scale, which measures 6 domains of basic ADLs. We used IRT procedures to estimate dementia severity by weighting each CDR domain according to its ability to indicate overall dementia severity and a patient's pattern of responses across those domains.

Results: IRT-based scores of dementia severity were significantly correlated with ADLs within CDR global scores 1, 2, and 3. The correlation between IRT-based scores and ADL indices within CDR global score 0.5 was not statistically significant, which fits with the notion that ADLs are largely preserved among those with a CDR score of 0.5.

Conclusions: An IRT approach shows considerable advantages over global CDR staging not only because it increases precision in dementia measurement, but also because it enables one to discover more precise associations with functional outcomes such as ADLs.

Correspondence: *Deborah A. Lowe, Department of Psychology, Texas A&M University, 4235 TAMU, College Station, TX 77843. E-mail: dalowe@tamu.edu*

R. MADATHIL, H.G. TRONTEL, H. WADSWORTH, B. CLARK & S. HALL. Diagnosis Threat Affects Executive Functioning in an Adult ADHD Population.

Objective: Previous research has shown that diagnosis threat has affected test performance in mTBI patients. In particular, this research has shown diagnosis threat to impair performance on Trails B of the Trail Making Test (TMT B). The current study aims to expand previous research in examining the role of diagnosis threat in adults with a diagnosis of Attention Deficit/Hyperactivity Disorder (ADHD) on both the TMT B and the Color-Word Interference task of the Delis-Kaplan Executive Functioning System (Color-Word task; D-KEFS).

Participants and Methods: Thirty-six participants diagnosed with ADHD were randomly assigned to either a diagnosis threat group or a control group. The diagnosis threat group was told that they were selected to participate based on their diagnosis of ADHD and given minimal information about their expected performance and asked to perform to the best of their ability. Participants in the control group were told only to perform to the best of their ability. All participants were given the Color-Word task and TMT B. It was hypothesized that individuals who were in

Results: Results indicated that scores on the Color-Word task were statistically significantly lower for participants in the diagnosis threat group than for participants in the control group. However, performance on the TMT B was not significantly different.

Conclusions: This study is the first of its kind in examining how diagnosis threat impacts individuals with ADHD. These findings appear to be mixed; results indicated that there was a significant difference between groups on the Color-Word task, however, results from the TMT were not found to be significant. This latter finding was inconsistent with previous research. Overall results suggest that diagnosis threat is an important factor to consider in neuropsychological test performance. The current study aims to expand on and more closely examine the influence of diagnosis threat in individuals with ADHD.

Correspondence: *Renee Madathil, M.A., Psychology, The University of Montana, 707 39th St., Apt 3, Missoula, MT 59803. E-mail: renee.madathil@umontana.edu*

R. MADATHIL & S. HALL. Diagnosing Adult ADHD: Self-Report vs. Objective Measures.

Objective: This study examined the relationship between self-report and objective measures that are commonly used in the assessment of impulsivity and inattention, two constructs that are central to the diagnosis of Attention Deficit/Hyperactivity Disorder (ADHD). Currently, there is no official diagnosis for adult ADHD in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition Text Revised (DSM-IV TR; APA, 2000). In addition, there is no diagnostic test for ADHD. Therefore, clinicians must choose from a variety of diagnostic techniques, including a choice of objective and self-report measures. It is important to consider the relationship of these techniques in their ability to measure the same constructs.

Participants and Methods: Thirty-six college-aged students with a diagnosis of ADHD were administered the Conners' Continuous Performance Test-II (CPT-II) and the Barkley Adult ADHD Rating Scale-IV (BAARS-IV). It was hypothesized that the impulsivity and inattention subscale scores from the BAARS-IV would be significantly correlated with the commission and omission error scores of the CPT-II, respectively.

Results: Pearson correlations indicated that, contrary to our hypothesis, scores from the BAARS-IV inattention subscale and CPT-II omission scores are not significantly correlated ($p = .45$). Likewise, the BAARS-IV impulsivity subscale and CPT-II commission were also found to be non-significantly correlated ($p = .70$).

Conclusions: Interestingly, these findings suggest that although the BAARS-IV and the CPT-II are both used to measure impulsivity and inattention, these two measures are not related on the assessment of impulsivity nor inattention in the current sample of college-aged students. It also appears that one's self-report of symptoms on these two constructs was not necessarily related to his/her performance on our objective measure. This research has direct implications for the consideration of the use of self-report and objective test data in adult ADHD assessment.

Correspondence: *Renee Madathil, M.A., Psychology, The University of Montana, 707 39th St., Apt 3, Missoula, MT 59803. E-mail: renee.madathil@umontana.edu*

C. NIKI, T. KUMADA, M. TAMURA, T. MARUYAMA, Y. MURAGAKI & H. ISEKI. Chronological changes of cognitive function in glioma patients from pre- and postoperative stages.

Objective: It is reported that in glioma patients, cognitive dysfunction is revealed after a resective operation. However, chronological changes of cognitive dysfunction of glioma patients after a operation have not been investigated. In this study, we assessed cognitive function of glioma patients from pre and post operative stages, and investigated how their cognitive function change.

Participants and Methods: 16 glioma patients (tumor area: 6 in the left frontal lobe, 7 in the right frontal lobe, 1 in the right front-parietal lobe, 1 in the right temporal lobe, 1 in the left parietal lobe) were participated. A cognitive battery task investigating 8 cognitive domain (verbal memory, working memory, speed of information processing, attention/concentration, set-shifting, interference, fluency, perception) was performed. Mini mental state examination-Japanese (MMSE-J) was also performed. These tasks were performed in pre-operative stage, and 1 month, 3 months, and 6 months after their operation.

Results: Repeated measures analysis of variance was conducted on z scores of each cognitive domain. As a result, scores of verbal memory, fluency, speed of information processing and set-shifting were significantly lower in 1 month than in pre-operative stage. Scores of speed of information processing and fluency in 3 months after operation also significantly declined than those in pre-operative stage. In 6 months after an operation, a score of verbal memory was lower than that in pre-operative stage, although scores of speed of information processing, fluency, set-shifting were significantly higher than in pre-operative stage. Differences in scores of MMSE-J were not statistically significant.

Conclusions: In 1 month after operation, general cognitive dysfunction was found. 6 months after a resective operation, cognitive dysfunction without verbal memory recovered. We proposed that cognitive function of glioma patients should be assessed after 6 months or more after their operations.

Correspondence: *Chiharu Niki, Institute of advanced biomedical engineering and science, Tokyo women's medical university, 8-1 Kawada-cho, Shinjuku-ku, Tokyo 1628666, Japan. E-mail: nkchi@yahoo.co.jp*

C.E. PARANAWITHANA & P. DE ZOYSA. The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS): Preliminary Clinical Validity of Individuals Diagnosed with Schizophrenia.

Objective: Despite the suggested importance of taking into account cognitive deficits in the prognosis and treatment of schizophrenia patients, to date, no standardized neuropsychological assessment tool capable of briefly or accurately measuring this deficit has been available in the Sri Lankan setting. As part of a larger study on validating the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) to the Sri Lankan context, the RBANS underwent a standardized translation procedure and judgmental validity was established successfully. Henceforth the study aimed at assessing preliminary clinical validity.

Participants and Methods: Preliminary clinical validation in this study involved comparing the performance on RBANS, of 134 patients diagnosed with schizophrenia with that of 134 age, gender and education matched normal (neurologically tact) controls.

Results: The patient group was significantly different from the normal control group, on the total RBANS score ($F=11.32, P<0.000$) and for all five Index scores (i.e. Immediate Memory($F=5.06, p<0.000$); Visuospatial/Constructional ($F=21.61, p<0.000$); Language($F=3.09, p<0.000$); Attention ($F=17.65, p<0.000$); Delayed Memory ($F=5.06, p<0.000$), demonstrating clear impairment relative to the performance of normal controls. The performance of the 134 patients diagnosed with schizophrenia is consistent with the reported pattern of the neurocognitive impairment in this disorder. As expected, the highest Index score for patients diagnosed with schizophrenia are on the Language and Visuospatial/Constructional indexes. The lowest scores were for the Attention Index.

Conclusions: The schizophrenia patients performed significantly well below their age, gender and education-matched normal control group, and displayed markedly impaired performance across all Indexes and the Total RBANS score. Thus, results were strongly suggestive of the fact that the Sinhala RBANS is a sensitive measure in terms of detecting cognitive impairment in schizophrenia patients.

Correspondence: *Chrishara E. Paranawithana, M.Phil, Psychiatry, Colombo South Teaching Hospital, NO 177 Stalmaj H.S, Athurugiriya, Sri Lanka, No : 76/5 1/1, Madawelakada Road, Rajagiriya, Sri Lanka, Colombo 000, Sri Lanka. E-mail: chrishcool.p@gmail.com*

C.E. PARANAWITHANA & P. DE ZOYSA. The Sinhala version of the Repeatable Battery for the Assessment of Neuropsychological Status and its association with to patients' functional outcome.

Objective: As part of a larger study on validating the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) to the Sri Lankan context, This study assessed the association between the RBANS findings and a patients' functional outcome

Participants and Methods: The RBANS is a brief individually administered test that determines the neuropsychological status of adults aged 20 to 89 years. It is composed of 10 subtests corresponding to 5 Indexes (i.e. Immediate Memory, Visuospatial/Constructional, Language, Attention, and Delayed Memory); the five indexes yield a total test score.

RBANS was administered on 121 patients diagnosed with schizophrenia at a clinic at the National Hospital of Sri Lanka. The objective of the present study was to assess if a patients' performance on the Sinhala version of the RBANS could be used to indicate his/her long-term functional outcome. Functional outcome was measured by the patients' stated competitive employment or unemployment. "Competitive Employed" was defined as work of at least 20 hours or more a week, a rating achieved by 28 of 121 patients diagnosed with schizophrenia. All patients not meeting this criterion were considered "Unemployed". Further, the number of years educated was also obtained from each patient.

The resulting two groups were similar in age and onset of disease, but differed significantly in number of years of education. A Discriminant Function Analysis was performed to assess the extent to which employment status can be associated with the RBANS score.

Results: The results indicated that employed patients performed significantly better than unemployed patients on the RBANS and the mean years of education was more for the employment patients

Conclusions: Hence, It is possible to correctly classify employment status by equal to or more than 61% of the time by using the RBANS total score. Also, Level of education is significantly related to the RBANS total score.

Correspondence: *Chrishara E. Paranawithana, M.Phil, Psychiatry, Colombo South Teaching Hospital, NO 177 Stalmaj H.S, Athurugiriya, Sri Lanka, No : 76/5 1/1, Madawelakada Road, Rajagiriya, Sri Lanka, Colombo 000, Sri Lanka. E-mail: chrishcool.p@gmail.com*

N. RAYMOND, B. YOCHIM & S. BEAUDREAU. Development of a Naming Test for Older Adults with Visual Impairment.

Objective: Naming and word-finding difficulties are common among patients with dementia or left hemisphere damage. The most commonly

used measures of naming ability (e.g., Boston Naming Test [BNT], Naming subtest of the Neuropsychological Assessment Battery [NAB]) are visual in nature, and these measures cannot be easily used in patients with visual impairment. Therefore, we created a modification of an auditory naming test by Hamberger & Seidel (2003) in order to expand its use in the assessment of older adults with visual impairment. This new version includes words of lower frequency-of-use in the English language to increase its sensitivity, and replaces items that can be problematic with patients with long histories of blindness (e.g., "camera," "chalk").

Participants and Methods: The new measure was administered to a sample of 91 community-dwelling older adults (m age = 75.2, SD = 7.0) as part of a larger battery of neuropsychological tests, which included the BNT.

Results: The new measure did not correlate with age, education, or sex. It was highly correlated with the BNT ($r = .61, p < .01$), and also correlated with Rey AVLT Trials 1-5 ($r = .22, p < .05$), WMS-IV Visual Reproduction I ($r = .30, p < .01$), D-KEFS letter ($r = .26, p < .05$) and category ($r = .27, p < .01$) fluency and Judgment of Line Orientation (JLO; $r = .30, p < .01$). Likewise, the BNT correlated with WMS-IV Visual Reproduction I ($r = .20, p < .05$), D-KEFS category fluency ($r = .20, p < .05$), and JLO ($r = .34, p < .01$), but not with the Rey AVLT or D-KEFS letter fluency.

Conclusions: The test appears to be a valid measure of naming ability in older adults and is similar to the BNT in its correlations with other cognitive measures. Future directions include revising the measure to include additional lower frequency items to increase its sensitivity to mild word-finding deficits and to collect data from a clinical sample and a sample of visually impaired individuals. This research was supported by a grant from the Alzheimer's Association (NIRG-09-133592).

Correspondence: *Brian Yochim, Ph.D., MIRECC 151Y, VA Palo Alto HCS, 3501 Miranda Avenue, Palo Alto, CA 94304. E-mail: byochim@stanford.edu*

G.Z. RECKESS, M. VARVARIS, S. TESTA & D.J. SCHRETLEN. Calibrating Performance for Age, Sex, Race, Education and Estimated Premorbid Ability Can Increase the Diagnostic Precision of Cognitive Testing.

Objective: Neuropsychologists interpret test data in the context of a person's demographic background and estimated premorbid abilities, but they often do so implicitly. The Calibrated Neuropsychological Normative System (CNNS) offers several explicit calibration options for converting raw scores to T-scores. However, the CNNS models were developed using neurologically normal adults. We sought to validate the use of such calibration in a clinical sample.

Participants and Methods: We analyzed data from 459 elderly adults referred from the Johns Hopkins Neuropsychiatry and Memory Group clinic for cognitive testing between February 1996 and September 2004. We divided the sample into three severity subgroups: Mild (MMSE ≥ 26 ; $N = 106$), Moderate (MMSE = 21-25; $N = 150$) and Severe (MMSE < 21 ; $N = 203$). Each MMSE subgroup was further subdivided into tertiles based on estimated premorbid IQ, yielding a total of nine subgroups. We then calculated two sets of T-scores for each of 13 neuropsychological measures using CNNS software. In one set, T-scores were calibrated only for age. In the other, they were fully calibrated (for age, sex, race, education, and estimated premorbid ability). We then compared mean neuropsychological T-scores of the highest (High IQ) and lowest (Low IQ) estimated premorbid IQ tertiles within each MMSE group.

Results: When calibrated only for age, High IQ patients outperformed Low IQ patients in every MMSE subgroup (Cohen's $d = .36$ to $.40$). Conversely, when fully calibrated T-scores were used, High IQ patients performed worse than Low IQ patients, but the differences were moderated by MMSE severity, such that the difference was greatest in the severe MMSE subgroup ($d = -.03$ to $-.31$).

Conclusions: In a clinical sample of patients referred for dementia evaluations, full calibration appears to provide more accurate interpretation of neuropsychological test performance than calibrating only for age.

Correspondence: Gila Z. Reckess, PhD, Psychiatry, The Johns Hopkins University School of Medicine, 600 North Wolfe Street, Meyer 218, Baltimore, MD 21201. E-mail: greckes1@jhmi.edu

B.Y. SAFFER, C.K. ROSENBLATT, S.C. LANTING, M.S. KOEHLE & G.L. IVERSON. Identifying Invalid Computerized Cognitive Test Performance in Older Adults.

Objective: Computerized cognitive testing is often used in clinical practice and research. Older adults with limited computer experience could have difficulty completing a computerized battery of self-directed tests. This study examined the new Validity Indicators for CNS Vital Signs battery (CNS-VS) in a sample of older adults.

Participants and Methods: Older adults who were self- or physician-referred completed a computerized cognitive screening evaluation [N = 71, age=63.7 years (SD=6.9), education=15.0 years (SD=2.7), 53.5% men, 98.6% were Caucasian]. The CNS-VS battery was administered in the presence of an examiner. New Validity Indicator cut-offs and a set of supplementary validity indicators created by the present authors were applied. Out-of-range normative scores (i.e., below 40) were also identified. Behavioral observation notes were reviewed for those with failed validity criteria or out-of-range scores to determine if there was evidence that the subject misunderstood the test instructions.

Results: Using the 8 CNS-VS Validity Indicators, 6 subjects (8.5%) had invalid scores. For 5 of those subjects, scores were out-of-range (i.e., below 40) and there was evidence that the subjects did not correctly complete the test. One of the 6 subjects had scores that were deemed valid because they were not out-of-range and there was no clear evidence that the subject failed to follow test instructions. A total of 10 additional subjects (14.1%) were identified as having either an out-of-range normative score or failing the supplementary validity criteria. Of those, scores from 6 subjects were deemed invalid and scores from 4 subjects were considered valid but needed to be truncated.

Conclusions: The CNS-VS Validity Indicators correctly identify some invalid scores. There appear to be some false positives, however, and some scores that are likely invalid are missed by these indicators (i.e., false negatives).

Correspondence: Boaz Y. Saffer, B.A., Copeman Healthcare, Suite 400, 1128 Hornby Street, Vancouver, BC V5Z3S6, Canada. E-mail: bsaffer@copemanhealthcare.com

B.Y. SAFFER, S.C. LANTING, C.K. ROSENBLATT, M.S. KOEHLE & G.L. IVERSON. Examining the Construct Validity of Computerized Cognitive Testing in Older Adults.

Objective: To examine the concurrent validity of computerized cognitive testing in older adults undergoing a cognitive screening evaluation in a private Canadian healthcare center.

Participants and Methods: 56 older adults (M age=63.5 years, SD=6.7, range=55-83; M education=15.0 years, SD=2.8) completed CNS Vital Signs® and a battery of traditional neuropsychological tests, including the Memory Module from the Neuropsychological Assessment Battery (NAB), selected tests from the Delis Kaplan Executive Function System (D-KEFS), the Reynolds Intellectual Screening Test (RIST), and the Test of Premorbid Functioning (ToPF). A Spearman multi-trait/multi-method matrix was used to examine the convergent and discriminant validity of CNS-VS.

Results: The CNS-VS domain scores were not correlated with intellectual ability, as assessed by the RIST. The CNS-VS Psychomotor Speed domain had a small significant correlation with the ToPF-Simple-Demographics-Predicted FSIQ ($r=.30$). The intercorrelations between immediate and delayed recall on the NAB verbal learning tests (List Learning and Daily Living Memory) ranged from $r=.56$ to $r=.74$. The intercorrelations between the CNS-VS Verbal Memory domain and these NAB verbal learning tests were lower, ranging from $r=.27$ to $r=.33$. CNS-VS Visual Memory was not correlated with the NAB Shape Learning

test. CNS-VS Reaction Time (which measures speed of responding on the Stroop test) had medium significant correlations with the D-KEFS CW Inhibition ($r=.43$) and CW Inhibition/Switching ($r=.51$) subtests. For comparison, the correlation between CW Inhibition and CW Inhibition/Switching was $r=.50$.

Conclusions: There was a pattern of correlations supporting aspects of both the convergent and discriminant validity of CNS-VS. There also appeared to be evidence of the expected attenuation of correlations attributable to method variance. In general, the convergent validity coefficients between computerized and traditional testing were small to medium.

Correspondence: Boaz Y. Saffer, B.A., Copeman Healthcare, Suite 400, 1128 Hornby Street, Vancouver, BC V5Z3S6, Canada. E-mail: bsaffer@copemanhealthcare.com

B.Y. SAFFER, G.L. IVERSON, K. KJERNISTED & D. MCINTOSH. Identifying Invalid Computerized Cognitive Test Performance in Patients with Depression.

Objective: Computerized cognitive testing is often used in clinical practice and research with patients with mood disorders. Computerized testing is often unsupervised; therefore, it can be difficult to determine whether a patient fully understood the instructions or might have invalidated a test for other reasons. The purpose of this study was to systematically examine the new Validity Indicators for the CNS Vital Signs battery (CNS-VS) in a sample of adult outpatients with depression who completed the test three times as part of a treatment study.

Participants and Methods: Participants were 48 outpatients with depression who were enrolled in a treatment study [age= 43.8 years (SD=12.9), education= 14 years (SD=2.3), 50.0% women, and 76.1% Caucasian]. Patients completed the CNS-VS battery three times (at a one week interval and again after approximately 8 weeks). The new Validity Indicator cut-offs and a set of supplementary validity indicators created by the present authors were applied. Out-of-range normative scores (i.e., standard scores below 40) also were identified.

Results: Using the 8 CNS-VS Validity Indicators, 19.6% were identified as having invalid scores at time 1, 13.0% at time 2, and 10.9% at time 3. Supplementary invalid scores were seen in 2.2%, 2.2%, and 0% at times 1, 2, and 3, respectively. Out-of-range domain scores occurred in 19.6%, 6.5%, and 10.9% at times 1, 2, and 3, respectively.

Conclusions: The CNS-VS Validity Indicators correctly identify some invalid scores. There appear to be some false positives, however, and some scores that are likely invalid are missed by these indicators (i.e., false negatives). Additional research is needed to refine the interpretation of valid versus invalid CNS-VS scores.

Correspondence: Boaz Y. Saffer, B.A., Copeman Healthcare, Suite 400, 1128 Hornby Street, Vancouver, BC V5Z3S6, Canada. E-mail: bsaffer@copemanhealthcare.com

J. YOUNG, J. YOUNG, R.J. MCGOVERN & T. VIRIDEN. Using Rey Effort Tests to Distinguish Amnesic Impairment.

Objective: Correlate Rey screenings with neuropsychological tests to distinguish among three groups: no amnesic impairment, Mild Cognitive Impairment, amnesic type (aMCI) and probable dementia (PD).

Participants and Methods: 233 patients over 65 presenting to a neuropsychology clinic for assessment of cognitive decline were studied. Groups were formed using standard scores on memory tests. This retrospective study included regression analyses, correlation matrices and Receiver Operating Characteristic (ROC) curve analyses.

Results: A cutoff score of ≤ 8 on the Rey 15 item Memory Test yielded acceptable rates of both specificity and sensitivity (78%) in distinguishing patients with PD from patients without amnesic impairment. Scores on the Rey Word Recognition and Dot Counting tests did not yield acceptable levels of sensitivity and specificity. ROC analyses found that qualitative errors on the RMT could discriminate among groups. Confabulation positively distinguished 88.9% of patients with aMCI from those with no amnesic impairment, though

a high negative predictive value (35.2%) was found. Confabulations also discriminated aMCI patients from PD patients. Using the RMT cutoff score and confabulation along with total score on the DCT also distinguished level of amnesic impairment. Correlation matrices and multiple regression analyses suggest that all three brief screening measures, especially the RMT, correlate moderately well with longer, more intrusive tests of memory, and if substituted for the WMS, a model including the RMT accounts for 61% of the variance in amnesic impairment.

Conclusions: Rey effort tests can be used to distinguish patients with different levels of amnesic impairment. The RMT may be able to replace longer formal memory testing in an optimal testing battery to distinguish level of amnesic impairment in older adults. The RMT has clinical utility in screening for amnesic impairment, especially when using a cutoff score of ≤ 6 along with the presence of confabulations.

Correspondence: Jeffrey Young, MA, *Clinical Psychology, AZ School of Professional Psychology, 2233 W. Dunlap Ave., Suite 150, Phoenix, AZ 85021. E-mail: jeffreyyoung@yahoo.com*

B. UTTL, C.A. WHITE & C.A. LEONARD. WMS-IV Verbal Paired Associates: Can It Assess Memory?

Objective: Standardized tests are used to measure individual differences in cognitive abilities to make diagnostic decisions, assess impairments, track recovery, and for research purposes. The tests are first administered to large samples of individuals drawn from a normal healthy population to establish the norms. The norms are then used to assess examinees' performance relative to these norms. The Wechsler Memory Scale (WMS) III Verbal Paired Associate (VPA) subtest was unable to measure individual differences in memory due to severe ceiling effects. Accordingly, the new revision of the VPA (WMS-IV; Wechsler, 2009) was extended by adding six additional easy (related) word pairs in an attempt to avoid ceiling effects. The main objective of the present study was to determine if the increase of the WMS-IV VPA test length to 14 word pairs was sufficient, that is, whether the revised test can measure individual differences in memory within the normative population. If so, we expect nearly all examinees to score below the ceiling of the revised test. If not, we expect a substantial proportion of examinees to be able to recall all 14 word pairs.

Participants and Methods: The WMS-IV VPA was administered to over 200 healthy normal participants. They were given the WMS-IV VPA test as part of a larger study on memory and cognition.

Results: The score distribution analysis showed that many participants reached the ceiling/maximum scores on the revised 14-item WMS IV VPA subtest. Ceiling effects continue to be present in all but the first trial and are particularly severe on the 3rd and 4th trial. Although a few participants reached the ceiling on the first trial, nearly half of the participants achieved the maximum score on the fourth trial.

Conclusions: The WMS VPA has been substantially revised in the WMS-IV (Wechsler, 2009). Despite these revisions, the test is still unable to measure individual differences in memory within the normative population; it continues to be afflicted by severe ceiling effects.

Correspondence: Bob Uttl, *Psychology, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, AB T3E 6K6, Canada. E-mail: uttlbob@gmail.com*

Memory Functions

B. UTTL, C.A. WHITE, D. WONG GONZALEZ, J. MCDOUALL & C.A. LEONARD. Prospective Memory, Personality, and Individual Differences.

Objective: A number of studies investigating the relationship between personality and prospective memory have appeared during the last decade. However, a review of these studies reveals little consistency in their conclusions. The main objectives of the present research were to clarify the relationship between prospective memory, personality, and individual differences such as intelligence.

Participants and Methods: We conducted two studies: a meta-analysis of prior research investigating relationships between prospective memory and personality and a large sample study with nearly 400 participants examining the relationships between prospective memory, personality, verbal intelligence, retrospective memory, and other factors.

Results: Our review of prior research revealed a great variability in the measures used to assess prospective memory as well as in the methodological quality of prior research that may explain inconsistent findings in the literature. Our experimental study showed that prospective memory performance was related to individual differences such as verbal intelligence as well as to personality factors.

Conclusions: In combination, these two studies suggest that prospective memory performance is relatively weakly related to personality factors and more strongly related to individual differences in cognitive factors.

Correspondence: Bob Uttl, *Psychology, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, AB T3E 6K6, Canada. E-mail: uttlbob@gmail.com*

M.E. AXELRAD, D.D. SCHWARTZ & J.M. KATZENSTEIN. Verbal Memory in Costello Syndrome.

Objective: Costello syndrome (CS) is a genetic disorder caused by germline mutations in the HRAS proto-oncogene, which plays a key role in synaptic long-term potentiation (LTP) and memory formation. Enhanced LTP-like activity has been found in CS, which based on mouse models would predict enhanced memory function; however, prior research has found impaired verbal recall in individuals with CS, even when controlling for IQ. As CS is also characterized by oral-motor and expressive deficits, the reported impairment in recall might be due to problems with verbal expression rather than memory. We hypothesized that recognition memory (which minimizes demands placed on expressive output) would be dissociated from recall performance and show the memory enhancement predicted by findings of enhanced LTP.

Participants and Methods: Participants were seven girls and two boys with molecularly confirmed CS. The girls had the common G12 mutation; both boys had G13 mutation. Age range = 15-25 years. All participants were administered WRAML-2 verbal memory tests as part of a longitudinal study.

Results: On the Verbal Learning subtest, immediate and delayed recall were in the borderline range ($M=4.0 \pm 2.7$ and 4.2 ± 2.6 respectively), while recognition was low average ($M=7.0 \pm 1.7$). The difference between delayed recall and recognition was significant, $T(8)=-3.95, p=.004$. In Story Memory, immediate and delayed recall were in the borderline range ($M=3.8 \pm 3.3$ and 4.1 ± 3.4), while recognition was average ($M=8.1 \pm 3.8$). The difference between delayed story recall and recognition was significant, $T(8)=-5.59, p=.001$.

Conclusions: Individuals with CS show relative preservation of the verbal recognition memory system, consistent with reports of enhanced LTP-like activity. Participants' average recognition of narrative information suggests that there may also be relative preservation in oral language comprehension. These are the first reported findings of relatively average functioning in any domain of cognitive functioning in CS.

Correspondence: Marni E. Axelrad, PhD, *Pediatrics, Baylor College of Medicine, 6701 Fannin St. Ste. 1630, Houston, TX 77030. E-mail: axelrad@bcm.edu*

D. CORRELL, M. ZAMROZIEWICZ, S. RASKIN, J. MAYE, A. ROGERS & M. KURTZ. Prospective Memory in Schizophrenia: Relationship to Medication Adherence, Neurocognition and Symptoms Symptoms in Individuals With Schizophrenia.

Objective: Medication management is a serious concern for individuals with schizophrenia. One possible reason for poor adherence to medication is poor ability to remember future intentions. It has been demonstrated in several studies that individuals with schizophrenia do have impairments in prospective memory. However, there have been no studies, to our knowledge, examining the relationship of prospective memory to medication adherence.

Participants and Methods: Twenty-five individuals with schizophrenia and twenty-five healthy adults were administered a standardized measure of prospective memory and a standardized measure of medication adherence.

Results: Individuals with schizophrenia demonstrated impairments specifically in prospective memory. Performance on the test of prospective memory was correlated with the standardized measure of medication adherence.

Conclusions: This suggests that prospective memory should be assessed before assuming that individuals with schizophrenia will be independent in medication management. It also suggests that prospective memory intervention may be important in this population.

Correspondence: *David Correll, Trinity College, 300 Summit St, Hartford, CT 06106. E-mail: david.correll@trincoll.edu*

C. ESOPENKO & B. LEVINE. Episodic and Semantic Autobiographical Memory and Traumatic Brain Injury.

Objective: Autobiographical memory (AM) is a multifaceted capacity entailing recall of memory for personal events and experiences. Episodic autobiographical memory (EAM), the first-person recollection of unique events, is affected in many neuropsychological disorders. A classic finding in Traumatic Brain Injury (TBI) is retrograde amnesia, usually affecting EAM. Although research has shown that damage to the temporal lobes is associated with such impairments in EAM, how diffuse axonal injury (DAI) associated with TBI impacts EAM is not well understood. As such, the goal of the current research was to examine how TBI severity affects EAM, and whether impairments in EAM are affected by widespread changes in brain volume typically shown in DAI.

Participants and Methods: EAM was assessed in 60 patients with mild to severe TBI and age- and education-matched controls using the autobiographical interview (AI). All patients received a high resolution structural MRI, which was quantitatively analyzed, with regional brain volumes derived and related to AI measures.

Results: There was no evidence of retrograde memory loss in either the TBI or controls. All participants were able to recall a greater number of internal EAM details compared to external (non-episodic) details; however, patients with severe TBI had a lower ratio of internal details than patients with less severe TBI and controls, suggesting reduced specificity of their autobiographical protocols. Widespread volume loss due to DAI was related to performance on the AI; specifically, decreases in CSF, as well as grey and white matter in the temporal, parietal, and frontal regions were associated with a decrease in internal details and an increase in external details over all time periods.

Conclusions: While there was no evidence of retrograde amnesia for EAM in this sample, TBI was related to the specificity of AM recall, suggesting that patients with TBI are unable to focus retrieval. This pattern was related to white and grey matter volume loss in regions important to AM.

Correspondence: *Carrie Esopenko, PhD Psychology, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2X5, Canada. E-mail: cesopenko@research.baycrest.org*

L. GONZALEZ, K. PARKER, N. MAHDAVI, V. ANDERSON & A. HARVEY. Changes in everyday memory in children and young people with temporal lobe epilepsy: A follow up study.

Objective: In adults with temporal lobe epilepsy (TLE) everyday memory function is influenced by mood but not objective test performance. There is some evidence to suggest that different factors influence everyday memory in children with TLE (eg Chapieski et al., 2011). This study explores self and parent ratings of everyday memory in young people with TLE, with a view to understanding the memory complaint more fully.

Participants and Methods: This study investigated predictors of everyday memory in a sample of 19 children and adolescents (8-23 years) with TLE who had participated in a baseline study (Gonzalez et al., 2008). Eleven had subsequently undergone epilepsy surgery. Partici-

pants were administered neuropsychological and mood measures. Parents rated everyday memory utilizing the (Observer Memory Questionnaire – Parent Form (OMQ-PF) (n=13) and children over 12 rated their own abilities using the newly developed Subjective Memory Questionnaire (n=15).

Results: There was no change in OMQ-PF ratings over time. Parent ratings were predicted by objective memory performance (paired associate learning) ($p=.005$) and mood ($p=.02$) but not surgical status. On the SMQ those who had surgery rated their memory better than non-surgical cases ($p=.004$), despite no difference in objective results. Surgical status ($p=.02$) significantly predicted SMQ ratings but not objective memory or mood. Self and parent ratings of everyday memory were not correlated.

Conclusions: The stability of parent ratings of everyday memory over time suggests a stronger relationship between this aspect of memory and objective test performance than reported for adults. This association may reflect that parents of children and young people with TLE are particularly attuned to memory function. In contrast, SMQ ratings are more strongly influenced by surgical status, with young people undergoing surgery perhaps invested in viewing their memory as improved. Results highlight that multiple informants have different perceptions of everyday memory in TLE.

Correspondence: *Linda Gonzalez, PhD, Psychology, Royal Children's Hospital, Flemington Rd, Parkville, VIC 3052, Australia. E-mail: linda.gonzalez@rch.org.au*

A. HAMMAR & G. ÅRDAL. Verbal memory functioning in recurrent depression during partial remission and remission.

Objective: Cognitive impairment in acute phase of Major Depressive Disorder is well documented. However, less is known regarding the neuropsychological profile in phases of remission and moreover, little research is published showing cognitive strengths in depressed patients. The aim of the present study was to investigate verbal memory performance in a group of patients with remitted and partial remitted major depressive disorder.

Participants and Methods: Thirty-one patients who formerly met the DSM-IV criteria for a unipolar recurrent MDD diagnosis, with a mean symptom load of 8 (SD=5), as measured by the Hamilton Depression Rating Scale. A healthy matched control group (N=31) were included in the study. All participants were assessed with the California Verbal Learning Test (CVLT).

Results: Results showed intact verbal memory performance in the patient group regarding learning, recall and recognition. However, patients had significantly poorer performance compared to healthy controls on immediate recall of the first trial in the verbal memory test. There was no difference between patients in partial remission and full remission.

Conclusions: The present finding of impairment in immediate recall in the patient group is highly in accordance with self reports of memory difficulties in this patient group, since daily life memory functioning often requires immediate recall without repetition. However, it is important to highlight the intact memory performance when repetitions are provided, and further the intact short and long-term memory. This knowledge is important for clinicians and the patients themselves.

Correspondence: *Asa Hammar, PhD, University of Bergen, Jonas Lies vei 91, Bergen 5009, Norway. E-mail: aasa.hammar@uib.no*

M. IRISH, D. ADDIS, J.R. HODGES & O. PIGUET. Deconstructing Episodic Future Thinking in the Dementias.

Objective: The profound loss of semantic knowledge in semantic dementia (SD) has illuminated our understanding of the cognitive architecture of episodic and semantic memory, yet the capacity for future-oriented thought in SD remains poorly understood.

Participants and Methods: We assessed the retrieval of events from the past year and the generation of events within the next year using a structured interview, in 14 SD, 11 Alzheimer's disease (AD), and 14 age- and education-matched controls. Voxel-based morphometry was used to correlate task performance with regions of neural atrophy.

Results: SD patients showed relatively intact past retrieval, in contrast with marked deficits in AD. For episodic future thinking, both patient groups were strikingly impaired. Atrophy in the left inferior temporal gyrus and bilateral temporal poles, regions classically associated with semantic memory, correlated with future thinking deficits in SD. Atrophy in episodic memory regions, namely the posterior cingulate, parahippocampal gyrus, and frontal pole, underpinned future thinking deficits in AD. Analyses of the contextual details provided by SD patients revealed important dissociations between past and future conditions. Episodic Event details were exclusively impaired in the future compared with the past condition, yet off-target external Event details were significantly inflated in the future condition. Further, a majority of imagined events represented past memories that had been recapitulated, or recast, into the future condition.

Conclusions: Our findings highlight the crucial role of episodic and semantic memory in imagining the future. While retrieval from episodic memory forms the building blocks of future simulations, semantic memory provides scaffolding to impart meaning to the event. Finally, the ability to integrate details from past memories into semantic scaffolding requires a recombination process, which acts as cement to create novel and coherent scenarios. Correspondence: *Muireann Irish, Neuroscience Research Australia, Barker Street, Randwick, Sydney, NSW 2031, Australia. E-mail: m.irish@neura.edu.au*

C.D. KAY, M. SEIDENBERG, C.C. KANDAH, M.A. MATTHEWS, M.A. LANCASTER, S. DURGERIAN, K.A. NIELSON, J.L. WOODARD, J.C. SMITH, C.M. FIGUEROA, K.E. HAZLETT, N.C. HANTKE, M.A. SUGARMAN, A.L. NORMAN & S.M. RAO. Fine Motor Variability, APOE- ϵ 4, and Longitudinal Memory Outcome in Healthy Elders.

Objective: Recent research suggests that ambulation and other gross motor tasks predict cognitive decline in asymptomatic older adults. The APOE- ϵ 4 allele is also a well-established risk factor for memory decline. To date, the possible association between APOE- ϵ 4 and fine motor task variability as predictors of cognitive decline has not been examined.

Participants and Methods: Ninety-three asymptomatic subjects (Mage=72.7) were administered a repetitive finger-tapping task (rFTT) at baseline and neuropsychological measures at baseline and 18-month follow up. The rFTT required participants to tap in synchrony with a flashing (3 Hz) checkerboard over eight 10-second intervals. Indices of variability for the rFTT include coefficient of variability and standard deviation (SD) of inter-tap intervals. The sample consisted of 37 APOE- ϵ 4 carriers and 56 non-carriers. Subjects were further divided into four groups based on APOE- ϵ 4 and cognitive decline status: Stable/ ϵ 4- (n=42), Stable/ ϵ 4+ (n=18), Decline/ ϵ 4- (n=14), Decline/ ϵ 4+ (n=19). Decline was defined as a reduction of ≥ 1 SD from baseline to follow up on one or more outcome measures (RAVLT 1–5, Delayed Recall, DRS-2 Total).

Results: Baseline rFTT variability indices did not distinguish APOE- ϵ 4 carriers from non-carriers ($p>.05$). One-way ANOVA also revealed no significant group differences in rFTT variability indices between the four APOE- ϵ 4/cognitive decline status groups ($p>.05$).

Conclusions: Our results indicate that variability in a repetitive fine motor task is not related to presence of the APOE- ϵ 4 allele nor to 18-month memory outcome of cognitively intact adults. These findings suggest that the predictive utility of fine motor task variability is not comparable to that of gross motor task variability in predicting future cognitive decline. Additional research using both fine and gross motor tasks is needed to determine the relationship between behavioral variability, gene risk, and memory performance.

Correspondence: *Christina D. Kay, MA, Psychology, Rosalind Franklin University of Medicine and Science, 3333 Green Bay Road, North Chicago, IL 60064. E-mail: christina.kay@my.rfums.org*

C.D. KAY, W. SONG, C.C. KANDAH, M. SEIDENBERG & J.L. WOODARD. Discriminability of Transient and Enduring Remote Note Famous Names in Alzheimer's Disease.

Objective: Memory impairment in Alzheimer's disease (AD) is typically characterized by better performance for remote than recent memories.

Remote famous names can be divided into those that remain in the public domain for an extended time and those that had a more limited time of exposure. We examined the effect of fame duration (transient or enduring) and the ability to discriminate famous from non-famous names in AD patients and cognitively intact healthy controls (HC).

Participants and Methods: Twenty-one AD (Mage=78.1) and 21 HC subjects (Mage=71.1) completed a famous name discrimination task (famous-not famous) for 20 recent (2000-2010), 20 transient remote (1950-1970), and 20 enduring remote (1950-2010) famous names, as well as 60 non-famous names. The transient and enduring remote names were selected to be similar in memory age. Names were divided into the three time epochs based on normative findings from independent samples of younger and older individuals.

Results: Compared to the HC group, the AD group had fewer famous name hits ($p<.001$, $d=1.6$), and more false positives ($p<.001$, $d=1.6$), but not false negatives ($p>.05$). A mixed design ANCOVA (controlling for age) revealed a significant group x time epoch interaction ($p=.004$, $\eta^2=.133$). HC subjects exhibited better discriminability for the recent, transient remote, and enduring remote time epochs compared to AD subjects ($ps<.001$) but showed a similar level of within-group discriminability between transient and enduring remote time epochs ($p=.149$, $d=0.1$). In contrast, the AD group showed markedly better discriminability for enduring compared to transient remote famous names ($p<.001$, $d=0.5$).

Conclusions: These findings suggest that both persistence of fame and memory age are important factors affecting remote memory impairment in AD. The famous name discrimination task using enduring and transient remote names may be used to inform and expand current models of long-term memory consolidation and retrieval.

Correspondence: *Christina D. Kay, MA, Psychology, Rosalind Franklin University of Medicine and Science, 3333 Green Bay Road, North Chicago, IL 60064. E-mail: christina.kay@my.rfums.org*

V. LA CORTE, P. PRADAT-DIEHL & G. DALLA BARBA. Selective and chronic confabulation in personal temporality: a longitudinal case study.

Objective: Clinical evidences show that confabulating patients retrieve personal habits or repeated events and mistake them for actually unique events (Habit Confabulations La Corte, 2010). According to the Memory, Consciousness and Temporality Theory (MCTT, Dalla Barba, 2002), this pathological condition does not reflect a pure memory disorder, but a disorder involving temporal consciousness (TC). TC means to become aware of something as part of a personal past, present or future. Confabulation is usually a transient phenomenon whereas amnesia often persists.

In this study we report a patient, TA, who developed a chronic amnesic-confabulatory syndrome three years ago, following rupture of the right internal carotid siphon aneurysm.

Our principal aim was to study the evolution of the amnesic-confabulatory syndrome.

Participants and Methods: Confabulations were collected with the Confabulation Battery (Dalla Barba, 1993), which comprises 169 questions tapping various aspects of semantic and episodic memory.

Results: Neuropsychological examinations showed severe impairment on episodic memory, whereas general semantic memory was unimpaired throughout. TA's confabulations were selective to the personal temporality (i.e. questions concerning the personal past, present and future) over different evaluations; in contrast he never confabulated in questions tapping impersonal semantic knowledge. At qualitative level most confabulations consisted of Habits Confabulations.

TA's brain MRI showed lesions involving right hippocampus, thalamus, fornix, mammillary bodies and parahippocampus. Moreover TA showed sub-cortical lesions in bilateral caudate nucleus, which has been rarely described in amnesic-confabulatory syndrome.

Conclusions: In conclusion TA's confabulation reflects a chronic and selective pathological awareness of personal temporality. These findings are discussed within the framework of the different theories proposed to explain mechanisms underlying confabulation and in particular within the MCTT.

Correspondence: *Valentina La Corte, Post-Doc, CRICM/INSERM/UPMC, 5, rue guillaumot, Paris 75012, France. E-mail: valentina.la_corte@etu.upmc.fr*

S. LACKOVIC, W.B. BARR & K. BLACKMON. Auditory/Verbal Attention and Memory in Focal Brain Lesion Patients.

Objective: Attention and memory dysfunction are commonly associated with brain damage in the frontal or temporal lobes. However, there is variability in the resulting pattern of performance on neuropsychological tests, which can be partially explained by the location of damage. Although the impact of damage to the mesial temporal lobe on memory is well established, frontal lobe contributions to verbal attention and memory are still debated. The current study investigated the impact of selective lesions to the temporal and frontal lobe on dissociable components of auditory/verbal attention and memory tasks.

Participants and Methods: Participants included individuals post brain surgery or middle cerebral artery stroke (N=49). Three groups were created according to the site of resection or stroke – anterior temporal (ATL; n=26), dorsolateral prefrontal cortex (dlPFC; n=11), and dorsomedial prefrontal cortex (dmPFC; n=12). Participants were administered the CVLT-II and the Digit Span (DS) subtest of the WAIS-IV. All raw scores were normalized to z- or t-scores based on comparison with age-matched normative group.

Results: An ANOVA with two fixed factors (lesion group and side of lesion) showed significant impairments in the ATL group compared to the dlPFC and dmPFC group on measures of delayed word recall on the CVLT-II; and significant impairment in the dlPFC group relative to the dmPFC and ATL group on measures of auditory/verbal attention on DS.

Conclusions: Results demonstrate a double dissociation between impaired attention with intact retention in the dlPFC group and impaired retention with intact attention in the ATL group. Additionally, there was an effect of lesion side with left, but not right, side lesions contributing to performance deficits in both the ATL and dlPFC groups. Results provide information about the critical role that focal brain lesions play in differential components of auditory/verbal attention and memory and can inform targeted cognitive remediation strategies.

Correspondence: *Sandra Lackovic, Psychology, New York University, 6 Washington Place, New York, NY 10003. E-mail: slackovic@gmail.com*

G.C. LOEHAUGEN, K.J. BJULAND & J.S. SKRANES. Relationship between hippocampal volume and memory functions in VLBW young adults.

Objective: Reductions in hippocampal volume have been related to working memory problems in VLBW toddlers (Beauchamp, 2008) and reduced cognitive ability in VLBW adolescents (de Kieviet, 2012). The relationship between episodic memory and hippocampal volume has only been described in a small sample of preterm children (n=9) (Isaacs, 2000). The aim of study was to investigate the relationship between hippocampal volume and episodic memory in VLBW young adults compared to term born controls.

Participants and Methods: In this hospital based long-term follow-up study, 42 non-disabled VLBW (birth weight \leq 1500 grams) and 61 age-matched controls were examined at age 19 with WAIS-III, Wechsler Memory Scale-III and cerebral MRI. An automated MRI technique at 1.5 Tesla for morphometric analysis of hippocampal volumes was applied. General Linear model was used to compare relative hippocampal volumes between groups with gender and age as covariates.

Results: All participants had IQ within normal range (VLBW: 72-110; Controls: 80-127), and there were no difference in socio-economic status between groups. The VLBW young adults scored significantly lower than controls on tasks assessing visual immediate and delayed memory, general memory and working memory, but the reductions were not significant on auditory memory tasks. The VLBW group had lower absolute and relative hippocampal volumes than controls. Within the VLBW group, positive correlations were especially found between right hippocampal volume and visual, long-term general memory and working memory test results, and between left hippocampal volume and auditory memory tasks.

Conclusions: The absolute and relative hippocampal volumes were reduced in non-disabled VLBW young adults, indicating perinatal brain injury. A relationship was found between these volume reductions and lower memory scores in VLBW subjects with normal IQ.

Correspondence: *Gro C. Loehaugen, Phd, Child rehabilitation, Sorlandet Hospital, Sykehusveien, Arendal 4801, Norway. E-mail: gro.c.loehaugen@ntnu.no*

M.R. MEAGER, G.P. LEE & W.T. BLESSING. Do Patients with Frontal Lobe Memory Disorders Benefit More from Cueing than Patients with Temporal Lobe Memory Disorders?

Objective: Patients with frontal lobe/diencephalic (FL) memory disorders reportedly show poor organization during encoding, and haphazard retrieval during recall, among other deficits. This has entered the neuropsychology clinical lore as an assumption that FLs will benefit from cueing during delayed recall while TLs will not. Despite this widely held clinical view, there have been few studies directly testing it.

Participants and Methods: 103 (48 male, 55 female) patients with memory disorders (delayed recall < 5th %ile) on the California Verbal Learning Test-II (CVLT) or WMS-III Logical Memory (LM) subtest were classified into either a FL/diencephalic or TL memory disorder group. FLs included patients with focal frontal lesions (tumors, strokes, epilepsy), Korsakoff's syndrome, Lewy body dementia, and FTD-frontal variant. TLs included patients with TL epilepsy, tumors, FTD-temporal variant, and temporal lobectomies. There were no significant differences in the demographic composition of groups.

Results: Using T scores, there were no significant group differences in severity of the memory disorder (CVLT-delay: $p = .96$; LM-II: $p = .13$), recognition memory performance (CVLT-Rec: $p = .41$; LM-Rec: $p = .99$), or number of false positive errors on the CVLT ($p = .09$). To correct for guessing, one-half the false positives were subtracted from recognition hits, and again, there were no differences between groups (Corrected hits: FLs = 7.76, TLs = 7.68, $p = .45$). Finally using corrected CVLT recognition scores, patients were classified as either improved with cueing (CVLT > 8) or as showing no change with cueing, and 34% of FLs, and 48% of TLs, improved with cueing ($\chi^2 = 1.47$, $p = .22$).

Conclusions: Results suggest the assessment practice of using the "benefit from cueing" sign during recognition memory testing as an indicator of a frontal/diencephalic memory disorder is not acceptable. Patients with hippocampal and frontal/diencephalic memory disorders both regularly benefit from cueing.

Correspondence: *Michael R. Meager, PsyD, Neurology, Medical College of Georgia / Georgia Health Science University, 1120 15 th Street, Department of Neurology BI 1016, Augusta, GA 30912. E-mail: mmeager@georgiahealth.edu*

R.N. BAEK, S.A. MARGOLIS, L. NAKHUTINA & J.S. GONZALEZ. The Relationship between Memory Complaints, Diabetes Knowledge, and Treatment Adherence in Predominantly Ethnic Minority Adults with Type-2 Diabetes Mellitus.

Objective: Self-management is important to prevent poor health outcomes in Type-2 Diabetes Mellitus (T2DM). Yet, adherence is suboptimal in many patients. This study examined the relationship between memory complaints, diabetes knowledge, and treatment adherence in adults with T2DM (n=107, M age=56, SD=8.9; 68% female; 58% Black; 22% Hispanic).

Participants and Methods: Measures included the Prospective and Retrospective Memory Questionnaire (PRMQ), Diabetes Self-Care Inventory (SCI), Diabetes Knowledge Test (DKT), Morisky Medication Adherence Scale (MMAS), and validated self-ratings of medication adherence. Multiple regression analyses were conducted to examine whether memory complaints were associated with diabetes medication adherence and self-care behaviors. Memory complaints were also evaluated as a moderator of the relationship between diabetes knowledge and treatment adherence. All analyses controlled for age.

Results: Results showed that PRMQ total score was significantly associated with poorer treatment adherence, as indicated by MMAS ($\beta = .35$,

$p < .001$), SCI ($\beta = -.30$, $p = .001$), and self-ratings ($\beta = -.29$, $p = .002$; $\beta = -.31$, $p = .001$). Findings were consistent for both Retrospective Memory (MMAS: $\beta = .37$, $p < .001$; SCI: $\beta = -.27$, $p = .004$; Self-ratings: $\beta = -.27$, $p = .004$; $\beta = -.26$, $p = .006$) and Prospective Memory (MMAS: $\beta = .30$, $p = .002$; SCI: $\beta = -.30$, $p = .001$; Self-ratings: $\beta = -.29$, $p = .003$; $\beta = -.32$, $p = .001$). In contrast, diabetes knowledge was not associated with any measure of treatment adherence; no evidence of moderation by memory complaints was found.

Conclusions: Findings suggest that patients' subjective experience of memory problems is important for diabetes self-management. Given these findings, more attention should be paid to the influence of memory on self-management behaviors. Ethnic minorities, who are at risk for poor diabetes health outcomes, may especially benefit from evaluation and intervention for memory problems.

Correspondence: *Rachel N. Baek, M.S., Ferkauf Graduate School of Psychology, Yeshiva University, 1165 Morris Park Ave, Bronx, NY 10461. E-mail: nahyeon.baek@gmail.com*

D. LI & B. PYYKKONEN. The Efficacy of Memory Training Programs Among Non-Demented Elderly Adults: a Meta-Analysis of Prospective, Longitudinal Studies.

Objective: The efficacy of memory training has been repeatedly examined in a number of populations (e.g., TBI, stroke, and schizophrenia). However, Glisky, et al (1999) report a relative dearth of studies examining these interventions in the non-demented elderly. Within the existing literature, reports on the efficacy of memory training in the elderly are mixed (Fairchild, 2010). The current meta-analytic study examines the literature assessing memory intervention in non-demented elderly participants published from 1998-2012.

Participants and Methods: The following terms were queried in academic search engines: cognitive rehabilitation, memory enhancement, memory intervention, and memory treatment effectiveness. Studies were selected using the following inclusion criteria: (a) prospective design, (b) pre- and post-treatment procedures, (c) use of reliable/valid measures of memory, (d) presence of memory training, (e) assessing non-demented individuals ages >49 years, and (f) appropriate reporting of data including mean and standard deviation. 10 studies met criteria.

Results: If effect sizes were not provided in the original study, individual effect sizes (Hedges' G) were calculated for change in memory performance from baseline to follow-up. Individual study effect sizes were weighted by sample size. The average weighted effects size was small (Hedge's $g = 0.12$), suggesting limited improvement. The time from baseline to follow-up varied from 4 to 14 weeks.

Conclusions: The current meta-analytic review suggests that there is slight improvement in memory performance on formal measure in elderly participants receiving memory training. The reasons for this limited improvement are unclear as the potential benefit of exposure to the memory paradigm or direct practice effects cannot be excluded. Although a number of studies employed appropriate controls, this practice was not universal. Additional research designed to control for practice effects is warranted.

Correspondence: *Benjamin Pyykkonen, PhD, Wheaton College, 501 College Avenue, Wheaton, IL 60187. E-mail: ben.pyykkonen@wheaton.edu*

J. SALVADOR CRUZ, I. NEVAREZ DELGADO, C. AGUILLÓN SOLÍS, F.A. HERNÁNDEZ ORTIZ, D.A. ORTIZ ROMO, F. GORDILLO LEÓN & L. MESTAS HERNÁNDEZ. Neuropsychological Development of Attention and Semantic Memory in Elementary School Children.

Objective: Attention and semantic memory are necessary for learning of all cognitive, academic and everyday life activities. The objective of this study was to analyze the development of attention and semantic memory in school children.

Participants and Methods: We attended to 7 schools from México City and its suburbs; 200 students were selected (60% women and 40% men), children aged from 4 to 8 who did not present neurological and/or psy-

chiatric history, and were enrolled in elementary education. Participants were applied the following measuring instruments in the following order: Neurological and/or psychiatric Background Questionnaire (Galindo and Salvador, 1996) Complutense Children Spain Verbal Learning Test (TAVECI) (Benedet et al., 2001) and Five Digit Test (Sedo, 2007).

Results: The statistical analysis showed that the use of semantic strategies is directly proportional to the number of correct items in TAVECI ($\beta = .821$, $p = .01$) and hits in Five Digit ($\beta = 0.337$, $p = .01$); and inversely proportional to the time of execution of Five Digit ($\beta = -.512$, $p = .01$).

Conclusions: The record that participants performed was in immediate and literally form, while the level of storage and use of semantic strategies increased with age, the frequency of perseverations and intrusions, decreased. This points the active role of two processes: the flexibility of thought and working memory. Essential processes in academic and personal infant's development. Thanks to the National Autonomous University of Mexico for its financial support through project IN308711 PAPIIT for this investigation.

Correspondence: *Judith Salvador Cruz, FES Zaragoza UNAM, Batalla 5 de Mayo s/n Esq. Fuerte de Loreto. Col. Ejército de Orient, México 09230, Mexico. E-mail: salvadcj@gmail.com*

A. TOLEDO & J.B. HERNÁNDEZ. Modularity vs. Non-modularity of Working Memory for Musical Srimuli: A Systematic Review.

Objective: Systematically review the research supporting the modular or non-modular structure of working memory in music cognition.

Participants and Methods: A search of articles published between 1970 and 2011 on Google Scholar, using the following key entries: memory music cognition, music cognition working memory, short term memory music, memory amusia. We selected 18 articles whose title suggested to be linked with the issue directly (WM as an object of study) or approximate (memory generally related to amusia memory, attention).

Results: The articles reviewed were grouped according to their objectives and methods in studies of brain architecture and performance studies in behavioral tasks.

Conclusions: In the last three decades, neuropsychological research on music cognition has increased. Several of these studies, directly or indirectly, aim to clarify the role of working memory in the processing of musical stimuli. As for the relationships between music and the brain in general, there are two fundamental approaches to understand the involvement of working memory: the non-modular paradigm, which understands it as a part of a central executive system that guides and maintains general attention to all kinds of stimuli, including the musical ones, and the modular approach that defines working memory as a specialized sub-module within the processing of music, with its own characteristics of functionality and differentiated brain networks. Several cognitive as well as neuroimaging studies are reviewed in this work, finding that the differences between the conclusions of each of the approaches might reside merely on the methodology applied, and that neuroimaging studies tend to have more homogenous results, thus giving support to the notion of working memory as a non-specialized system for the processing of music.

Correspondence: *Jonathan B. Hernández, Master, UNAM, zaragoza, Mexico city 67129, Mexico. E-mail: j.hernandez.unam@hotmail.com*

M. TSUTSUI, M. NOTOYA, N. SUNAHARA, T. FUJITA, K. NAKATANI & K. HASHIMOTO. Development of a modified version of the visual memory test, using Rey-Osterrith Complex Figures.

Objective: The Rey-Osterrith Complex Figure (ROCF) test is frequently used as a method for neuropsychological assessment. However, some elderly people feel stressed while undergoing the test. We are developing a modified version of the ROCF test that allows the elderly to undergo examinations without feeling stressed. As part of the development of the Japanese version of a modified ROCF test, a study involving young, healthy people was conducted, in which they underwent the normal ROCF test and a modified version (they memorized the shape of a figure by tracing its outline), and their scores were compared.

Participants and Methods: Subjects were students who agreed to participate in the experiment. The mean age was 21.8 years. Two (replication/trace) groups consisted of 20 students each. The students performed the following task: they were asked to replicate or trace ROCF, and reproduce them in three minutes and at three days.

Results: The students had no difficulty in both replicating and tracing figures. When the students reproduced the figures, the scores for the replication group were markedly higher, compared to the trace group ($p < 0.05$): the mean score in the replication group was 33.2 (SD=2.4) and that in the trace group was 27.8 (SD=4.3). There were no differences in the scores for 3-days-later reproduction. Regarding the replication group, there were marked differences between the scores for 3-days- and 3-months-later reproduction ($p < 0.05$), whereas there were no significant differences between both scores in the trace group.

Conclusions: Although the scores received by the students of the trace group were significantly lower, compared to the replication group, when they reproduced the figures three minutes after the completion of the task, there were no marked differences between the two groups on Day 3. This suggested that the modified ROCF test is effective for rehabilitation implemented for the elderly and people with mild cognitive impairment.

Correspondence: *Makana Tsutsui, Occupational therapist, Kanazawa University Graduate School, 5-11-80, Kodatsuno, Kanazawa 920-0942, Japan. E-mail: t.makana@stu.kanazawa-u.ac.jp*

N. WISDOM, J. MIGNOGNA, L. AVERILL, B. MILLER, D. PROTO & R.L. COLLINS. Normal aging and verbal memory: A comparison of tests.

Objective: Normal aging is associated with a steady decline in raw mean scores as measured by the Wechsler Memory Scale (WMS-III), California Verbal Learning Test (CVLT-II), Hopkins Verbal Learning Test (HVLTR), and Rey Auditory Verbal Learning Test (RAVLT). However, the magnitude of raw score change and variability between these tests remains unknown. The purpose of the present study is to compare and contrast the patterns of raw score change and associated variability on each of these tests across age groupings.

Participants and Methods: Raw subtest means and standard deviations (SD) for all age groups within each test were tabulated from their respective manuals along with the coefficient of variation (CV), a measure of score dispersion that is the ratio of the SD to the mean. The CV further informs the magnitude of variability represented by each standard deviation and allows for more meaningful comparisons both within and between populations.

Results: Immediate recall mean scores within each test decline, on average, about 40% when comparing the youngest to the oldest age groups. The HVLTR demonstrated the smallest mean score decline over time (21%) although this is likely the result of a ceiling effect in the younger age groups. Percentage increases in the CV with aging suggest the CVLT-II has the least amount of intragroup variability within its normative sample. Delayed recall mean scores within each test decline about 50% with normal aging with the exception of the HVLTR (20%) given the aforementioned reasons. Intragroup variability increases more than 150% with age for each test except the CVLT-II which only increases 51% for women and 103% for men

Conclusions: Mean score declines of 40-50% on measures of immediate and delayed recall are to be expected with normal aging. However, this narrow understanding ignores the observation that increases in age necessarily result in increasing heterogeneity between age groups, as represented by the CV, and memory does not decline uniformly for everyone.

Correspondence: *Nick Wisdom, Ph.D., Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd, Houston, TX 77030. E-mail: nickandjen@gmail.com*

A. YU, M.E. GOMEZ, D.R. CARR, K.J. MILLER, S.D. MARION, K. THOMAS & M.G. HARRINGTON. Verbal and visuospatial measures of working memory most associated with cognitive impairment in older adults.

Objective: Research has presented varied definitions of working memory (Engle, 2002; Kane, Bleckley, Conway & Engle, 2001). Cowan et

al. (2005) notes differences between correlations of more 'routine' measures of working memory, measured by tasks which allow for rehearsal or grouping, and correlations of more 'attention-demanding' measures of working memory, such as tasks which disallow for rehearsal or grouping, with cognitive aptitude. As such, the current study examined several measures of working memory to determine which are more sensitive to cognitive impairment. We examined the internal consistency of working memory measures and their ability to predict cognitive decline in older adults.

Participants and Methods: We examined a group of 95 participants (mean age = 77.61; SD = 6.61), including a cognitively healthy (CH, N = 34) group, and a group with Mild Cognitive Impairment (MCI, N = 61); no significant differences were found on age, gender or education. Both groups were compared on the following measures of working memory: WAIS-III Digit Span (DS), Arithmetic (AR), Letter-Number Sequencing (LN), and the Brief Visuospatial Memory Test-Revised (BVMTR).

Results: All measures of working memory were significantly correlated with each other, with p-values ranging from 0.000 to 0.044. Results from the WAIS-III LN and AR measures were the most highly correlated with each other, ($r(94) = 0.57$). Additionally, significant group differences were observed in a MANOVA, Wilks' Lambda $\lambda = 0.70$, $F(1, 92) = 9.50$, $p = 0.000$. In each pairwise comparison, the most significant differences between CH and MCI were with the AR and BVMTR, with mean differences in scores of 0.69 and 0.79, respectively; MCI performing worse than CH.

Conclusions: Our results indicate that one verbal and one visuospatial working memory measure were most sensitive in detecting differences between MCI and CH. This suggests that screening batteries for MCI include AR and BVMTR when assessing for possible cognitive decline.

Correspondence: *Anna Yu, M.A., Huntington Medical Research Institute, 99 North El Molino, Pasadena, CA 91101. E-mail: annamariyu1@gmail.com*

S. RASKIN, M. ZAMROZIEWICZ, S. ISAAC, D. CORRELL, R. ROSEN, H. TENNEN, C. AUSTAD, C. FALLAHI, R. WOOD & G. PEARLSON. Effects of Drinking Patterns on Prospective Memory Performance in College Students.

Objective: Alcohol consumption in college students is of interest due to interactions between alcohol and the developing brain and this is an important age for the development of prospective memory (PM).

Participants and Methods: Thirty-one first-year college students completed the Self-Rating Effects of Alcohol (SREA), Modified Timeline Follow-back (TLFB), and Alcohol Effects Questionnaire (AEQ) and two measures of PM. The time-based PM measure required students to record the current survey question at exactly fifteen minutes during a survey questionnaire. The event-based PM measure required students to present a cash voucher when finished with a series of computerized cognitive tasks. Both measures were scored as 0 if no recognition of the task was given or if the task was partially completed or completed late, and 1 if the task was correct. The ongoing task was an online survey about drinking behavior and the JAvA Neuropsychological Test (JANET). At the end of the testing session, participants answered a retrospective recognition questionnaire of the PM tasks. Binge drinking was defined as consuming 5 or more drinks (male), or 4 or more drinks (female), in ~ 2 hours.

Results: Surprisingly, students performed significantly better on the time-based (mean = 0.81, s.d.=0.40) than on the event-based measure (mean=0.71, s.d.= 0.46) of prospective memory. Those who had consumed alcohol in the last 30 days performed better on the event-based measure (mean=1.00, s.d.=0.00) than teetotalers (mean=0.50, s.d.=0.53). Those who binge drank in the last 30 days performed better on the event-based measure (mean=1.00, s.d.=0.00) but worse on the time-based measure (mean=0.500, s.d.=0.55) than those who hadn't binged in the last 30 days (event-based mean=0.62, s.d.=0.51; time-based mean=0.85, s.d.=0.38).

Conclusions: These data are consistent with some previous studies but do not match predictions. The sample size is small, thus further testing of a larger proportion of the college population may yield data with more revealing trends.

Correspondence: *Marta Zamroziewicz, Trinity College, 300 Summit St, Hartford, CT 06106. E-mail: marta.zamroziewicz@trincoll.edu*

Cognitive Intervention/Rehabilitation

G. BIDELMAN, S. MORENO, Y. LEE, A. MOUSSARD & C. ALAIN. Enhanced Pre-attentive Auditory Processing Following Short-term Musical Training in Older Adults.

Objective: Psychophysiological studies demonstrate that long-term music experience acts to refine brain-behavioral mechanisms and provide robust enhancements to auditory function. The hearing advantages gained during musicianship afford the possibility that music training might serve as an effective remediation and/or training tool to strengthen declining listening abilities later in life. Yet, to date, studies documenting music-induced auditory benefits have been restricted almost entirely to examinations of young adults with decades of music experience. Here, we aimed to determine whether or not short-term music training could positively influence auditory processing in older listeners.

Participants and Methods: Older adults (age range: 58–82 years) matched in age, education, and IQ assigned to either a music or a visual art (i.e., active control) training group. Each cohort received classroom instruction in their respective activity by a professional teacher over a period of three months. Pre-attentive auditory processing was assessed before and after training using two oddball sequences consisting of a either music or speech sound contrast.

Results: Relative to controls, music students showed increased mismatch negativity (MMN) which peaked with shorter latency when evoked by musical stimuli suggesting that short-term music training enhances the automatic differentiation of trained auditory sounds. In response to speech contrasts, decreased MMN activity was observed but only in the music group which may indicate a down regulation in underlying neural mechanisms when processing auditory information not practiced during the course of training.

Conclusions: Results demonstrate that experience-dependent auditory plasticity can persist late into life and that intense-short term music training may offer a viable way to improve listening abilities in older adults.

Correspondence: *Yunjo Lee, PhD, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: ylee@research.baycrest.org*

Y. LEE, M. JANUS, E. BIALYSTOK & S. MORENO. Music and Language Short-term Training Reveal Brain Plasticity in Early Childhood.

Objective: Few training studies have qualified neural mechanisms of near and far transfer at the electrophysiological level. It has been shown that training such as music improves verbal skills and bilingualism enhances nonverbal cognitive processing compared to controls. Such outcomes allow us to explore differences between far and near transfer. We tested the outcomes of music vs second-language learning to determine whether training can change sound processing and whether this change is domain-specific.

Participants and Methods: We used an intervention design with 36 English-speaking children, 4–6 year old, with no prior training. Groups were equated on age, IQ score and maternal education and received computer-based music or French language training for one month. We measured ERP of the odd-ball task while children were passively listening to music notes (A, A#) or French vowels (u, ou). This design allowed us to dissociate near or far transfer following different types of training.

Results: After training, both groups showed near and far transfer across the music and vowel tasks, with the nature of effect depending on the type of training. Both groups showed enhanced mismatch response

(MMR) in their trained task (note–Music; vowel–French) and reduced MMR in the untrained task. Increased MMR for the trained task accompanied by reduced MMR for the untrained task might reflect better processing of the relevant (trained) sound as a result of training while filtering out the irrelevant (untrained) sound.

Conclusions: These results show that a short period of music and second language training induced domain-specific and domain-general brain plasticity of sound processing with electrophysiological variations. Correspondence: *Yunjo Lee, PhD, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: ylee@research.baycrest.org*

C.Z. BURTON & E.W. TWAMLEY. Neurocognitive Insight, Cognition, and Treatment Utilization in Individuals with Schizophrenia.

Objective: Cognitive deficits and functional disability are core features of schizophrenia. Neurocognitive insight (awareness of cognitive deficit) may affect participation in and benefit from cognitive interventions. This study examined the relationship of neurocognitive insight to cognition, functioning, and treatment utilization in outpatients with schizophrenia-spectrum disorders.

Participants and Methods: Sixty-nine outpatients participated in a trial of Compensatory Cognitive Training, a 12-week manualized intervention emphasizing strategy training in prospective memory, attention, learning/memory, and executive functioning. Only those who demonstrated cognitive impairment at baseline (n=43) were included in the analyses. The discrepancy between objective cognitive performance and self-reported frequency of cognitive problems was used to estimate neurocognitive insight.

Results: Among those with cognitive impairment, cognitive performance and self-reported cognitive problems were not related. Participants endorsing frequent cognitive problems were rated as having “intact” neurocognitive insight (n=13); those reporting few cognitive problems despite objective impairment were rated as having “impaired” neurocognitive insight (n=11). Those with impaired neurocognitive insight reported fewer depressive symptoms and performed better on verbal memory and functional assessments. However, in a multivariate model, only depressive symptom severity was associated with neurocognitive insight. Baseline neurocognitive insight was not related to treatment attendance, cognitive strategy use at follow-up, or satisfaction with the intervention.

Conclusions: Individuals with schizophrenia who show objective cognitive impairment vary widely in their self-report of such deficits, and those with higher levels of depressive symptoms appear to have more awareness of their cognitive deficits. Awareness of cognitive impairment may not affect treatment adherence, at least in a treatment-seeking sample.

Correspondence: *Cynthia Z. Burton, SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 140 Arbor Drive, San Diego, CA 92103. E-mail: czburton@ucsd.edu*

M. CASTRO, J. FIELDS, M. YUTSIS & G. SMITH. Procedural and Declarative Memory Differences in Mild Cognitive Impairment.

Objective: We have previously found procedural memory, as measured by mirror tracing (MT), to be impaired in Alzheimer’s Disease (AD) yet preserved in Mild Cognitive Impairment (MCI; Yutis, et al 2012). Thus procedural memory may prove useful in memory compensation strategies for MCI. Here, we further examine procedural memory processes in MCI using a novel mirror-reading (MR) paradigm. We hypothesize that, like MT, MR skills will remain preserved in MCI.

Participants and Methods: Participants with MCI (n=12) and control participants (CTL, n=10) were recruited from the Mayo HABIT program for MCI. Average age was 70 (SD=8) for CTL and 73 (SD=7) for MCI. Groups did not differ in terms of education attained (CTL=16.08, MCI=16.7 years) or MMSE scores (CTL=28, MCI=27). We administered tests of declarative (DRS-2, AVLT) and procedural memory (MT, MR). On the MR task, subjects learned to read pseudo-words as if presented in a mirror and were subsequently tested for procedural learning and repetition priming effects.

Results: MCI subjects performed worse than CTLs on declarative memory measures (DRS-2 Memory: $t(20)=4.38$, $p<.001$ and AVLT Delayed Recall: $t(20)=4.93$, $p<.001$). In contrast, the MCI group performed equivalent to CTL on both the MT, $t(20)=-1.04$, $p=.31$, and MR tasks, $t(20)=.66$, $p=.52$). On the MR task, a one way repeated measure ANOVA revealed all subjects improved in reading speed over time, Wilks' $\Lambda=.66$, $F(3,19)=3.26$, $p=.04$, multivariate $\eta^2=.34$. Furthermore, the skill generalized to novel stimuli with no reduction in speed, $t(21)=-.24$, $p=.82$; suggesting our results can be attributed to a procedural learning effect alone independent of repetition priming.

Conclusions: Our findings indicate that procedural memory remains intact independent of declarative memory decline in MCI. Whereas individuals with MCI benefit from procedural learning similar to elderly CTLs, perceptual priming does not confer any additional advantage. These findings have important implications for cognitive based interventions for MCI and early AD.

Correspondence: *Melissa Castro, PsyD, Psychiatry & Psychology, Mayo Clinic, 2416 Crystal Bay Court SW, Rochester, MN 55902. E-mail: castro.couch@gmail.com*

M. CHERRIER, C. HIGANO, H. GRAY, K. ANDERSON & D. DAVID. Effectiveness of a Group-Based Intervention of Cognitive Rehabilitation in Cancer Survivors.

Objective: The second most frequently reported post-treatment symptom in cancer survivors is concerns about impaired cognition. These residual symptoms of impaired cognition can be severe enough to interfere with basic activities of daily living. Although some studies in brain-injured patients have shown efficacy in cognitive rehabilitation, the effectiveness of various methods of treatment in cancer survivors is a new area of investigation. This study examined the efficacy of a group-based cognitive rehabilitation intervention in cancer survivors.

Participants and Methods: Participants were 8 men and 34 women (median age 67 years), with post primary/adjuvant treatment for breast, bladder, prostate, colon, or uterine cancer. All participants reported cognitive difficulties. Participants were randomized into a treatment group or control group. The treatment consisted of a 7-week cognitive rehabilitation intervention delivered in group format. Participants were evaluated with questionnaires and a comprehensive neurocognitive battery before and after treatment.

Results: Compared to baseline, cancer survivors in the treatment group demonstrated improvement in their perceived cognitive impairments ($p < .01$), abilities ($p < .01$) and quality of life with regard to cognitive symptoms ($p < .01$). The treatment group also demonstrated improvement on objective measures of cognition, including a working memory attention task ($p < .05$), and showed a trend toward improvement on verbal memory. The control group showed no change compared to baseline.

Conclusions: A group-based cognitive rehabilitation intervention was shown to improve memory and attention abilities as well as overall quality of life related to cognition in cancer survivors. In addition, the intervention improved confidence and ability to solve everyday memory and cognitive difficulties. Overall, these results suggest that group-based cognitive rehabilitation may be an effective intervention for treating cognitive dysfunction in cancer patients and should be further studied.

Correspondence: *Monique Cherrier, University of Washington, University of Washington, Box 358280, Seattle, WA 98108. E-mail: cherrier@u.washington.edu*

W.T. JOHNSON, A.M. HERGES, K.L. HUSK, R. PERUMPARA-ICHALLAI, S.M. MYLES & P.S. KLONOFF. The Relationship of Neurocognitive Functioning to Driving Status Following Holistic Neurorehabilitation.

Objective: To explore how neuropsychological tests relate to driving status following holistic neurorehabilitation in patients with brain injury.

Participants and Methods: 115 (65 male) patients with acquired brain injury (traumatic brain injury, cerebrovascular disorders, tumor, anoxic brain injury, and neuroinfectious disorders) from a holistic neuroreha-

bilitation program. The mean age at admission was 36.9 years ($SD = 13.6$) and the mean level of education was 14.4 years ($SD = 2.5$). The duration of treatment ranged from two to 29 months ($M = 10.2$; $S.D = 4.8$). Neuropsychological testing was administered twice; at admission and prior to discharge. All patients in the sample were not driving at admission. Fifty four percent of the patients returned to driving successfully; 46% did not return to driving at the time of discharge. Scores on measures of verbal memory (CVLT-II Short [SDFR] and Long Delay [LDFR] Free Recall), visual memory (Rey Complex Figure Test Delayed Copy), visuoconstruction (Rey Complex Figure Copy) and executive functioning (Wisconsin Card Sort Test [WCST] – Perseverative Errors; Category Test – Total Errors; and COWAT) at admission and discharge neuropsychological evaluations were subjected to statistical analyses.

Results: A paired t-test between the admission and discharge evaluations revealed significant improvements from admission to discharge on all measures. On a repeated measures ANOVA, the patients who returned to driving successfully performed significantly better than those who did not return to driving on verbal SDFR ($p = 0.001$), verbal LDFR ($p = 0.002$), visual memory ($p = 0.001$), visuoconstruction ($p < .001$), and one measure of executive function (Category Test, $p = 0.024$).

Conclusions: Although both groups made significant improvements on the discharge evaluation, the patients who returned to driving demonstrated significantly greater improvements in cognitive functioning than those who did not across the aforementioned measures.

Correspondence: *William T. Johnson, Ph.D., Center for Transitional NeuroRehabilitation, Barrow Neurological Institute, 222 West Thomas Rd., Ste 401, Phoenix, AZ 85013. E-mail: wtjohnsua@barrowneuro.com*

N. OJEDA, E. BENGOTXEA, J. PEÑA, A. GARCÍA, P. SANCHEZ, E. ELIZACARATE, M. GUTIERREZ, I. EGUILUZ & R. SEGARRA. First Episode Psychosis and Chronic Schizophrenia show a similar pattern of improvement after cognitive rehabilitation with REHACOP.

Objective: The efficacy of cognitive remediation in psychosis has been proven by many studies in last years. Last meta-analysis suggested that cognitive remediation shows efficacy in all patients (Wykes, T. 2011), although age and symptomatology may moderate its efficacy (McGurk, S. 2007). The aim of this study was to compare the differences in clinical, cognitive and functional improvements between patients with First Episode Psychosis (FEP) and Chronic Schizophrenia (CS) that received cognitive rehabilitation with REHACOP.

Participants and Methods: Twenty-six CS patients and twenty-two with FEP were recruited. During three months they learnt cognitive strategies and were encouraged to transfer their knowledge by homework or daily life activities. All patients received clinical and pharmacological treatment as usual and underwent pre and post treatment assessment in clinical, functional and neuropsychological variables.

Results: FEP and CS patients differed in years of education, promorbidity adjustment and sex. Therefore, further analyses included these variables as covariates. Repeated measures of MANCOVA showed that patients attending REHACOP improved in most of clinical, cognitive and functional outcome domains. Group (FEP vs. CS) x Time (pre vs. post-treatment) interactions showed that there were not significant differences between both groups in clinical, cognitive and functional outcome improvements. However, FEP patients improved significantly more than CS group in Clinical Global Impression ($F=5.11$, $p=0.029$).

Conclusions: Results suggest that the improvement obtained in clinical, cognitive and the most of functional outcome scales did not significantly differ between groups. This study supports the efficacy of REHACOP in the intervention of patients with schizophrenia, despite their severity.

Correspondence: *Javier Peña, University of Deusto, Av Universidades 24, Bilbao 48007, Spain. E-mail: javier.pena@deusto.es*

A. PRITCHETT, G. LOHAUGEN, J. SKRANES, E. FUKAYA, A. HER-NANDEZ, J. HOLT, T. ERNST & L. CHANG. Computerized Working Memory Training in Stimulant Exposed Children.

Objective: Children prenatally exposed to stimulants (methamphetamine and/or nicotine) in utero are at an increased risk for developing attention, executive function and other cognitive problems. The efficacy of a working memory (WM) training program's ability to improve cognitive function in drug exposed children has never been assessed.

Participants and Methods: 9 stimulant exposed children (age 6-10, 4 girls+5 boys) completed Cogmed Robomemo, a computerized training program (25 sessions over 5-8 weeks). Each session includes 8 modules (15 trials in each) targeting different types of WM. Testing was conducted before starting training and within 1 month after completion and included stories, spatial span, and wordlists from the Children's Memory Scale and letter-number sequencing and digit span from the Wechsler Intelligence Scale for Children IV. At each visit the child's primary guardian completed the Du Paul ADHD Rating Scale IV Home and the Personality Inventory for Children (PIC-2).

Results: All children improved with an Index of Improvement ranging from 17-29. Using single tailed paired T-tests, significant improvements ($P < 0.05$) from baseline to follow up were seen in the letter-number sequencing, digit span and spatial span ($P < 0.0001$). Word list delayed recognition showed a trend towards significance ($P = 0.08$). At baseline several PIC-2 scores were elevated in the clinical range and at follow up "Cognitive Impairment" was significantly lower ($P = 0.01$).

Conclusions: Children with prenatal stimulant exposure showed improved WM after Cogmed RM training. The largest improvements were on non-trained WM tasks that were similar to the training games. Whether the WM training improvements are generalized to other cognitive tasks remains unclear due to the high variability between participants. However, the Cogmed Robomemo program may be an effective intervention to improve cognitive function and hence school performance in stimulant exposed children. Grant Support: 1R01-DA021016; 2K24-DA016170; U54-NS56883; P20-RR011091

Correspondence: *Alexandra Pritchett, B.S., Medicine, University of Hawaii, University of Hawaii Neuroscience and MRI research Group, 1356 Lusitana St 7th fl, Honolulu, HI 96813. E-mail: lexi.pritchett@gmail.com*

S. RASKIN, M. ZAMROZIEWICZ, G. MILLS, D. CORRELL & M. SMITH. Cognitive Remediation of Prospective Memory Deficits after Traumatic Brain Injury.

Objective: Prospective memory impairments continue to be among the greatest impediments to daily life after traumatic brain injury (TBI). The two approaches to remediation that have shown the most promise are visual imagery training and rote repetition training. This project aimed to investigate the efficacy of visual imagery training and rote repetition.

Participants and Methods: Fifty individuals with TBI were included. The study used an AB-BA crossover design with multiple baselines and a healthy adult comparison group at pre and post-testing. A standardized measure of prospective memory and measures of generalization were used. All participants received a battery of neuropsychological measures. Training took place once per week for eight weeks. Participants were instructed in visual imagery techniques. As the individual demonstrated successful performance the time span was then increased by one minute. Prospective tasks were naturalistic ("In five minutes please open the door.")

Results: Individuals with traumatic brain injury demonstrated significant improvements in prospective memory performance and on generalization measures only in the treatment condition. Significant improvements after treatment were demonstrated on measures of executive functioning (Tower of Hanoi; Color-Word Interference; Sorting). The healthy adults did not demonstrate any significant change.

Conclusions: The data suggested improvement on neuropsychological measures, a standardized measure of prospective memory and a generalization measure of prospective memory in daily life using visual imagery and rote repetition. These data lend support to the notion that prospective memory may be one area of cognition that is responsive to restorative intervention approaches.

Correspondence: *Sarah Raskin, Ph.D., Psychology, Trinity College, 300 Summit Street, Hartford, CT 06119. E-mail: sarah.raskin@trincoll.edu*

C. CATROPPA, K. STONE, S. ROSEMA, C. SOO & V. ANDERSON. Preliminary efficacy of an attention and memory intervention post childhood brain injury – case series.

Objective: Impairments in attention and memory have been reported in the long-term post-traumatic brain injury in childhood. Despite the implications of poor attention and memory skills for future development and learning, evidence based interventions for these skills are scarce. International researchers using the Amsterdam Memory and Attention Training for Children (Amat-c) have shown promising results. The aim of this study was to translate the Amat-c into English and then obtain preliminary efficacy of the Amat-c in an Australian population.

Participants and Methods: 2 children (age 13 and 12) with an ABI were identified through audits of presentations to the Royal Children's Hospital Emergency Department. Participants were included if they had a (i) ABI diagnoses, (ii) between the ages of 8-16 years at time of intervention, (iii) minimum of 1 year post-injury/diagnosis, (iv) IQ 70 or above, (v) English speaking, (vi) attention and/or memory difficulty. The training consisted of 18 weeks, where the child and parent met with the therapist weekly and then completed homework based on the session for the remainder of the week.

Results: Pre-, post-, and 6 months post intervention assessment results were analysed for both children. Post intervention both children presented with significant improvements in attention and memory, with gains maintained to 6 months post-injury.

Conclusions: Preliminary results suggest potential benefits for children with attention and memory problems. Interestingly the intervention seemed to have a positive influence on behaviour as well.

Correspondence: *Stefanie Rosema, M.Sc, Murdoch Childrens Research Institute, 16 David St, Carlton, TAS 3053, Australia. E-mail: stefanie.rosema@mcri.edu.au*

C. SETER, T. GIOVANNETTI & D. OTTEMILLER. Does Planning Improve Performance on Everyday Tasks?

Objective: Although planning training is utilized in cognitive rehabilitation programs, the role of planning in everyday task execution is unclear. We examined the extent to which plans are assembled prior to task execution, and whether and how planning facilitates or impedes everyday action performance in a healthy sample.

Participants and Methods: 92 participants (47.8% male; $M_{age} = 21.80$ years) completed the 2x3 Multi-Level Action Test (MLAT) a performance-based measure of everyday action, and rated task familiarity and frequency. Planning Time and Plan Quality were scored for participants who chose to verbally plan before initiating the tasks. Planning during the tasks (online planning behaviors) and MLAT performance (total errors, completion time) were also scored.

Results: 45 participants planned before initiating the everyday tasks. There was no significant difference between Planners and Non-Planners in total errors, completion time, nor in online planning behaviors. Non-Planners reported engaging in the everyday tasks less frequently than Planners ($t(90) = 2.03, p = .046$); both groups reported the tasks to be equally familiar. Among the Planners, planning time and the quality of plans were significantly related ($r = .60, p < .01$). All other relations between planning, task performance, and task familiarity/frequency variables were weak and non-significant.

Conclusions: Although participants did not benefit from planning, half the sample planned before initiating the tasks. Non-planners reported greater frequency with engaging in the tasks, indicating the possibility that Planners compensated for task knowledge by planning. Although results are contrary to prior studies (Seter et al., 2011), this is the first study to our knowledge to directly and reliably assess both plan formulation and planning behaviors during the performance of everyday tasks. This method holds promise for improving the ecological and face validity of planning assessments.

Correspondence: Colette Seter, MA, Psychology, Temple University, 1701 North 13th Street, Weiss Hall- Room S57, Philadelphia, PA 19122. E-mail: tua93506@temple.edu

M. SHIBASAKI. Cognitive Rehabilitation of Response Inhibition Deficit in a Chronic Stroke Patient: A Near-Infrared Spectroscopy Study.

Objective: Disinhibition is a frequent problem in individuals with executive dysfunction; it may negatively influence not only the patients' cognitive performances but also their social activities. In this study, near-infrared spectroscopy (NIRS) and behavioral measurements were performed to evaluate the effectiveness of cognitive rehabilitation of inhibition deficit in a patient with frontal lobe lesions.

Participants and Methods: A 40-year-old right-handed man had chronic severe executive dysfunction due to lesions in both the frontal lobes. A 7-month restorative cognitive rehabilitation consisting of repeated computerized exercises on stimulus-response (S-R) compatibility tasks was conducted to improve his response inhibition process. The target behaviors of the rehabilitation were decreases in error rates and reaction times (RTs) for the tasks. A double-channel NIRS device was used to measure prefrontal activation during the tasks before and after the training and at a 1-month follow-up.

Results: Although the RTs showed no clear quantitative improvement, the error rate markedly reduced after the training, and this effect was maintained at the 1-month follow-up. Further, NIRS revealed qualitative changes in the prefrontal activation pattern after the training. The patient showed greater activation in the right than the left prefrontal region during the S-R incompatible condition after the training and at the follow-up, while he had showed the opposite activation pattern before the training; the former pattern is observed in healthy adults.

Conclusions: Cognitive rehabilitation of inhibition deficit not only improved the patient's behavioral performance but also affected activation in the damaged prefrontal area of his brain, as measured by NIRS. NIRS can be effective for assessing plastic changes in the brain following cognitive rehabilitation intervention.

Correspondence: Mitsuyo Shibasaki, Meisei University, 2-1-1, Hodokubo, Hino, Tokyo 191-8506, Japan. E-mail: mitsuyo@psy.meisei-u.ac.jp

J. SMITH, K.A. NIELSON, P. ANTUONO, J. LYONS, M.D. VERBER, N.C. HANTKE, A.M. BUTTS, R.J. HANSON & E. BROWNING. Effects of an Exercise Intervention on Semantic Memory fMRI Activation in Mild Cognitive Impairment.

Objective: Despite the known neurotrophic and cognitive benefits of exercise in healthy older adults, little is known about the effects of exercise training on brain function in those with early signs of Alzheimer's disease (AD). While exercise has been shown to improve cognitive function in mild cognitive impairment (MCI) patients, it is unknown if exercise training alters functional brain activation during memory retrieval in MCI patients. We compared the effects of a 12-week walking exercise intervention on semantic memory fMRI activation in MCI patients and healthy controls.

Participants and Methods: Seventeen MCI/early AD patients (7 M, 10 F; mean (SD) age 78.7 (7.5 y), education 15.5 (3.0 y)) and 17 healthy controls (3 M, 14 F; mean (SD) age 76.5 (7.2 y), education 16.5 (2.0 y)) participated in a 12-week exercise intervention consisting of supervised treadmill walking (30 min/day, 4 days/wk) at a moderate intensity (60-70% HRR). Before and after the intervention participants completed a famous name discrimination task during fMRI and a neuropsychological battery. Voxel-wise and functional region of interest (fROI) analyses were conducted (famous minus unfamiliar area under the curve) with whole-brain error correction $p < .05$ (individual voxel $p = 0.005$, cluster size 343 μL).

Results: The groups did not differ in sex, age, education, or depression. Twenty-six fROIs were identified. A Group x Time repeated meas-

ures ANOVA showed a significant main effect of Time in 11 regions ($ps = .048$ to $.0001$), reflecting a decrease in activation after the intervention in both groups. The groups differed in 4 regions (patients > controls in 3 fROIs), and significant Group x Time interactions occurred in 4 regions.

Conclusions: These findings suggest exercise training may improve neural efficiency during semantic memory retrieval in MCI patients. Longitudinal clinical trials are required to determine whether walking exercise is effective in MCI to improve or maintain memory performance and reduce or delay conversion to AD.

Correspondence: J. Carson Smith, PhD, Department of Kinesiology, University of Maryland, SPH Bldg 2351, College Park, MD 21114. E-mail: carson@umd.edu

J. STUBBERUD, D. LANGENBAHN, B. LEVINE, J. STANGHELLE & A. SCHANKE. Enhanced Attentional Performance Following Goal Management Training in Individuals With Spina Bifida.

Objective: Despite the documented presence of executive dysfunction (ED) in Spina bifida (SB), no previous research has been directed towards the amelioration of ED amongst SB patients. Goal Management Training (GMT) is a rehabilitation approach that targets disorganized behaviour resulting from ED. The aim of the present study was to determine the feasibility and efficacy of GMT in SB subjects, hypothesizing that GMT would have specific beneficial effects for executive attentional skills, namely attentional control and accuracy.

Participants and Methods: In this randomized controlled trial, 38 SB subjects (58% female, age 32 ± 8 years) with ED complaints were included. Experimental subjects ($n=24$) received 21 hours of GMT, with efficacy of GMT being compared to results of subjects in a wait-list (WL) condition ($n=14$). Treatment compliance determined feasibility. Instruments administered at baseline, post-intervention, and 6 months follow-up, included Conners' Continuous Performance Test II (CPT) and D-KEFS Color-Word Test (CW) as measures of attention.

Results: All GMT subjects completed GMT. Data were analyzed using *T*-tests and a 2 X 3 mixed-design ANOVA. In CPT there was a significant Group X Time interaction for commission errors, $F(2, 33) = 6.98$, $p = .003$, due to a reduction in non-target responses across time for the GMT group, $F(2, 33) = 20.05$, $p = .001$, but not the WL group. Also, there was a main effect on omission errors across time, $F(2, 33) = 3.43$, $p = .044$, apparent only for the GMT group at baseline vs. follow-up, $t(22) = 2.251$, $p = .035$, and indicating less omission errors for the GMT group at follow-up compared to baseline. In CW there was a significant Group X Time interaction for total errors, $F(2, 34) = 3.68$, $p = .036$, due to a decline in total errors across time for the GMT group, but not the WL group.

Conclusions: The results suggest that GMT is feasible for SB patients, and that deficits in the executive aspects of attentional skills can be ameliorated in persons with congenital brain dysfunction.

Correspondence: Jan Stubberud, Sunnaas Rehabilitation Hospital, Bjørnemyrveien 11, Nesoddtangen 1450, Norway. E-mail: jan.stubberud@sunnaas.no

J. STUBBERUD, D. LANGENBAHN, B. LEVINE, J. STANGHELLE & A. SCHANKE. Self-reported Executive Functioning in Daily Life Following Goal Management Training in Patients With Spina Bifida.

Objective: Impairments in executive functioning (EF) have a severe impact on the ability to function independently in everyday life for patients with Spina Bifida (SB). Thus, effective interventions aimed at improving EF in daily life are needed. Goal Management Training (GMT) is a cognitive rehabilitation approach that targets disorganized behaviour resulting from EF deficits. In addition to assessing treatment effects via cognitive testing, they should also be measured in terms of improvement on daily life functioning indicators. The aim of the present study was to determine the efficacy of GMT in subjects with SB, hypothesizing that GMT would reduce dysexecutive problems in daily life.

Participants and Methods: Thirty-eight SB subjects (58% female, age 32 ± 8 years) with EF complaints were included in this randomised controlled trial. Experimental subjects ($n=24$) received 21 hours of GMT, with efficacy of GMT being compared to results of subjects in a wait-list (WL) condition ($n=14$). Assessment of behavioral changes related to executive dysfunction at pre- and post-intervention, and at 6 months follow-up included a self-rating measure of everyday manifestations of executive dysfunction; Dysexecutive Questionnaire (DEX).

Results: Data were analyzed using a 2 X 3 mixed-design ANOVA that treated Group as a between-subjects factor and Session as a within-subjects variable. Preliminary data showed significant GMT-related treatment effects on DEX. There was a significant Group X Session interaction for total score, $F(2, 34) = 7.15, p < .01$, due to a reduction in self-reported everyday indications of executive dysfunction across sessions for the GMT group, $F(2, 34) = 10.14, p < .001$, but not the WL group.

Conclusions: The GMT group significantly improved their performance on a measure pertaining to daily-life executive functioning, lasting at least 6 months post-treatment. These preliminary results suggest that executive difficulties in daily life for individuals with congenital brain dysfunction can be reduced with GMT.

Correspondence: *Jan Stubberud, Sunnaas Rehabilitation Hospital, Bjørnemyrveien 11, Nesoddtangen 1450, Norway. E-mail: jan.stubberud@sunnaas.no*

E.H. TRITTSCHUH & K. FREDRICKSON. Outpatient Memory Skills Training for Older Adult Veterans with PTSD and Cognitive Concerns.

Objective: Aging Veterans are at high risk for cognitive decline that could indicate prodromal dementia; those with PTSD are at even greater risk (Yaffe, et al. 2010). Early identification of these Veterans allows for treatment and monitoring that may help them remain independent in the community for longer and thus reduce societal and individual financial burdens. This VISN-sponsored clinical demonstration project aimed to provide and evaluate a memory skills group tailored for these Veterans with the goal of improvement in self-management of PTSD, monitoring of cognitive changes, and a reduction in the impact these conditions might have on daily living.

Participants and Methods: Participants are Veterans identified through Providers at the VA Puget Sound Health Care System; inclusion criteria of age >50 , a diagnosis of PTSD, and subjective complaints of cognitive change. Ten Veterans participated in the pilot phase of this study and 15 additional are anticipated by the end of 2012. Methods consisted of 8 weekly training group sessions (1.5 hrs each) that were adapted to the needs of these Veterans. Pre- and post-measurements included cognitive screen, as well as questionnaires aimed at identifying quality of life variables, symptom severity, and daily function.

Results: Preliminary analyses of the QA/QI measures indicate significant improvement in Veteran's sense of self-efficacy as well as ratings of improvement in quality of life. In addition, while no significant change was noted in their ratings of PTSD symptoms or severity of cognitive problems, a notable improvement in the degree to which these problems interfered in their daily lives was reported.

Conclusions: A Memory Skills group targeted toward older adult Veterans with PTSD and subjective cognitive complaints improved subjective sense of self-efficacy and management of these conditions. Further research is warranted to determine if such programs provide improved screening and monitoring of these veterans who are at higher than average risk of dementia. Correspondence: *Emily H. Trittschuh, PhD, Psychiatry/GRECC, UW/IAP-SHCS, 1660 S. Columbian Way, S-182-GRECC, Seattle, WA 98108. E-mail: etritt@uw.edu*

T. TSAOUSIDES. Online Group Treatment for Individuals with Traumatic Brain Injury: Preliminary Feasibility Study.

Objective: To assess whether treatment could be delivered simultaneously to a group of individuals with TBI using web-based videoconferencing.

Participants and Methods: Participants included 7 individuals with mild to severe TBI, ranging in age from 26 to 59. Two online treatment groups were formed, with 4 and 3 participants respectively. Participants received 16 biweekly 1-hour sessions of emotional regulation training (EmReg), a CBT-based treatment designed to improve emotional regulation post-TBI. Qualitative and quantitative data were collected to assess feasibility of delivering the treatment online by tracking attendance, participation, interpersonal interaction, homework completion, skill acquisition, generalization, and ease of use of technology.

Results: All 7 participants completed treatment (3 completed 16, 2 completed 15, 1 completed 14 and one completed 13 sessions). Reasons for absences were tracked. Participants were able to join the online meetings easily. Four encountered minor technical difficulties (e.g., malfunctioning webcam, poor audio or video transmission, emails from therapist going to junk mail folder). Skill acquisition was variable, and participation and quality of group interactions increased over time as participants became more familiar with each other. Over 95% of the assigned homework was completed.

Conclusions: This is the first study exploring the viability of online group treatment for individuals with TBI, with therapists and group members in multiple remote locations. Practicability of online EmReg was demonstrated. Use of videoconferencing was successful, meaningful group interactions were possible and online group treatment was delivered to as many as 4 individuals at once. Implications for increased access to healthcare are discussed.

Correspondence: *Theodore Tsaousides, Ph.D., Mount Sinai School of Medicine, One Gustave E. Levy Place, Box 1240, New York, NY 10029. E-mail: theodore.tsaousides@mountsinai.org*

E.W. TWAMLEY, L. VELLA, C.Z. BURTON, R.K. HEATON & D.V. JESTE. Compensatory Cognitive Training for People with Severe Mental Illness: Effects on Cognition, Functional Capacity, and Psychiatric Symptoms.

Objective: Treatments for cognitive impairment and unemployment associated with severe mental illness are urgently needed. We tested a 12-week, manualized, Compensatory Cognitive Training (CCT) intervention targeting prospective memory, attention, learning/memory, and executive functioning in the context of supported employment, the evidence based practice for people with severe mental illness who want to return to work.

Participants and Methods: 153 unemployed, work-seeking outpatients with schizophrenia ($n=58$), bipolar disorder ($n=37$), or major depression ($n=58$) were randomized to receive supported employment plus CCT or enhanced supported employment, which matched the CCT condition for therapist contact. Assessments of neuropsychological performance, functional capacity, psychiatric symptom severity, and self-reported functioning and quality of life were administered at baseline and post-treatment.

Results: ANCOVAs controlling for baseline performance demonstrated significant CCT-associated effects on measures of learning ($p=0.042$), financial capacity ($p=0.009$), depressive symptom severity ($p=0.011$), and self-reported everyday functioning ($p=0.021$). There were also significant positive effects of CCT on working memory and functional capacity for participants with schizophrenia, and on general psychiatric symptom severity and quality of life for those with bipolar disorder.

Conclusions: Compensatory Cognitive Training has the potential to improve cognitive performance, functional skills, psychiatric symptom severity, and self-rated functioning and quality of life in people with severe mental illness. Supported employment outcomes are being measured for two years following study enrollment to gauge the effect of CCT on job placement and tenure.

Correspondence: *Elizabeth W. Twamley, PhD, Psychiatry, UCSD, 140 Arbor Drive (0S51), San Diego, CA 92103. E-mail: etwamley@ucsd.edu*

S. ZWICK, A. KÜNEMUND, W. RIEF & C. EXNER. “Don’t you know what we need?” Social Burden and Quality of Life in patients after acquired brain injury and their partners.

Objective: Acquired brain injuries (ABI, e.g. stroke) can impact patients’ and their partners’ mental health. It is known that social support promotes patients’ successful coping with ABI consequences whereas social burden can restrict successful coping efforts. This cross-sectional study aimed at comparing couples after ABI with healthy controls with respect to their social burden and quality of life.

Participants and Methods: Self-report measures were applied to 23 couples with one partner who had experienced an ABI (time since injury in months: 2.21, SD=1.6) and to 23 healthy controls matched regarding age, sex and education. Both partners completed measures of Depression (ADSK), Quality of Life (WHOQoL-Bref) and social support and burden (F-SozU). Statistics: MANOVA, simple regression, correlation.

Results: There was a significant group effect on depression ($F(2, 43)=6.89, p<.01$) indicating higher depressive symptomatology for the patients ($M=13.09, SD=8.81$) and their partners ($M=18.22, SD=9.68$) compared to the controls ($M=8.26, SD=5.6; M=9.74, SD=7.47$). The perception of social burden could account for 44.4% of the variation in depressive symptomatology in patients ($\beta=.69$) and for 45.2% ($\beta=.69$) in their partners. Within ABI couples, there was a significant negative relationship between social strain and general quality of life (patients $r=-.48, p<.05$; partner $r=-.72, p<.001$) but this effect could not be observed in control couples.

Conclusions: Couples with one partner who sustained an ABI report more depressive symptoms than control couples. Nearly half of the variation is explained by the perception of social burden. Additionally the general quality of life of ABI-couples is also affected by the perception of social strain. To facilitate the adjustment process for both partners not only the existence of support by the social network but particularly the kind of support (e.g. criticism, excessive demands) should be taken into account.

Correspondence: Sarah Zwick, Philipps-University Marburg, Gutenbergstraße 18, Marburg 35032, Germany; E-mail: sarah.zwick@staff.uni-marburg.de

C. MOORE, E. RUDOLPH, A. SCRIBNER, A. SNYDER, S. MULLEN, J. SEVERSON, A. KRAMER, M. DUNNAM & C. ANDERSON-HANLEY. Cybercycling for Cognitive Health: Interactive versus Simultaneous Physical and Mental Exercise.

Objective: Research has demonstrated the benefits of exercise on cognition. It is unclear whether the effects of combined mental and physical exercise are maximized when simply co-occurring (i.e., “simultaneous”), or if there is added benefit from interactivity between mental and physical exercise. We hypothesized that cognitive functioning would be relatively stronger following a single bout of interactive versus simultaneous exercise.

Participants and Methods: 20 college students (ages 18 to 21) were randomly assigned to one of two exercise conditions: (1) a cybercycle condition with an “interactive” videogame (physical activity, via pedaling and steering which affected on-screen play) or (2) a stationary bike and the same videogame controlled only by a joystick (“simultaneous”). Measures of executive function (Digit Span, Color Trails, Stroop C, and computerized Flanker and Trails) were obtained following a 20-minute warm-up (baseline), and after the 20-minute randomized intervention (post-test).

Results: The combined sample from both exercise conditions revealed that performance on executive function (Stroop C) improved from pre- to post-test ($p = .05$). However, no significant difference in executive function was found between the two conditions (interactive vs. simultaneous). It may be that a larger sample and longer intervention is needed to detect a subtle difference in cognitive benefits for interactive vs. simultaneous mental and physical exercise. Furthermore, in the simultaneous condition, 7 out of 10 participants did not pedal as hard/consistently and did not reach their target heart rate (compared with only 2 out of 10 interactive condition participants).

Conclusions: A single bout of either interactive and simultaneous mental and physical exercise appear to have similar effects on executive function; however behavioral and physiological differences are clear and may have a significant impact on cognitive benefits over a longer intervention period.

Correspondence: Mina Dunnam, Ph.D., Behavioral Health, VA Medical Center, 113 Holland Avenue, Albany, NY 12208. E-mail: mina.dunnam@va.gov

Cognitive Neuroscience

E. RUDOLPH, C. MOORE, A. SNYDER, M. DUNNAM & C. ANDERSON-HANLEY. Cycling for Cognitive Health: Virtual versus Real Outdoor Rides.

Objective: While research has demonstrated the benefits of exercise on cognition, it is unclear whether adjusting certain variables can maximize the benefit. A recent study revealed that older adults who pedaled on a stationary bike with an interactive virtual landscape improved more than those who rode a stationary bike (Anderson-Hanley et al., 2012). We aimed to determine if the cognitive benefit of the virtual tour would be similar to that of a naturalistically occurring outdoor ride. We hypothesized that cognitive functioning would be relatively similar following a single bout of cycling in a virtual versus outdoor landscape.

Participants and Methods: 24 adult participants were randomly assigned to one of two exercise conditions: (1) a cybercycle condition with an “interactive” videogame (physical activity, via pedaling and steering which affected on-screen play) or (2) an outdoor bike along a similar pathway. Measures of executive function (Digit Span, Color Trails, Stroop C) were obtained following a 20-minute warm-up (baseline), and after the 20-minute randomized intervention (post-test).

Results: The combined sample from both exercise conditions revealed that performance on executive function (Stroop C) improved from pre- to post-test ($p = .01$). However, no significant difference in executive function was found between the two conditions (virtual vs. outdoor). It appears the two conditions are comparable, although it may be that a larger sample and longer intervention is needed to detect a subtle difference in cognitive benefits for virtual vs. outdoor tours while cycling.

Conclusions: A single bout of cycling in either a virtual and outdoor landscape appeared to have similar positive effects on executive function. Additional research is needed to confirm that similar cognitive benefit can be obtained with older adults over a longer intervention, and if so, it may be reassuring that a safe indoor option for older adults may yield similar cognitive benefits as a naturalistic outdoor experience.

Correspondence: Cay Anderson-Hanley, PhD, Psychology, Union College, 807 Union Street, Schenectady, NY 12308. E-mail: andersoc@union.edu

G.L. ANDREWS & M. MADDIX. Changes in Physiological and Behavioral Measures Following Four Weeks of Meditation.

Objective: The purpose of this study was to investigate the effect of daily meditation on neural and behavioral functioning in college students as measured by physiological and self-report scales.

Participants and Methods: University students ($n=28$) enrolled in a course on neuroscience and spiritual formation. Students were invited to participate in the research project. The control group ($n=23$) were enrolled at the university but not in a common course. At the beginning of the semester each student completed anxiety and depression inventories. Each student was fitted with a 14 channel EEG cap, ECG and GSR. Measures were taken as the student completed a visual response task. The experimental group were instructed in meditation techniques and required to complete 20 minutes of meditation daily. Records of daily behaviors were kept by each student of both groups. The physiological and behavioral measures were repeated 4 weeks later.

Results: The students did not score higher on the anxiety or depression scales compared to college student norms. Depression scores significantly

decreased for the meditation group. The same patterns of correct responses to the visual task were seen in pre and post testing. The meditation group decreased their time on the stroop task, and showed significant decreases in ECG during rest and on the simple visual task. Post-test EEG changes for the meditation group included decreased mv for the right frontal during the stroop, increased mv in right occipital during all visual tasks, and increases in mv in the right temporal during rest

Conclusions: Participating in daily meditation decreases self-reported levels of depression symptoms and affects the activity of the right hemisphere increasing activity in the occipital and temporal lobe and decreasing activity in the right frontal. Students reported more energy, better quality sleep, and improved mood after 4 weeks of daily meditation. Correspondence: *Glenn L. Andrews, Ph.D., Behavior Science, Northwest Nazarene University, 623 S University Blvd, Nampa, ID 83686. E-mail: glandrews@nnu.edu*

J. CAMCHONG, V.A. STENGER & G. FEIN. Resting State Synchrony in Short-Term and Long-Term Abstinent Alcoholics.

Objective: We previously reported that when compared to controls, long-term abstinent alcoholics (LTAA) have increased resting state synchrony (RSS) of the inhibitory control network and reduced synchrony of the appetitive drive network, and hypothesized that these levels of synchrony are adaptive, and support the behavioral changes required to maintain abstinence. In the current study, we investigate whether these RSS patterns can be identified in short-term abstinent alcoholics.

Participants and Methods: Resting state functional magnetic resonance imaging data were collected from 27 short-term abstinent alcoholics (STAA), 23 LTAA and 23 non-substance abusing controls (NSAC). We examined baseline RSS using seed-based measures.

Results: We found ordered RSS effects from NSAC to STAA and then to LTAA within both the appetitive drive and executive control networks: increasing RSS of the executive control network, and decreasing RSS of the reward processing network. Finally, we found significant correlations between strength of RSS in these networks and (a) cognitive flexibility and (b) current antisocial behavior.

Conclusions: Findings are consistent with an adaptive progression of RSS from short- to long-term abstinence so that, compared to normal controls, the synchrony (a) within the reward network progressively decreases and (b) within the executive control network progressively increases.

Correspondence: *Jazmin Camchong, PhD, Neurobehavioral Research Inc., 1585 Kapiolani Blvd, Honolulu, HI 96814. E-mail: jcamchong@nbresearch.com*

A. CLAWSON, P.E. CLAYSON & M.J. LARSON. Dopaminergic Influences on Performance Monitoring Across the Menstrual Cycle.

Objective: Dopamine (DA) may play a role in reinforcement learning, facilitating accurate performance monitoring necessary for goal-directed behavior. Studies of estrogen and DA suggest that fluctuations in estrogen levels across the menstrual cycle are associated with changes in DA; when dopamine and estradiol levels are heightened during the follicular phase of the menstrual cycle, females demonstrate decreased inhibitory control. We compared the effects of natural variations in DA levels on performance monitoring processes during the follicular and luteal phases of the menstrual cycle using the error-related negativity (ERN), an event-related potential associated with performance monitoring processes. We hypothesized decreased neural and behavioral indices of performance monitoring during the follicular phase compared to the luteal phase.

Participants and Methods: Fifteen women completed two sessions during the follicular and luteal phases of their menstrual cycles. High-density electroencephalogram recordings were collected during both sessions while participants completed a computerized Stroop task. Behavioral (response times [RTs], error rates) and electrophysiological (ERN, CRN amplitudes) data were analyzed using separate 2-Phase (follicular, luteal) x 2-Accuracy (error, correct) ANOVAs.

Results: Results of the ANOVAs for RTs and error rates revealed no significant main effects or interactions by menstrual cycle phase. Likewise, there were no significant differences in ERN or CRN amplitude.

Conclusions: Behavioral and electrophysiological results indicated no difference in performance monitoring processes during the follicular and luteal phases of the menstrual cycle. Accordingly, increases in DA associated with fluctuations in estradiol across the menstrual cycle may not alter performance monitoring processes. Future research is necessary to examine the influence of estradiol and DA on other cognitive control component processes.

Correspondence: *Ann Clawson, Brigham Young University, 6575 S. 2475 E., Salt Lake City, UT 84121. E-mail: clawson.ann@gmail.com*

P. CLAYSON, A. CLAWSON & M. LARSON. The Effects of Dopamine on Reinforcement Learning Across the Menstrual Cycle: An ERP Investigation.

Objective: Previous research using dopaminergic medications and psychiatric populations implicates dopamine in reinforcement learning processes. Little is known, however, regarding how natural fluctuations in dopamine alters reinforcement-learning processes. One way to elucidate the effects of natural variations of dopamine on feedback monitoring is through observing females during different phases of the menstrual cycle. To this end we examined neurobiological manifestations of feedback monitoring during the luteal phase, when dopamine levels are normal, and follicular phase, when basal levels of dopamine are elevated. We hypothesized that females would demonstrate intact reinforcement learning, as indexed by more negative feedback-related negativity (FRN), during the luteal phase but impaired reinforcement learning during the follicular phase.

Participants and Methods: High-density event-related potential (ERP) data were acquired while 12 females completed a reinforcement-learning task during the follicular phase and luteal phase of the menstrual cycle. Ovulation tests were administered to ensure that participants were in the correct phase. 2-Condition (menstrual, luteal) x 2-Feedback (unexpected, expected) robust ANOVAs were conducted on FRN amplitude.

Results: The Condition x Accuracy robust ANOVA was significant. FRN amplitude was more negative to unexpected feedback than expected during the luteal phase; no differences were shown during the follicular phase.

Conclusions: Findings are consistent with previous research indicating impaired inhibitory control processes during the follicular phase but not luteal phase. Feedback monitoring appears to be impaired when basal levels of dopamine are raised; it is possible that heightened basal levels of dopamine prevent effective phasic dips of dopamine leading to nonsignificant FRN differences between unexpected and expected feedback. These findings provide further support for the role of dopamine in feedback-monitoring processes.

Correspondence: *Peter Clayson, University of California-Los Angeles, 1285 Franz Hall, Box 951563, Los Angeles, CA 90095. E-mail: pclayson@ucla.edu*

P. FERRÉ, R.P. FONSECA, V. ABUSAMRA, A. TAVANO & Y. JOANETTE. Communication Profiles And Executive Impairments Following Right-Hemisphere Stroke: A Crosscultural Perspective.

Objective: It is now accepted among the scientific and clinical community that a right-hemisphere-stroke may lead to impairments in prosodic, discourse, pragmatics and/or lexico-semantic components of communication. But so far, no pattern of impairment has been described at the group level, restricting proper identification and clinical intervention. This research aimed at classifying communication profiles among right-brain-damaged adults with an intercultural perspective and with regards to executive processes.

Participants and Methods: The sample is made up of 154 right-brain-damaged individuals from four nationalities (Canadians, Brazilians, Italians and Argentines). They were assessed using 13 language tasks from the Protocol MEC and a neuropsychological battery addressing executive processing and attention.

Results: A hierarchical cluster analysis revealed four distinct clinical profiles of communication: 1- extensive impairments in all components; 2-mixed impairments of semantic, prosodic and discursive fields; 3-exclusive conversation impairment and 4- mild or no impairment.

Since only few distinctions between nationalities, time post onset or age were to be observed, the results suggest that there probably is a universality of clinical patterns after a right-brain damage. Exploration of executive impairment indicates that deficits in inhibition, cognitive flexibility and attention may exacerbate the severity and extent of deficits in all components of communication. Nonetheless, there is no linear association between profiles of communication and executive impairments. Furthermore, clear dissociations at the individual level are observable.

Conclusions: This study proposes a specific taxonomy of communication disorders among right-brain-damaged individuals in a crosscultural and cognitive perspective. It might contribute to a better detection of communication disorders and to the development of a more accurate clinical intervention for adults suffering from consequences of a right hemisphere stroke.

Correspondence: Perrine Ferré, Master, CRIUGM, 4545 queen mary, montreal, QC H3W1W3, Canada. E-mail: perrine.ferre@gmail.com

P. FERRÉ, J. PROVOST, M. GIROUX & Y. JOANETTE. White Matter Tracts And Cognitive-Linguistic Impairments Following A Right-Hemisphere Stroke: A MRI-DTI Multiple Case Study.

Objective: Distinct clinical profiles of communication and cognitive impairments are observed after right hemisphere (RH) stroke. No anatomical correlates have yet been described, suggesting contribution of a more widespread network. Nowadays, neuroimaging techniques such as diffusion tensor imaging (DTI) are used to study white fiber matter in stroke patients in relation with clinical manifestations. The aim of this study is to describe the role of specific white matter pathways involved in executive and communicative behaviors in the RH.

Participants and Methods: Four domains of communication have been assessed: lexical-semantics, prosody, pragmatic, and discourse. Furthermore, executive functions were assessed. Four RH stroke patients and two healthy controls underwent a MRI and DTI to assess the integrity of four pathways: the uncinate fasciculus (UF), the arcuate fasciculus (AF), the inferior (IFL) and superior longitudinal fasciculus (SLF).

Results: Patient 1 shows extensive cognitive deficits, in relation with wide cortico-subcortical lesion. All patients present conversational discourse and prosody impairment, except for patient 2 who shows massive lexical-semantic deficits. Although his cortical lesion is limited, all pathways are damaged. The UF is impaired in all patients but patient 3, who exhibit overall milder deficits in communication. Patient 4 shows the most severe cognitive deficit, although he is the only to show intact AF. All patients suffer from disconnection of the SLF and none of the ILF.

Conclusions: To the best of our knowledge, it is the first time that a study explores the links of such impairments in RH stroke patients. We observe that the integrity of the UF in the RH can be related to better communicative performances. Conversely, preservation of the ILF and AF does not impede the apparition of cognitive disorders. This study highlights the fact that communicative and executive functioning after stroke can be better explained when analysing white fibre matter in addition to cortical damages.

Correspondence: Perrine Ferré, Master, CRIUGM, 4545 queen mary, montreal, QC H3W1W3, Canada. E-mail: perrine.ferre@gmail.com

M. HAINSELIN, P. QUINETTE, A. JUSKENAITE, B. DESGRANGES, O. MARTINAUD, V. DE LA SAYETTE, H. DIDIER, F. VIADER & F. EUSTACHE. Just Do It! Performing an Action Enhances Remembering in Transient Global Amnesia.

Objective: Transient global amnesia (TGA) is a syndrome characterized by a sudden onset of a massive episodic memory deficit that spares other cognitive functions. Therefore, it provides a unique model allow-

ing to unravel the enactment effect (better remembering for performed actions compared to verbally encoded sentences), one of the most robust memory enhancements described. Our main aim was to test whether the enactment effect persists in TGA patients and to gain a better understanding of the functions sustaining this effect.

Participants and Methods: Object-action pairs were encoded under four conditions: verbal, experimenter performed, and two enactment conditions i-e self-performed (without choice) and self-performed with choice. We tested the retrieval of object-action pairs using cued recall and recognition tasks. In addition, we assessed episodic memory, executive functions, working memory (storage and binding processes), anxiety and mood to control for their putative effects on memory for action, by the means of correlations. Data were collected from 24 patients, 16 of which were examined during the acute phase and 8 the day after, as well as from 18 healthy controls.

Results: For cued recall and recognition, repeated measures ANOVA showed significant effects of group ($p < .001$) and condition ($p < .001$) but no interaction. Post-hoc Tukey tests highlighted patients' better memory performances i) in self-performed with choice condition on cued recall ($p < .05$) and ii) in both enactment conditions on recognition ($p < .05$) compared to verbal condition. Correlations have been found between self-performed task enhancement (verbal/self-performed ratio) and the binding process.

Conclusions: We showed, for the first time, that patients with TGA benefit from the enactment effect. These results help to understand the role of motor components and episodic integration (binding) in memory for actions. Beyond this theoretical interest, we also suggest to use memory for action, and enactment effect in particular, for memory rehabilitation. Correspondence: Mathieu Hainselein, Inserm-EPHE-UCBN U1077, Laboratoire de Neuropsychologie CHU Côte de Nacre, F-14033 Caen Cedex, Caen 14000, France. E-mail: mathieu.hainselein@gmail.com

G.R. HERNANDEZ, G. RODRIGUEZ, N. KESHAVARZIAN, R. ZHANG & K. KEE-ROSE. Gender Variations in Perception of Children and Adolescents in Distress: A Stroop Interference Study.

Objective: Evolution studies of social behaviors have documented that females (i.e., mothers) generally would be more invested in their children compared to male partners. This difference might be due to the amount of resources females contributed from the beginning at conception through gestation and after birth. Although these findings are interesting, little is currently known about whether female's perception of children in distress would be comparable to that of male's perception. The current study examines the effects of children and adolescents in distress using a modified Stroop Interference Task on female and male undergraduate students.

Participants and Methods: Data are currently available on 30 female and 30 male students. Participants' responses (errors) and latency were assessed using a modified Stroop Interference Task, which involved identifying a colored circle (red, green, yellow, or blue) superimposed on a total of 48 images, with each image representing one of four conditions: children in distress, adolescents in distress, children/adolescent non-distress, and color control.

Results: A series of t-tests revealed that the female group made significantly fewer errors compared to the male sample in the adolescents in distress condition ($t(58) = 1.76, p = .015$ Cohen's $d = 0.45$). The groups also differed at a trend level when viewing children in distress ($t(58) = 1.58, p = .059$ Cohen's $d = 0.41$). Furthermore, female students took less time to respond compared to their male counterparts for these conditions (children in distress: $t(58) = 1.95, p = .028$, Cohen's $d = 0.50$; adolescent in distress: $t(58) = 1.44, p = .077$, Cohen's $d = 0.37$). No significant group differences were found when viewing the other conditions (children/adolescent non-distress and color control).

Conclusions: These preliminary findings may increase our understanding of the role of children and adolescents in distress and how it affects female's and male's cognition differently.

Correspondence: Gina R. Hernandez, B.A., California State University Channel Islands, 425 N 5th ST, Santa Paula, CA 93060. E-mail: gina.r.hernandez@gmail.com

B. KIRWAN & Q.R. SMITH. Prospective Memory is Not Impaired in Pregnancy.

Objective: Pregnancy is a complicated biological process that is often accompanied by reported cognitive changes among pregnant women. Previous literature examining subjective reports indicate that a majority of women rated their cognitive functioning as being worse than normal, with “forgetfulness” and “a poor memory” being the primary complaints. However, despite anecdotally reported deficits, only a limited amount of research has been conducted to objectively evaluate memory performance of pregnant women and the results of such studies have been equivocal. It appears that some, but not all, measures of memory are impaired in pregnant women. Memory measures that have high executive function demands may be differentially impaired in pregnancy. Prospective memory (remembering to perform a task in the future, such as starting a load of laundry after finishing dinner) is one such memory task. We sought to determine if prospective memory is impaired in pregnant women.

Participants and Methods: We tested a group of pregnant women ($n=42$) and a group of nulliparous controls ($n=98$) in a prospective memory task in which participants were required to make a separate response to specific stimuli during an ongoing task.

Results: We observed no effects of pregnancy on prospective memory performance, even when controlling for factors such as depression inventory scores and sleep quality. There were no significant trends when considering prospective memory performance across trimesters in the pregnant group.

Conclusions: Our findings indicate that prospective memory is not impaired in pregnancy. These findings will be discussed in the context of neuronal changes that occur in pregnancy.

Correspondence: Brock Kirwan, PhD, Brigham Young University, 1052 SWKT, Provo, UT 84602. E-mail: kirwan@byu.edu

H. KLEIDER, T. KING & K. REVILL. Vivid Imagining of False Events Leads to False Memories: Comparisons of Neural Activity Show Differences in Rejection and Acceptance of Imagined Events.

Objective: Research suggests that vivid imagery facilitates false memories. fMRI was employed to investigate whether BOLD response underlies false memories of imagined events (false alarms; FA), consistent with true event recall (hits); and whether activation differs when a new or imagined event is correctly rejected (CR).

Participants and Methods: Participants watched event scenes and read descriptions of 2 people who performed various actions. Half of the actions were presented as a sentence to be imagined; the other half were viewed pictorially. Two days later they completed the fMRI paradigm; recalling the video and judging whether the presented written actions were, viewed, imagined or new. Nine of the 12 demonstrated false alarms to the imagined descriptions and were included in the analyses.

Results: Data were preprocessed with SPM8 and analyzed with AFNI 3dDeconvolve; thresholded at a corrected $p < 0.05$ with Monte Carlo simulation cluster size correction. Conjunction analysis of hits and FA revealed overlapping BOLD activation in posterior cingulate, left parahippocampal gyrus and middle temporal gyrus. Recall of viewed events (hits) versus CR of a new or imagined events showed increased BOLD in precuneus/superior parietal lobe. Falsely remembering an imagined event as viewed compared to CR of a new event revealed greater BOLD activation in precuneus, and medial/superior frontal gyrus. ROI analyses of hippocampal and posterior cingulate regions from conjunction analysis revealed greater BOLD activity for hit and FA relative to CRs (one-tailed).

Conclusions: Vivid imagining of event scenes facilitates false memory creation and shares the same neural activation as accurate memory for viewed scenes. Conversely, activation differs when a subject correctly rejects a new event (whether or not imagined) or imagined event, knowing that the event was not viewed. Findings build on similar work of imagined false memory for everyday objects.

Correspondence: Heather Kleider, PhD, Psychology, Georgia State University; p.o. Box 5010, Atlanta, GA 30345. E-mail: hkleider@gsu.edu

M. LÖVSTAD, I. FUNDERUD, T. MELING, U. KRÄMER, B. VOYTEK, P. DUE-TØNNESEN, T. ENDESTAD, M. LINDGREN, R.T. KNIGHT & A. SOLBAKK. Neuropsychological and electrophysiological findings in two patients with lesions to dorsomedial prefrontal cortex.

Objective: Neuroimaging studies of healthy subjects have demonstrated an association between the anterior cingulate cortex (ACC) and cognitive control functions, but lesion studies are sparse and have produced mixed results. Based on single cases of ACC damage, it has been suggested that the ACC is not involved in cognitive operations. The main goal of this study was to examine behavioral and electrophysiological indices of neurocognitive functioning following ACC injury. A specific aim was to investigate the proposition that the ACC is not involved in cognitive processing.

Participants and Methods: Two patients, one with one with left- and one with right hemisphere lesion to dorsal medial prefrontal cortex (MPFC) encompassing the ACC, were assessed with a neuropsychological test battery as well as Event-Related Potentials in two experimental paradigms known to engage prefrontal cortex (PFC); an auditory Novelty Oddball task and a visual Stop-signal task (SST).

Results: Both patients had normal Stroop-performance, but impaired learning and memory. Altered attentional control was reflected in a diminished Novelty P3 ERP-component, whereas the posterior P3b to target stimuli was present in both patients. The error-related negativity (ERN), which has been hypothesized to be generated in the ACC, was present in both patients, but alterations of inhibitory behavior were observed.

Conclusions: While learning and memory was affected by unilateral ACC lesions, performance on the Stroop-task was not. Electrophysiologically, unilateral ACC-damage was sufficient for bilateral extinction of the Novelty P3, but did not diminish the posterior target-related P3b. Unilateral ACC damage was not sufficient to abolish the error-related negativity. Although the findings are suggestive, this study allows for two broad conclusions; 1) the ACC is not irrelevant to cognitive control functions, and 2) the MPFC is involved in various cognitive control tasks rather than being limited to specific cognitive operations such as error detection.

Correspondence: Marianne Løvstad, Neuropsychologist, Sunnaas Rehabilitation Hospital, Bjørnmyrve 11, Nesoddtangen 1450, Norway. E-mail: mar.lovstad@gmail.com

M.E. MCCOURT, G. WYLIE & G. PADMANABHAN. Cue Potency Modulates Task Switching Costs: The Role of Perceptual Processes in Cognitive Control.

Objective: Whereas the repeated execution of a task such as classifying the color of a stimulus is relatively fast and error free, the cued trial-by-trial alternation (switching) between two different tasks, such as classifying stimuli according to either color (red or blue) or shape (X or O), incurs significant costs in both reaction time (RT) and accuracy. Switch costs may reveal cognitive control processes, and arise due to the time-consuming exchange of task-sets, or they may reflect proactive interference from previously active task-sets, or they may reflect a relative perceptual cue-encoding benefit on repeat versus switch trials. We examined the role of cues in a task-switching paradigm.

Participants and Methods: Subjects ($N=32$) made cue-contingent speeded classifications of stimuli according to color (red or blue) or shape (X or O) at two levels of Cue-Target Interval (150 and 800 ms). Cues were either Strong or Weak. Cue strength was varied dramatically using an immersive virtual reality display system. Weak Cues were a square or diamond shape which surrounded the target region in an otherwise featureless environment. In the Strong Cue condition the entire immersive environment signaled which task to perform. The environments were a theatre setting (targets appeared on a large projection screen),

or a laboratory setting (targets appeared on a computer monitor). The experimental design was within-subjects, with Switch State (Blocked, Repeat2+, Repeat1, Switch), Cue Condition (Strong, Weak), and CTI (150 ms, 800 ms) as factors; dependent measures were RT and response accuracy.

Results: All main effects and interactions were significant. RT increased and accuracy decreased as Switch State varied from Blocked to Switch. RT was faster and accuracy was higher for Strong Cues, which were most beneficial on short CTI Switch trials.

Conclusions: These results support a cue-encoding account of switch costs and provide an approach for reducing these ubiquitous costs.

Correspondence: *Mark E. McCourt, Ph.D., Psychology, North Dakota State University, North Dakota State University, Fargo, ND 58105. E-mail: mark.mccourt@ndsu.edu*

M. MEINZER, R. LINDENBERG, D. ANTONENKO, L. ULM, T. FLAISCH & A. FLÖEL. Impact of tDCS on Task-Related Brain Activity and Resting-State Functional Connectivity in Older Adults.

Objective: Functional imaging studies of word-retrieval in aging have linked increased right hemisphere activity to reduced performance. Excitatory anodal transcranial current stimulation (atDCS), a non-invasive brain stimulation technique, has been shown to enhance cognitive functions. In young adults, atDCS of the left inferior frontal gyrus (IFG) resulted in improved performance and more efficient neural processing during word-retrieval tasks (Meinzer et al. 2012 J Neurosci). Therefore, we assessed whether atDCS applied to the left IFG would improve word-retrieval performance in healthy older adults as well. Furthermore, we were interested in age-specific changes induced by tDCS in functional brain activity in this group of subjects, as compared to a young control group.

Participants and Methods: In a cross-over sham-controlled study, functional magnetic resonance imaging (fMRI) was used to investigate tDCS effects on word-retrieval and resting state functional connectivity in 20 healthy older adults. Subjects were scanned twice, either with simultaneous intrascanner atDCS or sham tDCS. 20 younger adults were scanned using the same fMRI protocol, but without tDCS.

Results: During sham tDCS, older subjects produced fewer correct responses in the word-retrieval task and exhibited more pronounced activity in right frontal areas than young adults. atDCS significantly improved performance in the older group and resulted in reduced task-related activity in the left/right ventral IFG and right dorsolateral prefrontal cortex. The latter correlated with behavioral improvement induced by atDCS. Resting-state fMRI during sham tDCS revealed enhanced connectivity of bilateral prefrontal areas and reduced connectivity of posterior brain areas in older compared to younger adults. During atDCS, both phenomena were reversed.

Conclusions: Our results indicate that age-associated cognitive decline can be temporarily ameliorated by atDCS and that the stimulation induced a more “youth-like” pattern of functional activity and connectivity.

Correspondence: *Marcus Meinzer, PhD, Neurology, Charite University Medicine, Bonhoefferweg 3, Berlin 10177, Germany. E-mail: marcus.meinzer@charite.de*

T.T. NGUYEN, J.D. THOMAS, E.P. RILEY & R.W. SIMMONS. Goal-directed Regulation of Force in Children with Heavy Prenatal Alcohol Exposure.

Objective: Alcohol exposure during development results in extensive damage to brain regions involved in the planning and generation of motor force. This study explored whether prenatal alcohol exposure adversely affects goal-directed force regulation to a visual target.

Participants and Methods: Children with (AE=19) and without (CON=24) heavy prenatal alcohol exposure completed a computerized task in which they exerted force on a load cell that produced a signal which they aimed to “shoot” at a small rectangular target located in the top right quadrant of the screen. The target was positioned such that

two levels of target force (25%, 50%) were investigated in combination with three criterion time periods (200ms, 800ms, 2000ms), allowing for varying degrees of visual feedback. Dependent variables included accuracy, duration of the primary segment (PS)(defined as the first reversal in the force-time curve from an increase to a decrease in force), and the rate of force production during the PS.

Results: Repeated measures ANOVA analyses revealed that children with AE were significantly less accurate in hitting the target and produced a shorter PS with higher rates of force production than controls. As defined, the PS reflects a period of open-loop control, and results indicate that AE children spend less time in this phase and more time in a closed-loop control phase in which visual feedback could be used to guide the response. However, even with more feedback, AE children were less accurate in reaching the target force, reflecting difficulties integrating visual feedback to modify their motor response in order to meet goal demands.

Conclusions: These data likely reflect alcohol-induced damage to sensorimotor circuits involving the basal ganglia that lead to difficulties in performing daily functional skills in which coordination of accurate, goal-directed movements is required. Therapeutic strategies designed to increase feedback and facilitate visuomotor integration could improve motor functioning in these children.

Correspondence: *Tanya T. Nguyen, M.S., SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 6330 Alvarado Court, Suite 100, San Diego, CA 92120. E-mail: tanguyen@projects.sdsu.edu*

L. PAPEO & R.I. RUMIATI. Lexical and Gestural Symbols in Left-damaged Patients.

Objective: Extensive evidence of neural activity in areas for motor production during the semantic processing of words, has initiated a new era in the neurobiology of language. Given the impact on methods for aphasia rehabilitation, it is imperative for basic research to clarify the nature (and relevance) of this interplay between language and extra-language (motor) systems. To begin with, is the motor system truly a part of the word-semantic system?

Cognitive neuropsychologists have shown that damage to the system for producing object-directed (transitive) actions does not necessarily lead to detrimental changes in the ability to understand the corresponding action words. We have addressed this question focusing on intransitive symbolic gestures (emblems; e.g., waving goodbye), which are held to engage different resources or neural representations than object-directed actions, and to enjoy a special relationship with language, due to a lexicalized relation between form (gesture) and its meaning.

Participants and Methods: We tested 12 left-damaged patients (and 17 healthy controls) on praxis (imitation and gesturing-to-verbal-command) and lexical-semantic tasks (naming and word-picture matching) involving the same emblems.

Results: The group-level analyses replicated correlations between praxis and language deficits typically observed in left-damaged patients. The analyses at the single-case level, however, revealed double dissociations between the ability to produce emblems and the ability to retrieve and recognize their lexical-semantic definition.

Conclusions: Double dissociations, even in the event of positive group-level correlations across tasks, imply that the motor representation of a gesture and the lexical-semantic representation of the corresponding word rely on functionally independent system. This study is the first neuropsychological investigation of the relationship between the lexical-semantic and the motor representation of emblems, the closest counterpart of words in the gestural domain.

Correspondence: *Liuba Papeo, PhD, Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, MA 02138. E-mail: liuba.papeo@gmail.com*

H.A. RAAB, V.E. THORNTON, M.P. RAKSIT & A.E. GREEN. Effects of DAT1 and APOE Polymorphisms on Structural Connectivity and Cognitive Performance.

Objective: Investigating variations in genes that affect neuronal development and communication may lead to insights into the neural basis

of intelligence. Previous work has indicated positive correlations between structural connectivity and IQ. Therefore, the neural basis of intelligence may depend on genetic variants that influence the integrity of white matter connections in the brain. We aim to generate a gene-brain-cognition path-analytic model, bridging genetics and intelligence with diffusion tensor imaging (DTI) data.

Participants and Methods: Taking a candidate gene approach, we investigated the relationship of polymorphisms in two genes, APOE and DAT1, to measures of cognitive function and a measure of structural connectivity obtained via DTI. Fifty-six healthy young adults participated in a battery of cognitive tasks, provided saliva DNA, and underwent DTI.

Results: Results indicated that individuals without the APOE $\epsilon 4$ allele, a risk factor for Alzheimer's disease, had significantly greater structural integrity in the right superior longitudinal fasciculus, anterior thalamic radiation, cingulum, and forceps minor. However, participants with the $\epsilon 4$ allele had quicker response times during an inhibition task, suggesting that better cognitive performance is associated with the $\epsilon 4$ allele. For the DAT1 polymorphism we investigated, 10 repeat homozygotes had greater structural integrity values than 9 repeat homozygotes or 9/10 heterozygotes in numerous tracts throughout the brain. However, the 10/10 genotype was associated with significantly lower scores on the Wechsler Adult Intelligence Scale (WAIS) and on tasks of creative thinking.

Conclusions: These results suggest that, for subjects without the APOE $\epsilon 4$ allele, and those with the 10/10 DAT1 genotype, higher structural integrity of white matter tracts may be disadvantageous for cognition. However, at least in the case of APOE, this effect may reverse with age, as those with the $\epsilon 4$ allele are at an increased risk of developing Alzheimer's.

Correspondence: *Hillary A. Raab, Psychology, Georgetown University, 360S S St. NW, Washington, DC 20007. E-mail: har9@georgetown.edu*

M.P. RAKSIT, J.P. MIKHAIEL, B. STRAUBE, A. CHATTERJEE & A.E. GREEN. Perception of Causality Predicts Spirituality and Lifetime Change in Religious Belief.

Objective: Individual differences in the perception of causality have recently been empirically established. Individual differences in degree of spiritual belief have long been relevant and have become an important target of psychometric investigation. However, it is not yet known whether these two characteristics are linked. To gain insight into a potential relationship between these variables, we assessed perceptual judgments of causality and degree of religiosity in the same individuals.

Participants and Methods: Perception of causality was assessed using a variant of the classic Michotte colliding balls task. Animations of a red ball and blue ball showed multiple collision events, varying the angle and delay of the launch. Subjects decided whether or not the blue ball caused the red ball to move. Subjects then completed the Religious Orientation Scale (ROS), which measures religious beliefs in two subscales: Extrinsic and Intrinsic. The former subscale measures the role of religion in one's social life and feeling of comfort. The latter assesses one's internal, spiritual motives. Subjects also rated their change in spiritual beliefs since childhood.

31 healthy subjects (18-35 years old, 12 male) completed the causality task and ROS. Correlations between stimuli parameters (angle, delay, interaction between angle and delay) and proportion of events judged causal were calculated. These correlations were in turn regressed on ROS scores on Extrinsic and Intrinsic subscales, as well lifetime change in beliefs.

Results: Results indicated that the interaction between angle and delay significantly predicted ROS scores and change in beliefs.

Conclusions: The pattern of data suggests that individuals who used both angle and delay cues to judge causality tend to have higher Extrinsic and lower Intrinsic religiosity, i.e., a greater external relationship with religion but lower internal spiritual motivation. Additionally, those who used angle and delay cues to judge causality had less change in religious belief since childhood.

Correspondence: *Megna P. Raksit, B.S., Psychology, Georgetown University, 3900 O Street NW, 305 White Gravenor, Washington, DC 20007. E-mail: megna.raksit@gmail.com*

R. SCHIFF & E. VAKIL. The Development of Skill Learning as Demonstrated by the Tower of Hanoi Task.

Objective: Much of our knowledge regarding the maturation of skill learning is based on studies that used perceptual skill learning tasks. Little is known about the development of skill learning in children when performing conceptual tasks. The aim of this study was to investigate skill learning development using the Tower of Hanoi Puzzle task

Participants and Methods: This task was used to assess the baseline performance, rate of learning, overnight retention, and transfer in 60 Israeli school-aged children. Three measures were chosen for each aspect of performance: the number of moves that accounts for the accuracy in completing the task, the average time per move, that reflects efficiency, and the time of first move, which reflects planning time

Results: Altogether, in the learning phase, a tradeoff between accuracy and time was evident. Additionally, the results of the offline learning phase showed a clear advantage for the older group in the time of first move. The results of the transfer phase indicate that the younger participants' skill learning was shallow, and therefore did not result in long-lasting remains.

Conclusions: Overall, findings from the present study support the view that the TOHP is sensitive to age. This is seen across the different stages of the learning process in the measure of time. Furthermore, the phases of retention and transfer were found to be more sensitive than the learning to the effect of age. This study indicates that a conceptual skill learning task may deepen our comprehension of the process and development of procedural learning.

Correspondence: *Rachel Schiff, PhD, Bar Ilan University, School of Education, Ramat Gan 52900, Israel. E-mail: rschiff@mail.biu.ac.il*

C. SEMENZA, S. DE PELLEGRIN, E. SALILLAS & A. DELLA PUPPA. Intra-operative Mapping of the Parietal Lobe: Addition and Multiplication.

Objective: This study used intra-operative cortical stimulation and mapping to investigate the respective roles of right and left parietal areas (the Angular gyrus (AG), the Horizontal Inter-Parietal Gyrus (HIPS) and the Ventral Inter-Parietal Gyrus (VIPS)), in basic number related tasks: simple addition and multiplication.

Participants and Methods: Four participants, affected by low-grade parietal gliomas (one in the left and three in the right hemisphere) took part in the study.

Two different types of calculation were administered:

- single-digit addition with one operand (for example $4+7$; $8+6$; $5+7$).
 - single-digit multiplication with one operand (for example 8×4 ; 5×6 ; 9×7).
- Each operation had to be solved within the four-seconds time of the stimulation.

Each participant was presented a block of 14 additions, repeated three times, in random order, alternating stimulation every other trial. On each stimulation site the patient performed three additions, for a total of 22 trials with and 20 trials without. A block of 15 multiplications was then administered with the same procedure, for a total of 24 tests with and 21 without stimulation.

Results: Positive sites for addition were found only in the posterior portion of the AG bilaterally. Positive sites for multiplication were found bilaterally in the anterior portion of the angular gyrus, and in the HIPS. In the left hemisphere sites the majority of addition errors seems to unveil an underlying arithmetic procedure of approximation while multiplication clearly relied more on retrieval. No such pattern was found for the errors following stimulation of the right hemisphere. No positive site was found in the VIPS.

Conclusions: Processing of addition in the AG has not been clearly found before. In the AG addition and multiplication seem to be processed in distinct sites, bilaterally. The pattern of errors suggests different roles for each area.

Correspondence: *Carlo Semenza, Medicine, Neurosciences, University of Padova, via Giustiniani 5, Padova 35128, Italy. E-mail: carlo.semenza@unipd.it*

A.G. SENI, E. VERA-ESTAY, J.J. DOOLEY & M.H. BEAUCHAMP. Cognitive and Emotional Predictors of Sociomoral Decision-Making in Adolescence.

Objective: Sociomoral reasoning (SMR) is a complex socio-cognitive process fostered through learned behaviors, biological and social mechanisms, and exposure. Although much research has focused on the independent contributions of cognitive and emotional factors to the sociomoral decision-making (SMDM) process, an integrative approach has the potential to yield a more accurate and comprehensive understanding of the sociomoral landscape. Using a new ecological SMR task, this study aimed to investigate the contributions of both cognitive and emotional processes to SMDM during the decisive developmental period that is adolescence.

Participants and Methods: Empathy, SMR and SMDM skills were assessed in healthy adolescents ($N = 92$, 65% female) aged 13 to 19 years ($M = 16.3$, $SD = 2.1$). SMR and SMDM were measured using the Socio-Moral Reasoning Aptitude Level task (So-Moral, Dooley et al., 2010), a new visual task developed to appropriately reflect adolescent reality and investigate developmental stages of SMR. Empathy was measured using The Empathic Tendency Index (Bryant, 1982).

Results: SMDM is positively correlated with SMR maturity ($r=0.26$, $p=0.012$), as well as with empathy ($r=0.23$, $p=0.036$). Multiple regression analyses indicate that, together, both SMR and empathy explain 11% of the variance in adolescents' levels of socially adapted decisions. Empathy approached significance as an independent predictor ($\beta=0.20$, $p=0.052$) and SMR was a significant independent predictor of SMDM ($\beta=0.24$, $p=0.022$). Together, both functions were predictive of SMDM ($F(2,83)=5.120$, $p=0.008$).

Conclusions: This study provides new support for the value of an integrative approach, one including both cognitive and emotional processes, to the investigation of sociomoral mechanisms and moral development in healthy adolescents. Not only are both SMR and empathy related to SMDM, both skills are necessary for making socially adapted decisions. These results are further reinforced by the use of an ecological and age-appropriate measurement tool.

Correspondence: *Anne G. Seni, PhD candidate, Psychology, Université de Montréal, 2400 Trenton, Montreal, QC H3P 3N4, Canada. E-mail: aseni@mac.com*

L.M. SILVA & R.E. JUNG. Between-Sex Differences in the Relationship Between Thalamic Volumes and Aspects of Creative Achievement.

Objective: The thalamus has been shown to be involved in cognitive processes underlying creativity. Recent studies have related decreased dopamine D2 receptors on the thalamus to lowered gating activity, hypothesized to promote creative ability in healthy adults. However, sex differences in those relationships have not been extensively examined.

Participants and Methods: We investigated thalamic volume differences in a sample of 125 healthy young adults (45.6% female) between 18 and 29 years old (mean = 21.7 years). Volumetric data collected using a Siemens 3T Trio TIM scanner showed significant group differences in both raw and relative thalamus volumes: Males had larger raw volume (means: male = 16002.12 mm³, female = 14545.58 mm³; $t = -6.7$, $p < 0.01$), though females had a larger normalized volume (means: male = 0.008, female = 0.009; $t = 2.4$, $p < 0.05$).

Results: Total Creative Achievement scores on the Creative Achievement Questionnaire were not significantly different between groups (means: male = 18.4, female = 17.2; $t = -0.4$, ns). However, subtest analyses revealed group differences on the following two subtests: Inventions (means: male = 2.8, female = 0.7; $t = -3.0$, $p < 0.01$), and Scientific Discovery (means: male = 3.0, female = 1.3; $t = -2.6$, $p < 0.05$). Total normalized thalamus volume was significantly correlated with Cre-

ative Achievement in the total sample ($r = -0.21$, $p < 0.05$). However, when examined separately, the correlation was only significant for males ($r = -0.35$, $p < 0.01$), and not for females ($r = -0.73$, ns). At the subtest level, total normalized thalamus volume was significantly negatively correlated with Architecture ($r = -0.27$, $p < 0.05$), Inventions ($r = -0.39$, $p < 0.01$), and Scientific Discovery ($r = -0.25$, $p < 0.05$) for males, and positively with Inventions for females ($r = 0.26$, $p < 0.05$).

Conclusions: These results suggest the possibility of a differential relationship between thalamus volume and aspects of creativity between sexes. Correspondence: *Lynette M. Silva, M.S., Psychiatry, University of Illinois at Chicago, 5559 N. Magnolia Ave, Apt. 3E, Chicago, IL 60640. E-mail: lynettesilva@gmail.com*

B.M. STOESZ & L. JAKOBSON. Sex Differences in Interference between Identity and Expression Processing with Static but not Dynamic Faces.

Objective: Research in face processing suggests that motion cues facilitate identity and expression processing, leading to more accurate and faster recognition than that seen with displays that show static form cues only (Ambadar et al., 2005; Pilz et al., 2006). To explore this dynamic advantage, we asked whether adding dynamic cues alters the manner in which the processing of identity and expression cues interact. In addition, we sought to determine if the addition of dynamic face cues affects women and men differently; this is of interest as women show a face processing advantage for static faces (Godard & Fiori, 2012; McClure, 2000).

Participants and Methods: In our study, 20 women and 20 men made speeded identity or expression judgments of faces while the irrelevant cue (expression in the identity task or identity in the expression task) was held constant (baseline) or varied (orthogonal condition).

Results: We calculated interference scores by subtracting baseline from orthogonal reaction times. Significant interference effects occurred with static faces (as in Ganel & Goshen-Gottstein, 2004) but were negligible for dynamic faces. These results suggest a dynamic advantage of sorts, where better integration of facial information, or greater resistance to interference, occurs with dynamic than with static displays. The gains made in integration or resistance, however, come with an overall cost in processing time. In addition, women but not men showed an asymmetrical interference effect in the static condition, with variations in identity affecting expression judgments more than the opposite. This finding may reflect sex differences in hemispheric cooperation and/or in global/local processing biases (see Godard & Fiori, 2012).

Conclusions: The fact that these sex differences disappear with dynamic faces is noteworthy and merits further study. Our findings stress the importance of using dynamic displays and of considering participant sex distributions when characterizing typical face processing mechanisms. Correspondence: *Brenda M. Stoesz, MA, Psychology, University of Manitoba, P404 Duff Roblin Building, 190 Dysart Road, Winnipeg, MB R3T 2N2, Canada. E-mail: sbrenda@mymts.net*

M. VARVARIS, P.G. UNSCHULD, B. GORDON & D.J. SCHRETLEN. Compensatory Neural Structures of High-Performing Adults with Schizophrenia.

Objective: While most persons with schizophrenia (SZ) show impoverished productivity on tests of verbal fluency (VF), some patients perform better than expected based on their demographic background. The aim of this study was to examine the neural correlates of intact VF in such high-performing patients and determine if these correlates are unique to SZ.

Participants and Methods: Twenty-two adults with schizophrenia who produced demographically-calibrated T-scores of 55 or higher on a verbal fluency task were matched with 22 healthy adults (NC) who produced T-scores of 55 or higher. Both groups underwent a brain MRI scan. Voxel-based morphometry (VBM) was used to compare regional gray matter volumes. Regions identified by this analysis were then used to compare 56 patients with SZ and 10 NCs who produced T-scores of 45 or less on the same VF test.

Results: Analyses showed that the high-performing SZ group had larger globus pallidus (GP) volumes bilaterally than high-performing NCs. A

between-subjects ANCOVA was used to compare GP volume as a function of diagnostic group (SZ vs. NC) and VF performance (high vs. low). This showed an overall effect of GP volume [$F(3,114) = 116.8; p < .001$]. Post-hoc comparisons with Bonferroni correction indicated that (1) the mean GP volume of high-performing SZ patients was significantly larger than all other groups, (2) the mean GP volume of low-performing SZ patients was larger than both NC groups, and (3) the NC groups did not differ significantly from each other in GP volume.

Conclusions: High-performing patients with SZ have larger GP volumes than low-performing SZ and both NC groups. Given that GP volumes did not differ between high- and low-performing NCs, these results suggest increased GP brain volume is a compensatory mechanism unique to SZ. Consistent with the dopamine hypothesis of schizophrenia, larger GP volume may allow for utilization of excess dopamine in SZ while providing no benefit for NC.

Correspondence: *Mark Varvaris, Psychiatry, Johns Hopkins, 600 North Wolfe Street, Meyer 218, Baltimore, MD 21287. E-mail: mvarvar2@jhmi.edu*

Y. WATANABE & S. FUNAHASHI. Information transformation of thalamic mediodorsal neurons during spatial working memory performance.

Objective: The thalamic mediodorsal nucleus (MD) has been known to participate in spatial working memory. To examine information represented by activity of each MD neuron and its temporal change during spatial working memory performances, we analyzed neuronal activity recorded from the MD while monkeys performed two oculomotor delayed-response tasks (ODR and R-ODR tasks).

Participants and Methods: Two rhesus monkeys were used in this study. In the ODR, monkeys were required to make a memory-guided saccade to the location where a visual cue had been presented 3 s before, whereas in the R-ODR, they were required to make a memory-guided saccade 90-degree clockwise from the cue direction. In our previous study (Watanabe and Funahashi, 2004), we found that information represented by MD activities changed from sensory nature to motor nature along the progress of the task, by comparing preferred directions of task-related activity between the ODR and R-ODR tasks. In the present study, to understand possible neural mechanisms for changing representation during the delay-period in the MD, we divided the 3-s delay period into three 1-s sub-periods and examined information represented during each sub-period.

Results: Among 17 neurons representing the visual information during the 3-s delay period, 24% represented motor information during the last 1-s sub-period. On the other hand, among 14 neurons representing the motor information during the 3-s delay period, 29% represented visual information in the first 1-s sub-period.

Conclusions: These results indicate that the information transformation from visual nature to motor nature occurs in single neuron level in the MD, although further examination is needed to elucidate its mechanism. Correspondence: *Yumiko Watanabe, PhD, Human Technology Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Umezono, Tsukuba, Ibaraki 3058568, Japan. E-mail: y.watanabe@aist.go.jp*

Invited Address:

Do Children Really Recover Better? Neurobehavioral Plasticity after Early Brain Insult

Presenter: Vicki Anderson

10:15–11:15 a.m.

V. ANDERSON. Do Children Really Recover Better? Neurobehavioral Plasticity after Early Brain Insult.

The young, healthy brain is highly ‘plastic’ and able to change in the context of environmental influences. This capacity for change is likely

to continue while the brain matures, throughout childhood and into late adolescence. The implications of this capacity for change in the context of brain insult is still to be determined. While some argue that ‘early plasticity’ is an advantage and will lead to minimal functional consequences, others claim that the young brain is uniquely susceptible (‘early vulnerability’) and disruption will lead to permanent and devastating effects. Neither of these views is able to fully explain the pattern of functional difficulties we observe in the context of childhood brain insult. This presentation will consider the theoretical and empirical evidence relevant to the ‘plasticity’ debate, in the context of both normal and disrupted development. Using research findings from our team’s research and those of others, we will evaluate the influence of insult-related factors (location, laterality and extent of brain pathology, and presence of epilepsy), child characteristics (age, gender, pre-insult abilities) and environmental factors (SES, family function), on cognitive and behavioral outcomes. The aims of the presentation are: 1) to provide a description of brain plasticity and vulnerability theories in the context of early brain insult; 2) to examine the influence of age at insult on neurobehavioral outcomes; and 3) to propose predictors of outcome following early brain insult, based on empirical findings.

Learning Objectives:

- (1) contrast differences in neural and behavioural recovery
- (2) list contributions of animal and human research to the field of brain plasticity
- (3) identify factors that predict outcome from early brain insult

Correspondence: *Vicki Anderson, Child Neuropsychology, Murdoch Childrens Research Institute/Royal Childrens Hospital, Flemington Road, 4th Floor West Building, Parkville, VIC 3052, Australia. E-mail: Vicki.Anderson@rch.org.au*

Birch Lecture: Clinical and Pathological Studies in the Oldest Old: The 90+ Study

Presenter: Claudia Kawas

11:30 a.m.–12:30 p.m.

C. KAWAS. Birch Lecture: Clinical and Pathological Studies in the Oldest Old: The 90+ Study.

In most of the world, the oldest old comprise the fastest growing segment of the population. As the leading consumers of healthcare and the individuals most affected by dementia, these pioneers of aging present public health challenges and research opportunities to better understand aging and dementia.

The 90+ Study, a population-based sample of more than 1500 people aged 90 years and older (Laguna Woods, California), comprises one of the largest studies of oldest old in the world. Participants (76% women; mean age 97 years) are followed longitudinally every 6 months with neuropsychological and neurological examinations, medical record review, informant questionnaires and interviews. DNA and brain donation are also requested.

Initial results in this population-based sample show a very high prevalence and incidence of dementia, cognitive impairment and functional disability in the oldest old. However, typical neuropathological lesions associated with dementia, including Alzheimer disease, cerebrovascular, and other lesions, are not necessarily present. Moreover, risk factors associated with dementia and AD in younger old individuals do not appear to be operant in the oldest old. Our preliminary cross-sectional studies suggest that physical performance measures (e.g. gait speed, balance and handgrip) and systemic factors (e.g. arterial oxygen saturation) are associated with dementia in the oldest old. Prospective studies are currently underway to determine if these factors precede the development of dementia. Data from our epidemiological, clinical, and pathological studies will be presented, and implications for the study of dementia in younger individuals will be discussed.

Learning Objectives:

- (1) Identify factors associated with longevity in 90+ year-olds
- (2) Identify factors associated with dementia in 90+ year-olds
- (3) Compare incidence and prevalence rates of dementia in 90+ year-olds with rates in younger-old subjects

- (4) Contrast clinical-pathological correlations of dementia in 90+ subjects with those in younger subjects

Correspondence: *Claudia Kawas, Depts. of Neurology and Neurobiology & Behavior, University of California, Irvine, 1121 Gillespie, Irvine, CA 92697. E-mail: ckawas@uci.edu*

FRIDAY AFTERNOON, FEBRUARY 8, 2013

**Poster Symposium:
Promoting Health and Well-being in Individuals
with Mild Cognitive Impairment and Dementia:
The Roles of Cognition, Emotion and
Reminiscence.**

1:00–2:00 p.m.

Cognitive Intervention/Rehabilitation

N. CAZA, S. BELLEVILLE, A. ERGIS & N. CAZA. Promoting Health and Well-being in Individuals with Mild Cognitive Impairment and Dementia: The Roles of Cognition, Emotion and Reminiscence.

Symposium Description: With the rapidly aging population, it is expected that individuals with Alzheimer's disease and related dementias will more than double over the next 25 years in most modern countries, resulting in greater demands on long-term care, community-based services, and family members. Given there is no cure for dementia, interventions designed to a) prevent cognitive decline in those most at risk of developing dementia, namely individuals with mild cognitive impairment and b) maintain skills, maximize functioning, and slow deterioration in persons who already have dementia are warranted. In this symposium we have gathered three experts in neuropsychological rehabilitation to present their most recent work. Dr Sylvie Belleville will present studies that have assessed the efficacy of cognitive training in persons with mild cognitive impairment. Those studies have used either attentional training where patients are trained to modulate their attentional priority, or memory training where patients are taught different mnemonics to promote active encoding. Dr Anne-Marie Ergis will present studies on a memory intervention program, which combines visual imagery and emotions to improve explicit and implicit memory in individuals with Alzheimer's disease. Dr Nicole Caza will present studies on a reminiscence intervention program for staff members to reduce neuropsychiatric symptoms and improve quality of life in institutionalized individuals with dementia. Following these presentations, a general discussion will review methodological and conceptual challenges associated with intervention studies in clinical populations. In summary, this symposium will provide invaluable information regarding current interventions, which promote health and well-being in individuals with mild cognitive impairment and dementia.

Correspondence: *Nicole Caza, Ph.D., Centre de recherche, Institut universitaire de gériatrie de Montréal, 4565, Queen-Mary, Montreal, QC H3W 1W5, Canada. E-mail: nicole.caza@umontreal.ca*

S. BELLEVILLE, C. HUDON, M. OUELLETTE, S. GRENIER, N. BIER, B. GILBERT, V. CHANTAL, C. BRODEUR & L. GAGNON. The role of cognitive training to improve cognition in persons with mild cognitive impairment: efficacy, transfer effects and generalization to activities of daily living.

Cognitive training can improve cognition in persons with mild cognitive impairment (MCI), a preclinical phase of Alzheimer's disease. However, many studies have compared the effect of cognitive training to that of a no-contact condition. Furthermore, there is a lack of evidence regarding generalization of these training effects to activities of daily living or transfer to untrained tasks. This talk, will present two studies where memory training or attentional control training was compared to

control intervention conditions. These studies also examine whether the effects of cognitive training can transfer to related untrained tasks, and whether they generalize to activities of daily living. In the first study, persons with MCI were randomized to memory training, psychosocial intervention or no intervention. Memory training, but not psychosocial intervention, improved memory performance relative to the no-training condition. Both memory and psychosocial training were associated with improved performance on activities of daily living as measured with self-reported questionnaires. Likewise, we found in a second study that learning to modulate the focus of divided attention improved performance to a larger extent than simply practicing divided attention, but that both types of training were associated with improved performance on untrained transfer tasks. These findings indicate that the effects of cognitive training can generalize to activities of daily living and transfer to untrained tasks. However, the control interventions also showed positive effects on activities of daily living or untrained transfer tasks. This finding will be related to two of the methodological challenges associated with studying generalization effects: the selection of appropriate ways to measure generalization, and the difficulties in identifying cognitively inactive interventions as a control training condition.

Correspondence: *Sylvie Belleville, 4565 Queen Mary, Montréal, QC H3W 1W5, Canada. E-mail: sylvie.belleville@umontreal.ca*

G.C. CIQUIER, C. FOURNIER, C. LAGRANGE, L. DESCÔTEAUX & N. CAZA. The Beneficial Effects of Reminiscence on Mental Health and Quality of Life in Institutionalized Dementia Patients: Preliminary Results.

Most older adults in long-term care suffer from behavioral and psychological symptoms of dementia (BPSD), which in turn decrease quality of life (QoL). Structured reminiscence interventions have been shown to reduce depressive symptoms in community-dwelling older adults yet evidence for its beneficial effects in clinical populations is lacking. Reminiscence is a psychosocial intervention that involves retrieval of past personal and pleasurable memories. In dementia, older memories are more likely to be preserved than recent ones and may thus be retrieved during intervention. We will present studies that evaluated the effects of a reminiscence intervention in improving mental health and QoL in institutionalized dementia patients. In Study 1, we devised a training program enabling long-term care staff members to run reminiscence groups and assessed effectiveness of the intervention from their perspective in a focus group. In Study 2, we measured the effects of reminiscence in reducing BPSD and improving QoL in 8 patients with mild to moderate dementia. The outcome measures, taken before and after treatment, included apathy, anxiety, psychopathology, depression, and QoL. Results for Study 1 indicated that our training program was effective in providing appropriate training for staff to run reminiscence groups with confidence. Qualitative analysis of the focus group content revealed that reminiscence allowed staff members to get to know patients as individuals. Results for Study 2 showed significant improvements (Wilcoxon signed ranks test, $p < 0.05$) in patients on measures of anxiety and apathy after intervention, and improvement of QoL according to family members. Single case analyses indicated a substantial decrease in BPSD in a few patients after intervention. These preliminary results suggest that reminiscence has beneficial effects on improving mental health and QoL in institutionalized dementia patients and provide valuable information for geriatric care.

Correspondence: *Gabrielle C. Ciquier, 2552 rue St Charles, Montreal, QC H3K1E5, Canada. E-mail: gabrielle.ciquier@gmail.com*

A. ERGIS, B. BOLLER, F. TARGE & A. RIGAUD. The Role of Emotion as a Facilitator in Memory Rehabilitation in Persons with Mild Alzheimer's Disease.

Several studies have examined the relationships between memory and emotions in Alzheimer's disease (AD). Many of them have shown that using stimuli with emotional valence improves explicit memory performance, especially with positive ones. Others have demonstrated preserved implicit memory for emotional words and pictures. Recent data showed that the emotional content of stimuli influences memory for music. All these studies open up paths for new strategies in memory rehabilitation. However, clinical applications of these findings for memory rehabilitation or stimulation are still very infrequent. To date these scarce researches have examined more specifically the enhancing effect of music on autobiographical memory recall in AD patients. In this talk, I will present two studies in which we examined the impact of emotional stimuli in memory rehabilitation programs. In the first study, we proposed to one group of AD patients autobiographical memory rehabilitation using songs known as familiar and representative of 5 different periods of life. A control group of patients had occupational activities. An autobiographical memory interview was given to both groups of patients before and after training. Results showed that episodic scores improved after training only in the experimental group. Moreover these patients had also lower scores in the depression scale, suggesting that improving the sense of self has a positive impact on mood. In the second study we proposed a face-name associations learning intervention program to patients with mild AD. Each patient was his own control, and baselines were given before and after intervention. Absurd imagery and spaced retrieval were used, and stimuli were neutral and happy faces. Results showed abilities to learn these new associations in patients, and learning was better for happy faces. These findings show the interest of relying on emotional stimuli in order to improve memory rehabilitation in Alzheimer's disease.

Correspondence: *Anne-Marie Ergis, Equipe Neuropsychologie du Vieillessement EA 446S, Institut de Psychologie Université Paris Descartes 71 avenue Edouard Vaillant, Boulogne-Billancourt 92100, France. E-mail: anne-marie.ergis@parisdescartes.fr*

**Poster Session 6:
Cross Cultural/Emotional
Processes/Malingering/Psychopathology**

1:00–2:00 p.m.

Cross Cultural

J. BENNETT & S.P. VERNEY. Acculturation and Phonemic Fluency in Hispanic Bilinguals.

Objective: Phonemic fluency tests are widely used to measure executive functioning and to differentiate among various forms of dementia. Yet there is scant research delineating linguistic and cultural factors as potentially influencing phonemic fluency performance. The U.S. Hispanic population continues to grow rapidly, with Spanish-English bilinguals comprising a large portion of this group. This population experiences various acculturative processes while interacting with mainstream U.S. society. The purpose of this study is to investigate the associations of acculturation and phonemic fluency performance among Hispanic bilingual students.

Participants and Methods: Hispanic bilingual students completed the Controlled Oral Word Association Test, and an acculturation measure, the Scale of Ethnic Experience (SEE). Participants were divided into two groups: an early age of acquisition (AoA) group who learned their second language (L2) by age 6 ($n=77$) and a late AoA group ($L2 > 6$ years; $n=22$).

Results: For the early AoA group, a regression analysis resulted in SEE acculturation variables significantly accounting for 16% of the variance

in students' phonemic fluency scores, with ethnic identity and social affiliation being significant factors in the model ($R^2=0.16$, $F[2, 76]=7.03$). Early AoA Hispanic bilingual students who were more acculturated to mainstream U.S. society scored higher on phonemic fluency. A similar regression for the late AoA group accounted for a non-significant 17% of the phonemic fluency scores.

Conclusions: Early age of acquisition of L2 is advantageous in bilingualism, leading to better attention, cognitive flexibility, inhibitory control, and cognitive reserve than learning a second language later in life. Even with these and other advantages, acculturation was significantly associated with better phonemic fluency performance. Thus, understanding and accounting for acculturation when assessing Hispanic bilinguals will lead to more accurate diagnoses and treatment planning.

Correspondence: *Jennifer Bennett, M.S. Psychology; Psychology; Univ New Mexico, 1 University of New Mexico, MSC03-2220, Albuquerque, NM 87131-1161. E-mail: jenben@unm.edu*

R. CASAS, X. CAGIGAS, J.B. MILLER & R. BILDER. Differences in Visual Memory Span Performance in Latino and Caucasian Adults in a Healthy Community Sample.

Objective: Memory span tests are often used to assess both simple attention and working memory abilities across auditory and visual modalities. Research shows that cultural and linguistic factors influence scores on auditory memory span measures, including the Digit Span subtest of the Wechsler Adult Intelligence Scales (WAIS), but much less is known regarding their effects on visual memory span measures, such as the WAIS-IV Symbol Span subtest. The objective of this study was to examine the influence of self-reported ethnicity and language of test administration on WAIS-IV Symbol Span performance in a large sample of Latino and Caucasian adults.

Participants and Methods: Participants included healthy Latino adults tested in either English ($n=165$) or Spanish ($n=102$), and Caucasian adults tested in English ($n=349$) living in the greater Los Angeles area. Participants were recruited through the UCLA Consortium for Neuropsychiatric Phenomics, which aims to investigate the genetic bases of cognitive phenotypes such as memory and response inhibition. Participants completed the WAIS-IV Symbol Span subtest in addition to other neuropsychological tests, experimental cognitive tasks, and genetic analyses.

Results: Analysis of covariance revealed significant differences in Symbol Span scores between groups, even after accounting for age and education ($F(2, 611) = 8.64$, $p < .001$). Post-hoc comparisons revealed that Latinos scored significantly lower than Caucasians ($p < .001$) whether they were tested in Spanish (Cohen's $d = .62$) or in English (Cohen's $d = .34$), independent of language of test administration.

Conclusions: These preliminary findings suggest that as a group, Latinos obtain lower scores on the WAIS-IV Symbol Span subtest compared to Caucasians, and that cultural factors can influence performance on visual memory span measures. These findings cannot be better explained by differences in age or education between the groups, nor can they be accounted for by differences in language of test administration.

Correspondence: *Rachel Casas, Clinical Psychology; Graduate Psychology; California Lutheran University; 2201 Outlet Center Drive, Oxnard, CA 93036. E-mail: casas@callutheran.edu*

J.E. CELESTIAL, V. PALAD, M. HELD & A.M. WISNIEWSKI. Subjective Self-Rating of English Language Skills in Filipinos and Filipino Americans.

Objective: Examinees' level of English language skills should be considered prior to neuropsychological test administration in English. This study's purpose was to investigate psychometric properties of 4 new self-rating scales of English language in Filipinos and Filipino Americans.

Participants and Methods: 40 healthy, community-dwelling, Filipino and Filipino American adults from ages 18 to 76 ($M=42.8$; $SD=17.35$) with 11 to 20 years of education ($M=15.38$; $SD=2.25$) completed the 4 Rating Scales of English Language Fluency (RSELF) & the WRAT4

Word Reading (WR). Participants were 20 males & 20 females, 60% immigrants, 40% US born. The 4 RSELF scales were: Understanding Spoken English, Speaking English So Understood, Reading & Understanding English, & Writing in English So Understood. Each was a 7-point Likert scale with 1= no ability, 4=some ability, & 7=very good ability.

Results: Participants rated English skills on the 4 RSELF from some ability (3.5) to very good ability (7). Medians for each of the 4 scales were 6.5, indicating good English skills in all domains. Spearman intercorrelations among 4 RSELF scales ranged from .748 (Reading/Speaking) to .835 (Understand/Reading), indicating strong relations among ratings. Mean score on WR was 104.23 (SD=9.14), indicating overall average reading, with standard scores from 85 (low average) to 127 (superior). Spearman's correlations between 4 RSELF scales & WR were: Understanding .335, Speaking .165, Reading .320, Writing .372; all significant except Speaking.

Conclusions: Filipinos and Filipino Americans self-rated English language skills as good. The 4 RSELF scales were highly positively related to one another. Participants' WR ranged from low average to superior. Self-ratings of English Understanding, Reading, & Writing were positively related to WRAT4 Word Reading. The 4 RSELF scales show promise as subjective examinee ratings of English language fluency.

Correspondence: *Jeanne E. Celestial, M.S.W., L.C.S.W., Pacific Graduate School of Psychology, Palo Alto University, 1791 Arastradero Road, Palo Alto, CA 94304. E-mail: jcelestial@paloalto.edu*

V. FERNANDEZ, M. ALLEN, M.K. YORK, E.A. WILDE, C. KAR-MONIK & A.M. STRUTT. Neural Correlates of a Novel Spanish Word Recognition fMRI Memory Task.

Objective: To examine the clinical utility of a novel Spanish word recognition fMRI memory task with cognitively intact, primarily Spanish-speaking adults.

Participants and Methods: Primarily Spanish-speaking community volunteers performed a Spanish translation and adaptation of the Hopkins Verbal Learning Test formatted for the fMRI scanning environment during functional imaging. The sample was comprised of adults (N=14) between the ages of 50 and 62 (mean age = 55.29 ± 3.89; 13 female and 1 male) with an average of 11.4 years of education and an average score of 26.6 on a Spanish version of the Mini-Mental Status Examination (MMSE).

Results: Significant peaks of activation were observed throughout brain regions associated with executive functions and visual stimulus, memory and language processing. Specifically, activation of the hippocampus, as well as dorsolateral pre-frontal cortex suggested engagement of episodic and semantic memory systems.

Conclusions: These results are consistent with similar word recognition imaging studies performed on English speaking adults. Given the differential rates of neurodegenerative disorders observed across race and ethnicity in the elderly, research with primarily Spanish-speaking minorities is imperative for the investigation of cognitive decline, and having appropriate Spanish-language measures that can be implemented with novel scientific technologies facilitates this process.

Correspondence: *Vindia Fernandez, M.A./Ph.D. Student, Department of Psychology, University of Houston, 2151 W. Holcombe, 222 TMC Annex, Houston, TX 77204-5053. E-mail: vindia_f@yahoo.com*

H.M. GONZÁLEZ, T.H. MOSLEY, W. TARRAF, N. GOUSKOVA, E.J. PENEDO, W. ARGUELLES, C. SCALA MOY, E.A. WHITSEL, S.N. MATTSO, E. ARREDONDO, J.P. CHOCA & D.J. CATELLIER. Cultural and socioeconomic correlates of neurocognitive function among middle-aged and older Hispanics/Latinos: Results from the Hispanic Community Health Study/Study of Latinos.

Objective: To examine and describe cultural and socioeconomic correlates of cognitive function among middle-aged and older Hispanics/Latinos.

Participants and Methods: Cross-sectional data from a multisite (Bronx, Chicago, Miami and San Diego), probability sample of house-

hold resident adults (45- to 74-years old; N=9,593) were analyzed to calculate cognitive functioning scores and correlates. Cognitive functioning was measured using a brief neuropsychological test battery that included the: (1) Six-Item Screener (SIS); (2) Spanish English Verbal Learning Test (SEVLT); (3) Controlled Oral Word Association (or Word Fluency; WF) Test of the Multilingual Aphasia Examination; and (4) Digit Symbol Subtest (DSS) of the Wechsler Adult Intelligence Scale-Revised. Tests were performed in Spanish or English to reflect respondents' preference.

Results: There were significant differences in cognitive scores between Hispanic/Latino ethnicities (e.g., 8.7 points on DSS) that were maintained after controlling for our model covariates (age, sex, education and language). Male sex and older age were associated with lower average cognitive scores, whereas education and English language preference were associated with higher cognitive scores.

Conclusions: We found differences in cognitive scores between Hispanics/Latinos ethnicities that were not explained by the cultural and socioeconomic factors considered herein. The cognitive performance differences we found in this large, Hispanics/Latinos multiethnic, cross-sectional study are similar to two earlier neuroepidemiologic studies of cognitive impairment and dementia among older Hispanics/Latinos in New York and California. We will continue to monitor the neurocognitive health and aging of this cohort of Hispanic/Latinos.

Correspondence: *Hector M. González, PhD, Institute of Gerontology & Department of Family Medicine & Public Health Sciences, Wayne State University, 57 East Ferry Street, Detroit, MI 48202. E-mail: hmgonzalez@med.wayne.edu*

R. KAMAT, T.D. MARCOTTE, J. BADIEE, I. MAICH, M. CHERNER, S. DE ALMEIDA, A. DE PEREIRA, C. RIBEIRO, F. BARBOSA, R. ELLIS & T. HNRP GROUP. Correlates of apathy in a Brazilian cohort of HIV-infected individuals.

Objective: In western cohorts, neuropsychiatric symptoms (e.g., cognitive impairment, depression, and apathy) associated with HIV infection have significant functional and medical consequences. It is not known whether these findings generalize internationally as the correlates and expression of psychiatric distress may differ across cultures. In a cohort of Brazilian HIV+ individuals, we aimed to characterize the relationship between apathy and depression, neuropsychological impairment (NPI), and functional difficulties.

Participants and Methods: Participants were 44 HIV+ and 27 HIV-Brazilians, with 3–19 years of education and 20–69 years of age. They underwent a neuropsychological and neurological evaluation that included self-report measures of depression (Beck Depression Inventory-II; BDI-II), neurocognitive complaints (Patient's Assessment of Own Functioning Inventory) and declines in instrumental activities of daily living (IADLs; Activities of Daily Living questionnaire). The MINI-plus provided Major depressive disorder (MDD) diagnoses. The neurological evaluation's apathy item and 3 BDI-II items (i.e., social withdrawal, decision-making, and loss of energy) were summed to generate an apathy z-score (Cronbach's $\alpha=.8$).

Results: HIV+ individuals endorsed higher levels of apathy relative to HIV- subjects ($p<.001$). Apathy was significantly associated with current mood symptoms ($r=.60$, $p<.001$), current MDD, $t(38)=3.48$, $p=.001$, but not CD4 level, AIDS status or NPI. After adjusting for mood, apathy was significantly correlated with increased IADL dependence ($r=.48$, $p<.001$) and cognitive complaints ($r=.49$, $p<.001$). In multivariable models with NPI, CD4 level, and current MDD as covariates, apathy significantly predicted IADL dependence ($\beta=.52$, $p<.01$), but not cognitive complaints.

Conclusions: Our Brazilian HIV+ cohort endorsed apathy and depression. Although correlated with depression, apathy was uniquely associated with functional difficulties. Apathy may be worthy of clinical consideration in HIV-infected Brazilians.

Correspondence: *Rujvi Kamat, MS, SDSU/UCSD Clinical Psychology JDP, 150 West Washington, 2nd Floor, San Diego, CA 92103. E-mail: rkamat@ucsd.edu*

M. PARIKH, J. FALKOWSKI, L. LACRITZ, M. WEINER & C. CULLUM. A Cross-Cultural Investigation of the Texas Card Sorting Test.

Objective: The Texas Card Sorting Test (TCST) is a brief, nonverbal measure of mental flexibility and reasoning developed for use in cross-cultural settings. Previous studies have found the TCST to be a valid assessment of executive functioning in dementia, schizophrenia, epilepsy, and healthy populations. The purpose of this investigation was to compare TCST performance across three groups of healthy ethnic minorities. **Participants and Methods:** The TCST consists of 6 cards that can be grouped according to a variety of principles. This study examined TCST total sorts (TS), logical sorts by a novel principle (LS), and perseverative sorts (PS) in 65 African Americans (AA), 54 American Indians (AI), and 57 Hispanics (H), age 19–50, who were administered the TCST as part of a larger study of healthy controls. Groups were similar in years of education [M(SD): AA=13.6(1.6), AI=13.3(1.5), H=13.6(1.6)] and gender (% female: AA=27%, AI=33%, H=31%). The African American group was older than the Hispanic group [M(SD): AA=34.2(7.7), AI=33.0(8.6), H=30.7(8.0)], so ANCOVAs were performed with age as a covariate.

Results: TS were significantly different between groups, with American Indians completing significantly more sorts than the other groups [M(SD): AA=7.6(1.9), AI=8.9(2.5), H=7.3(1.8)]. American Indians had more LS than African American subjects ($p < 0.05$), but performed similarly to Hispanics [M(SD): AA=6.4(1.9), AI=7.11(1.9), H=6.5(1.8)]. The American Indian group also had more PS compared to the other groups [M(SD): AA=0.75(0.8), AI=1.6(1.7), H=0.47(0.7); $p < 0.05$]. African Americans and Hispanics created a similar number of LS and PS.

Conclusions: While some differences were seen between groups, these findings support the use of the TCST as a brief tool for cross-cultural evaluation of executive functioning. However, as with most other neuropsychological measures, consideration must be given to cultural and ethnic background prior to interpreting findings.

Correspondence: *Mili Parikh, B.A./B.S., University of Texas Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, TX 75330-9044. E-mail: mili.parikh@utsw.edu*

G. PLUCK, D.R. BANDA-CRUZ, M.V. ANDRADE-GUIMARAES, S. RICAURTE-DIAZ & T. BORJA-ALVAREZ. Cognitive Function of a Sample of 'Street Children' in Quito, Ecuador.

Objective: Very little has been published about the cognitive function of street children in developing countries, despite them being exposed to multiple factors with the potential to impair neuropsychological function (e.g. trauma, substance abuse) and despite the implications for interventions. The aim of this research was to assess the intellectual functioning of a group of former street children in Quito, Ecuador.

Participants and Methods: A group of 37 former street children was recruited from a charitable service which was providing them with meals, education and health care. The mean age of the sample was 13.3 (range 10–16) and 28/37 (76%) were male. All of the children were assessed with the two performance subtests of the Wechsler Abbreviated Scale of Intelligence (WASI); Block Design and Matrix Reasoning. These tests were chosen as both provide relatively culture fair assessments of general intellectual function. In addition demographic data and substance abuse status were recorded.

Results: The children appeared to show unusually low function as measured by either of the WASI performance subtests. However, Matrix Reasoning scores were significantly lower than Block Design scores. Ecuadorian IQ population norms were not available, but using USA norms, the group average score was more than two standard deviations below the mean average. Using an estimated Ecuadorian population mean point, the children as a group still scored more than one standard deviation below it. Indeed, the cognitive scores were all significantly below population norms. Their cognitive test performance was not significantly related to any demographic variables or to substance abuse status.

Conclusions: The children in our sample displayed evidence of significantly low cognitive function, suggestive in many cases of mental retardation. Substance abuse does not appear to be the cause of this low function. The results are comparable with others from around the world which have reported measures of IQ in street child samples.

Correspondence: *Graham Pluck, Policy Studies, Chuo University, 742-1 Higashinakano, Hachioji-shi Tokyo 192-0393, Japan. E-mail: g.pluck@sheffield.ac.uk*

P. SAYEGH, J.L. KELLOUGH & M.C. FENG. Cross-cultural Differences in the Role of Language-based Neuropsychological Tests in Dementia Diagnosis among Hispanic and Non-Hispanic White Outpatients.

Objective: Cross-cultural differences in the clinical diagnosis of dementia merit further attention as the surging elderly population in the United States becomes increasingly diverse. Though neuropsychological tests play a key role in diagnosis, some tests suffer from limitations (e.g., lack of representative normative data) when applied to ethnic minority groups, particularly non-native and non-primary English speakers, that may lead to systematic differences in diagnosis across cultures. Given clinicians' likely awareness of these limitations, we hypothesized that language-based neuropsychological tests would be weaker predictors of diagnosis in Hispanic compared to non-Hispanic White (NHW) patients.

Participants and Methods: Our sample was composed of 436 Hispanic and 436 NHW (randomly selected out of 10,937) outpatients diagnosed with either dementia or normal cognition at their initial Alzheimer's Disease Research Centers evaluations nationwide. We used multivariate logistic regression to test for cross-cultural differences in the predictive roles of a confrontation naming test (30-item Boston Naming Test [BNT]) and semantic fluency tests (animals and vegetables) in diagnosis, covarying for age, sex, education, primary language, and functional abilities.

Results: Results revealed that the BNT was a significant predictor of a dementia diagnosis among Hispanics only, OR = 0.890, 95% CI [0.793, 0.999], whereas vegetable fluency was only significant for NHWs, OR = 0.804, 95% CI [0.688, 0.939]. Animal fluency predicted diagnosis to comparable degrees across Hispanics, OR = 0.787, 95% CI [0.661, 0.936], and NHWs, OR = 0.832, 95% CI [0.743, 0.932].

Conclusions: These findings suggest that the BNT was relatively unimportant in the diagnostic process in this sample of NHWs perhaps due to a ceiling effect. Additionally, vegetable but not animal fluency was inconsequential in the diagnostic process for Hispanics perhaps due to cultural influences on the familiarity, salience, and relevance of items in this category.

Correspondence: *Philip Sayegh, M.A., Departments of Psychology and Preventive Medicine, University of Southern California, 3620 S. McClintock Ave., SCM 501, Los Angeles, CA 90089-1061. E-mail: psayegh@usc.edu*

P.A. SUAREZ, T. GOLLAN, R. HEATON & M. CHERNER. Bilingual Advantages on Test Performance Persist after Controlling for Education Among Spanish Speakers Tested in their Native Language.

Objective: Previous studies suggest an advantage of bilingualism on certain executive function tasks. However, bilingualism and education tend to be highly correlated in these studies. We therefore attempted to isolate effects of bilingualism on test performance with bilingual and monolingual Spanish speakers matched for education.

Participants and Methods: Participants were 23 male and 23 female, adult native Spanish speakers from the U.S.–Mexico border region with mean (SD) age of 37.4 (9.5) and 10.7 (4.4) years of education. Spanish preference was ascertained using a language use questionnaire. The Controlled Oral Association Test was administered (PMR in Spanish, FAS in English) to confirm relative language dominance and fluency. Participants were divided into groups based on their relative English fluency, calculated as the ratio of English words to the total in both languages (0–0.33 = monolingual; 0.34–0.66 = bilingual). Participants in the upper tertile were excluded. Participants received a comprehensive neuropsychological battery in Spanish. Effects of bilingualism on test performance were examined as means comparisons with education matched groups covarying for effects of age and sex.

Results: Despite comparable education levels, bilinguals out-performed monolinguals on tests of processing speed (Digit Symbol, and Symbol Search, Stroop Color Naming), attention/working memory (Letter Number Sequencing, Digit Span), and executive function (Trail Making Test B, Stroop Color-Word) with some additional, unexpected advantages in memory (Aprendizaje de Palabras Delayed Recall, Figure Memory Delayed Recall). No differences were found in other domains.

Conclusions: Findings suggest that bilingual advantages on test performance cannot be explained by differences in education. These results imply that bilingualism likely confers a true neuropsychological advantage that needs to be considered when interpreting test performance, adding complexity to the generation and application of test norms in bilingual groups.

Correspondence: *Paola A. Suarez, M.A., Psychiatry, UCSD, 220 Dickinson St., 3rd Floor, San Diego, CA 92103. E-mail: pasuarez@ucsd.edu*

Emotional Processes

C. ABEARE & S. FREUND. Physiological Reactivity During the Emotion Word Fluency Test in Comparison to Phonemic and Semantic Fluency Measures.

Objective: Verbal fluency tasks have been shown to have utility in assessing aspects of executive and language functioning (Henry et al., 2006) and in the differential diagnosis of various disorders. The utility of these measures comes from established validity relationships as well as the ease and quickness of administration. This study aimed to further examine the validity of the Emotion Word Fluency Test (EWFT; Abeare et al., 2009) as a measure of emotional, executive, and language functioning.

Participants and Methods: Skin conductance response and heart rate were examined as physiological measures of emotional arousal in order to examine the responses evoked by phonemic fluency (FAS), semantic fluency (Animals), and the Emotion Word Fluency Test (EWFT). Data were gathered from an undergraduate sample ($N = 103$).

Results: When controlling for depression (BDI-II scores), skin conductance response, at time of task, positively correlated with EWFT performance ($r = .541, p = .014$), but did not correlate with FAS ($r = -.066, p = .781$) or Animals ($r = .057, p = .810$). Heart rate at time of task was correlated with FAS performance ($r = -.444, p = .050$) and EWFT performance ($r = -.554, p = .011$), but not with Animal fluency performance ($r = -.199, p = .401$).

Conclusions: The correlation between the EWFT and skin conductance suggests that greater emotional activation during task completion may result in better performance on this task. The presence of a correlation between heart rate and the EWFT, but not Animals, is interesting given that the EWFT is a type of semantic fluency task, but does not behave like a semantic fluency measure in terms of physiological reactions. The correlation between FAS and heart rate may be an artifact related to the novelty of the task since the FAS was the first cognitive task administered. Future research should randomize task order to assess for order effects. Overall, these findings suggest that the EWFT measures a unique aspect of verbal fluency that is affectively activating in nature. Correspondence: *Sabrina Freund, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada. E-mail: sabrinafreund@hotmail.com*

S. FREUND & C. ABEARE. Physiological, Affective, and Cognitive Aspects of Alexithymia.

Objective: Previous research has suggested that alexithymic individuals exhibit difficulties in cognition and emotion-processing, and demonstrate differences in tonic and phasic autonomic activity (Koven & Thomas, 2010; Lane et al., 1996; Franz, Schaefer, & Schneider, 2003). This study aimed to further explore physiological, cognitive, and affective aspects of alexithymia.

Participants and Methods: Data was collected from a population of undergraduate students ($N = 103$). Alexithymic traits were measured using the TAS-20. Autonomic arousal (heart rate, skin conductance) was measured before and during verbal fluency tasks (phonemic, semantic, and emotion word fluency).

Results: Relationships between alexithymia, verbal fluency, and autonomic activity were analyzed using linear regressions. After controlling for depression (BDI-II scores), results showed that degree of alexithymia was not associated with performance on any of the verbal fluency measures, including the emotion word fluency task (EWFT). In regards to the physiological measures, degree of alexithymic traits was not associated with differences in autonomic activity at baseline or during performance measures.

Conclusions: The absence of a relationship between alexithymia and verbal fluency suggests that alexithymia is not related to difficulties with the particular cognitive and verbal emotion-processing tasks employed in this study. Deficits in the processing of affective words in alexithymia may be restricted to deeper levels of semantic processing, assessed by judging the valence of emotion words or describing their own emotional reactions. No relationship was found between alexithymia and any of the physiological measures, suggesting that alexithymia is not associated with differences in autonomic activity either at baseline or in response to cognitively-demanding tasks, but may be restricted to differences in reactivity when exposed to sufficiently emotion-provoking stimuli or tasks.

Correspondence: *Sabrina Freund, University of Windsor, 401 Sunset Avenue, Windsor, ON N9B 3P4, Canada. E-mail: sabrinafreund@hotmail.com*

K. ALTERESCU, E.M. MURRAY, M.M. HALFACRE, J. TWAITE, K.A. SCORPIO, K.R. SAVAGE, J.L. SPIELMAN, L.O. RAMIG & J.C. BOROD. Facial Emotional Expressivity Following Voice Treatments in Individuals with Parkinson's Disease (PD).

Objective: Impairments in emotional facial expression (i.e., masked facies) are widely observed in PD. However, little attention has been given to remediating masked facies. Preliminary work has shown that the treatment of voice using the Lee Silverman Voice Treatment (LSVT®; Ramig et al., 1995) has beneficial effects on some aspects of facial expression in PD (Spielman et al., 2003). We examined the effects of two voice treatments on facial expression in PD using 3 aspects of facial emotional expressivity: frequency (EF), variability (EV), and intensity (EI). **Participants and Methods:** Participants included 56 posers (individuals who produced emotional and non-emotional monologues) and 18 raters (individuals who rated posers' facial expressions from video-recorded monologues). Ratings were made by trained raters on a 7-point scale for each of the 4 variables. Raters were trained to criterion, and interrater reliability was high for each variable (ICC=.70-.89). There were 4 poser groups: 3 PD groups randomly assigned to LSVT (voice treatment), ARTIC (articulation treatment), or a no-treatment control group, and a healthy control group.

Results: To evaluate effects of voice treatments, we conducted a Poser Group (4) x Gender (2) x Time (2: Baseline, Post-Treatment) x Monologue (4: Happy, Sad, Angry, Neutral) ANCOVA (controlling for depression scores) for each facial expression variable. Poser Group x Time interactions revealed that posers who received LSVT were rated as having greater expressivity for all variables, with statistically significant improvement after treatment for EF ($p=.04$) and a trend for EI ($p=.08$) and EV ($p=.06$). Changes over time were not observed for the other 3 poser groups.

Conclusions: It is speculated that LSVT improves facial emotional expression because facial and vocal expression are emotional communication channels that exist within a larger network of emotional processing. The broader clinical implications of our findings are that masked facies can be remediated using LSVT.

Correspondence: *Karin Alterescu, Ph.D., Psychology Department, Queens College, CUNY, 65-30 Kissena Blvd., Flushing, NY 11367. E-mail: karin.alterescu@yahoo.com*

E. MÜLLER-OEHRING, T. SCHULTE, I.M. COLRAIN & F.C. BAKER. Cognitive Interference from Emotional Faces in Severe Premenstrual Syndrome.

Objective: Premenstrual syndrome (PMS) is characterized by a combination of distressing physical and emotional symptoms that recur in the luteal phase of the menstrual cycle. To test if task performance is affected by PMS, women with and without severe PMS performed an emotional Match-to-Sample task during the follicular and late luteal phases of the menstrual cycle.

Participants and Methods: 23 women (11 with prospectively confirmed severe PMS) matched the color of a probe to that of a target; in half of the trials emotional faces were presented between probe and target. Emotional Face effects were computed for sad and happy faces with higher scores indicating more interference from emotional faces during color matching.

Results: Both groups demonstrated higher interference from sad than happy emotional faces, i.e., emotional sensitivity, especially during the late luteal phase. Group differences emerged for the follicular phase, with PMS women showing higher emotional face interference than control women, particularly for sad faces. Despite the fact that severe PMS symptoms are typically observed during the luteal phase, PMS severity, trait anxiety, and depressive symptoms were related to greater emotional interference from sad faces during the follicular phase.

Conclusions: These findings suggest enhanced emotional sensitivity during the late luteal phase in all women independent of the presence of severe PMS. Enhanced emotional interference during the follicular phase in women with PMS implies a tendency to experience emotional sensitivity to sadness even during the asymptomatic phase of the menstrual cycle.

Support: HL088088

Correspondence: *Fiona C. Baker, PhD, Center for Health Sciences, SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025. E-mail: fiona.baker@sri.com*

A.I. DUMER, E.B. TEAGUE, A. BONO, R. STAFFORD, A. ALIMOV, H. OSTER, L.A. RABIN, J.L. SPIELMAN, L.O. RAMIG & J.C. BOROD. Behavioral and Personality Judgments of Patients with Parkinson's Disease: A Focus on Observers.

Objective: Individuals with Parkinson's disease (PD) demonstrate a variety of impairments that are manifest through the face and voice. Studies carried out by Pentland and colleagues (1987 & 1988) demonstrated that these non-verbal deficits have a negative effect on the way that personality and behavior of PD patients are perceived. We re-examined these effects and extended them by controlling for various methodological factors and observer characteristics, which have received relatively little attention in the field.

Participants and Methods: Participants were 45 PD patients (73.3% men; M age=67.7; 91% Caucasian [Cau.]) and 11 healthy controls (HCs; 36.4% men; M age=61.9; 91% Cau.), who were videotaped while producing happy emotional monologues (Borod et al., 1992). Observers were 110 healthy adults (40.9% men; M age=19.6; 51.8% Cau.) who rated the monologues. Monologues without sound were divided into segments; participants' faces were rated using 7-point scales for 3 personality (e.g., extroverted) and 4 behavioral (e.g., engaged) characteristics. Ratings were combined into 3 scores: Overall, Personality, and Behavior.

Results: A one-way ANOVA with Group (PD & HC) as a between-subjects factor was performed on each of the rating scales. The mean ratings of PD participants were significantly lower than those of HCs for Overall ($p < .01$), Personality ($p < .01$), and Behavior ($p < .01$) scales. These effects remained significant after controlling for observer characteristics (age, gender, race, and education) and for methodological variables (e.g., order).

Conclusions: These findings show that personality and behavioral characteristics of PD participants were rated more negatively than those of healthy controls, regardless of observer characteristics and methodological factors. A potentially confounding effect of this study pertains to participant characteristics, which should be addressed in future studies with larger samples. Further, therapeutic interventions targeting disturbances in facial communication in PD should be examined.

Correspondence: *Joan C. Borod, Ph.D., Psychology, Queens College, 6530 Kissena Blvd, Flushing, NY 11367. E-mail: joan.borod@qc.cuny.edu*

A. CARTER, M.R. BASSO, D. COMBS & A. SHERMAN. Alexithymia and Facial Affect Recognition in Healthy Controls.

Objective: Alexithymia is a deficiency in understanding, identifying, processing, or describing emotions. It frequently occurs in medical or psychiatric illnesses such as autism spectrum disorders, posttraumatic stress disorder, and somatoform disorder. In these psychiatric disorders, patients with alexithymia demonstrate diminished ability to recognizing facial affect in others, revealing a deficit in social cognition. The underlying neurocognitive aspects of alexithymia are poorly understood. Further, it is uncertain whether alexithymia corresponds with social cognition deficits in healthy controls. Accordingly, this study examined the relationship between alexithymia and deficits in facial affect recognition and visual perceptual skill in healthy individuals.

Participants and Methods: Participants included 26 healthy controls (7 men and 19 women; age: M=25.42 years, SD=9.95 years; education: M=13.81 SD=1.29). All were administered the Toronto Alexithymia Scale (TAS), the Benton Facial Recognition Test, and the Test of Facial Affect Recognition.

Results: Correlations revealed a significant relationship between the TAS and Test of Facial Affect Recognition ($r(24) = -.401, p < .05$). In contrast, the TAS and Benton Facial Recognition Test were not significantly correlated ($r(24) = .043, p > .05$). Lastly, scores on the Benton Facial Recognition Test and the Test of Facial Affect Recognition measure of facial affect recognition were not significantly correlated ($r(24) = .374, p > .05$).

Conclusions: These data suggest that healthy controls with alexithymia demonstrate deficits in recognizing facial affect in others. However, individuals with alexithymia did not demonstrate diminished abilities in facial recognition. The ability to recognize emotions was not related to the ability to recognize faces. Thus, ability to discern emotional expressions in others is not due to a general perceptual deficit. Rather, it is a specific abnormality, for which the underlying neural correlates remain poorly understood. Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michael-basso@utulsa.edu*

J. DIETZ, M. BRADLEY, J. JONES, W. PERLSTEIN, M. OKUN & D. BOWERS. Parkinson's Disease, Apathy, and the ERP to Emotional Pictures.

Objective: Parkinson's disease is associated with emotional changes including depression, apathy, and anxiety. A previous study showed the PD patients show reduced startle potentiation during aversive picture viewing and that this response was negatively correlated with apathy. The goal of this study was to investigate whether this abnormality might extend to an electrocortical measure of emotional picture processing, the late positive event-related potential (the LPP). The LPP is a robust index of emotional picture processing and is correlated with emotional arousal.

Participants and Methods: Seventeen non-demented patients with Parkinson's disease and sixteen control participants viewed pleasant, neutral, and unpleasant pictures while EEG was recorded from a 64-channel electrode net. The PD patients were tested on medication. Exclusion criteria were dementia, psychiatric disturbance, and other neurologic disorders. Both early (P100, N150, N250) and late (LPP) components of the ERP were scored to test for basic differences in early perceptual processing of emotional stimuli as well as later detection of emotional significance. Correlations examined the relationship between these components and anxiety (STAI), depressive symptoms (BDI-II), and apathy (Apathy Scale).

Results: The Parkinson patients did not differ from controls in terms of early electrophysiological components that indexed basic visual processing (P100, N150). However, PD patients exhibited reduced LPP amplitude, specifically when viewing unpleasant pictures when compared to controls. Notably, the LPP was most attenuated for patients reporting high apathy and unrelated to depression or anxiety.

Conclusions: These data are consistent with findings of blunted startle potentiation in PD, suggesting a specific difference in aversive processing between PD patients and healthy controls. The data further suggest that apathy in PD is specifically related to defensive motivation, and may be indexed cortically using event-related potentials.

Correspondence: Jenna Dietz, M.S., University of Florida, PO Box 100165, Gainesville, FL 32605. E-mail: jdietz@phhp.ufl.edu

V. LA BUISSONNIÈRE ARIZA, J.R. SÉGUIN, M. NASSIM, M. BOIVIN, D.S. PINE, F. LEPORÉ, R.E. TREMBLAY & F. MAHEU. Neural Fear Circuitry Function and Harsh Parenting in High and Low Anxious Healthy Youths: Preliminary Results.

Objective: Adverse care-giving may increase risk for anxiety disorders that may persist throughout the lifespan. This could reflect anomalies in the neural “fear” circuit including the amygdala and subgenual anterior cingulate cortex (sgACC). Recent fMRI studies reported altered patterns of fear circuitry responses during fear conditioning and extinction in adults with anxiety and childhood maltreatment. We aim to use fMRI fear conditioning and extinction tasks to examine fear circuitry function related to anxiety and adverse rearing in youths.

Participants and Methods: Subjects: 100 youths aged 12-17 split in 4 groups according to anxiety (high/low) and mother’s harsh parenting (HP) practices levels (high/low).

Tasks: Valid fMRI fear conditioning and extinction tasks.

Data acquisition: Functional scans acquired with a Siemens TRIO 3-T.

Results: Preliminary results (N=49): Greater right amygdala ($k=87$, $T=6.57$, $P_{corr}=.018$) and hippocampus ($k=71$, $T=8.51$, $P_{corr}<.004$) activation to CS+ vs CS- were found during conditioning. These structures were more activated in high (vs. low) anxiety/HP groups (all $P_{corr}\leq.05$). During extinction, we found a trend for greater left ACC ($k=196$, $T=4.6$, $P_{uncorr}=.007$), and right middle frontal gyrus ($k=149$, $T=6.04$, $P_{uncorr}=.002$) to CS+ vs CS-. Youths with high anxiety showed less activation ($P_{corr}=.06$) vs youths with low anxiety/low HP. Compared to the latter group, youths with low anxiety/high HP showed a trend for greater ACC activation ($P_{uncorr}=.01$).

Conclusions: This suggests harsh parenting and anxiety are linked to altered fear circuitry function in youths. Identifying such neural markers is essential for advancing the management of harshly reared and anxious teens. Understanding this in youths is crucial as the implementation of better management may effectively influence a behavioural trajectory early on, before anxiety becomes chronic.

Correspondence: Valérie La Buissonnière Ariza, Psychology, Université de Montréal, C.P. 612S, succursale Centre-Ville, Montréal, QC H2V 2S9, Canada. E-mail: valeja.lba@gmail.com

E.P. MELTZER, L.M. KWIATKOWSKI & J.C. BOROD. Bodily Expression of Emotion: Factors Affecting the Accuracy of Emotion Identification.

Objective: Motor and sensory feedback from the body play an integral role in processing emotion. Research shows that imitation (“mimicry”) of facial expressions can facilitate emotion recognition (Lipps, 1907; Wallbott, 1991). We examined factors that might facilitate identification of bodily emotional expressions (gestures and postures): processing mode (evaluation via emotion recognition or experience), motor mimicry, perceiver gender, and emotion expression.

Participants and Methods: Participants were 65 undergraduates (M age=24.1±8.8, 69% female), comprising 4 experimental groups (Recognition, Recognition-Mimicry, Experience, Experience-Mimicry). While viewing pictures of bodily emotional expressions (provided by Dr. A. Atkinson, U. of Durham), the Recognition group identified the emotion recognized, and the Experience group identified the emotion personally experienced. Participants in the Recognition-Mimicry group imitated each expression before recognition, and those in the Experience-Mimicry group imitated each expression before identifying the emotion they experienced.

Results: A Mode (2) x Motor Mimicry (2) x Gender (2) x Emotion (6: anger, disgust, fear, sadness, happiness, neutral) ANOVA on accuracy

scores yielded a significant Emotion effect ($p<.001$), with neutral and happy easiest and disgust hardest to accurately identify. There was a Mode x Gender trend ($p<.10$), with women more accurate in the Recognition mode and men in the Experience mode. Further, 1-way ANOVAs were conducted on the accuracy scores for Mode (2), Mimicry (2), and Experimental Group (4), separately for each emotion. For fear, happiness, and sadness, conditions fostering objectivity (e.g., recognition without mirroring) led to greater accuracy.

Conclusions: Results suggest that the perceiver, in addition to emotion content, affect emotion identification accuracy. Findings have implications for the understanding of mirror neuron circuits and for individuals with social/emotional cognition deficits who might benefit from social-skills training.

Correspondence: Erica P. Meltzer, CUNY Graduate Center, 86 Larch Drive, Manhasset Hills, NY 11040. E-mail: epm234@gmail.com

A.E. OATLEY, M.K. DABEK, B. SIMMONS, J.K. STEEVES & R.E. GREEN. Using Eye-Tracking to Develop an Emotion Perception Treatment and Tackle the Challenge of Community Integration After Traumatic Brain Injury (TBI).

Objective: As evidence of the relationship between facial emotion perception (FEP), and post-brain-injury community integration continues to emerge, delineating how emotional faces are efficiently processed is increasingly essential to the development of evidence-based treatments. Visual attention is one mental process needed to accurately read facial emotions. This is one of the first studies to provide a visual scanning analysis of emotional faces under fixed-duration (i.e., typical experimental task) and speeded, voice-controlled (i.e., self-paced, motor-free novel experimental task) conditions.

Participants and Methods: The eye movements of 34 typically developing (TD) adults were recorded while viewing static facial expressions of neutral faces and the six basic universal emotions. Faces were presented in two blocks of fixed and self-paced presentation duration. Each expresser was presented only once, thereby eliminating the potential influence of prior expresser exposure given the prevalence of memory impairments following TBI. Number and proportion of foveal fixations to predetermined eye, nose and mouth areas of interest (AOIs) were analyzed.

Results: A significant emotion X AOI interaction emerged with respect to proportion of fixations. On the self-paced task, there was a significant effect of emotion on voice-response time, with mean response time being 1-3 s faster than the reaction times previously reported in button-press studies. Further, the raw-fixation data provide definitive evidence that TD adults fixate the eyes of fearful faces more than those of other basic emotions ($p <.05$).

Conclusions: In terms of neuropsychological and treatment implications, the study provides evidence of emotion- and task-specific visual scanning patterns which can be incorporated into future visual-attention evidence-based FEP remediation. Moreover, these results suggest that the reductions in processing speed associated with TBI and other neurological conditions may have an even greater impact on FEP than previously understood.

Correspondence: Alexandra E. Oatley, PhD Candidate, Department of Research, Toronto Rehabilitation Institute - UHN, Cognitive Neurorehabilitation Sciences Lab, 11207-550 University Avenue, Toronto, ON M5G2A2, Canada. E-mail: alexandra.arnold-oatley@uhn.ca

G. PARK, E. MOON, D. KIM & S. LEE. Individual differences in cardiac vagal tone are associated with differential neural responses to facial expressions at different spatial frequencies: An ERP and sLORETA study.

Objective: According to the neurovisceral model (Thayer & Lane, 2000), vagally-mediated heart rate variability (HRV) is associated with the functional capacity of cognitive and emotional regulatory systems. We studied whether individual differences in resting HRV were associated with differential event-related brain potentials (ERPs) in response to fearful and neutral faces at broad, high, and low spatial frequency.

Participants and Methods: Thirty-six healthy participants were asked to identify the emotion of fearful and neutral faces at broad, high and low spatial frequencies, while event-related potentials (ERPs) were recorded.

Results: Participants with low resting HRV—associated with poor functioning of regulatory systems—showed significantly greater N200 activity in response to fearful faces at low spatial frequency and greater LPP responses to neutral faces at high spatial frequency compared to participants with high resting HRV—associated with highly functional regulatory systems. Source analyses—estimated by standardized low-resolution brain electromagnetic tomography (sLORETA)—revealed that participants with low resting HRV showed increased source activity in visual areas, such as the cuneus and the middle occipital gyrus, compared to participants with high resting HRV.

Conclusions: The hyperactive neural activity associated with low resting HRV may account for hypervigilant response patterns and emotional dysregulation, which heightens the risk of developing physical and emotional problems.

Correspondence: *Geunhi Park, Ph.D., Psychology, Azusa Pacific University, 901 E. Alosta Ave. Wynn 100E, Azusa, CA 91702. E-mail: park.671@gmail.com*

J.E. ROSENQVIST, P. LAHTI-NUUTILA, M. LAASONEN & M. KORSMAN. Preschoolers' Recognition of Emotional Expressions: Relationships With Other Neurocognitive Capacities.

Objective: The development of facial emotion recognition, as well as the relationship between this ability and other neurocognitive capacities (attention/executive functions, language, memory/learning, sensorimotor functions, theory of mind, and visuospatial processing), was cross-sectionally examined.

Participants and Methods: The participants were 370 typically developing 3-to-6-year-old children (54.9% girls) drawn from the Finnish standardization of the NEPSY-II. The ability to match emotional expressions nonverbally was assessed with the subtest Affect Recognition. Domain scores, consisting of performance on thirteen other subtests from all the domains of the NEPSY-II (attention/executive functions, language, memory/learning, sensorimotor functions, theory of mind, and visuospatial processing), were included as indicators of the other neurocognitive functions.

Results: Performance on the nonverbal emotion matching task improved with age, polynomial contrasts revealing a mild deceleration of the development between ages five and six. Emotion recognition ability correlated with all other neurocognitive domains.

Regression analyses revealed that language, attention/executive functions, and theory of mind were significant predictors of emotion recognition ability ($R^2 = .140$). Commonality analysis indicated that language was the most important domain of these significant predictors (65% of R^2).

Conclusions: The ability to match facial expressions nonverbally improved with age during the preschool years, decelerating mildly between ages 5 and 6. Linguistic ability, the ability to sustain attention and to perceive and understand feelings of others were significantly related to emotion recognition. As revealed by the commonality analysis, and in contrast to most previous studies, language was the most important predictor of nonverbal emotion recognition. The results suggest that nonverbal emotion matching is an early maturing skill that develops in relation to other neurocognitive capacities, especially linguistic ability.

Correspondence: *Johanna E. Rosenqvist, Institute of Behavioural Sciences, University of Helsinki, P.O. Box 9 (Siltavuorenpenger 1), Helsinki FIN-00014, Finland. E-mail: johanna.rosenqvist@helsinki.fi*

K. RYMARCZYK, L. ZURAWSKI & K. JANKOWIAK-SIUDA. The relation between emotion empathy and facial muscle activity.

Objective: Empathy is an ability to share and understand emotional state of other person and facial mimicry is one of markers of an empathic responses. In particular, activity of corrugator supercilli and ac-

tivity of zygomaticus major muscles are valid measures of physiological responses to external emotional stimuli. It seems that people high in emotional empathy are more facially reactive than are the low empathic, when exposed to emotional pictures (Dimberg et al., 2011). However, some results are inconsistent (Achaibou et al., 2008). In our study we showed facial emotional expressions (video movies of actors) when recording facial electromyography (EMG). The aim of the current study was to examine reactivity differences in low and high empathic subjects.

Participants and Methods: Forty one subjects (low and high empathic) were exposed to natural emotional facial expressions (happy, anger, sad and fear) while facial electromyography activity was recorded from corrugator supercilli, orbicularis oculi and zygomaticus major muscles.

Results: The analysis of data showed that high empathic subjects reacted strongly for happy and sad expressions. Happy faces evoked the strongest activity in zygomaticus major (increase) and corrugator supercilli (decrease); sad faces induced the strongest activity in corrugator supercilli (increase) and zygomaticus major (decrease). On the contrary, low empathic group do not differ in muscle reactivity when exposed to different emotional facial expressions. Two other emotional expressions (anger and fear) did not evoke any significant changes in EMG activity in none of two groups.

Conclusions: In summary, the present study showed that emotional empathy is related to capacity of higher reactivity to happy and sad natural facial expressions. It seems that high empathic people are more capable of emotional contagion.

This study was supported by grants no. 2011/03/B/HS6/05161 and no. N N106 36 1740 from the Polish Ministry of Science and Higher Education

Correspondence: *Krystyna Rymarczyk, Nencki Institute of Experimental Biology, Pasteura 3, Warsaw 02-495, Poland. E-mail: kr@nencki.gov.pl*

K.R. SAVAGE, J.C. BOROD, A.M. BRICKMAN, N.S. FOLDI, K. FINLEY, A. KLUGER, K. BHATT, J. TWAITE & T. MYERS. Age Differences in the Perception of Discrete Emotions.

Objective: Research suggests that emotion perception declines with age, but there may be variation by emotion type (e.g., fear), with the perception of some emotions declining and others remaining stable. Few studies have investigated age differences in the perception of discrete emotions across multiple communication channels or included individuals older than 80 years. This study examined age differences in emotion perception across three communication channels in adults aged 20-89.

Participants and Methods: Healthy adults ($n=117$) were screened for absence of dementia, learning disability, substance abuse, and neurological, psychiatric, and/or major medical disorders. Participants completed emotion perception tasks and nonemotional control measures from the New York Emotion Battery (Borod, Welkowitz, & Obler, 1992). Emotion identification tasks examined 3 positive and 5 negative emotions via facial, prosodic, and lexical channels.

Results: Age differences were examined on accuracy scores from the emotion tasks with a mixed-design repeated measures ANOVA (Age [7: 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80-89] x Channel [3: Facial, Prosodic, Lexical] x Emotion [8: anger, disgust, fear, sadness, unpleasant surprise, pleasant surprise, happiness, interest]). Results indicated a significant main effect of Age ($p<.001$), with participants in their 70s and 80s scoring lower than all other age groups. A significant interaction ($p=.03$) between Emotion and Age revealed age effects for all emotions but disgust. An interaction ($p=.02$) among Age, Channel, and Emotion showed that age differences were most evident in the prosodic channel for fear, happiness, and interest.

Conclusions: Older adults were less accurate than younger adults in emotion perception across three communication channels; the most pronounced differences were in the prosodic channel for fear, happiness, and interest. This work has important clinical implications in terms of understanding social functions in late life. Results may also serve as normative data.

Correspondence: *Kimberley R. Savage, Ph.D., Transitions Professional Center, 927 SE 45th Street, Portland, OR 97215. E-mail: Kim.R.Savage@gmail.com*

J.M. STINSON, K. MCCULLOCH & R.L. COLLINS. Exploring the Impact of Anxiety on Learning in the California Verbal Learning Test-2nd Edition.

Objective: It has been suggested that initial learning (e.g., trial 1) on the California Verbal Learning Test, 2nd Edition (CVLT-2) is associated with anxiety, not attentional capacity, with some patients learning fewer words on trial 1 as a result of increased anxiety related to ambiguity of the initial list presentation (Delis et al., 200; Lezak, 1995). The present study sought to explore the theory around anxiety levels and learning on the CVLT-2. The following hypotheses were made: (a) higher anxiety scores would be correlated with higher (steeper) Trial 1-2 Learning Slope (LS) scores; (b) anxiety and depression scores would be positively correlated; (c) Trial 1 raw scores would be not be correlated with longest digits forward of the Wechsler Adult Intelligence Scale (WAIS) III & IV.

Participants and Methods: Veterans referred for neuropsychological evaluation (N=81; mean age = 59.1 [10.4]; mean education = 13.1 [2.9]) completed a full testing battery to include the Beck Anxiety Inventory (BAI), the Beck Depression Inventory-II (BDI-II), WAIS-III or IV digit span subtest, and the CVLT-2. Only Veterans who passed the CVLT-2 forced choice and had at least average short delay retention were included in analyses.

Results: As predicted, there were significant correlations between CVLT-2 Trial 1-2 LS and the BAI ($r=.23, p<.05$), as well as the BAI and BDI-II ($r=.74, p<.01$). The correlations between WAIS digits and CVLT Trial 1 raw scores and Trial 2-5 LS and BAI scores were not significant. A hierarchical multiple regression was performed with age and education entered first, followed by BAI scores, and then BDI-II scores. Results indicated BAI scores predicted a significant amount of variance in Trial 1-2 LS scores above age and education, $R^2 \text{ Change}=.05, F(1, 74)=.019, p<.05$. Scores on the BDI-2 did not predict a significant amount of variance above age, education and anxiety ($p >.05$).

Conclusions: Although the magnitude of the effect is small, anxiety, not attentional capacity, moderates initial learning on the CVLT-2.

Correspondence: *Jennifer M. Stinson, MA, Educational Psychology, University of Houston, 4800 Calhoun Rd, 491 Farish Hall, Houston, TX 77004. E-mail: jenstinson@gmail.com*

L. SUN, A. BATEMAN & J.N. RUST. Impairment in Emotion Recognition in Brain Injury Patients.

Objective: Emotion recognition deficits have been consistently reported in brain injury patients. A number of brain areas (e.g. bilateral amygdala) have been implicated in emotion recognition processes. The present large sample study aimed to investigate impairment in emotion recognition in brain injury patients and explore the influence of age, gender, aetiology, and potential fatigue and learning effects.

Participants and Methods: The sample consisted of 194 brain injury patients from the Oliver Zangwill Centre for Neuropsychological Rehabilitation (62 female and 132 male; age: $M=35.34$ years, $SD=11.45$ years; 138 traumatic brain injury (TBI) patients and 40 non-TBI patients, 16 not recorded) and 194 controls collected online from the UK and Ireland (117 female and 77 male; age: $M=26.30$ years, $SD=10.15$ years). All participants were administered the Ekman 60 Faces Test, which examines the ability to recognize facial expressions of emotion.

Results: The brain injury patients were worse than the control group at recognizing all emotions (all $ps <.05$). They tended to easily confuse negative emotions (for example, Fear, Disgust and Anger). Learning effect was discovered for the patients with emotions Sadness, Disgust and Anger, while fatigue effect emerged with the Fear emotion. Mixed design ANOVA revealed significant main effects of Emotion ($F(5,1840) = 20.80, p <.001$) and Group ($F(1, 368) = 69.82, p <.001$), and a significant interaction between them ($F(5,1840) = 11.93, p <.0001$). There was also an interaction between Emotion and Age ($F(5, 1840) = 3.82, p <.01$).

Conclusions: The study showed that brain injury patients exhibited deficits in recognizing all basic emotions, and that the impairment was differential across emotions, particularly with negative emotions such as Fear. Both learning and fatigue effects were unveiled, suggesting that different mechanisms may be involved in recognizing emotions. The roles played by age, gender and aetiology in emotion recognition are also discussed.

Correspondence: *Luning Sun, Department of Psychology, University of Cambridge, The Psychometrics Centre, The Mond Building, New Museum Site, Free School Lane, Cambridge CB2 3RQ, United Kingdom. E-mail: ls523@cam.ac.uk*

J.T. TWAITE, J.C. BOROD, M. LUBOMSKI, J.L. SPIELMAN, K.R. SAVAGE & L.O. RAMIC. A New Measure to Assess Subjective Emotional Experience and Application to Parkinson's Disease (PD).

Objective: Emotional experience (EE) has significant social and clinical relevance, but there is a paucity of EE measures. Using a new self-report measure, we evaluated relationships among 3 variables (Accuracy, Intensity, Immediate Feelings) to determine if we are tapping distinct aspects of EE. This measure was then used to evaluate EE in PD patients and healthy adult controls (HCs), as this domain is understudied in neurological populations.

Participants and Methods: Participants were 55 individuals with idiopathic PD (71% men; $M \text{ age}=67.4\pm 8.8$) and 18 demographically matched HCs (61% men; $M \text{ age}=64.8\pm 8.6$), recruited from a larger treatment study. EE was elicited via an emotional monologue produced for 3 emotions (happiness, sadness, anger) at 3 times (baseline, 1 mo., 6 mo.). The 3 EE variables were rated on a 7-point Likert scale after each monologue.

Results: Correlations were conducted among the 3 variables by emotion and time. Median coefficients were moderate for all subjects (Intensity x Feelings = .66, Feelings x Accuracy = .55, Intensity x Accuracy = .46), with similar patterns for PDs and HCs. A Group (2) x Gender (2) x Time (3) x Emotion (3) ANOVA was conducted for each experimental variable. Higher-order interactions superseded lower-order main effects and interactions. For Accuracy, a significant 4-way interaction occurred ($p=.02$); for Feelings, a trend occurred for the Group x Gender x Time interaction ($p=.07$). Post-hocs for Group differences showed that HCs were higher than PDs among men whereas the groups were relatively similar among women. Comparisons for Gender revealed that women were higher than men among PDs but that men were generally higher than women among HCs. For Intensity, a Group x Time interaction ($p=.05$) showed HCs were higher than PDs but only at baseline.

Conclusions: This measure captures distinct aspects of emotional experience, and it discriminated on the basis of group and gender. This measure has potential for use with a variety of emotion elicitation procedures and clinical disorders.

Correspondence: *Jamie T. Twaiite, M.A., Neuropsychology, CUNY Graduate Center, 102-40 67th Rd, Apt 5N, Forest Hills, NY 11375. E-mail: jtwaite@qc.cuny.edu*

J. WINGO, J. FINK, R. LEE & N. PLISKIN. Examining Post-Traumatic Stress Disorder in Electrically Injured Individuals Using Optimal Data Analysis.

Objective: One of the leading causes of work-related injury in the U.S. is electrical shock. Individuals who sustain an electrical injury (EI) have been reported to experience a variety of neuropsychological changes. In addition to cognitive problems, individuals who suffer an EI can develop psychiatric sequelae. One of the most common psychiatric problems following EI is the development of Post-Traumatic Stress Disorder (PTSD). Few studies have examined predictors of PTSD in EI patients, but there have been no studies to date using Optimal Data Analysis (ODA). ODA finds a decision rule for each predictor that maximizes the overall percentage of classification accuracy for the sample. This study investigated neuropsychological, psychological and demographic variables associated with the development of PTSD in individuals who have suffered an EI.

Participants and Methods: This study utilized archival data from 38 EI patients (92% Caucasian, 92% male, mean age = 41.39 years), derived from a convenience sample of individuals who received neuropsychological and psychiatric evaluations at an outpatient clinic. They also completed questionnaires assessing depressive and trauma-related symptoms. Patients were diagnosed with PTSD on the basis of a clinical interview, self-report measures of PTSD symptoms, and clinical judgment. **Results:** Variables examined include: length of loss of consciousness, gender, no-let-go experience, time since injury, immediate and delayed verbal memory performance, and depressive symptomatology. Main effects were analyzed using univariate ODA. PTSD or no-PTSD was established as the class variable from which a decision-making “tree” was grown based on neuropsychological, psychological, and demographic factors. **Conclusions:** Results suggest that length of loss of consciousness, time since injury, gender, no-let-go experience, time since injury, symptom validity performance, immediate and delayed verbal memory performance, and depressive symptomatology did not predict PTSD. Implications are discussed. Correspondence: *Jana Wingo, M.A., University of Chicago, 5841 S. Maryland Ave., Chicago, IL 60637. E-mail: jana.wingo@gmail.com*

E.L. WORTHY, D.A. WORTHY, J. SHEN & D.M. TUCKER. Affective Priming Following Unilateral Temporal Lobectomy: The Role of the Amygdala.

Objective: It has been proposed that a direct pathway exists for processing emotional information that is mediated by the amygdala and independent of cortical control (Murphy and Zajonc, 1993). This study serves to replicate those original findings and to investigate potential laterality effects in this route using suboptimal priming adapted from the paradigm of Murphy and Zajonc.

Participants and Methods: Happy and angry faces were presented for 4 ms before the presentation of a neutral stimulus (Chinese Ideograph) that participants were asked to rate based on how much they liked each one. One group of healthy young adults (n=51, ages 18-23) completed this task with centrally presented primes and another group (n=51, ages 18-23) completed the task with hemifield presentation of primes. Twelve patients with epilepsy who were at least three months post temporal lobectomy also completed the latter task (9 right, 3 left). In this surgery, not only is the seizure focus (typically the hippocampus) removed, but the amygdala and anterior temporal cortex are as well.

Results: Repeated measures ANOVAs were conducted for all studies. In the young adult sample, participants rated ideographs preceded by happy primes as significantly more liked than those preceded by angry primes ($p=.003$). However, the priming effect was only observed in participants who reported high positive mood on the PANAS. When primes were presented in either the left or right hemifield there was a significant interaction between prime type and hemifield of presentation ($p<.001$). Priming was only found in the right hemifield, and was driven by higher liking ratings for ideographs preceded by happy primes. No priming effect was found in the patient group.

Conclusions: In summary, affective priming may be influenced by both hemifield of prime presentation and mood. Although this was not seen in patients post temporal lobectomy, the small sample size and high prevalence of mood disorders in this group may have made it difficult to detect an effect if it was present.

Correspondence: *Emily L. Worthy, PhD, University of Texas at Austin, 1 University Station A8000, Austin, TX 78712. E-mail: emily.l.worthy@gmail.com*

Malingering/Effort Testing

K.M. ADAMS, R.J. SPENCER & S.H. PUTNAM. Cross-validation of the Grooved Pegboard test as an embedded performance validity measure.

Objective: Embedded Performance validity tests (PVTs) are measures within neuropsychological examinations that gauge the completeness of effort. The current project is a cross-validation of the diagnostic accuracy of embedded performance cut-offs for the Lafayette Grooved Pegboard (LGP) peg insertion and peg removal times.

Participants and Methods: Data were collected from 150 individuals (age = 40.9 [13.7]) undergoing medicolegal evaluations following reported head trauma. Examinees underwent comprehensive neuropsychological testing, including the LGP and five PVTs. The 41 (27.3%) failing two or more PVTs were categorized as invalid performers. ROC analyses were used to evaluate the utility of LGP insertion and removal times in classifying valid and invalid performers. Previously established cut-offs of >92 and >101 seconds for dominant and non-dominant hand insertion times, and >29 and >30 seconds for dominant and non-dominant hand removal times were applied.

Results: Valid performers outperformed their counterparts for all LGP variables. ROC analyses indicated that areas under the curve for LGP ranged from 0.74 to 0.87. Previously established cut-offs resulted in the following classification rates: Dominant insertion (PPP = .59, NPP = .80), Dominant removal (PPP = .88, NPP = .80), Non-dominant insertion (PPP = .58, NPP = .82), Non-dominant removal (PPP = .91, NPP = .78). Eighty-seven percent of individuals passing all cut-offs were classified as valid performers, whereas 85% of individuals failing three or four cut-offs were classified as invalid performers.

Conclusions: The LGP yields promising indicators of performance validity. The limited sensitivity and positive predictive values underscore the importance of using LGP indicators in conjunction with other well-validated embedded and stand-alone PVTs.

Correspondence: *Robert J. Spencer, Ph.D., Ambulatory Care (11A), VA Ann Arbor Healthcare, 2215 Fuller Road, Ann Arbor, MI 48105. E-mail: rspencer33@gmail.com*

R.J. SPENCER, S.H. PUTNAM & K.M. ADAMS. Grooved Pegboard is an acceptable embedded performance validity measure among medicolegal evaluatees.

Objective: Performance validity tests (PVT) are imperative when interpreting test data in medicolegal examinations. Embedded PVTs are measures within standard neuropsychological tests that gauge the representativeness of performance. The current project explores embedded performance cut-offs for the Lafayette Grooved Pegboard (LGP) peg insertion and peg removal times.

Participants and Methods: Data were collected from 352 individuals (age = 37.5 [12.6]) undergoing medicolegal forensic evaluations following claimed head trauma. Exclusion criteria included upper extremity impairment and a head injury with greater than 60 minute's loss of consciousness. Examinees underwent comprehensive neuropsychological testing, including the LGP and seven PVTs. The 137 (39%) failing two or more PVTs were categorized as invalid performers. ROC analyses were used to evaluate the utility of LGP insertion and removal times in classifying valid and invalid performers. Sensitivity (SE) was described for each LGP variable with cut-offs set at 90% specificity.

Results: Valid performers outperformed their counterparts for all LGP variables. ROC analyses indicated that all LGP variables resulted in acceptable classification accuracy, with areas under the curve ranging from 0.71 to 0.75. Cut-offs included >92 and >101 seconds for dominant (36% SE) and non-dominant hand (33% SE) insertion times, and >29 (32% SE) and >30 (29% SE) seconds for dominant and non-dominant hand removal times.

Conclusions: The LGP is an acceptable embedded PVT. Insertion and removal times have limited sensitivity, and therefore during clinical application of LGP as a PVT, other embedded and stand-alone PVTs should be included.

Correspondence: *Robert J. Spencer, Ph.D., Ambulatory Care (11A), VA Ann Arbor Healthcare, 2215 Fuller Road, Ann Arbor, MI 48105. E-mail: rspencer33@gmail.com*

J. BIRATH, E. ANDERSON MACKILLOP & M.D. HORNER. Standard Neuropsychological Measures as Embedded Indicators of Effort in a Clinical Sample.

Objective: Embedded effort indices allow supplemental evaluation of effort without additional test burden. We examined standard neuropsychological measures as discriminators of low effort using two heterogeneous clinical patient subsamples.

Participants and Methods: Archival data were examined from a VA Medical Center Neuropsychology Clinic. Patients who were given either the Test of Memory Malingering (TOMM; $n=775$) or the Word Memory Test (WMT; $n=174$) were included. Patients were divided into two subsamples, based on which of these SVTs they were given. Each subsample was then divided into adequate and low effort groups based on failure of the subsample's SVT, using standard cutoffs. Embedded indices were examined using receiver operating characteristic curves and included Reliable Digit Span; Digit Span raw score (from WMS-III or NAB); FAS raw score; Trail Making Test (TMT) A time and errors; TMT B time and errors; four indices derived from TMT times (A+B, B-A, B/A, $[A*B]/100$); Rey Complex Figure copy, 3-minute delay, and percent retained; Wisconsin Card Sorting Test Categories and Failure to Maintain Set; and WMS-III Mental Control.

Results: Seven embedded indices had at least modest sensitivity (22-77%) with specificity set at $\geq 90\%$: Digit Span raw score, TMT A time, TMT B time, TMT total (A+B), TMT difference (A-B), TMT interaction ($[A*B]/100$), and Mental Control. Mental Control in the WMT subsample had the highest sensitivity (77%) and positive and negative predictive values (PPV=87%; NPV=82%). Cutoff scores in the WMT subsample were consistently higher than in the TOMM subsample.

Conclusions: Several embedded indices showed modest ability to discriminate adequate vs. low effort. In conjunction with "stand-alone" symptoms validity tests, these indices can be used throughout a clinical evaluation to monitor effort. Differences in cutoff scores for these indices between the two subsamples highlight the importance of SVT criterion selection when examining any effort indices.

Correspondence: *J. Brandon Birath, Ph.D., Psychiatry, Harbor-UCLA Medical Center, 1000 West Carson Street, Box 488, Torrance, CA 90509. E-mail: brandonbirath@gmail.com*

J. DENBOER, S. SCHALK, S. HALL, L. JENSEN & R. TANAKA. Validation of the Memory for Complex Pictures (MCP) test in a Post-Acute TBI Sample.

Objective: This study covers inpatient results from a new symptom validity test (SVT), Memory for Complex Pictures (MCP). The MCP has been shown to have good face validity, sensitivity, and specificity. The test has been shown to be highly correlated to the TOMM, a frequently-used and well-validated SVT. Although the MCP has been shown to be an effective tool for detecting client effort in outpatient patients with TBI and those that are approximately 1-month post-acute TBI, the efficacy of the measure has not been studied in individuals in the close post-acute stages of TBI.

Participants and Methods: Data was collected from 10 clients (7 males, 3 females) diagnosed with mild-moderate TBI who were seen for inpatient mental status consultation. Patients ranged from 8 hours post-acute TBI to 30 hours post TBI (mean = 12 hours).

Along with the MCP, all patients were administered the GOAT and the MMSE-2, along with other brief mental status assessment instruments. Patients with significant visual impairments were not included in this sample.

Two outliers with severe global neurocognitive impairment and MCP scores <30 were not included in this analysis.

Results: Patients obtained a mean MCP Trial 1 score of 41.35 (SD = 4.35) and a mean MCP Trial 2 score of 44.35 (SD = 3.45). The mean consistency score (i.e., the number of correct responses on Trial 2 that were also answered correctly on Trial 1) was 72%.

The patient's average MMSE-2 score was 21 (SD = 5.63) (average MMSE T score was <20).

The patient's average GOAT score was 56 (SD = 12.34).

Conclusions: Patients in the close post-acute stages of TBI recovery with significant neurocognitive deficits came very close, and in many cases, did, pass the MCP. This results lend support for the MCP as an effective and useful measure of client effort during neuropsychological assessment.

Correspondence: *John DenBoer, Ph.D., Clinical Neuropsychology, Casa Colina Center for Rehabilitation, 921 W. Willetta St., Phoenix, AZ 85007. E-mail: jvdenboer@yahoo.com*

S. SCHALK, J. DENBOER, S. HALL, L. JENSEN & R. TANAKA. Memory for Complex Pictures: Validation with Patients with HIV-related Memory Deficits.

Objective: This study highlights preliminary results from an emerging symptom validity test (SVT), entitled the Memory for Complex Pictures (MCP). The MCP is a computerized measure employing 50 high-resolution color photographs of complex visual scenes presented over two trials. DenBoer's (2007) research with the MCP lends support to the theory that visual pictures work well as test stimuli in SVT's because the task appears difficult to participants while, at the same time, is quite easy. Furthermore, the MCP has equivalent face validity and specificity, and greater sensitivity than the TOMM (DenBoer 2007).

HIV-associated neurocognitive dementia is a severe form of the disease affecting 35-50% of patients with HIV (Cysique & Brew, 2011). It is largely affects sub-cortical structures which consists of a variety of behavioral, cognitive, and motor disturbances (Navia et al., 1986). If left untreated, HIV-associated neurocognitive dementia may develop and leave the afflicted individual mute, incontinent, and suffering from paraplegia (Navia et al., 1986).

Participants and Methods: Data was collected from 15 patients diagnosed with HIV-related dementia who were referred for outpatient neuropsychological evaluation by their PCP. All patients had corresponding neuroimaging findings corroborating their diagnosis. All patients were administered the MCP, HVLIT, and BVMT as part of a larger (4-hour) neuropsychological battery.

Results: Patients obtained a mean MCP Trial 1 score of 45.29 (SD = 4.3) and a mean MCP Trial 2 score of 45.34 (SD = 2.4). Mean consistency rating (i.e., the percentage of responses that were answered correctly on Trial 1 that were also answered correctly on Trial 2) was 87% (SD = 9.1%).

All participants demonstrated significant memory deficits, as shown by HVLIT of BVMT Immediate Recall or Delayed Recall Total T scores of < 40 .

Conclusions: The MCP may be a useful and effective symptom validity test with patients diagnosed with HIV related dementia.

Correspondence: *John DenBoer, Ph.D., Clinical Neuropsychology, Casa Colina Center for Rehabilitation, 921 W. Willetta St., Phoenix, AZ 85007. E-mail: jvdenboer@yahoo.com*

S. SCHALK, J. DENBOER, S. HALL, R. TANAKA & L. JENSEN. Memory for Complex Pictures (MCP) and TOMM: Validation in a TBI Sample.

Objective: This study highlights preliminary results from an emerging symptom validity test (SVT), entitled the Memory for Complex Pictures (MCP). The MCP has equitable face validity and specificity, and greater sensitivity than the TOMM (DenBoer 2007).

According to Vakil (2005), deficient learning and memory are frequently reported as a consequence of traumatic brain injury (TBI). The long-term effects of moderate to severe TBI on different memory aspects include deficits in explicit and implicit forms of memory (Vakil, 2005).

Participants and Methods: Data was collected from 264 patients diagnosed with a TBI secondary. TBI was found to be due to a multitude of etiologies (e.g., MVA's, ground-level falls, assault). All patients were administered the MCP and the TOMM as part of a larger standard neuropsychological battery.

Results: The vast majority of patient's TOMM and MCP scores highly correlated.

The mean correlation between TOMM Trial 1 and MCP Trial 1 is $r=.78$. The mean correlation between TOMM Trial 2 and MCP trial 2 is $r=.84$.

In looking at the response latency times for the MCP, the mean response latency time for Trial 1 correct responses was 177.36 seconds, whereas the mean latency response time for Trial 1 for incorrect responses was 274.94. In viewing the the response latency times, the mean response latency time for MCP Trial 2 for correct responses was 155.63 seconds and the mean response latency time for incorrect responses was 241.64 seconds. There was a significant difference in response latencies for correct and incorrect responses for both trials ($p<.05$).

Conclusions: The MCP and TOMM, the current standard test used to measure effort, appear to be significantly correlated with one another. That is, individuals who are administered the TOMM and/or the MCP tend to perform very similarly on both tests. This lends support for the MCP as a useful and effective SVT for use in TBI patient populations. Correspondence: *John DenBoer, Ph.D., Clinical Neuropsychology, Casa Colina Center for Rehabilitation, 921 W. Willetta St., Phoenix, AZ 85007. E-mail: jwdenboer@yahoo.com*

D.S. GOLDSTEIN, L.A. SWOROWSKI, M.A. MATTHEWS & J.I. NOVITSKI. Cross-Validation of Failure Rates, Sensitivity and Specificity and Predictive Power Findings on the REY-15, TOMM, VSVT, WMT, and CVLT-II Among Criminal Defendants Using a Compensation-Seeking Sample.

Objective: Using a compensation-seeking sample, this investigation aimed to extend and cross-validate findings from Goldstein & Sworowski's 2007 investigations into the failure rates, sensitivities and specificities, and use of alternate cutoff scores to improve the predictive power of five commonly used effort tests in criminal evaluations.

Participants and Methods: Felony defendants consecutively referred to a court clinic for neuropsychological examination (Criminal Group) and compensation-seeking plaintiffs, worker compensation patients and disability applicants (Compensation-Seeking (C-S) Group) were compared in order to determine whether failure rates and/or optimal cutoff scores for sensitivity and specificity differed between groups. Optimal and suboptimal effort groups were determined for both Criminals and Compensation-Seekers (see Goldstein et al., 2007). Failure rates were calculated, and chi-square analyses identified any differences between Criminals and Compensation-Seekers. Effort group means on the five measures were compared within and between Criminal and C-S Groups, and optimal cutoff scores and sensitivities and specificities were explored for each measure using Receiver Operating Characteristic area under curve analyses.

Results: Base rates of suboptimal effort for Criminals and Compensation-Seekers are consistent with 2007 findings and the empirical literature. Identification of most and least useful effort measures among Criminals confirms 2007 findings, and C-S Group findings are similar. Alternative cutoff scores confirm the relative superiority of certain effort measures in both Criminals and Compensation-Seekers.

Conclusions: Despite some differences, the predictive power of certain effort measures identified in 2007 to discriminate between optimal and suboptimal effort remains robust within a Criminal sample. Findings persist in a C-S Group, cross-validating the utility of these measures and recommended cutoff scores in another group with relatively high base rates of suboptimal effort.

Correspondence: *Monica A. Matthews, B.S., Psychology, Rosalind Franklin University of Medicine and Science, 240 S. Riverside Dr., Villa Park, IL 60181. E-mail: monica.matthews@my.rfums.org*

M.A. MATTHEWS, J.I. NOVITSKI, L.A. SWOROWSKI & D.S. GOLDSTEIN. Sensitivity and Specificity of Response Latencies from the Victoria Symptom Validity Test and WAIS-III Digit Symbol Incidental Recall as Embedded Measures of Effort Among Criminal Defendants.

Objective: This investigation examined the potential utility of Victoria Symptom Validity Test (VSVT) response latencies and WAIS-III Digit Symbol incidental recall (IR) scores as embedded measures of effort in a sample of adult criminal defendants.

Participants and Methods: Felony defendants consecutively referred to a court clinic underwent comprehensive effort and neurocognitive assessment and were subsequently classified into optimal and suboptimal effort groups based on extensive clinical interviews, comprehensive neuropsychological evaluation, and record review. Performances were examined on response latencies from VSVT easy, hard, and total trials, and WAIS-III IR scores (pairing and free recall). Failure rates on these five measures were calculated, mean group differences assessed, sensitivity and specificity and optimal cutoff scores determined using Receiver Operating Characteristic area under curve analyses.

Results: Effort group differences on VSVT and WAIS-III measures are presented and compared to those on other embedded measures, including Reliable Digit Span; CVLT-FC; WAIS-III Digit Span and Digit Symbol age-corrected scaled scores.

Conclusions: Numerous symptom validity tests are available with adequate sensitivity and specificity ratings. Nonetheless, the optimal selection, number and combination of stand alone and embedded measures remains without consensus. Slick et al. (1997) acknowledged in the VSVT manual that while insufficient data existed at the time of publication to justify the use of response latencies as a criterion to assess effort, response latencies "...may be helpful interpreting VSVT results" (p. 33). Current findings suggest the potential contribution of these newly investigated measures may be greater than once believed, and in fact can outperform other commonly available embedded SVTs (see Novitski et al., 2012), adding to the armamentarium of neuropsychologists who increasingly rely on embedded measures of effort as important complements to stand alone SVTs. Correspondence: *Monica A. Matthews, B.S., Psychology, Rosalind Franklin University of Medicine and Science, 240 S. Riverside Dr., Villa Park, IL 60181. E-mail: monica.matthews@my.rfums.org*

M.A. MATTHEWS, E.H. MITCHELL, J.I. NOVITSKI, L.A. SWOROWSKI, T.L. ROGERS & D.S. GOLDSTEIN. The Relationship between Intelligence and Effort in Test Profiles of Criminal Defendants.

Objective: The purpose of this investigation was to examine the relationship between intelligence and performance on various stand alone and embedded effort measures in a sample of adult criminal defendants.

Participants and Methods: A large sample of adult felony defendants consecutively referred to a court clinic underwent comprehensive effort and neurocognitive assessment. Optimal and suboptimal effort groups were determined based on extensive clinical interviews, comprehensive effort and neuropsychological assessment, and record review. In addition to actual WAIS-III Full Scale (FSIQ) scores obtained for all participants, WTAR demographics-only predicted WAIS-III FSIQ scores were calculated using race, gender, age and education in order to provide an IQ estimate free from potential contamination by suboptimal effort. Analyses included obtaining correlations between demographics-predicted FSIQ and each individual effort measure; between demographics-predicted FSIQ and effort group; and assessing the ability of demographics-predicted IQ score to predict effort group. These analyses were repeated using the actual obtained WAIS-III FSIQ

Results: A significant relationship was found between demographics-predicted and performance-based FSIQ, despite the relatively high rate of suboptimal effort in our sample. Significant and nonsignificant correlations were found between the many variables assessed, which are presented by predicted versus actual obtained WAIS-III FSIQ. The relative capacities of these FSIQ variables in predicting effort group membership differed, and are presented.

Conclusions: These results contribute to the expanding literature on the important relationship between effort and general intellectual functioning in samples with relatively high base rates of suboptimal effort. Correspondence: *Monica A. Matthews, B.S., Psychology, Rosalind Franklin University of Medicine and Science, 240 S. Riverside Dr., Villa Park, IL 60181. E-mail: monica.matthews@my.rfums.org*

E.H. MITCHELL, M.A. MATTHEWS, J.I. NOVITSKI, L.A. SWOROWSKI & D.S. GOLDSTEIN. Increasing the Positive Predictive Power of the Rey Fifteen Item Test in Criminal Defendants Through the Use of Alternative Scoring Methods and Sample-Relevant Cutoff Scores.

Objective: This investigation compared the sensitivity and specificity of Rey FIT cutoff scores in a group of criminal defendants using traditional and experimental scoring procedures, and cross-validated findings in a sample of compensation-seeking examinees.

Participants and Methods: Using traditional and experimental Rey FIT scoring, performances of felony defendants consecutively referred

to a court clinic for neuropsychological examination (Criminal Group) and compensation-seeking plaintiffs, worker compensation patients and disability applicants (Compensation-Seeking Group) were compared in order to determine whether failure rates and/or optimal cutoff scores for sensitivity and specificity differed between groups. Traditional Items earned points for correct rendition and location within the 3 x 5 matrix; Experimental Items included correct renditions irrespective of location, and enclosed Roman numerals (e.g., III versus III); Experimental Rows required correct item sequences irrespective of location, and excluded experimental Roman numerals. Optimal and suboptimal effort groups were determined for Criminals and Compensation-Seekers from extensive clinical interviews, comprehensive effort and neuropsychological assessment, and record review. Chi-square analyses identified any significant differences in failure rates between Criminals and Compensation-Seekers. Effort group means were compared within and between the Criminal and Compensation-Seeking Groups, and optimal cutoff scores and related sensitivities and specificities were explored for each measure in Criminals vs. Compensation-Seekers using ROC area under curve analyses.

Results: Increases in sensitivity and specificity of Rey FIT variables were obtained with experimental scoring methods and alternative cutoff scores unique to these two samples with high base rates of suboptimal effort.

Conclusions: The use of experimental scoring and altered cutoff scores improves the positive predictive power of the Rey FIT in both criminals and compensation-seekers.

Correspondence: *Monica A. Matthews, B.S., Psychology, Rosalind Franklin University of Medicine and Science, 240 S. Riverside Dr., Villa Park, IL 60181. E-mail: monica.matthews@my.rfjums.org*

C. GROTE & M. HOOGS. "Go/No Go" Decisions for Neuropsychologists: Utilizing Estimated-Achieved IQ Discrepancy Scores to Help Determine Whether to Continue Testing in Clients Displaying Poor Effort.

Objective: This paper first investigates if poor effort scores are a harbinger of non-credible results on other measures of cognition. We will use these data to provide a conceptual framework to help clinicians know when, faced with poor effort from a client, it is advisable to (not) inform the clients of their poor scores on tests of effort and/or to (not) continue with the evaluation.

Participants and Methods: Study subjects were in one of two groups, the first being 25 patients with intractable epilepsy, none of whom were compensation-seeking. The second group included 40 patients who were compensation-seeking and referred for neuropsychological evaluation, most of whom had a mild TBI. All completed a measure of cognitive effort, the Victoria Symptom Validity Test (VSVT), and the WAIS-III. Estimates of "premorbid intelligence" were made using the Barona index.

Results: Clients who did poorly on the VSVT were significantly more likely to under-perform on the WAIS-III in comparison to those who did well on the VSVT, when achieved IQ scores were compared to Barona-derived estimates.

Conclusions: Clients who fail a measure of cognitive effort are likely to not give their best effort on other measures of cognitive ability. In some cases, clinicians might be tempted to immediately alert clients about effort test results in order to encourage better cooperation with the evaluation procedure. We make clinicians aware of the potential (dis) advantages of giving such feedback, and discuss when it may be advisable to either continue with or abort the remainder of the neuropsychological evaluation.

Correspondence: *Christopher Grote, PhD, Behavioral Sciences, Rush University Medical Center, 1645 W. Jackson, Chicago, IL 60521. E-mail: christopherlgrote@yahoo.com*

A. HARRISON & I. ARMSTRONG. Do research pool subjects fake Dyslexia in the same way as real world students who meet the Slick et al. criteria for malingering?

Objective: Use of undergraduate participants as a proxy for various criterion groups has become an increasingly common practice in research,

especially in the area of malingering. The question, however, is whether these undergraduates perform in a way that is similar to individuals who are truly motivated to feign a given disorder for reasons of secondary gain. This study examined the performance patterns of 3 groups: undergraduates asked to feign Dyslexia without being caught; Students with Dyslexia who were found to be performing honestly; and students undergoing a Dyslexia assessment who met the Slick et al. criteria for malingered neurocognitive performance.

Participants and Methods: Undergraduate participants (N=62) were asked to feign Dyslexia in a manner that was believable, and were warned not to be caught feigning. Their scores were compared with data from students who were assessed for Dyslexia and passed tests of effort (N=90 Dyslexic), and those who were found to meet the Slick et al. criteria suggestive of malingering (N = 11). Scores were compared on the Word Memory Test (WMT), the DASH including the Feigning Index, and measures of IQ.

Results: Students instructed to feign (ITF) returned significantly lower Verbal, Performance and Full Scale IQs ($P < .01$) than either the Dyslexic or Slick criteria group. Further the ITF group returned significantly lower scores than the Slick or Dyslexic groups on all subtests of the WMT. Scores on the DASH were also significantly worse for the ITF group relative to the other two groups ($p < .01$) with the Slick group being indistinguishable from the Dyslexic group.

Conclusions: While proxy malingerers are often used in research these results suggest that they do not perform in a manner consistent with post-secondary students suspected of feigning Dyslexia. Although replication is needed, these results call into question the ability of undergraduate volunteers to accurately mimic the behaviors of actual malingerers. Correspondence: *Allyson Harrison, Ph.D, Psychology, Queen, Mackintosh-Corry Hall, B100, 68 University Avenue, Kingston, ON K7L 3N6, Canada. E-mail: harrisna@post.queens.ca*

D.B. KAY, S. ROECKEMAN, B.H. GORDON & T.C. BENNETT. Performance On The Medical Symptom Validity Test (MSVT) Related To Insomnia Complaint: A Preliminary Report.

Objective: Ensuring adequate effort is put forth on neuropsychological testing is essential to confirming a valid profile. Factors which may impact effort include secondary gain, hostility to testing, and lack of engagement. Secondary gains may contribute to over-reporting of subjective health problems (e.g., insomnia) and poorer effort on cognitive tests. We hypothesized that individuals with subjective complaints of insomnia would perform worse on effort testing than individuals without insomnia complaints.

Participants and Methods: Sample included 202 non-demented Veterans that were given the Medical Symptom Validity Test as part of their clinical neuropsychological assessment between 2007 and 2010. Three scores of effort served as dependent variables in a multiple analysis of variance (MANOVA): Immediate Recognition (IR), Delayed Recognition (DR), and Consistency (CNS). Medical records were reviewed to determine the presence of an insomnia complaint.

Results: There was a non-significant omnibus trend, Pillai's trace=.03, $F(3,205)=2.25, p=.08$. There were significant main effects for insomnia on IR and CNS, $F(1,208)=6.05, p=.02$ and $F(1,208)=4.44, p=.04$, respectively. Individuals with insomnia had lower performance on IR ($M=85.78 \pm 16.59; M=90.75 \pm 14.12$) and CNS ($M=85.78 \pm 16.59; M=90.80 \pm 10.74$) than non-complaining individuals. There was a non-significant effect for insomnia on lower DR, $F(1,208)=3.6, p=.06$ ($M=86.60 \pm 17.16; M=91.25 \pm 10.88$). Multivariate test assumptions were violated.

Conclusions: These findings support the hypothesis that decreased effort on neuropsychological testing may occur in conjunction with increased complaints of conditions that lack objective criteria, such as insomnia. Alternatively, insomnia may directly contribute to poorer effort. Additional research is needed to test whether rates of inadequate effort are greater among individuals with insomnia complaints as compared to non-complaining Veterans and to replicate these results in other self-reported healthy conditions and in non-VA samples.

Correspondence: *Steve Roeckeman, Psy.D., G.V. Sonny Montgomery VA Medical Center, 1500 East Woodrow Wilson Avenue, Jackson, MS 39216. E-mail: sroeck@gmail.com*

S. ROECKEMAN, D.B. KAY, B.H. GORDON & T.G. BENNETT. Comparative Data On The Medical Symptom Validity Test (MSVT) Among Veterans With An Insomnia Complaint: A Preliminary Analysis.

Objective: Symptom validity tests are designed to identify suboptimal effort during cognitive testing. One such test, the Medical Symptom Validity Test (MSVT), examines the immediate and delayed recognition of 10 semantically related word pairs. An advantage of clinical interpretation of the MSVT is the inclusion of several comparative groups stratified by a range of neurologic, psychiatric and medical diagnoses. To date, we are unaware of any published studies documenting performance on the MSVT among Veterans with subjective complaints of insomnia. As such, the purpose of our study was to present preliminary comparative data on this population.

Participants and Methods: The clinical sample used to derive comparative data included 41 non-demented Veterans that were given the MSVT as part of their neuropsychological assessment between 2007 and 2010. Medical records were reviewed to confirm a subjective insomnia complaint and rule out the presence of other common sleep disorders, including fractured sleep, nightmares, or obstructive sleep apnea.

Results: Mean age of the sample was 49 years-old (range = 20 to 88) and mean level of education was 12.80 years (SD = 2.12). Means and standard deviations on MSVT subtests were as follows: Immediate Recognition (IR; M = 91.71, SD = 13.94), Delayed Recognition (DR; M = 87.56, SD = 17.96), Consistency (CNS; M = 85.85, SD = 18.47), Paired Associates (PA; M = 82.68, SD = 20.00), and Free Recall (FR; M = 58.65, SD = 22.47).

Conclusions: The purpose of our study was to expand on the available comparative MSVT data and examine performance among a cohort of Veterans with subjective insomnia complaints. Of interest, mean performance within our sample produced an overall failed effort profile with CNS mean performance falling at the suggested 85% cutoff value. In conclusion, this comparative group can be used as a reference to assist in clinical interpretation of normative performance on the MSVT among Veterans with subjective insomnia complaints.

Correspondence: *Steve Roeckeman, Psy.D., G.V. Sonny Montgomery VA Medical Center, 1500 East Woodrow Wilson Avenue, Jackson, MS 39216. E-mail: sroeck@gmail.com*

Y. LAPIS, M. PADUA & J.H. POOLE. Breadth of Effort: Relation of Two RBANS Effort Measures to Performance on Multiple Neuropsychological Tests in a Polytrauma Clinic.

Objective: To determine whether two proposed effort measures for the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) predict decrements on other neurocognitive tests.

Participants and Methods: 70 military personnel and veterans with positive screens for mild to moderate traumatic brain injury (TBI) completed the RBANS (Randolf 1998) as part of a comprehensive battery. We calculated the RBANS effort measures of Silverberg et al 2007 (ES) and Novitsky et al 2012 (EN), and tested whether failing them related to lower scores on other tests (1-tail t-test, $\alpha=.05$).

Results: Subjects who failed either effort test scored significantly lower on RBANS measures of attention and memory (Digit Span, Word List, Story and Figure Recall), processing speed (Coding, Semantic Fluency), and Line Orientation, but not other RBANS tests. Subjects failing either effort measure also scored significantly lower on non-RBANS tests of processing speed, dexterity, visual search, visual memory, affect recognition, executive skills, and had higher Beck Anxiety scores. EN and ES were not related to age, education, vocabulary, reported TBI severity indices, posttraumatic stress or depression. On most measures, EN showed larger effect sizes than ES.

Conclusions: Test effort is not a unitary factor that affects all domains equally during testing. EN and ES are expected to correlate with the

RBANS attention and memory tasks, from which they are calculated. However, failing EN and ES was also associated with lower RBANS and non-RBANS measures of processing speed, memory, visual-spatial, fine-motor and executive skills. This verifies the relevance of these embedded effort measures to a broader range of neurocognitive assessments. Effect sizes for EN and ES were consistent with other studies suggesting that EN may be a psychometrically stronger measure of effort. These findings also prompt future studies to identify both neurologic and motivational contributors to poor effort, which may be addressed during feedback and treatment.

Correspondence: *John H. Poole, PhD, Psychology, VA Medical Center, 1452 Valota Road, Redwood City, CA 94061. E-mail: jhpoole5@att.net*

M. PADUA, Y. LAPIS & J.H. POOLE. RBANS Forced-Choice List: Initial Evaluation of a New Effort Measure in a Polytrauma Clinic.

Objective: To assess the potential utility of a Forced-Choice List added to the Repeatable Battery for Assessment of Neuropsychological Status (RBANS).

Participants and Methods: 70 military personnel and veterans with positive screens for mild to moderate traumatic brain injury (TBI) were given the RBANS (Randolf 1998) as part of a comprehensive battery. We added a Forced-Choice List (FCL) binary recognition trial for the RBANS 10-word list, five being paired with Abstract foils (FCL-A) and five with Concrete foils (FCL-C). We tested concordance of FCL-A, FCL-C and FCL-Total with the Reliable Digit Span index, RDS <7 suggesting poor effort (Greiffenstein et al 1995). Additionally, we assessed FCL's correlation with effort indices by Silverberg et al 2007 (ES) and Novitsky et al 2012 (EN), which also utilize the RBANS Word List.

Results: FCL-A, FCL-C and FCL-Total correlated significantly with RDS ($r=.38$, $r=.34$, $r=.38$). On FCL-A, a cut-score of one or more errors had optimum concordance with RDS (specificity =93%, sensitivity =42%). The same cut was optimal for FCL-C (specificity =90%, sensitivity =32%). The FCL correlated significantly with prior RBANS effort indices, EN ($r=.36$) and ES ($r=.34$). The FCL was also significantly related to lower scores on two-thirds of the RBANS tests ($r=.3$ to $.5$), to more self-reported symptoms of posttraumatic stress, depression and anxiety ($r=.3$ to $.4$), but not to education, vocabulary, or age.

Conclusions: These analyses found convergent validity of the FCL with the Reliable Digit Span effort index, as well as with two RBANS effort indices that use the list recognition trial. However, the FCL's binary choice algorithm is a distinct approach that has shown utility for embedded effort measures. Thus, it may tap into motivational and neurologic factors that are not redundant with other effort measures. Determining effort requires multiple semi-independent criteria. Future studies should examine the FCL's relation to several effort criteria, in diverse patient populations.

Correspondence: *John H. Poole, PhD, Psychology, VA Medical Center, 1452 Valota Road, Redwood City, CA 94061. E-mail: jhpoole5@att.net*

S. LAWLEY, T. KIMPTON & S. HALL. Does the Internet Represent a Threat to the Security of Symptom Validity Tests?

Objective: Previous research has shown that there is a variable amount of information on Internet sites about symptom validity tests (SVTs) that threaten the security and validity of these measures. However, this work was conducted a number of years ago. Given the continued advances in technology and Internet services, the goal of the present study was to examine the current level of threat to SVT security posed by Internet sites.

Participants and Methods: Internet searches using Google were performed for two SVTs: Word Memory Test (WMT) and the Computerized Assessment of Response Bias (CARB.) The name of each test was entered into the search engine and the first twenty-five links were examined. The websites were classified into four levels of test security threat: None, low, moderate or high using criteria consistent with previous research.

Results: For the WMT, 28% of the sites were determined to be No Threat, 28% were Low Threat, 20% were Moderate Threat, and 12% were High Threat. In addition, 12% of the links were broken (i.e., not working). For the CARB, 36% of the sites were determined to be No Threat, 20% were Low Threat, 40% were Moderate Threat, and 4% were High Threat. **Conclusions:** Compared to previous research, these data indicate an alarming increase in the number of Internet sites that contain content that threatens the test security of the SVTs investigated. For the WMT, increases were found at every level of threat severity. For the CARB, which was not examined in earlier research, a troubling percentage of sites that threatened test security were also found. Finally, there were interesting differences between the two measures in terms of the severity of threat. These findings likely reflect the increase in accessibility of information on the Internet, test usage patterns, along with other factors. Examples of different types of threat are provided.

Correspondence: *Stuart Hall, Ph.D., Psychology, University of Montana, Skaggs 143, Dept. of Psychology, Missoula, MT 59812-1584. E-mail: stuart.hall@umontana.edu*

A. LYNCH, D. DRASNIN & J. IKANGA. Effort and attention in motor vehicle accident victims.

Objective: Previous research has shown that controlled attentional processes require a greater allocation of effort than do automatic attentional processes. In order to examine this relationship in a specific type of civilian trauma, we compared the performance of motor vehicle accident (MVA) victims suspected of malingering with those considered to have put forth adequate effort on neuropsychological tasks with both automatic and controlled attention demand components.

Participants and Methods: Outpatient neuropsychological evaluations were performed by a neuropsychologist and trained technicians. Using archival data, 22 adult participants suspected of putting forth suboptimal effort, based on Test of Memory Malingering (TOMM) scores below 45 on Trials II or III, were matched with 22 MVA victims considered to have put forth adequate effort, based on scores of 45 or above on TOMM trials II and III. Participants ($m = 30$, $f = 14$) were matched based on age ($M = 40.57$, $SD = 11.94$), IQ ($M = 90.41$, $SD = 11.94$) and time since MVA ($M = 20.18$ mos., $SD = 37.39$ mos.). A paired-samples t -test was conducted to examine differences in performance on specific components of the Stroop Test, Trail Making Test and Rey Auditory Verbal Learning Test (RAVLT).

Results: Significant differences were observed between the two paired groups on Stroop Color ($t = 2.25$, $p < .05$) and Color Words ($t = 2.15$, $p < .05$); Trails B; and RAVLT Total score and Delayed Recall. No significant differences were observed on Trails A, Stroop Word and RAVLT Recognition.

Conclusions: Findings suggest that controlled, but not automatic, attentional processes are affected by level of effort. Further research should focus on whether or not consistently poor performance on across controlled attentional dependent tasks could be a reliable indicator of suboptimal effort and/or malingering in MVA victims and other clinical populations.

Correspondence: *Adam Lynch, M.A., University of Detroit Mercy, 1431 Washington Blvd. #2204, Detroit, MI 48226. E-mail: tobiaslynch@yahoo.com*

A. HARRISON, S. MAGRYS & I. ARMSTRONG. Development of Self-report Index of Feigning ADHD.

Objective: Self-reported symptoms are central to assessment of adult ADHD; however, it is difficult to identify individuals who are feigning on these measures. The aim of this study was to develop an index to distinguish those feigning from those with genuine ADHD and other conditions that may present with attention symptoms.

Participants and Methods: Within the Connor's Adult ADHD Rating Scale (CAARS), we embedded 18 items that appeared as if they should occur with ADHD but are actually rarely endorsed. We hypothesized that individuals feigning ADHD would report these items

at higher levels than other individuals, even those with attention symptoms (e.g. psychiatric disorders). Validation of the embedded items was exploratory. 259 university students comprised 5 groups. Three groups were students who completed cognitive assessments in a clinical setting: ADHD, clinical controls (psychiatric disorders) and known malingerers. The remaining 2 groups were recruited to participate: healthy normal controls and individuals instructed to feign ADHD. All participants completed the CAARS including 18 additional embedded items.

Results: Overall, the DES showed moderate accuracy in distinguishing the groups. Univariate ANOVAs showed that the 5 groups differed significantly on almost all embedded items. The feigning group and known malingerers reported higher scores compared to the ADHD group and controls (healthy, clinical). Discriminant Function Analysis identified four items that were the strongest predictors; ROC analyses revealed that these items had moderate-poor accuracy against a criterion measure of response validity.

Conclusions: Consistent with our hypothesis, the embedded items were endorsed with significantly higher levels than the control groups. Accuracy of this index is moderate in general. Further development of this index is needed to support its clinical utility.

Correspondence: *Sylvia Magrys, M.Sc., Queen's University, 62 Arch St, Kingston, ON K7L3N6, Canada. E-mail: 7sm47@queensu.ca*

J.B. MILLER, R. CASAS, X.E. CAGIGAS & R.M. BILDER. The Reliable Digit Span: Standard Criterion of Seven Yields Excessive False Positives in a Healthy Bilingual Latino Sample.

Objective: The reliable digit span (RDS) is a widely used embedded indicator of symptom validity obtained from the Digit Span subtest of the Wechsler Adult Intelligence Scale, 4th Ed. A commonly referenced criterion of poor effort is an RDS of less than or equal to 7. The aim of the present study was to determine the influence of administration language on the distribution of RDS scores in a bilingual Latino population and the classification accuracy when standard cutoffs are applied.

Participants and Methods: Participants were drawn from a large research sample and included healthy bilingual Latino adults tested in English ($n = 159$) or Spanish ($n = 97$), as well as a comparison sample of healthy, monolingual English speaking adults ($n = 329$). The Digit Span subtest was administered in either Spanish or English using standard instructions and the RDS calculated for each participant. Frequency distributions were plotted for the RDS in each group and a one-way ANCOVA was run between groups, accounting for age and education.

Results: Analysis of covariance revealed significant differences in RDS scores between groups, even after the effects of age and education were accounted for ($F(2, 580) = 27.86$, $p < .001$). Post-hoc comparisons revealed that bilingual Latinos obtained significantly lower RDS ($p < .001$) scores than monolingual English speakers, whether they were tested in Spanish (Cohen's $d = 1.08$) or English (Cohen's $d = 0.42$). Among monolingual English speakers, 0.9% of participants obtained an RDS at or below published cutoffs while 17.5% of Latinos tested in Spanish and 4.4% of Latinos tested in English obtained false-positive scores.

Conclusions: The findings of the present study suggest that use of the RDS as a measure of symptom validity in bilingual Latinos may be ill advised. Whether tested in English or Spanish, bilingual Latinos obtained significantly lower scores than monolingual English speakers, which resulted in an unacceptable number of false-positive classification errors.

Correspondence: *Justin B. Miller, PhD, Psychiatry & Biobehavioral Sciences, UCLA, 760 Westwood Plaza, CS-749, Los Angeles, CA 90095. E-mail: justin.b.miller@gmail.com*

C. MILLIKIN. Motivated Forgetting: Factitious Disorder and Malingering in Older Adults Presenting for Dementia Assessment.

Objective: Factitious disorder and malingering are rarely considered in the differential diagnosis of dementia. This report describes factors contributing to these diagnoses in 4 cases (2 factitious, 2 malingering).

Participants and Methods: Cases of older adults with probable factitious disorder or malingering were selected from the files of an out-patient dementia assessment service. Factors contributing to the diagnoses were identified in each case.

Results: Two females (age 60 and 64) were diagnosed with probable factitious disorder. One had joined the local Alzheimer Society following a geriatrician's diagnosis of "possible Alzheimer's." Factors contributing to the diagnosis of factitious disorder were below chance symptom validity test performance, behavioral evidence of intact memory functioning, and absence of clear financial incentive. Malingering was suspected in a male (age 65) and a female (age 63), the latter patient referred to evaluate possible frontotemporal dementia. Key factors supporting these diagnoses were inconsistent patient and spouse symptom report (Cognitive Difficulties Scale, CDS) and report of important details (e.g., marital status), qualitative aspects of behavior (e.g., saying "I honestly don't remember."), and possible financial secondary gain. Compared to embedded effort indices, stand-alone effort measures were more likely to detect response bias. Structured Interview of Malingering Symptoms (SIMS) scores were elevated in 3/3 cases.

Conclusions: Assessment of possible factitious disorder or malingering in older adults will be increasingly important as more people delay retirement. Formal effort testing is recommended in younger patients presenting with possible dementia, as well as those with atypical presentations. Self-report measures such as the SIMS and CDS (patient and informant versions) may be helpful. More research is needed to evaluate symptom validity measures in dementia assessment.

Correspondence: *Colleen Millikin, Ph.D., Department of Clinical Health Psychology, University of Manitoba, 2109 Portage Avenue, Winnipeg, MB R3J 0L3, Canada. E-mail: cmillikin@deerlodge.mb.ca*

J.I. NOVITSKI, M.A. MATTHEWS, L.A. SWOROWSKI & D.S. GOLDSTEIN. Sensitivity and Specificity of Commonly Available Embedded Effort Measures in a Sample of Adult Criminal Defendants.

Objective: The purpose of this investigation was to compare the failure rates and sensitivity and specificity of embedded effort measures commonly available to neuropsychologists in a sample of adult criminal defendants.

Participants and Methods: In a large sample of felony defendants consecutively referred to a court clinic for neuropsychological examination, participants were categorized into optimal and suboptimal effort groups based on extensive clinical interviews, comprehensive effort and neuropsychological assessment, and record review. In addition to assessing performances on stand alone symptom validity tests (see Goldstein et al, 2012), performances on multiple embedded measures referenced in the literature were assessed, including Reliable Digit Span; CVLT-FC; WAIS-III Digit Span, Digit Symbol and Picture Completion age-corrected scaled scores; Trails A time; CPT-II omissions; JLO score; and mean dominant Finger Tapping score. Failure rates on each measure were calculated, mean group differences were assessed (with non-parametrics when necessary), sensitivity and specificity and optimal cut-off scores determined using Receiver Operating Characteristic area under curve analyses.

Results: The sample base rate of suboptimal effort is consistent with that contained within the literature. Failure rates and effort group differences on all measures are presented, and optimal sensitivity and specificity using different cutoff scores for each effort index reveal the relative superiority of certain embedded measures to detect poor effort.

Conclusions: Several embedded measures are associated with excellent sensitivity and specificity ratings and are encouraged for use in conjunction with stand alone symptom validity measures when assessing individuals from groups associated with relatively high base rates of suboptimal effort. These findings contribute to the literature regarding measures of embedded effort within standard neurocognitive tests.

Correspondence: *Julia I. Novitski, M.S., Psychology, Rosalind Franklin University of Medicine and Science, 525 W. Hawthorne Pl., #2S05, Chicago, IL 60657. E-mail: julia.novitski@my.rfums.org*

L. BERTHELSON, S.S. MULCHAN, A.P. ODLAND, L.J. MILLER & W. MITTENBERG. The Effect of Using Multiple Effort Measures on Diagnostic Specificity.

Objective: Effort indicators are used to determine if obtained test results can be considered valid measures of a patient's cognitive abilities. The use of multiple effort measures is often advocated as a means of increasing sensitivity to invalid performance. Cutoff scores for individual effort tests are ideally set to reduce false positive diagnoses to 10%, but the false positive rate for a group of multiple indicators depends on the number of measures used and the correlation among indicators. This study presents a meta-analysis of correlations among effort measures. False positive rates for groups of multiple indicators are then estimated using Monte Carlo simulations.

Participants and Methods: Literature search identified 14 peer reviewed published studies in which 143 correlations among 22 effort measures were available in an aggregate sample of 922 participants with no potential motivation to perform with less than normal effort. Participants were patients with neurological or psychiatric disorders and healthy volunteers. Studies that involved litigating or compensation seeking samples were excluded.

Results: Meta-analysis showed a mean correlation among effort indicators of $r=.33$ ($s=.21$), $p<.001$. Monte Carlo simulation (based on a 10% false positive rate for individual indicators and a correlation among measures of .33) showed that when 15 effort indicators are used together, 35% of patients with valid performance will be incorrectly identified as demonstrating inadequate effort if 2 failures is the diagnostic standard. Failure on 5 of 15 measures is required to maintain 90% specificity. If 10 effort indicators are used, a false positive rate of 25% results when 2 test failures are assumed to characterize poor effort, and failure on 4 measures is required for 90% specificity. When 5 effort measures are interpreted 3 failures are necessary for a false positive rate of 10% or less.

Conclusions: False positive rates for effort tests increase significantly as the number of indicators that are administered is increased.

Correspondence: *Wiley Mittenberg, PhD, Center for Psychological Studies, Nova Southeastern University, 3301 College Avenue, Fort Lauderdale, FL 33314. E-mail: wiley@nova.edu*

P.L. RAMBO, J.L. CALLAHAN, L.R. HOGAN & S.E. HULLMANN. Finger Oscillation as a Symptom Validity Test in Children.

Objective: Finger oscillation is a measure of manual dexterity that is widely used in adult neuropsychological evaluations. Simulation studies with adults have established cut-offs for this measure that are suggestive of purposeful underperforming. The present study aimed to explore finger oscillation as a potential imbedded measure within the context of simulated malingering in children.

Participants and Methods: Thirty-four children between the ages of 6 and 12 were administered a KBIT-2 at full effort in order to estimate intellectual functioning before being randomly assigned into either a simulated poor effort condition or a full effort condition. Groups did not differ significantly by age, education, or full effort IQ. Prior to completing the WASI, Dot Counting, and finger oscillation, as part of a larger battery, the poor effort group listened to a poor effort script, completed a practice poor effort task, and were informed of a potential small reward. The full effort condition was informed that they would receive a small reward for trying their best.

Results: Univariate analysis of variance revealed that finger oscillation total ($x = 68.15$) and non-dominant ($x = 32.48$) both approached significance for differentiating the groups ($p = .074$; $p = .067$, respectively). This trend was stronger than one of the SVT's (Dot Counting) and three of the WASI subtests. The average tap total found in the poor effort group was slightly higher than what has been observed in the adult symptom validity literature (~5 combined taps).

Conclusions: The data suggests that finger oscillation has potential as an imbedded measure of validity with children. Given that finger tap-

ping has received support within the adult literature as an identifier of sub-reasonable effort, the present finding warrants further investigation in establishing more definitive guidelines, particularly when considering the relative lack of scientific investigation into underperforming in younger populations.

Correspondence: *Philip L. Rambo, PhD, West Virginia University School of Medicine, 930 Chestnut Ridge Road, Morgantown, WV 26505. E-mail: philiprambo@gmail.com*

D.M. RANSOM, R.W. HANDEL, S. SAUTTER, R. GERVAIS & R. ARCHER. Psychometric Properties of the Minnesota Multiphasic Personality Inventory-2-Restructured Form, FBS-r, Fs, and RBS Scales in a Neuropsychological Setting.

Objective: This study sought to examine the relationship between the RBS, Fs, and FBS-r over-reporting validity scales of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2-RF), Green's Medical Symptom Validity Test (MSVT), Green's Memory Complaints Inventory (MCI), and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). It was hypothesized that elevated scores on the MMPI-2-RF over-reporting scales would predict diminished performance on measures of symptom validity and cognitive functioning, in addition to an increase in subjective memory complaints.

Participants and Methods: Archival data were collected from 77 patients who were administered the above listed measures in a private neuropsychology practice. Demographic information was gleaned from a record review and included age, gender, etiology of complaint, and highest education level attained.

Results: Hierarchical linear and binary regression analyses were utilized to assess the ability of the MMPI-2-RF over-reporting scales to predict performance on each measure after accounting for age, sex, ethnicity, highest education level attained. Scores on RBANS scales were compared by dividing the sample into those identified as over-reporting on at least one MMPI-2-RF validity scale versus valid respondents using independent *t*-tests. Results of this study supported the clinical utility of the RBS, FBS-r, and Fs, though RBS demonstrated superior predictive utility by explaining performance above and beyond FBS-r and Fs.

Conclusions: The current study found RBS was predictive of pass/fail classification status on a cognitive symptom validity test, subjective memory complaints, and performance on immediate and delayed memory measures. The FBS-r provided significant predictive utility on these measures also, though not above and beyond what was explained by RBS to a statistically significant degree. The results of the current study support the utility of RBS with supplemental data from FBS-r as part of a neuropsychological assessment.

Correspondence: *Danielle M. Ransom, Psy.D., Division of Neuropsychology, Children's National Medical Center, 1209 McKinley Street, Annapolis, MD MD. E-mail: daniellemransom@gmail.com*

P. RIORDAN, A. URBAN, M. DAVIS & D. KINSINGER. Evaluation of the Predictive Value of Inconsistent Errors on the Test of Memory Malingering (TOMM) in a Veteran TBI Sample.

Objective: The current study evaluated the predictive significance of the rate of TOMM Trial 2 errors on items the patient had correctly identified in the previous trial (i.e., inconsistent errors). We hypothesized that inconsistent errors would be rare among participants passing the TOMM and other symptom validity tests (SVTs), and that a high correlation would be observed between rate of inconsistent errors and SVT failure.

Participants and Methods: Using archival data from 113 patients seen for neuropsychological evaluation, each participant's rate of TOMM Trial 2 inconsistent errors was calculated and other available SVT data were collected. The rate of inconsistent errors was compared across participants failing at least one administered SVT (i.e., TOMM, WMT, MSVT, and/or VSVT) and those passing all administered SVTs using an independent samples *t*-test. Furthermore, where available, the correlations between TOMM trial 2 error types (i.e., inconsistent and non-inconsistent) and second SVT performance (i.e., WMT, MSVT, or VSVT) were calculated.

Results: A statistically significant difference was found for rate of inconsistent TOMM errors across participants failing at least one SVT and those passing all administered SVTs. Furthermore, a statistically significant correlation was observed between rate of TOMM inconsistent errors and performance on a second, non-TOMM SVT, while the correlation between non-inconsistent errors and second SVT performance was non-significant.

Conclusions: Obtained results suggest that analysis of inconsistent errors across trials of the TOMM may provide clinically useful information above that provided by standard cut-off scores.

Correspondence: *Patrick Riordan, Hines VA Hospital, 5000 S. 5th Avenue, Hines, IL 60141. E-mail: patrick.f.riordan@gmail.com*

K. SHANEYFELT & J. REMONDET WALL. Comparing the Classification Accuracy of Symptom Validity Measures in a Simulated Malingering Design.

Objective: This study examined classification accuracy of symptom validity tests and embedded measures in a simulation study.

Participants and Methods: This study involved secondary analysis of data collected as part of a larger experimental study examining effort conducted at a Midwestern university during 2009 and 2010. Exclusion criteria included a history of neurological injury and psychiatric illness. Participants consisted of 123 undergraduates: 89% were female, 75% Caucasian, 17% African American, and 94% right-handed. Mean age was 23.0 years ($SD = 7.54$), and mean educational level, 12.7 years ($SD = 1.06$). Participants were randomly assigned to control, naïve simulator, or coached simulator groups, and given instructions for performance. Participants completed a test battery administered in standard order that included the Word Memory Test (WMT; Green, Allen, & Astner, 2002), the Test of Memory and Malingering (TOMM, Tombaugh, 1996), and the working memory sub-scales from the Wechsler Adult Intelligence Scale, 4th Edition (WAIS-IV; Wechsler, 2008).

Results: An examination of individual test scores noted that 24 participants scored below the cut-off on the TOMM (20%), 42 (35%) on the WMT, 17 (14.2%) on the Reliable Digit Span, and 31 (25.8%) on the LNS. An examination of the comparability of these measures found an 81.7% classification agreement between the WMT and the TOMM ($kappa = 0.55$). Between the WMT and RDS, an agreement of 75.8% was obtained ($kappa = .38$). Using a cut score of 7 on LNS, a 70.8% agreement was observed ($kappa = 0.29$). Correct classification of 90% was found for the TOMM and RDS ($kappa = 0.62$), and 84.9% for the TOMM and LNS ($kappa = 0.46$). Lowering cut scores on RDS to 6, yielded correct classifications of 75.8% with the WMT ($kappa = 0.38$) and 90.0% with the TOMM ($kappa = 0.62$). Combining pass rates on the WMT and the TOMM creating a total score yielded a classification accuracy score of 74.1% ($kappa = 0.37$).

Conclusions: Further examination of combinations of effort test scores is recommended.

Correspondence: *Kara Shaneyfelt, M.A., University of Indianapolis, 3214 Brunswick St., Danville, IL 61832. E-mail: kshaneyfelt@gmail.com*

L. SHARKEY, S. MOONEY, B. GARDNER & J. RAIN TREE. Preliminary Validation of a Force Choice Measure of Performance Validity Embedded Within the ANAM-IV.

Objective: The US Army has identified the ANAM-IV as a neurocognitive screening tool for altered mental status/mTBI in service members. A limitation of the ANAM-IV is lack of a sensitive measure of performance validity. The purpose of the present study was to develop a cut-score for an embedded force choice subtest that may be sensitive to dubious performance credibility on the ANAM-IV.

Participants and Methods: 29 consecutive enlisted or recently retired Service Members [i.e., $AVG(SD)$ Age = 36.8(8.8); 65% Caucasian, 24% AA, 7% Hispanic; 96% Army; 17% E1-E4, 62% E5 or

higher, 21% Commissioned] with a history of concussion [AVG(SD) # of concussion = 2.8(1.0), all without positive radiology findings; 72% with LOC <30mins, 28% with no LOC] presented for neuropsychological screening by postdoctoral commissioned psychologists in training at a regional MTF. Patients completed a battery of psychological and neuropsychological tests available in their deployment kit, including WAIS-IV, Reliable Digit Span (RDS), RBANS, expanded COWAT, TOMM, and ANAM-IV. Cut scores from the Force Choice ANAM-IV Match to Sample (MTS) were derived based upon evidence of variable or noncredible performances from previously published SVTs.

Results: RDS [AVG(SD) = 9.2(2.8)], RBANS EI [AVG(SD) = .5(1.1)], expanded COWAT [AVG(SD) = 47(14.6)], TOMM Best T2/RT [AVG(SD) = 46.9(7.2)], and ANAM-IV MTS incorrect performances [AVG(SD) = 2.9(2.5)] were appreciated. The number of incorrect ANAM-IV MTS errors amongst patients evidencing variable (failing 1 SVT) or noncredible performance validity (failing \geq 2 SVTs) was AVG(SD) 3.1(2.3), where a cut score of 3 demonstrates 100% sensitivity for detecting noncredible performance but 75% specificity.

Conclusions: Preliminary data suggests that three or more ANAM-IV MTS incorrect errors were commonly associated with variable or noncredible performances on known SVTs in our small sample of Service Members. Further validation of this cut-score's sensitivity and specificity is indicated in a larger military sample.

Correspondence: *Scott Mooney, PhD, Neuroscience & Rehabilitation, Dwight D. Eisenhower Army Medical Center, 300 E. Hospital Rd, RM 12C-03, Fort Gordon, GA 30905. E-mail: scott.r.mooney@us.army.mil*

C. SIDERS, P. SAEZ, A. GEFFNER-MIHLSTEN, F. MARTINEZ, E. ROMERO, H. KAKAVAND, K. BOONE & M.J. WRIGHT. Detection of Suboptimal Effort in a Clinical Sample on the California Verbal Learning Test Second Edition (CVLT-II).

Objective: Our goal was to determine whether we could use the CVLT-II to differentiate between non-credible and credible participants in a clinical sample.

Participants and Methods: We divided 72 participants into two age/education equivalent groups; 51 credible participants (CP) with no evidence of suboptimal effort and 21 non-credible participants (NCP) with \geq 2 failed symptom validity measures, external motivation to give suboptimal effort, and inconsistency between reported history/ability to perform IADLs and performance on neuropsychological measures. Participants completed a neuropsychological evaluation including the CVLT-II and 10 symptom validity/effort measures.

Results: Compared to the NCP, CP demonstrated significantly better performance on multiple CVLT-II recognition indices. Specifically, they had more true hits, fewer false positives, more true hits from the first five and last five items from the recall portion of the test, and had fewer false positives from distractors that were not semantically related to items on the recall list. We generated cutoff scores for these recognition indices and combinations of these recognition indices such that obtained specificity would remain >90%. Recognition true hits, false positives, and primacy and recency recognition all had moderate sensitivity. The most optimal combination of these recognition indices (True positives + Number of words recognized from first five words on the recall list – false positives – false positives on semantically unrelated distractors) was associated with high sensitivity (86%) and specificity (94%) when using a cutoff score of \leq 8.

Conclusions: The results demonstrate that a combination of CVLT-II recognition indices are sensitive to suboptimal effort. Further research is needed to replicate these findings with larger samples, and to assess whether the findings generalize to specific subgroups.

Correspondence: *Craig Siders, Ph.D., Harbor-UCLA Medical Center, 1124 W. Carson St., Torrance, CA 90502. E-mail: siderscraig@gmail.com*

S.R. THORGUSEN & Y. SUCHY. Exploring the Relationship Between Low IQ and Invalid Effort Testing.

Objective: Prior research has demonstrated a relationship between IQ and performance on tests of effort (Frazier et al., 2007; Loring, Lee, & Meador, 2005). However, the exact nature of this relationship remains unclear. The present study sought to investigate whether low IQ leads to poorer performance on tests of effort due to limited cognitive ability or, conversely, whether low IQ is the result of poor effort on IQ testing.

Participants and Methods: One-hundred six adults with multiple sclerosis seen by the Cleveland Clinic Foundation. Participants completed the WAIS-III, followed by the Victoria Symptom Validity Test (VSVT), followed by the WMS-III. Fifty-three patients produced invalid VSVT performance and were compared to 53 demographically matched patients with valid VSVT performance. Following VSVT administration, 25 of the patients with invalid VSVT scores were confronted about poor effort and encouraged to give their best effort on the WMS-III.

Results: A repeated measures analysis of variance (ANOVA), using standard scores (Full Scale IQ [FSIQ] and General Memory Index [GMI]) as the dependent variable, test order (Pre-VSVT vs. Post-VSVT) as a within subjects factor, and group (Valid vs. Invalid-Confronted vs. Invalid-Nonconfronted) as a between-subjects factors yielded an interaction between test order and group ($F[2,103]=4.045, p<.05$). Both Valid and Invalid-Confronted groups had GMI scores that were comparable to their FSIQ scores. In contrast, the Invalid-Nonconfronted group had significantly lower GMI relative to FSIQ, suggesting that effort was insufficient during memory, but not IQ, testing.

Conclusions: Poor effort is more likely to emerge on tests of memory than IQ. Intervention following invalid scores on effort tests may curb suppressed memory performance.

Correspondence: *Sommer R. Thorgusen, MS, University of Utah, 380 S. 1530 E., Room 502, Salt Lake City, UT 84112. E-mail: sommer.thorgusen@psych.utah.edu*

G.A. VARGAS, A. RABINOWITZ & P.A. ARNETT. Changes in Observation-Based Motivation Ratings Between Baseline and Post-Concussion Testing.

Objective: Awareness is growing of the impact motivation might have on concussion testing. Differences in motivation have been found from baseline to post-concussion testing and these differences can make test interpretation and return-to-play decisions difficult. Developing more detailed motivation measures should make it easier to detect changes in motivation, thus improving test interpretation. The Motivation Behavior Checklist (MBCL) is a 27-item measure based on observation report of athlete behavior and approach to testing. This measure has previously been found to have two orthogonal factors representing high and low motivation.

Participants and Methods: The MBCL was completed for 86 varsity athletes at baseline, and 23 post-concussion (avg. age=18, 61-67% male respectively). Three male athletes had the measure at both time points.

Results: The low motivation factor decreased significantly from baseline to post-concussion testing ($t=2.65, p<.01$). Specifically, athletes showed fewer behaviors such as complaining, careless or impulsive responding and poor posture at the post-concussion testing point. Interestingly, the high motivation factor also significantly decreased ($t=3.57, p<.001$). This factor includes behaviors like asking clarification questions, making error-related adjustments to testing, demonstrating interest in performance, and taking adequate time. The three athletes with the MBCL at both time points showed the same pattern, with the low motivation factor also decreasing significantly.

Conclusions: These results describe in more detail the types of motivation changes seen from baseline to post-concussion testing. Possible reasons for these changes will be discussed, such as familiarity with testing and motivation to return to play. Hopefully this and further research will increase understanding of different motivational environments at baseline and post-concussion and will lead to more accurate and safer return-to-play decisions.

Correspondence: Gray A. Vargas, MS, Clinical Psychology, Penn State University, 737 Cricklewood Dr., State College, PA 16803. E-mail: gav111@psu.edu

C.J. ROBERSON, T.L. VICTOR, K.B. BOONE, H. GOLDBERG, D. MIORA, M. COTTINGHAM, E. ZIEGLER, M. ZELLER & M. WRIGHT. Cross Validation of the b Test in a Large Known Groups Sample.

Objective: The b Test (Boone, Lu, & Herzberg, 2002) is a measure of cognitive symptom validity originally validated on 91 noncredible subjects and seven credible clinical comparison groups (total $n = 161$). The purpose of the current study was to provide cross-validation of this test. **Participants and Methods:** A known groups sample of noncredible subjects ($n = 212$) and credible heterogeneous neuropsychological clinic patients ($n = 105$) were administered the b test as part of a clinical neuropsychological battery according to standardized instructions. Scores used for analysis included: 1) Effort Index score (E-score), 2) "d" commission errors, 3) total commission errors, 4) total omission errors, and 5) total time.

Results: The new data showed that while the original E-score cut-off of >155 achieved excellent specificity (99%), it was associated with relatively poor sensitivity (41%). However, the cut-off could be substantially lowered to >82 , while still maintaining adequate specificity ($>90\%$) and raising sensitivity to 68%. Examination of noncredible subgroups showed that b Test sensitivity in feigned mild traumatic brain injury (mTBI) was 58%, whereas in noncredible patients claiming depression and psychosis, cut-off sensitivity was 76% and 67%, respectively.

Conclusions: These data suggest that the b Test may have a particular role in detection of noncredible cognitive symptoms associated with feigned psychiatric symptoms, and that fabricated deficits in processing speed and vigilance/visual scanning, detected by the b Test, are more prominent in feigned psychiatric presentations than in feigned mTBI. Further, b Test failures in patients with somatoform disorders were common, indicating that the b Test may have a specific use in detection of nonconsciously created cognitive dysfunction associated with somatoform conditions.

Correspondence: Tara L. Victor, PhD, Psychology, California State University Dominguez Hills, 1000 E Victoria Street, SBS G305, Los Angeles, CA CA. E-mail: tvictor@csudh.edu

T.L. BELL-SPRINKEL, T.L. VICTOR, K.B. BOONE, D. MIORA, M. COTTINGHAM, E. ZIEGLER, M. ZELLER & M. WRIGHT. Cross-validation of The Rey Word Recognition Symptom Validity Test.

Objective: The Rey Word Recognition Test, a cost-effective, brief, and simple to administer free-standing symptom validity test, is an underutilized tool in the detection of feigned cognitive impairment. Nitch, Boone, Wen, Arnold, and Alfano (2006) validated use of a total Recognition Correct score and a Combination score (involving double-weighting of words recognized from the first half of the list) in 92 noncredible and 82 credible subjects; the latter score outperformed the standard recognition score in a subsample of noncredible mild traumatic brain injury (mTBI) patients ($n = 38$).

Participants and Methods: The current study included a large known groups sample (122 credible neuropsychological clinic patients and 137 noncredible patients) who were administered the Rey Word Recognition Test as part of a clinical neuropsychological battery according to standardized instructions.

Results: Results indicated that the Combination score was less effective in the total noncredible group (cut-off <8 ; 48% sensitivity) than was total Recognition Correct (cut-off <6 ; 55% sensitivity). The same pattern was found for a noncredible mTBI ($n = 49$) subgroup, indicating that there is no added benefit associated with the extra time required to calculate the Combination score. The Rey Word Recognition Test identified more subjects feigning deficits in the context of mTBI than subjects feigning in the context of other injuries (59% versus 52% on Total Recognition). Sensitivity rates were much higher in noncredible female versus male mTBI patients (68% versus 52% for Recognition Correct).

Conclusions: These data are consistent with the Nitch et al. (2006) observation that subjects feigning in the context of mTBI target verbal memory measures on which to underperform and suggest the Rey Word Recognition Test is particularly effective in identifying symptom invalidity in female mTBI compensation-seekers.

Correspondence: Tara L. Victor, PhD, Psychology, California State University Dominguez Hills, 1000 E Victoria Street, SBS G305, Los Angeles, CA CA. E-mail: tvictor@csudh.edu

S. REEDY, T.L. VICTOR, K.B. BOONE, M. COTTINGHAM, D. GLASER, P. LU, E. ZIEGLER, M. ZELLER & M. WRIGHT. Cross-validation of the Lu et al., (2003) Rey-Osterrieth Complex Figure Test Effort Equation in a Large Known Groups Sample.

Objective: The Rey-Osterrieth Complex Figure Test (ROCFT) was originally developed to assess for visual constructional skill and visual memory, but subsequently a symptom validity indicator incorporating copy and recognition scores from the test was found to be useful in detecting negative response bias in neuropsychological assessments (ROCFT Effort Equation; Lu et al., 2003). This study is a cross-validation of the test for this purpose.

Participants and Methods: Archival data were accessed for a known groups sample of 146 credible patients (124 with Effort Equation data) and 157 noncredible patients (115 with Effort Equation data). Each subject was administered the ROCFT in the context of a comprehensive neuropsychological evaluation. Group performance comparisons were examined for the following scores: Copy, 3-minute Recall, Total Correct on Recognition Trial, and the ROCFT Effort Equation.

Results: The credible patient group outperformed the noncredible group on all four ROCFT scores. The Effort Equation was most effective in classifying subjects; a cut-off of <47 achieved similar sensitivity to the Lu et al. (2003) study (i.e., nearly 68% versus 76%) while maintaining specificity of 96.0%. However, current findings indicate that the cut-off can be raised to <50 while still maintaining specificity of $>90\%$, and thereby increasing sensitivity to 80%.

Conclusions: Thus, results of the current cross validation confirm that the ROCFT Effort Equation is an effective measure of neurocognitive response bias.

Correspondence: Tara L. Victor, PhD, Psychology, California State University Dominguez Hills, 1000 E Victoria Street, SBS G305, Los Angeles, CA CA. E-mail: tvictor@csudh.edu

A.R. CUIEL, T.L. VICTOR, K.B. BOONE, P. LU, C. MITCHELL, C. KEATINGE, E. ZIEGLER, M. ZELLER & M. WRIGHT. A Re-examination of the Meyers and Volbrecht (2003) Motor Equation for the Identification of Neurocognitive Symptom Invalidity.

Objective: The present study re-examined the Meyers and Volbrecht (2003) motor formula as a neurocognitive symptom validity test.

Participants and Methods: Archival data was analyzed for a large known groups sample of credible ($n = 180$) and noncredible ($n = 101$) patients administered a comprehensive neuropsychological test battery in the context of an outpatient neuropsychology clinic. The original formula, incorporating scores from the Rey Osterrieth Complex Figure copy trial, WAIS-III Block Design and Digit Symbol subtests, and dominant Finger Tapping data, was examined with respect to its ability to identify nonplausibly poor Finger Tapping scores.

Results: In the current sample, sensitivity of the algorithm was only 30.7% at $>90\%$ specificity. When the formula was reconfigured to delete Finger Tapping data and retain only the first part of the formula (i.e., $[\text{ROCFT raw score} \times .185] + [\text{Digit Symbol scale score} \times .491] + [\text{Block Design scale score} \times .361]$), a cut-off of <10.3 achieved significantly increased sensitivity (70.3%) while still maintaining specificity of $>90\%$. When cut-offs were chosen to maintain specificity of $>90\%$ in each gender separately, a cut-score of <10.47 could be used with men (77% sensitivity in noncredible men), while a cut-score of <9.94 was necessary with women (55% sensitivity in noncredible women).

Conclusions: These findings indicate that the partial Meyers and Volbrecht (2003) formula is a much more effective measure of response bias in men, and raises the very intriguing likelihood that men are more likely than women to target constructional/psychomotor tasks on which to display negative response bias.

Correspondence: *Tara L. Victor, PhD, Psychology, California State University Dominguez Hills, 1000 E Victoria Street, SBS G305, Los Angeles, CA CA. E-mail: tvictor@csudh.edu*

L.A. WARDIN, D. WHITESIDE, G.D. WIDMANN, L. GRANITE, T. MA, J. KOGAN & M. BASSO. Delayed Recall Trials of the California Verbal Learning Test II as Embedded Measures of Effort.

Objective: The current study built on existing California Verbal Learning Test-II (Delis et al., 2000) research (Bauer et al., 2005; Curtis et al., 2006; Wolfe et al., 2010) by examining the classification accuracy of several delayed recall trials of the CVLT-II in identifying biased responding in a mixed neuropsychological sample.

Participants and Methods: Participants were consecutive outpatients seen for comprehensive neuropsychological assessment, with a mean age of 44.36 (SD=18.32) and a mean education level of 13.61 (SD=2.47). Participants included 49.2% males and 50.8% females. Primary diagnoses included 12.5% mild traumatic brain injury and 5.2% moderate and severe traumatic brain injury. Other significant diagnoses included: 21.3% Dementia Disorders, 7.3% Depressive Disorders, 15.8% Anxiety Disorders, 8.6% Adjustment disorders, and 12.7% Learning Disorders. Participants were assigned to the Biased Responding (BR, N=49) group based upon failure on any TOMM trial (Tombaugh, 1996), while those participants who passed the TOMM were assigned to the Unbiased Responding (UR, N=252) group.

Results: T-tests indicated several CVLT-II measures were significantly lower in the BR group compared to the UR group. ROC analysis indicated that several CVLT-II recall measures, including Long Free Recall, Long Cued Recall, Percent Middle Recall, Total Hits, Recognition Discrimination, Across List Intrusions, Recall Discriminability, Free Discrimination, Recognition Discrimination, and Cued Discrimination, all had acceptable classification accuracy (AUC > .70).

Conclusions: Sensitivity, specificity, and positive and negative predictive power were calculated for all CVLT-II measures with acceptable classification accuracy. Results provide further evidence that CVLT-II is an effective embedded effort measure.

Correspondence: *Douglas Whiteside, Ph.D., Adler School of Professional Psychology, 17 N. Dearborn Street, Chicago, IL 60611. E-mail: dwhiteside@adler.edu*

J.C. YOUNG, A.M. RACH, C.L. BROWN & B.L. ROPER. Word Memory Test Performance and VA Disability Rating: A Dose-Response Relationship.

Objective: Prior research has shown evidence of dose-response relationships between financial incentive and symptom validity test (SVT) failure in private medicolegal contexts. The VA disability rating system incentivizes claimants to maximize their percentage of service connection (SC). This study examined the effect of evaluation context on Word Memory Test (WMT) performance, and also evidence of a dose-response relationship between WMT scores and percentage of both total SC and SC related to psychiatric conditions.

Participants and Methods: Retrospective review of neuropsychological exams identified 318 outpatient veterans at or below age 65 without diagnosis of dementia or psychosis who were administered the Word Memory Test (WMT) as part of neuropsychological assessment. In analyzing mean differences in WMT scores, assessments were grouped based on disability assessments (n = 60) and normal clinical assessments of veterans with no preexisting SC (n = 105), SC for one or more psychiatric conditions (n = 65), and SC for non-psychiatric conditions only (n = 88). Groups significantly differed in age (p = .006) but not sex, race, or education.

Results: Across groups, ANOVA analyses revealed significant differences on WMT scores (p < .001), with the disability-assessment group

performing significantly worse than all other groups on Immediate Recognition (IR), Delayed Recognition (DR), and Consistency (CNS). For all SC veterans (n = 213), the total SC percentage did not significantly correlate with IR, DR, or CNS (p > .05). However, in psychiatric SC veterans (n = 97), the percentage of psychiatric SC correlated significantly with WMT scores (IR: r = -.27; DR: r = -.27; CNS: r = -.24; p < .05).

Conclusions: Findings indicate that evaluation context influences SVT performance. Findings also support the presence of a dose-response relationship between SVT performance and psychiatric but not total disability rating levels. Additional findings and implications for clinical practice within the VA healthcare system are discussed.

Correspondence: *John C. Young, Ph.D., Siskin Hospital for Physical Rehabilitation, 1800 Crestwood Dr., Chattanooga, TN 37415. E-mail: jcyoung@siskinrehab.org*

E. ESTEVIS, M.R. BASSO, D. COMBS, D. WHITESIDE, B. ROPER & R. PURDIE. Judgment of Line Orientation as an Embedded Measure of Performance Effort.

Objective: Neuropsychologists frequently measure performance effort to determine the validity of assessments, especially in medical-legal evaluations. However, security of stand-alone effort measures is sometimes compromised through public disclosures, rendering them ineffective. To compensate, effort may be measured within commonly administered neuropsychological tests (e.g., Larrabee et al. 2008). One measure that holds potential in this regard is the Judgment of Line Orientation Test (JLO). Individuals with poor effort may not only make frequent errors, but the magnitude of their errors may be marked. In particular, the discrepancy between patient responses and correct choices may predict performance on stand-alone measures of performance effort. If so, this discrepancy score may serve as a proxy for performance effort.

Participants and Methods: 117 depressed inpatients (age = 37.4, SD = 12.6; education = 12.3, SD = 2.1) were administered the JLO and Word Memory Test (WMT), a measure of performance effort.

Results: Validity of effort was characterized according to standard WMT cutoff scores. JLO discrepancy scores were used to predict WMT performance. Receiver operating curve (ROC) analysis evaluated the accuracy of the JLO determined the ideal cutoff score. The ROC (hit rate = .86; base rate = .13) revealed that a JLO discrepancy cutoff of 23 (Yuden Index = .27) yields specificity of .94 (PPP = .45), sensitivity of .33 (NPP = .91), and overall classification accuracy of 65%, suggesting the JLO performs better than chance in detecting insufficient effort by examinees.

Conclusions: Similar to other embedded effort measures, JLO discrepancy scores hold weak sensitivity but excellent specificity in detecting inadequate effort among depressed inpatients. Overall, this index can alert neuropsychologists of the possibility of sub-optimal effort on evaluations in which malingering is suspected. Follow-up research should determine how well the JLO discrepancy score predicts poor effort in other populations.

Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michaelbasso@utulsa.edu*

Psychopathology/Neuropsychiatry (Other)

E. ESTEVIS, M.R. BASSO, N. THALER, J. SCOTT, R. ADAMS, C. CRANSTON & D. COMBS. Executive Function and Verbal Learning in Inpatient Depressives.

Objective: Executive functioning deficits are presumed to impair new-learning ability in a variety of clinical populations, but few studies have addressed this issue in people with major depression. Notably, deficits in executive function and new-learning occur commonly in depression, but the relationship between these constructs in depressed inpatients remains uncertain. Towards this end, this study extended previous findings by examining the association between executive functioning and verbal memory among unipolar depressed inpatients using canonical correlation analysis (CCA).

Participants and Methods: 41 unipolar depressed inpatients (25 females and 16 males; age = 37.5, SD = 12.1; education = 12.7, SD = 2.3) and 37 controls (34 females and 3 males; age: 35.9, SD = 14.7; education = 15.2 SD = 2.1) were administered a brief neuropsychological battery that included the Trail-Making Test B, COWAT, Logical Memory I/II subtests from the WMS-3/4, and CVLT 1 and 2.

Results: The first canonical correlation was .67 (82% overlapping variance) with the remaining correlation being non-significant. All verbal memory and executive functioning variables correlated highly with the identified variate and indicated that individuals with higher scores on the CVLT total (.93) and Logical Memory I (.66) also obtained higher scores on the COWAT (.72) and Trails B (.89).

Conclusions: These results suggest that executive functions and verbal memory have significant variance overlap in depressed inpatients. This is an important consideration in light of previous findings that only identified overlap ranging from 55- 60% (cf. Duff et al. 2005) in a sample of neurological and psychiatric patients. These findings suggest that depressed inpatients may exhibit global neurocognitive impairment that impacts both verbal memory and executive functions.

Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michael-basso@utulsa.edu*

L. LAU, E. ESTEVIS, M.R. BASSO, R. PURDIE, R.A. BORNSTEIN & D. COMBS. Functional Outcomes and Neuropsychological Impairment in Unipolar Depression.

Objective: Major depressive disorder coincides with significant functional impairment. Factors that contribute to functional impairment are poorly understood. Among schizophrenics, neuropsychological impairment predicts poor functional outcomes, but this has not been addressed in unipolar depressives.

Participants and Methods: The sample consisted of 56 unipolar depressed inpatients without psychotic features (34 females and 22 males; age = 36.9, SD = 11.9; educ = 13.1, SD = 2.4) and 24 controls (24 females; age = 29; educ = 15.1, SD = 1.60). Participants were administered measures of intellect, working memory, executive function, new-learning, visual-spatial perception, and motor speed as well as the MMPI-2, and SF-36. The latter measured functional outcomes. Vocational and disability status were also assessed.

Results: Neuropsychological performances falling 1.5 SD below the mean were summed to form an impairment index. Average MMPI-2 clinical scale score comprised an emotional distress scale. Age, education, cognitive impairment and emotional distress served as independent variables in multiple regression analyses. Neuropsychological impairment predicted financial status and scores on the SF-36 physical functioning, role-physical, and general health scales. Emotional distress predicted disability status. Neuropsychological impairment and emotional distress both predicted employment status, and vitality, social functioning, role-emotional, and mental health scales on the SF-36.

Conclusions: Cognitive impairment predicts poor physical health and adaptive independent living skills among unipolar depressed inpatients. Furthermore, emotional distress predicted an increased risk to be financially dependent on others. Together, these variables independently predicted multiple aspects of poor functional outcomes. To offset poor functional outcomes in major depression, treatment should ameliorate emotional distress and cognitive deficits.

Correspondence: *Michael R. Basso, Ph.D., Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104. E-mail: michael-basso@utulsa.edu*

G. ÅRDAL & ÅSA. HAMMAR. Depression and the association between cognitive inhibition and health related quality of life - a study of patients in remission.

Objective: The aim of the present study was to investigate the relation between cognitive inhibition and health related quality of life in patients in remission from recurrent depressive episodes.

Participants and Methods: Twenty nine patients meeting the DSM-IV criteria for recurrent unipolar depression, and twenty nine healthy matched controls were included in the study. Cognitive inhibition were assessed using the Stroop paradigm whilst the Short Form 36 health survey were used to evaluate health related quality of life.

Results: The results show impaired cognitive inhibition in the patient group, despite remission. Further, the patient group reported a serious disability in health related quality of life as measured by the Short Form 36 health survey questionnaire, compared to the healthy control group. An association between severe impairment in cognitive inhibition and poor health related quality of life was found for the physical functioning dimension. There were no association between depression severity and cognitive functioning, and further no association between severity and health related quality of life.

Conclusions: In conclusion, both cognitive inhibition and health related quality of life is significantly impaired in the remitted patient group compared to the healthy control group. Research should further aim to clarify how these impairments relate to each other and how it affects the high risk of relapses characterizing this patient group.

Correspondence: *Guro Årdal, Clinical Psychologist, University of Bergen, Jonas Lies vei 91, Bergen 5093, Norway. E-mail: guro.ardal@psybp.uib.no*

N.T. BOTT, H. KLETTER & V.G. CARRIÓN. Relationship Between Executive Function and Verbal Performance in Youth with a History of Interpersonal Violence.

Objective: Few studies have investigated executive function (EF) impairments in youth with posttraumatic stress (PTS), and those that have report mixed findings (Dagleish et al., 2005; DePrince et al., 2009). Measures of EF such as cognitive flexibility have been associated with verbal performance in adults (Lippa & Davis, 2010). The purpose of this study was to examine the relationship between measures of EF and verbal performance in youth with PTS. It was hypothesized that traumatized youth would have poorer EF compared to healthy controls (HC) and that this would be associated with verbal performance in youth with PTS.

Participants and Methods: 56 youth completed the study. Of those, 28 youth exposed to interpersonal violence (18 males and 10 females; age: M = 12.2, SD = 2.2) and 18 HC (12 males and 6 females; age: M = 13.3, SD = 1.8) completed the CMS, WASI, WRAT-3, and D-KEFS Color Word Interference Test (CWIT).

Results: The PTS group performed lower than HC in CMS attention/concentration (A/C) ($p=.004$). For the PTS group, CMS A/C was associated with CWIT inhibition and inhibition/switching ($p=.000$); however for HC, CMS A/C was associated only with CWIT inhibition/switching ($p=.043$). For the PTS group, CWIT inhibition/switching was associated with WASI verbal ($p=.002$), WASI total ($p=.001$), WRAT-3 reading ($p=.016$), and WRAT-3 spelling ($p=.003$); CWIT inhibition was associated with WRAT-3 spelling ($p=.001$); CWIT was not associated with either WASI or WRAT-3 in HC.

Conclusions: Results suggest that the experience of trauma affects resources available for EF in youth, or that this profile represents a risk factor for PTS in traumatized youth. Compared to HC, the PTS group required greater attention on the simpler task of inhibition, and the correlations between inhibition/switching and verbal domains suggest that impairments in EF are a contributing factor to deficits in verbal performance. Impairments in EF may also prevent the learning of verbal information posited as a performance variable on CWIT.

Correspondence: *Nicholas T. Bott, Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 401 Quarry Rd., MC 5719, Palo Alto, CA 94305. E-mail: nbott@stanford.edu*

E.M. BRICENO, L.J. RAPPORT, E. AVERY, B. HAASE, S. WALKER, J. HEIDEBRINK, B. GIORDANI, L. BIELIAUSKAS, H. KALES, J. ZUBIETA, S.L. WEISENBACH & S.A. LANGENECKER. Elder Men and Women with Major Depressive Disorder Exhibit Opposite Disruption in Emotion Processing Circuitry.

Objective: An aging population and diminished healthcare resources suggest that early differential diagnosis of later-life neurodegenera-

tive disorders is important for effective, personalized medicine. The intersection between depression, cognitive decline, and aging is of particular interest. Emotion processing is a critical human skill, supported by fronto-limbic circuitry known to be sensitive to the effects of aging, yet is relatively understudied in aging and geriatric depression. Prior research by our group revealed gender- and age- differential performance decrements in depression. Here we investigate neurophysiological disruptions that may underlie those age- and gender-specific effects.

Participants and Methods: One hundred adults grouped by MDD status, gender, and age (young, elder) underwent 3T fMRI while completing a facial emotion processing task. They viewed photographs of faces and categorized the emotion perceived (happy, sad, angry, fearful).

Results: Three-way interactions were present between MDD status, gender, and age group in regions pertinent to emotion processing, including frontal, limbic and basal ganglia. Young women with MDD and elder men with MDD exhibited hyperactivation in these regions compared to their respective gender-matched healthy control (HC) counterparts. In contrast, elder women and younger men with MDD exhibited hypoactivation compared to their respective gender-matched HC counterparts.

Conclusions: This is the first study to report gender- and age-specific differences in emotion processing circuitry during a cognitive-emotional challenge associated with MDD. The findings suggest that gender-different mechanisms underlie cognitive-emotional disruption in elders with MDD. Future studies should investigate potential sources of this differential dysfunction, with implications for linking to onset of neurodegenerative disorders.

Correspondence: *Emily M. Briceno, M.A., Psychology, Wayne State University, 1490 Bemidji, Ann Arbor, MI 48103. E-mail: emilybriceno@gmail.com*

E.L. DAWSON, M. RANSOM, B.J. MICKEY, S.J. WALKER, K. MEYERS, K. HAZLETT, A. WELDON, B. GIORDANI, J. ZUBIETA & S. LANGENECKER. Prediction of Antidepressant Treatment Response from Baseline Cognition in Depressed Adults.

Objective: Poorer neuropsychological test performance during untreated depression has been documented to significantly predict poorer subsequent response to SSRI monotherapy. This study evaluated whether cognition at baseline is associated with responsiveness to escitalopram or duloxetine, specifically, in depressed adults.

Participants and Methods: Participants included 40 adults initiating treatment in an outpatient research study with Hamilton Depression Rating Scale (HDRS) scores of 14 or greater. Twenty-four participants received escitalopram and 16 received duloxetine. Processing speed, attention, verbal and visual memory, and executive functioning were assessed at baseline and 10 weeks later using neuropsychological measures.

Results: HDRS scores decreased by approximately 64% after 10 weeks of treatment, with no effect for drug type. Using multiple regression, lower baseline HDRS scores significantly predicted lower follow-up HDRS scores. Better memory performance at baseline significantly predicted improved HDRS scores at follow-up. In separate, domain specific multiple regressions executive functioning, processing speed, and attention performance did not contribute significant variance after accounting for baseline HDRS scores. After treatment, improvement was demonstrated on measures of verbal processing speed and sustained attention.

Conclusions: Consistent with previous studies, memory performance significantly contributed to the prediction of treatment responsiveness to antidepressants, beyond the effect of baseline depressive symptoms. This study supports the utility of identifying cognitive weaknesses in adults seeking treatment for depression in outpatient settings, with the goal of tailoring treatments.

Correspondence: *Erica L. Dawson, Psychiatry, University of Michigan, 2101 Commonwealth Blvd, Suite C, Ann Arbor, MI 48108. E-mail: ericadaw@med.umich.edu*

V. DOUET, L. CHANG, C. JIANG, A. PRITCHETT, T. ERNST, T. JERNIGAN, A.M. DALE, S.S. MURRAY & C. PING. Relationship Of A Functional Variant In the Neuregulin 1 Gene to White Matter Microstructure In Children Of The Pediatric Imaging Neurocognitive Genetic (PING) Study.

Objective: The neuregulin-1 (NRG-1) gene is involved in neural development, and is a susceptibility gene for schizophrenia and psychosis. In healthy adults, the T-risk allele of rs6994992 NRG-1 variant is associated with changes in white matter integrity and density in brain regions affected by psychosis. However, when these changes occur in the brain and whether their relationship to psychosis is still unclear. We hypothesize that the TT-carriers of rs6994992 would be associated with white matter abnormalities

Participants and Methods: Group differences in rs6994992 genotype of 760 healthy children (ages 3-20 years; 265 CC, 381 TC, 114 TT) were evaluated on fractional anisotropy (FA) and apparent diffusion (ADC) using diffusion tensor imaging (DTI). Principal components (PC) analysis reduced the dimensionality of DTI data. Genotype effects and interactions with age and sex were assessed with ANCOVAs, covarying for device. Bonferroni corrected p-values are noted with asterisks.

Results: ADC in pallidum/putamen PC showed steeper decline with age in TC ($r=-0.59$, $p<0.001$, slope=-.13) and TT ($r=-0.58$, $p<0.001$, slope=-.12) than CC ($r=-0.43$, $p<0.001$, slope=-.08; interaction- $p=0.002^*$). FA in the superior longitudinal fasciculus (SLF) PC showed age-by-sex-by-genotype interaction ($p=0.008^*$); male TT showed age-related increase ($r=0.56$, $p<0.001$) while female TT showed no change in FA with age. Age-by-sex-by-genotype interactions in FA were also seen in thalamus PC (interaction- $p=0.04$) and amygdala PC (interaction- $p=0.02$).

Conclusions: Children with the T-risk allele showed steeper decline in diffusion, which suggest a possible altered or aberrant myelination pattern in the striatal regions. Furthermore, girls with TT allele did not show age-appropriate increases in FA in the SLF. How these changes in brain diffusion are related to cognitive performance or other risk factors for psychosis will be further explored in the rich PING database. Grant Support: RC2-DA29475, 2K24-DA016170.

Correspondence: *Vanessa Douet, Ph.D., Medicine, University of Hawaii, University of Hawaii Neuroscience and MRI research Group, 1356 Lusitana St 7th fl, Honolulu, HI 96813. E-mail: douet@hawaii.edu*

A. ELLIS, M. VANDERLIND & C. BEEVERS. Cognitive Style Moderates Negative Working Memory Bias in Healthy, But Not Depressed, Individuals.

Objective: Major depression has been associated with a number of disruptions in cognition—biased processing of negative material, maladaptive cognitive styles and neurocognitive impairments. Unfortunately, the relationships between these processes and how they interact to affect neurocognitive functioning remains unclear. This study sought to elucidate the effects of mood and cognitive style on negative information processing.

Participants and Methods: Depressed (MDD, N=41) and healthy (Non-MDD, N=37) participants completed the Dysfunctional Attitudes Scale (DAS) to assess cognitive style. Participants completed an affective working memory (WM) task which required recall of word strings of increasing length while re-ordering the words alphabetically. The task involved six sets of 3 trials with trials differing in affective valence of words (positive, negative & neutral). Number of correct trials within each valence was used as the dependent variables.

Results: Regression analyses examined the effects of DAS, MDD status, and DASxMDD on working memory biases. For negative working memory, the model including DAS, MDD and DASxMDD explained 25% of the variance, $F(3, 77)=7.99$, $p<.00$. MDD ($b=5.44$, $\beta=1.12$, $t=2.19$, $p=.032$), DAS ($b=0.36$, $\beta=0.73$, $t=4.77$, $p=.00$) and DASxMDD ($b=-0.32$, $\beta=-1.61$, $t=-2.85$, $p=.01$) were all significant predictors. Decomposing the interaction indicated that higher DAS in non-MDD participants resulted in greater correct responses for negative words. These effects were not observed with positive or neutral words (Neutral: $F(3, 77)=0.28$, $p<.84$; Positive: $F(3, 77)=1.36$, $p<.26$).

Conclusions: Non-MDD individuals with higher dysfunctional thinking displayed better working memory for negative material, while MDD individuals displayed similar recall of negative words, regardless of thinking style. These results highlight the effect of negative thinking styles on negative information processing biases, beyond the effects of mood, and may point to a potential mechanism of depression vulnerability.

Correspondence: *Alissa Ellis, Ph.D., UCLA, UCLA, 760 Westwood Plaza 5S-225, Los Angeles, CA 90095. E-mail: aellis@mednet.ucla.edu*

S. HOCH, R.M. BUSCH, C.S. KUBU & D. FLODEN. Change in Depressive Symptoms after Deep Brain Stimulation in Patients with Parkinson's Disease.

Objective: 1. To examine the dimensions underlying self-reported depression symptoms in patients with advanced Parkinson's disease (PD). 2. To determine whether changes in depression symptoms after Subthalamic Nucleus Deep Brain Stimulation (STN-DBS) are attributable to changes in physical function and medication burden. We hypothesized that a 2-factor model would appropriately characterize depression symptoms in PD and that, after DBS, better mood would be associated with better motor function and higher medication levels.

Participants and Methods: Beck Depression Inventory-2 (BDI-2) responses from 414 PD patients seeking DBS treatment were submitted to exploratory Factor Analysis. Based on this analysis, subscale scores were generated for pre- and post-surgical BDI-2 responses in a different sample of 77 PD patients who underwent STN-DBS. Regression analysis was used to evaluate variables related to post-operative depression.

Results: Two factors reflecting emotional and somatic symptoms accounted for 36.5% of the variance in BDI-2 scores. The surgical group had lower BDI-2 scores after surgery due to reductions on the somatic subscale. Pre-operative somatic scores and better quality of life ratings accounted for 26.5% of variance in post-operative somatic scores. Contrary to our hypothesis, neither motor improvement (UPDRS-III) nor medication changes (levodopa-equivalent daily dosage) predicted post-operative somatic scores. Nonparametric item analysis suggested that these improvements are driven largely by changes in sleep and fatigue.

Conclusions: Both emotional and somatic mechanisms influence depression ratings in PD but only the latter are influenced by STN-DBS. Nonetheless, improved motor function and medication changes do not influence self-rated somatic depression symptoms. This has implications for understanding the mechanisms of depression in advanced PD and argues against a 'mood-enhancing' role of dopamine medication in this population.

Correspondence: *Darlene Floden, Cleveland Clinic, 9500 Euclid Ave, Desk P57, Cleveland, OH 44195. E-mail: flodend@ccf.org*

A.M. GREGORY, C. TIRABASSI, C.B. ALLARD, S.B. NORMAN, S. THORP, M. STEIN & E. TWAMLEY. Neuropsychological Performance Predicts PTSD Treatment Outcome.

Objective: Intimate partner violence (IPV) is common, occurring in 1/3 of women, and can result in PTSD, depression, and cognitive impairments due to both brain injury and neuropsychiatric symptoms. It is unknown whether neuropsychological deficits affect psychotherapeutic treatment outcomes.

Participants and Methods: Twenty women with PTSD due to IPV participated in Cognitive Trauma Therapy for Battered Women (CTT-BW) for 12 weeks. A neuropsychological battery was administered before treatment and interview assessments of PTSD and depressive symptom severity were administered at baseline and again 2 weeks following treatment completion. On average, participants performed in the low average to average range on neuropsychological tests. Improvement in PTSD symptom severity was the primary outcome; bivariate correlations were used to examine relationships between baseline neuropsychological performance and symptom improvement, and t-tests were used to compare neuropsychological performance between participants who fully or partially remitted.

Results: Greater symptom improvement was predicted by better neuropsychological performance on measures of memory ($r=.49$,

$p=.029$), number ($r=.48$, $p=.034$) and letter ($r=.50$, $p=.026$) sequencing, and motor speed ($r=.45$, $p=.044$). Significant differences were observed between those who partially versus fully remitted in measures of verbal fluency, $t(17)=2.17$, $p=.045$, inhibition/switching, $t(18)=2.30$, $p=.034$, and cognitive flexibility, $t(15)=2.35$, $p=.033$.

Conclusions: Improvement in PTSD symptoms was related to not only better memory and processing speed, but also to better performance on measures of cognitive flexibility/switching. These results suggest women who can process information more quickly, remember it better, and have better cognitive flexibility may have better PTSD treatment outcomes. Therefore, CTT-BW outcomes may be improved by reducing the pace of treatment, repeating novel information, and augmentation with Problem Solving Training to improve cognitive flexibility.

Correspondence: *Amber M. Gregory, BA Psychology, Psychology, University of Alabama at Birmingham, 1131 16th Ave. South, unit A, Birmingham, AL 35205. E-mail: agregory@uab.edu*

P. HANSSON, R. MURISON, A. LUND & A. HAMMAR. Cognitive functioning and cortisol suppression in first episode major depression.

Objective: Major Depressive Disorder (MDD) is often associated with high levels of stress and disturbances in the Hypothalamic Pituitary Adrenal (HPA) system, yielding high levels of cortisol, in addition to cognitive dysfunction. Previous studies have shown a relationship between cortisol profile and cognitive functioning in recurrent MDD. However, no studies have investigated this relationship in patients diagnosed with first episode MDD. The aim of the present study was to examine the relationships between cortisol levels after the dexamethasone suppression test (DST) and cognitive function in first episode MDD patients.

Participants and Methods: Twenty-four patients meeting the DSM-IV criteria for a first episode of MDD were included in the study. The control group was matched for age, gender and education level. Cortisol was measured in saliva collected with Salivette sampling devices. Saliva samples were collected 4 times during a 24 hours period over two consecutive days: at awakening, after 45 minutes, after 7 hours and at 11 pm. Dexamethasone (1.0 mg) was given on Day 1 at 11 pm. The neuropsychological test battery consisted of standardized tests measuring executive functioning (EF).

Results: Cortisol levels did not differ significantly between patients and controls, except for the last sample before Dexamethasone administration, where the control group showed higher levels. Both groups showed significant suppression after Dexamethasone. Although, the first episode MDD patients showed cognitive impairment in EF compared to the healthy controls, there were no correlations between cortisol levels or suppression after Dexamethasone and cognitive measures.

Conclusions: The results indicate normal HPA-axis functioning in first episode MDD patients and no relation between cortisol profile and cognitive functioning in EF. It is important to follow this patients group longitudinally, since previous findings show that recurrent MDD patients have impaired cortisol profiles related to cognitive functioning.

Correspondence: *Asa Hammar, PhD, University of Bergen, Jonas Lies vei 91, Bergen 5009, Norway. E-mail: aasa.hammar@uib.no*

I. HUNT, D.D. RACKHAM, P.E. CLAYSON, S.A. BALDWIN & M.J. LARSON. Cognitive Control and Performance Monitoring in Adult Major Depressive Disorder: A Meta-Analysis.

Objective: Psychiatric disorders, including major depressive disorder (MDD), are frequently associated with impairments in cognitive control and performance monitoring. The error-related negativity (ERN) component of the event-related potential (ERP) provides a tool to understand performance monitoring processes. We aimed to quantitatively determine the degree of performance monitoring process impairments in individuals with MDD using meta-analytic techniques.

Participants and Methods: A search of the performance monitoring literature yielded 1,044 relevant studies. Of these, 9 met all inclusion criteria. Total participants included 162 individuals with MDD and 160

psychiatrically-healthy controls (total $n=322$). Cohen's d was calculated as a measure of effect size comparing the mean (\pm SD) of error-trial ERN amplitude. Overall effect size was calculated using a random effects model. Heterogeneity, influence and publication bias analyses were also conducted.

Results: Tests of heterogeneity and publication bias were significant ($Q=17.53$, $p=0.025$). The percentage of total variability due to heterogeneity (I²) among the studies was 54.6%. This high percentage of heterogeneity indicates that the studies are not consistently measuring the same variables. The random effects model showed a non-significant effect size ($d=-0.106$, $p=0.55$) for mean ERN amplitude differences.

Conclusions: Results indicate no significant differences in ERP reflections of performance monitoring between individuals with MDD and psychiatrically-healthy controls. Publication bias and high levels of heterogeneity between studies may have influenced findings. An important direction for future research is to isolate MDD from comorbid anxiety disorders and more closely examine environmental interactions with performance monitoring processes.

Correspondence: *Isaac Hunt, Brigham Young University, 4287 W Queens Ferry Dr, South Jordan, UT 84095. E-mail: isaacjameshunt@gmail.com*

R.Y. IP & S. PONGRACIC. Agitation and Decision Making Impairments in Neuropsychiatric Inpatients.

Objective: Decision making impairments have been associated with lesions of the orbital prefrontal cortex in neurological patients. Individuals with orbital prefrontal involvement often display agitated behaviours that include aggression, disinhibition, and lability. Limited research has been done to investigate the relationship between decision making and the underlying factors of agitation. The current study examines decision making impairments in relation to agitation in the neuropsychiatric population.

Participants and Methods: This preliminary study explores decision making impairments and agitated behaviours of 12 inpatients on a neuropsychiatric unit at a mental health centre. These patients have been diagnosed with psychiatric and neurological disorders.

Participants completed the computerized version of the Iowa Gambling Task (IGT; Bechara et al., 1994). The IGT assesses decision making ability by simulating real-life decisions in conditions of reward, punishment, and uncertainty. The Agitated Behaviour Scale (ABS; Corrigan, 1989) is an observational measure used by healthcare professionals to monitor agitation of inpatients. Factor analysis of the ABS reveals three underlying factors: aggression, disinhibition, and lability. Patients' socio-demographics and neurological involvement were examined in relation to their decision making and agitation. Associations of the IGT and ABS were also investigated.

Results: Preliminary findings indicate that agitation and decision making impairments are prevalent amongst the neuropsychiatric inpatients. Correlates of socio-demographic, decision making and agitation variables are examined. Differences in decision making performance in relation to factors of agitation are discussed.

Conclusions: Further understanding of factors underlying agitation and decision making impairments of the neuropsychiatric inpatients can help target specific interventions and monitor their responses to treatment.

Correspondence: *Rosa Y. Ip, PhD, Ontario Shores Centre for Mental Health Sciences, 700 Gordon Street, Whitby, ON L1N 5S9, Canada. E-mail: ipr@ontarioshores.ca*

R. KAY, L.J. RAPPORT, S.L. WEISENBACH, M.T. KASSEL, A. LAURENT, L.A. BIELIAUSKAS, B. GIORDANI, J. ZUBIETA & S.A. LANGENECKER. Effects of Psychotropic Medications upon Depression-Related Cognitive Decrements.

Objective: Individuals with Major Depressive Disorder (MDD) frequently experience cognitive decrements in addition to mood impairments. Ironically, antidepressant medications used to treat depression may have adverse effects on cognitive functioning. It is imperative to understand the relative cognitive costs of antidepressants when considering treatments for patients.

Participants and Methods: Participants were 157 adults with MDD (72 unmedicated-uMDD, 85 medicated- mMDD) and 134 healthy controls (HC) who were evaluated in several cognitive domains. The groups were equivalent in age and education. The MDD groups were equivalent in years of illness.

Results: Univariate analyses of variance (ANOVAs) indicated that the mMDD group had significantly fewer depressive symptoms than did the uMDD group, assessed via subjective self-report (Beck Depression Inventory-II) and clinician-ratings (Hamilton Depression Rating Scale). In contrast, ANOVAs based on medication status revealed significant adverse effects of medications on cognitive tests, showing small to medium effect size. Post hoc tests indicated that uMDD and HC groups were equivalent on all tests. In contrast, the mMDD group performed significantly worse than both HC and uMDD on finger dexterity and simple attention. On tests of psychomotor speed and working memory the mMDD group performed equivalent to uMDD but significantly worse than HC.

Conclusions: Antidepressants used to treat MDD improve dispositional symptoms of depression but have adverse effects on some areas of cognition. Comparing the effect sizes may be useful to clinicians and researchers in distinguishing cognitive effects of medication separately from those associated with MDD. Both the beneficial effects on depressive symptoms and adverse effects on cognition should be considered by practitioners and consumers when making treatment decisions.

Correspondence: *Rachel Kay, B.A., Psychology, Wayne State University, 5057 Woodward Ave, Detroit, MI 48202. E-mail: kayrach@wayne.edu*

C.A. KIMPTON HEALD, T.L. WILGENBUSCH, A.L. CONRAD & L.C. RICHMAN. Neuropsychological Characteristics of Children and Adolescents with Nonverbal Learning Disability.

Objective: The purpose of this study was to compare neuropsychological functioning of children with Nonverbal Learning Disability (NLD) to a contrast group of children with Dysphasia.

Participants and Methods: Ninety-three children with a diagnosis of NLD and 66 children with a diagnosis of Dysphasia were recruited from a Pediatric Psychology clinic. Univariate ANOVAs and Pearson correlations were used to compare demographic variables and Pediatric Behavior Scales (PBS) scores (e.g., attention, depression) to General Ability Index (GAI) scores and Verbal Comprehension/Perceptual Reasoning (VCI/PRI) discrepancy scores on the Wechsler Intelligence Scale for Children-IV (WISC-IV). Identical analyses were performed for a Dysphasia contrast group.

Results: Children in the NLD group showed significantly more dual/multiple-diagnoses, ADHD diagnoses, higher mother and father education, and higher VCI and GAI scores than those in the Dysphasia group. In addition, the NLD group showed significant relationships between GAI and the PBS Depression scale, GAI and both mother and father education, and VCI/PRI discrepancy and number of diagnosis.

Conclusions: The findings have important implications for the diagnosis and treatment of children who have NLD, and also provide tentative support for neural correlates and NLD subtypes.

Correspondence: *Carrie A. Kimpton Heald, PhD, Department of Psychiatry, University of Iowa, W 278 GH, 200 Hawkins Drive, Iowa City, IA 52242. E-mail: carrie-kimpton@uiowa.edu*

D.K. BJORN, J.E. FAIR, P.E. CLAYSON, Z.J. MCDONNELL & M.J. LARSON. Emotion-Related Conflict Adaptation in Generalized Anxiety Disorder.

Objective: Neuroscience research indicates that individuals with generalized anxiety disorder (GAD) show alterations in the cognitive control process of conflict adaptation (CA). CA aids in task performance by allocating greater resources for the current trial if conflict is detected in a previous trial. To test for CA, most studies have used variations of the Stroop task using words. We evaluated GAD-related behavioral differences in CA using a novel emotional face paradigm to determine whether CA deficits are unique to language-based Stroop tasks or include facial emotion processing.

Participants and Methods: An anxiety group (AG; 14 individuals with a diagnosis of GAD; 13 female) and 14 sex-matched healthy controls completed an emotional variation of the Stroop task, which consisted of paired images of human eyes and mouths. Participants responded by indicating whether images of eyes showed anger or happiness while ignoring an in/congruent mouth image. Response times (RT) and error rates (ER) were compared using a 2-group (AG, controls) x 2-Previous-trial-congruency x 2-Current-trial-congruency ANOVA.

Results: There was a significant difference between the groups for age and years of education with the AG being older and more educated. Results for the ANOVA of RTs showed a significant effect for previous x current trial congruency for both groups; however, there was no significant interaction or main effect of group. RT for current trial trended significant for the AG. ANOVA revealed lower ERs for the AG on current trials but not when considering previous trial congruency.

Conclusions: Possible reasons for the lower ER and RTs of the AG include 1) the sample was older and more educated, 2) the stimulus itself was not arousing enough for controls, or 3) greater vigilance among the AG. Lack of significant findings among RT and ER for previous and current trial congruency between groups suggests there are no deficits in CA in this sample. Correspondence: *Daniel K. Bjorn, Psychology, Brigham Young University, 1190 North 900 East # 170, Provo, UT 84602. E-mail: dbjorn@byu.edu*

A.B. LEWIN, M.J. LARSON, E. CRAWFORD, J.M. PARK, J. MCGUIRE & E.A. STORCH. Executive and Memory Impairment in Youth with Obsessive Compulsive Disorder (OCD).

Objective: Extant neuropsychological findings support etiological models of OCD, emphasizing frontostriatal dysfunction as evidenced by impairment in higher-order domains of cognition including planning, shifting, organizing, non-verbal memory and coordinating more basic cognitive functions. However, research in youth with OCD is limited. Aims for this study were to identify rates of neurocognitive impairment in youth with OCD, determine the relationship between the magnitude of neurocognitive impairment and OCD severity and other clinical correlates, and to examine relations between performance on specific aspects of executive function and memory and OCD severity/other clinical correlates.

Participants and Methods: Ninety-six youth with OCD (ages 7-17; 56% male) participated. All subjects underwent a diagnostic assessment, evaluation of OCD severity, and a 3 hour neurocognitive battery focused on executive and memory. Measures included selected subtests of the Delis-Kaplan Executive Function System (D-KEFS), the Rey Osterrieth Complex Figure Test, the California Verbal Learning Test, and Stories Memory from the WRAML II.

Results: Sixty-five percent of youth with OCD presented with neurocognitive sequelae. Approximately 30% showed impairment in non-verbal memory, 12% in processing speed, and 9% in inhibition. Twenty-seven percent showed impairment in multiple domains. Although neurocognitive deficits were not clearly linked to the severity of OCD symptoms, the presence of a chronic tic disorder was associated with increased neurocognitive impairment. The magnitude of neurocognitive impairment was also related to the number of psychiatric comorbidities and the use of neuroleptics.

Conclusions: The majority of youth with OCD in this sample showed neurocognitive impairments. These impairments appear to be driven by comorbidity (especially tic disorders) rather than by OCD severity alone. Neuroleptic medications decrease cognitive functioning in youth with OCD. Correspondence: *Adam B. Lewin, Ph.D., ABPP, Pediatrics & Psychiatry, University of South Florida, 880 6th St. South Box 7523 Suite 460, Rothman Center for Pediatric Neuropsychiatry, St. Petersburg, FL 33701. E-mail: alewin@health.usf.edu*

V. LLAMAS, S. LUU & P. HAERICH. Image-Based Affective Parity Task: Examining Psychopathic Traits and Attention.

Objective: Attentional deficits which restrict the accommodation of peripheral information when engaged in a goal-directed task have been related to high levels of psychopathy. The present study examined this attentional deficit using four versions of the image-based parity task.

Participants and Methods: 52 university students performed the four versions of the parity task in random order and completed the PPI-R. The parity task requires subjects to determine whether two digits match (or mismatch) in being odd or even. Digits are presented left and right of (in Control and Basic versions) or superimposed on a central, potentially interfering, non-task-relevant stimulus. Control (color block distractor), Basic (image distractor), Superimposed Low (SIL; image distractor with two numbers superimposed on the image), and Superimposed High (SIH; image distractor with two numbers and two letters superimposed on the image) versions were used to manipulate attentional demands and examine the impact across varying levels of psychopathy.

Results: The image-based parity task produced robust interference associated with emotionally arousing as compared with neutral distractor images. An omnibus (repeated measures ANOVA) interaction among Coldheartedness (C), arousal, valence, and version emerged, $p < 0.05$. For control and SIH versions, no effect of high and low levels of C was found on reaction times (RT). However, individuals high on C demonstrated significantly greater interference from negative images in the Basic task and positive images in the SIL task than low-C individuals.

Conclusions: Unexpectedly, emotional images were more effective in capturing the attention of individuals high on C. These findings fail to support – and actually run counter to – the attentional deficit hypothesis. Possible explanations include effects of gender differences, working memory load, and mechanisms of attentional capture.

Correspondence: *Veronica Llamas, Department of Psychology, Loma Linda University, 11130 Anderson Street, Suite 106, Loma Linda, CA 92350. E-mail: vlla709@gmail.com*

B.S. MCKENNA, A.N. SUTHERLAND & L.T. EYLER. Working Memory Component Processing Deficits in Euthymic Bipolar Patients.

Objective: Bipolar (BD) patients have working memory (WM) deficits and reductions in WM-related neuronal activation even during periods of euthymia. However, few studies have examined deficits in WM component processes in BD. We used an event-related functional MRI paradigm to examine WM encoding and maintenance processes separately.

Participants and Methods: 23 medicated euthymic BD (age=45.0±2.0yrs, 8m) and 23 healthy control (HC) subjects (age=44.6±2.2yrs, 8m) completed a verbal delayed match-to-sample WM task in which load was manipulated by varying syllable length (2, 3, or 4) during slow event-related functional MRI. Group differences, load effects, and their interaction were examined during encode and maintenance task epochs with mixed effects ANOVAs for behavioral and MRI data.

Results: Behaviorally, all participants performed worse and responded slower as load increased; BD were less accurate than HC, but had similar response times. During the encode epoch, BD patients failed to activate several prefrontal and basal ganglia regions compared to HC across all levels of load. In addition, BD patients failed to engage dorsolateral prefrontal cortex in response to increasing syllable length. During the maintenance epoch, BD patients showed less deactivation in posterior cingulate and increased activation in right precentral gyrus relative to HCs, independent of load. BD and HC participants equally engaged brain regions implicated in WM maintenance in response to increasing syllable length.

Conclusions: Consistent with the literature, we found that BD patients have WM deficits during euthymia. These deficits appear to be more associated with impaired prefrontal and basal ganglia processes required to encode verbal information of increasing complexity into the WM system as opposed to maintaining such information within WM. Consistent with attentional impairments observed in BD using other tasks, these findings suggest that attentional changes are an important component of patients' WM deficits.

Correspondence: *Benjamin S. McKenna, Ph.D., University of California, San Diego, 3350 La Jolla Village Drive, mail code: 9116A, San Diego, CA 92161. E-mail: bmckenna@ucsd.edu*

S. PANOS, A.D. THAMES, S. PATEL, T. ARENTSEN, N. ARBID, R. BALLARD, A. ARENTOFT, S. CASTELLON & C. HINKIN. Cognitive Reserve May Buffer against the Expression of Psychiatric Symptomatology.

Objective: Cognitive reserve (CR) capacity has been shown to have a protective effect against the expression of a variety of neurocognitive illnesses, including Alzheimer's disease and HIV-associated neurocognitive disorder. Although psychiatric disorders have effects on the brain, less is known about whether CR also serves to protect against the expression of psychiatric symptomatology. In the schizophrenia literature, there is evidence to suggest that premorbid reading difficulties predate the onset of schizophrenia as far back as elementary school. It is logical to opine, therefore, that CR may be related to psychiatric functioning in a variety of other populations. The current study seeks to determine whether CR is related to psychiatric functioning in a sample of HIV+ individuals.

Participants and Methods: A total of 170 HIV+ adults were administered the American National Adult Reading Test (AMNART). A CR composite score was computed based on averaged standardized education and AMNART scores. Participants were administered the Millon Clinical Multiaxial Inventory-III (MCMI-III), the drug use portion of the Structured Clinical Interview for DSM Disorders, and urine toxicology screens for the assessment of drug use. Regressions were used to assess the relationship between CR and MCMI-III scales.

Results: On the MCMI-III, CR was negatively associated with avoidant, depressive, dependent, sadistic, negativistic, masochistic, schizotypal, borderline, paranoid, somatoform, dysthymic, post traumatic stress, thought disorder, major depression, and delusional subscales. Follow-up regression analyses controlling for the effects of ethnicity, income (calculated as a ratio of income and number of individuals supported by this income), and substance use/abuse revealed that these effects held for the majority of these scales.

Conclusions: CR is related to the expression of psychiatric symptomatology. Similar to the relationship between CR and neurocognition, higher CR may buffer against the effects of psychiatric dysfunction.

Correspondence: *Stella Panos, PhD, UCLA, 760 Westwood Blvd. CS-746, Los Angeles, CA 90095. E-mail: spanos@mednet.ucla.edu*

M. REINLIEB, L. ERCOLI, P. SIDDARTH & H. LAVRETSKY. The Patterns of Cognitive and Functional Impairment in Amnestic and Non-Amnestic Mild Cognitive Impairment in Geriatric Depression.

Objective: Depressed older adults are at risk for the development of mild cognitive impairment (MCI), but few studies have characterized MCI subtypes in geriatric depression. The purpose of this study is to identify the clinical and cognitive patterns of MCI in late-life depression (LLD).

Participants and Methods: One hundred forty older adults with depression participated in this clinical study. Participants received evaluations of depression, apathy, quality of life, medical burden, and vascular risk factors, and completed a neuropsychological battery assessing memory, executive functioning, language, visuospatial ability, and psychomotor speed. Amnestic MCI was defined as a memory domain score 1SD below normal and non-amnestic MCI as any domain score 1SD below normal without memory impairment. Significance tests were evaluated at the 5% level.

Results: Of the 140 participants, 73 (52%) had MCI and 67 (48%) were cognitively normal. Of the MCI subjects, 15 (20%) had amnestic MCI and 58 (80%) non-amnestic MCI. Overall, the MCI group had greater depression severity and poorer quality of life than the non-MCI group, along with worse performance on the MMSE and all composite domain scores. Within MCI subgroups, the non-amnestic group had significantly greater depression severity than the non-MCI group, and the amnestic group had significantly lower body mass index than non-amnestic and non-MCI groups. Amnestic and non-amnestic MCI groups scored significantly lower on the MMSE and all composite domain scores than the non-MCI group. As expected, the amnestic MCI group also scored lower in memory than the non-amnestic group. Across all subjects, depression severity correlated with impaired performance on language, psychomotor speed, and visuospatial domain scores.

Conclusions: MCI in LLD is associated with greater depression severity and poorer quality of life. Non-amnestic and amnestic MCI in geriatric depression differ in the patterns of cognitive and functional impairment, which may require different therapeutic approaches.

Correspondence: *Michelle Reinlieb, Graduate Center, CUNY, 633 Midvale Avenue, apt 6, Los Angeles, CA 90024. E-mail: reinliebmg@gmail.com*

A.J. VERDEJO-GARCÍA, N. ALBEIN-URIOS, O. LOZANO & J. MARTINEZ-GONZALEZ. Sex differences in working memory and decision-making among cocaine users with comorbid personality disorders.

Objective: To investigate sex differences in the executive function and decision-making performance of cocaine dependent patients with comorbid personality disorders.

Participants and Methods: Thirty-four cocaine dependent individuals (10 females) with comorbid Cluster B personality disorders (antisocial, borderline, histrionic and narcissistic) were recruited as part of the COPERNICO study. They completed a neuropsychological assessment focused on different aspects of executive function and decision-making: Letter Number Sequencing, N-back, Stroop, Category Test and Iowa Gambling Task. They also completed the Personality Belief Questionnaire (PBQ) to assess dysfunctional beliefs associated with their personality pathology. Males and females were matched in age, years of education, full IQ scores and cocaine use patterns (age at onset, monthly use and duration). We conducted independent-sample t-tests to investigate sex differences in tests performance and Spearman correlation coefficients to explore the associations between dysfunctional beliefs and neuropsychological performance as a function of sex.

Results: Female cocaine dependent individuals with comorbid personality disorders performed significantly poorer than their male counterparts in tests of working memory (Letter Number Sequencing, $t=2.53$, $p<0.05$; N-back, $t=2.19$, $p<0.05$) and decision-making (Iowa Gambling Task, $t=2.30$, $p<0.05$). Correlation analyses showed that the severity of PBQ-indexed dysfunctional beliefs was negatively associated with working memory (N-back, $r=-0.87$) and decision-making ($r=-0.72$) performance in females, whereas in males the correlation was positive for working memory (N-back, $r=0.63$).

Conclusions: Comorbid personality disorders impact more negatively on working memory and decision-making in female vs. male cocaine users.

Correspondence: *Antonio J. Verdejo-García, Clinical Psychology, Universidad de Granada, Campus de Cartuja S/N, Granada 18071, Spain. E-mail: averdejo@imim.es*

L. WAAGE. Heart rate variability, attachment style, and psychopathy.

Objective: The aim of this study was to investigate the relationship between heart rate variability (HRV), an index of executive functioning and self-regulation, attachment styles, and facets of self-reported psychopathy.

Participants and Methods: 104 inmates from Bergen prison participated in this study. Heart rate variability (HRV) and heart rate were measured using the Actiheart system. Attachment style was measured by the Experiences in Close Relationships Questionnaire (ECR) and self-reported psychopathy was measured by Self-Report of Psychopathy-III.

Results: The results indicated that there were significant and positive relationships between the HRV and different facets of psychopathy. Further, there was a relationship between HRV and the Avoidance attachment dimension. All four facets of self-reported psychopathy correlated positively with the Avoidance attachment dimension.

Conclusions: The present results indicated that there might be a relationship between HRV and self-reported psychopathy, as well as attachment.

Correspondence: *Leif Waage, Centre for Research and Education in Forensic Psychiatry, Haukeland University Hospital, Bergen, Norway; solheimsgaten 13, postboks 2444, Bergen 5824, Norway. E-mail: luwaage@online.no*

S. WALKER, K.A. RYAN, S.L. WEISENBACH, K.K. MEYERS, A.L. WELDON, R.E. KAY, M. MCINNIS, J. ZUBIETA & S.A. LANGENECKER. Error Monitoring in Mood Disorders: The Effect of Depression and Bipolar Disorder on Post-Error Slowing.

Objective: Individuals monitor their behavior and performance based on many factors. Problematic error-processing has been implicated in mood disorders. This study examines error-processing among individuals in a euthymic phase of Major Depressive Disorder (MDD) or Bipolar Disorder I (BD) in comparison to each other and to healthy controls (HC). MDD and BD groups were hypothesized to exhibit slowed reaction time following commission errors in comparison to the HC group. This study addresses a lack of previous investigation into whether distinct post-error slowing (PES) patterns exist in MDD vs. BD, independent of acute disease exacerbations.

Participants and Methods: Reaction times to targets after commission errors on a Parametric Go/No-Go (Langenecker et al., 2007) task were measured (28 HC, 10 MDD, 29 BD). Groups were characterized via structured diagnostic interview (i.e., SCID-I, DIGS) and screening inventories (i.e., HDRS, YMRS). There were no significant age (all 18-55; M=31, SD=10), education (M=15, SD=2), or gender (47% male) differences between groups.

Results: Repeated-measures ANOVA indicated a within-group effect; reaction times as a whole slowed during the 7 seconds following commission errors, $F(13, 832) = 15.08, p < .001$. The main effect for group did not reach statistical significance, $F(2, 64) = 2.09, n.s.$, although a trend in the expected direction was observed. PES patterns (BD>MDD>HC) emerged that are expected to reach significance with ongoing data collection and improved power.

Conclusions: Contrary to hypotheses, diagnostic groups' differing responses to performance errors did not reach statistical significance. Nevertheless, this is an area of study that warrants investigation. MDD and BD may present similarly, depending on phase of illness, whereas they have distinct courses for which early diagnostic clarity is imperative. A better understanding of the cognitive and affective correlates of PES in MDD and BD may help distinguish between the two mood disorders.

Correspondence: *Sara Walker, PhD, Psychiatry, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, OP 02, Portland, OR 97239. E-mail: walkesar@ohsu.edu*

V. WEISSER, K.M. WROCKLAGE, J.C. SCOTT, J.L. JORDAN, M.M. TREJO, A.M. CHRISTENSEN, J.R. FANNING, S.M. SOUTHWICK, J.H. KRISTAL & B.C. SCHWEINSBURG. Prospective Memory in Post-Traumatic Stress Disorder and its Relationship to Executive Functioning.

Objective: Successful performance on prospective memory tasks requires intact executive functioning and memory processes, both of which have been shown to be impaired in posttraumatic stress disorder (PTSD). However, little is known about prospective memory performance in PTSD. The objective of this study was to examine prospective memory performance in combat-exposed veterans with and without PTSD and its relationship with traditional measures of executive functioning.

Participants and Methods: Participants were 24 veterans with PTSD (mean CAPS: 74.92, mean age: 35.54, mean education: 13.29) and 16 combat-exposed controls (mean age: 30.64, mean education: 14.13). The groups did not significantly differ on age, education, IQ, or mild traumatic brain injury history. Participants were administered the MIST, D-KEFS verbal fluency, D-KEFS Trails, and WCST-64 as part of a comprehensive neuropsychological battery. Errors on the MIST were examined between groups (Total Errors (TE), Time-Cued (TC), Event-Cued (EC)).

Results: Nonparametric tests were used due to non-normality in the MIST variables. Veterans with PTSD demonstrated significantly more

MIST TE than combat controls, $z = -1.92, p = .05$. There were no group differences for TC or EC errors. In the PTSD group, MIST TE was significantly negatively correlated ($p \leq .05$) with DKEFS verbal fluency switching accuracy ($r = -.40$) and trails switching ($r = -.49$), and with WCST total errors at a trend level ($r = -.35; p = .09$).

Conclusions: PTSD was associated with increased prospective memory errors. Poorer prospective memory was significantly associated with measures assessing task switching and conceptual reasoning. Findings are generally consistent with executive dysfunction in PTSD and may help explain some of the functional difficulties reported in this population.

Correspondence: *Valerie Weisser, Ph.D., VA Connecticut Healthcare System, 950 Campbell Avenue, West Haven, CT 06516. E-mail: vdweisser@gmail.com*

Invited Symposium: Advances in Cultural Neuropsychology

Chair: Desiree Byrd

1:30–3:00 p.m.

J. MANLY. Invited Symposium: Advances in Cultural Neuropsychology.

Symposium Description: This symposium will present new advances in research on cognition and cognitive assessment among ethnically, racially, and linguistically diverse people. There has been substantial progress in conceptualizing and measuring the effects of race, culture, and language on cognitive outcomes, as well as improving the accuracy of neuropsychological tests in detecting cognitive impairment in diverse people. The symposium will present research that leverages the complex experiences of diverse people in order to uncover basic knowledge about neural correlates of cognition, cognitive development, and cognitive flexibility. For example, life course approaches to measurement of racial, economic, cultural, and educational experiences will be shown to advance our understanding of cognitive aging. This session will also include research on cognition and cognitive test performance among bilinguals, which sheds light on the role of culture in early cognitive development. Research on whether bilingualism provides a reserve against cognitive decline in the face of brain pathology will be presented. Speakers will also provide creative solutions to methodological challenges that arise in the assessment of culturally and linguistically diverse people that will improve the quality and utility of neuropsychological measures for all people, not just cultural or linguistic minorities.

Learning Objectives:

- (1) explain how cultural neuropsychology can uncover basic knowledge about neural correlates of cognition, cognitive development, and cognitive flexibility
- (2) name several indices of educational experience and differentiate their relationship with cognitive function across the life span
- (3) describe the strengths and limitations of existing research on bilingualism as a source of cognitive reserve

Correspondence: *Jennifer Manly, GH Sergievsky Ctr, Columbia University, 630 W 168th St, P + S Box 16, New York, NY 10032. E-mail: jjm71@columbia.edu*

A.D. THAMES, C.H. HINKIN, D.A. BYRD, R.M. BILDER, K.J. DUFF, M. RIVERA-MINDT & A. ARENTOFT. The impact of non-cognitive factors on neuropsychological test performance: A closer look into stereotype threat and perceived discrimination.

Multiple factors impact the validity of neuropsychological assessments but only some of these factors are widely appreciated, particularly those that are relevant to ethnic minorities. Stereotype threat and per-

ceived discrimination are both factors unique to minority group status that have been found to disrupt cognitive processes. This session will discuss findings from a recent study that examined the effects of stereotype threat, perceived discrimination, and examiner-examinee racial discordance on neuropsychological performance in a non-clinical sample of African American and Caucasian individuals. Results supported the negative effects of stereotype threat and perceived discrimination on neuropsychological performance. For African Americans, racial similarity between examiner and examinee mediated the adverse effects of perceived discrimination. Overall, these results suggest that factors that are characteristic of the individual and the environment may impact the validity of neurocognitive test results. Although the study presented was focused on ethnic group membership, stereotype threat generalizes to a wide range of populations such as TBI, aging, and neurological disease populations. Speakers will discuss how stereotype threat may affect individuals with multiple group identities (e.g., An African American woman with a TBI) along with steps to counteract the effects of stereotype threat in the assessment context.

Correspondence: *April D. Thames, 760 Westwood Plaza CS-226, Los Angeles, CA 90095. E-mail: athames@mednet.ucla.edu*

T. GOLLAN. Bilingualism in Aging & Dementia: Evidence for Language-Specific Control Mechanisms.

A fundamental characteristic of language is that it provides multiple ways to express the same ideas, and therefore speaking presents the challenge of choosing between competing alternatives. Bilinguals provide a unique source of evidence about how speakers gain control over these selection challenges, given that they often face direct competition between languages. Current research suggests that bilinguals manage this competition with domain-general mechanisms of cognitive control. By implication, proposals that the language system may be equipped with its own specialized processing mechanisms are rejected. I will present a series of studies that question this basic claim by demonstrating that bilinguals with impairments in executive control (due to aging and Alzheimer's disease) exhibit relatively intact ability to do what bilinguals do best. This dissociation invites a psycholinguistic model that is equipped with at least some domain-specific control mechanisms, and that does not attribute all the consequences of bilingualism to mental juggling of two languages. These data also provide unique insights about why retrieval sometimes fails when people speak, and has practical applications for diagnosis of cognitive impairment in an increasingly multilingual society.

Correspondence: *Tamar Gollan, 9500 Gilman Drive, La Jolla, CA Ca. E-mail: tgollan@ucsd.edu*

D.A. BYRD & J.J. MANLY. Cultural neuropsychology: recent developments and applications.

Cultural neuropsychology is no longer limited to the measurement and explanation of test performance differences among groups of persons. This sub-specialty has expanded in scope to encompass innovative methods for the measurement of cultural experience, identity and cognitive outcome. Cultural neuropsychology has also prompted unique investigations into the neural correlates of cognitive abilities. Evidence for the bidirectional influence of culture and cognitive processing will be drawn from functional neuroimaging, cognitive neuroscience and cognitive aging. This presentation will review and critique multi-disciplinary investigations from cultural neuropsychology across the lifespan. Finally, psychometric innovations for methods used to evaluate the diagnostic accuracy of cognitive assessment tools in diverse populations will be reviewed. Implications of these recent advances for the areas of neuropsychological practice, science, and education will be discussed.

Correspondence: *Desiree A. Byrd, One Gustave Levy Place, Neurology Box 1052, New York, NY 10029. E-mail: desiree.byrd@mssm.edu*

Symposium 6: Trans-Disciplinary Approaches to the Assessment of Driving Safety: From Teens to the Oldest Old

Chair: Margaret O'Connor

Discussant: Linas Bieliauskas

1:30–3:00 p.m.

M. O'CONNOR, E. UC, B. OTT, S. CLASSEN, M. MONAHAN, L. KAPUST & L. BIELIAUSKAS. Trans-Disciplinary Approaches to the Assessment of Driving Safety: From Teens to the Oldest Old.

Symposium Description: This presentation will focus on the importance of establishing a dialogue between clinicians and researchers involved in driving assessments. Presentations will be given by neuropsychologists, occupational therapists, social workers and neurologists involved in driving assessment research. Dr. O'Connor will begin with a review of issues related to driving competence, tolerable risk, and reporting requirements. Medical conditions associated with driving challenges will be highlighted as will position papers issued by the AMA and the American Academy of Neurology. The relevance and limitations of current assessment approaches including simulator and road testing will be discussed. Dr. Classen and Ms. Monahan will present work on the unique driving challenges of young adults with Autism Spectrum Disorders. Dr. Ott will discuss neurological and cognitive predictors of driving fitness in patients with Alzheimer's disease including research on the Assessment of Driving-Related Skills (ADReS), a clinical tool recommended by the American Medical Association for identifying unsafe older drivers. Dr. Uc will discuss studies on road and simulator testing, and real life driving outcomes highlighting the motor, visual, and cognitive problems that compromise the driving fitness of patients with Parkinson's disease. Ms. Kapust will describe outcome data from DriveWise, a hospital based driving assessment program that has provided social work counseling, cognitive screening, and road tests for 600 individuals ranging from age 18 to 97. She will address the ethical and emotional consequences of participation in a driving assessment and the particular challenge of delivering bad news to the person who has failed a driving evaluation. Dr. Bieliauskas will discuss the presentations highlighting the role of the neuropsychologist as a member of a trans-disciplinary assessment team.

Correspondence: *Margaret O'Connor, Neurology, Harvard Medical School, Beth Israel/Cognitive Neurology, 330 Brookline Ave, Boston, MA 02215. E-mail: moconnor@bidmc.harvard.edu*

S. CLASSEN & M. MONAHAN. Clinical Indicators of Driving Performance in Adolescents with Autism Spectrum Disorder (ASD) vs. Controls.

The authors will first discuss a conceptual model that captures the complexities of driving performance, showing the person, vehicle and environment components and interactions. Then they will reveal the crash statistics of teens in the USA by type and severity. The authors will follow through with a discussion on the clinical characteristics of adolescents with ASD, and how the effects of that diagnosis may impact safe driving performance. Then, demonstrate, via research data, the clinical tests that are correlated with driving errors as tested in a driving simulator in and between the groups (teens with ASD vs. Healthy Controls). The authors will reveal the type and number of driving errors made on the driving simulator and show the statistical significant differences of the type of driving errors between the two groups. Finally a clinical battery of tests that may predict driving errors will be suggested. The role of the certified driving rehabilitation specialist (CDRS), who is also an occupational therapist, will be explained. Participants will:

1. Understand the complexities of driving performance
2. Realize the risk of teen drivers

3. Conceptualize that ASD and its effects may impair driving performance
4. Identify clinical indicators of driving errors
5. Recognize that the CDRS can evaluate mechanisms related to driving impairment and remediate driving related issues.

Correspondence: *Sherrilene Classen, 101 South Newell Drive, Gainesville, FL 32615. E-mail: sclassen@phhp.ufl.edu*

L.B. BIELIAUSKAS. The Role of the Neuropsychologist as a Member of a Trans-disciplinary Assessment Team.

The approach to assessment of fitness for safe driving may be best conceived as an algorithm, starting with simple and inexpensive screening for basic functional capacity to complex assessment of cognitive processing which engenders the response to challenging situations. Neuropsychologists have varying roles, from helping to design basic screens to complex assessment of processing of information and decision-making. Efficient and user-friendly approaches are necessary to maximize effectiveness when it is desirable to assess driving safety in large numbers of individual drivers.

Correspondence: *Linus B. Bieliauskas, Ann Arbor VA, U of Michigan, Ann Arbor, MI 48104. E-mail: linas@umich.edu*

B.R. OTT. Office Assessment of the Cognitively Impaired Older Driver.

When gauged on a per mile basis, older drivers are a significant risk group, with crash rates approaching those seen in teenage drivers. Moreover, due to frailty they are more likely to die in a motor vehicle accident than younger drivers. Age by itself should not be regarded as the problem, but rather a proxy for physical or cognitive impairments leading to unsafe driving. Drivers with dementia have a 1.5-8 times greater risk of involvement in a crash compared to age-matched controls, yet some drivers with Alzheimer's disease may still be competent to drive in the early stages of their illness. There is uniformity of opinion that moderately severe dementia precludes safe driving, but there is still no consensus on how to deal with those with questionable or mild dementia. Early intervention via forced or voluntary driving retirement can avoid serious accidents, yet one does not want to limit driving arbitrarily based on diagnosis alone, since autonomy for the elderly is an extremely important goal. The major question arises as to when a cognitively impaired older person should stop driving?

To address this question, we will review current recommendations from professional societies and consensus groups with a focus on recent research examining the sensitivity and specificity of the Assessment of Driving-Related Skills (ADReS), a clinical tool recommended by the American Medical Association for identifying potentially unsafe older drivers.

Correspondence: *Brian R. Ott, Rhode Island Hospital — APC 7, 593 Eddy Street, Providence, RI 02903. E-mail: BOtt@lifespain.org*

E.Y. UC. Driving in Parkinson's Disease.

Parkinson's disease (PD) is a clinically and etiologically heterogeneous condition which affects multiple neuronal systems and neurotransmitters in the brain and impairs motor function, cognition, visual perception, autonomic function, and sleep-wake cycle. These abnormalities are associated with reduced performance on experimental road and driving simulation studies. Although there is no well-established epidemiological association with increased crashes in drivers with PD, patients with PD are at higher risk of driving cessation.

Medical diagnosis or a clinician's assessment alone are inadequate to determine fitness to drive in PD. Various measures of motor, cognitive, and visual performance and disease specific features are associated with driving impairment in PD and are valuable in assessing fitness to drive. However, a universally applicable algorithm has not been developed yet. Research on driving rehabilitation in PD is in its very early phases of development.

In this review, the natural course in PD, mechanisms of impairment, assessment of driving performance and fitness, and potential methods for rehabilitation will be discussed.

Acknowledgement:

This material is based upon work supported in part by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Rehabilitation Research and Development (I01 RX000 170-01, Merit Review Award, PI: EYU, 2010-12) and by National Institute of Neurological Disorders and Stroke grant R01 NS044930 (PI: EYU, 2003-2010) from NIH. The content of this presentation is solely the responsibility of the author and does not necessarily represent the official views of the granting agencies.

Correspondence: *Ergun Y. Uc, 200 Hawkins Drive, 2RCP-UIHC, Iowa City, IA 52242. E-mail: ergun-uc@uiowa.edu*

L. KAPUST. DriveWise: An Inter-disciplinary Hospital Based Driving Assessment Program.

DriveWise, a hospital based driving assessment program, emphasizes the use of objective evidence, rather demographic data such as age and medical diagnosis, in making decisions about driving competence. The interdisciplinary team consists of social work, occupational therapy, certified driving instructors, and neuropsychology. To date, the DriveWise team has provided office based evaluations, road tests, and counseling for over 600 individuals with medical and/or psychiatric problems that could affect driving safety. In this presentation research initiatives will be discussed including studies of optimal neuropsychological predictors of driving skills, assessment of the "oldest old" driver (i.e., 90 years and older), development of a dynamic visual scanning paradigm for assessment of driving safety, and the usefulness of self and family report data on the "4C's" (crash history, concerns of caregivers, cognitive complaints and clinical condition). Educational initiatives geared towards the broader health care community will be discussed and specific examples of films developed for health providers and individuals with PD and ASD will be presented. The presentation will focus on the social and emotional ramifications of driving assessments which provide important information for some people who are not certain about their competence on the road but which also result in a loss of independence and increased social isolation for some individuals who are deemed unsafe drivers.

Correspondence: *Lissa Kapust, Harvard Medical School/Neurology, BIDMC/Cognitive Neurology, Boston, MA 02215. E-mail: lkapust@bidmc.harvard.edu*

Symposium 7: New Frontiers in Executive Functioning: The NIH EXAMINER

Chair: Joel Kramer

Discussant: Gerry Taylor

1:30–3:00 p.m.

J. KRAMER, K. POSSIN, K. RANKIN, B. BETTCHER, J. SCHREIBER, H. ROBINSON & G. TAYLOR. New Frontiers in Executive Functioning: The NIH EXAMINER.

Symposium Description: The NIH EXAMINER (Executive Abilities: Methods and Instruments for Neurobehavioral Evaluation and Research) is an executive function battery that is modular, appropriate for a broad range of ages and abilities, psychometrically robust, and suitable for clinical trials. There are English and Spanish versions, and multiple alternate forms. The core conceptual model encompassed inhibition, shifting, working memory, fluency, planning, error monitoring, insight, and social function. The battery includes computerized and paper-and-pencil tasks. In addition to individual test scores, item response theory was used to generate an Executive Composite plus Working Memory, Cognitive Control, and Fluency factor scores. This symposium reviews some of the latest NIH EXAMINER research.

Dr. Possin investigates the validity of the NIH EXAMINER's Executive Composite score by evaluating how well it predicts real world executive behavior in comparison to traditional measures, and reports on the neuroanatomical correlates of the Executive Composite.

Dr. Rankin describes the EXAMINER's social cognitive measure, including data on neuroanatomical correlates.

Dr. Bettcher uses NIH EXAMINER to study executive functioning in normal aging. Prior models of executive function in aging emphasize cognitive slowing and frontal atrophy. Dr. Bettcher reports that executive functioning is primarily driven by whole brain white matter integrity, even after controlling for the effects of cortical grey matter and processing speed.

Dr. Schreiber uses NIH EXAMINER factor scores to study how different aspects of executive functioning are differentially affected in children with ADHD, and reports on the relationship between working memory and learning problems in school.

Dr. Robinson reports on the executive functioning in a heterogeneous group of focal lesion patients, describing lesion correlates of various NIH EXAMINER scores.

Dr. Gerry Taylor is the discussant.

Correspondence: *Joel Kramer, UCSF, 675 Nelson Rising Lane, Suite 190, San Francisco, CA 94158. E-mail: jkramer@memory.ucsf.edu*

P. KATHERINE, K. WOOD, D. MUNGAS, A. LAMARRE, B. ASHLEY, L. SINHA & J. KRAMER. The EXAMINER Executive Composite Predicts Real-World Executive Behavior and Frontal Volumes.

Objective: Executive functions (EFs) refer to a constellation of higher-level cognitive abilities that enable goal-oriented behavior. The new NINDS EXAMINER battery was designed to assess EFs comprehensively and efficiently. The purpose of this study was to generate a single psychometrically-robust composite score based on overall EXAMINER performance and to investigate the score's concurrent validity and neuroanatomical correlates.

Participants and Methods: Ten measures were selected as donor scales, including measures of inhibition, shifting, working memory, and fluency. The measures were combined using item response theory into a single composite score that accounted for 53% of the variance in the observed variables. Concurrent validity of this Executive Composite was evaluated in a mixed sample of 203 neurological patients and controls using the Frontal Systems Behavior Scale (FrSBe), an informant-based measure of real-world EF behavior. Neuroanatomical correlates of the Composite were investigated using voxel-based morphometry in a sample of 76 patients diagnosed with dementia, mild cognitive impairment or as a healthy control. **Results:** The Executive Composite accounted for 29% of the variance in FrSBe scores beyond age. Even after including Trails B and Stroop as covariates, the Executive Composite remained a significant predictor, $p < .001$. Trails B was a significant but weaker predictor, $p = .01$, and the Stroop did not predict unique variance. Anatomically, after controlling for age and total intracranial volumes, the Executive Composite correlated primarily with lateral and medial prefrontal volumes.

Conclusions: The EXAMINER's Executive Composite outperforms the Stroop and Trails B in predicting real-world executive behavior. Poor scores on the Composite may reflect atrophy in lateral and medial prefrontal cortex, brain regions critical for good executive control. Taken together, these results support the validity of this new measure of EFs. Correspondence: *Possin Katherine, 675 Nelson Rising Lane, Suite 190, San Francisco, CA 94158. E-mail: kpossin@memory.ucsf.edu*

K.P. RANKIN, S. TAL, L. NGUYEN, S.R. WILLIAM, N. PATEL, K.L. POSSIN, B.L. MILLER, M.D. GREICIUS & J.H. KRAMER. Individual Differences in Intrinsic Functional Connectivity Predict Sensitivity to Social Norms.

The EXAMINER measures a practical and ecologically realistic aspect of executive functioning, the ability to access and correctly identify normative social rules, assessed by the Social Norms Questionnaire (SNQ). Though volume loss in neurodegenerative disease patients has

been shown to predict SNQ performance, we wished to investigate whether normal differences in functional connectivity within intrinsically connected networks (ICNs) also predicts SNQ performance. We hypothesized that ICNs related to language processing and salience (i.e., awareness of personally relevant stimuli) would relate to SNQ score. 3T resting state fMRI scans were collected from 40 healthy older controls (20M/20F; age range 57-87) who completed the SNQ. Step 1: Average connectivity within 9 ICNs were regressed on SNQ score with a backward selection procedure to yield a significant model ($p = 0.0372$) including language, salience, posterior salience, and auditory ICNs. Step 2: For data reduction pairwise connectivity between structures in these 4 ICNs were correlated with SNQ. Step 3: The twelve node pairs correlating with SNQ ($p < 0.10$, $r > 0.25$) were entered into an Allen-Cady regression forcing age and sex into the model. The final model explained 51% of variance in SNQ score ($F = 7.88$, $p < 0.0001$) with 4 pairs in the language and salience networks, including R inferior frontal gyrus—superior temporal gyrus (std beta/B=0.40, $p = 0.006$), R insula—L middle frontal gyrus (B=-0.52, $p = 0.0004$), R cingulate—R supramarginal gyrus (B=0.22, $p = 0.08$), R posterior insula—L supramarginal gyrus, (B=0.39, $p = 0.008$). These results suggest that brain networks responsible for language functions, such as grammar and semantic interpretation of abstract concepts, work together with the insula in the salience network to improve decisionmaking about learned social rules. Also, this study shows that the SNQ reflects normal individual differences in brain connectivity among healthy older subjects.

Correspondence: *Katherine P. Rankin, 675 Nelson Rising Lane, Suite 190, San Francisco, CA 94158. E-mail: kraink@memory.ucsf.edu*

B.M. BETTCHER, C. WATSON, N. PATEL, L. SINHA & J.H. KRAMER. NIH EXAMINER Battery and Brain Structure: Is White Matter Integrity the Keystone to Executive Functioning?

Objective: Research suggests a contributory role of white matter (WM) in executive functioning (EF); however, it is unclear whether this relationship is driven by processing speed, and if WM is a more robust correlate of EF than grey matter. We hypothesized that WM integrity, particularly fronto-parietal WM would be significantly related to the NIH EF battery (EXAMINER), even after controlling for the effects of grey matter and processing speed. **Methods:** We evaluated 117 normal older adults (mean age=72), all of whom underwent structural 3T MRI with diffusion tensor imaging. Total cortical grey matter volume was measured using FreeSurfer, and regressed over intracranial volume to create a single measure. Whole brain analysis of WM fractional anisotropy (FA) was conducted using tract-based spatial statistics. Participants were administered measures of processing speed and the EXAMINER battery, and composite scores were used for each. **Results:** Age, gender, and processing speed were used as covariates in all whole brain analyses. Significant positive correlations between the EXAMINER score and FA values were found throughout the entire brain, with the exception of medial temporal and posterior occipital regions. When cortical grey matter was added as a covariate, the EXAMINER score remained robustly correlated with similar WM regions throughout the brain, although ventral temporal areas (e.g. uncinate) were no longer significant. Peak voxels included areas encompassing the corpus callosum ($p = .001$), anterior/superior corona radiata ($p = .01$), thalamic radiations ($p = .001$) and superior longitudinal fasciculus ($p = .01$). **Conclusion:** The EXAMINER composite score was significantly relate to WM integrity throughout the brain, particularly fronto-parietal regions. Findings could not be attributed to processing speed, and were not better explained by cortical grey matter. This suggests that white matter integrity is independently and disproportionately associated with EF.

Correspondence: *Brianne M. Bettcher, UCSF Memory and Aging Center- Box 1207, 675 Nelson Rising Lane, Suite 190, San Francisco, CA 94143-1207. E-mail: bbettcher@memory.ucsf.edu*

J.E. SCHREIBER, C. REY-CASSERLY, J. GIRARD, K. POSSIN & J. KRAMER. Executive Function in Children with Attention Deficit/Hyperactivity Disorder.

Objective: Children with ADHD demonstrate more academic problems compared with typically developing peers. Theories of ADHD have in-

creasingly highlighted the role of neuropsychological impairment in ADHD. Although working memory and inhibitory control deficits have been suggested as core deficits, a consistent and identifiable pattern of performance on neuropsychological tests is not well established. This is likely due, in part, to problems with concept definition and test development. Use of a reliable and valid domain specific executive function battery that provides measures of common variance across multiple tests is necessary to meaningfully characterize which executive functions are most affected in children with ADHD. The present study utilized the EXAMINER battery to examine executive function in a group of children diagnosed with ADHD and a group of matched healthy control children. **Participants and Methods:** Thirty-four children (24 male), ages 8-15 years ($M=12.02$, $SD=2.29$), diagnosed with ADHD and no comorbid learning disorders completed the EXAMINER battery. Sixty age and gender matched healthy control children were chosen from a database of participants enrolled in the EXAMINER multi-site study. **Results:** Children with ADHD had poorer working memory factor scores compared with the healthy controls, $F(1,92)=7.03, p<.01$. No differences were found in Cognitive Control, $F(1,92)=0.15, p=.70$ or Fluency factor scores, $F(1,92)=2.72, p=.10$. Within the sample of children with ADHD, poorer working memory performance predicted parent report of child learning problems ($\beta = -.597, t = -3.400, p=0.002$). Cognitive control ($\beta = -.377, t = -1.786, p=0.085$) and Fluency ($\beta = -.285, t = -1.697, p=0.101$) factors did not predict learning problems. **Conclusion:** Children with ADHD and no comorbid learning disorders have worse working memory ability compared with healthy controls. Poor working memory is associated with more learning problems in children with ADHD.

Correspondence: Jane E. Schreiber, 262 Danny Thomas Place, Mail Stop 740, Memphis, TN 38105. E-mail: jane.schreiber@stjude.org

Poster Session 7: ADHD/Learning Disabilities/TBI

2:15–3:15 p.m.

ADHD/Attentional Functions

E. ANDRESEN & D.C. OSMON. College Students With ADHD Do Not Perform Significantly Differently Than Controls On Continuous Performance Tests.

Objective: Continuous performance tests (CPTs) are thought to provide an objective measure about an individual's performance in situations designed to assess the key deficits in people with ADHD. CPTs are widely used in ADHD evaluations, even by clinicians who do not believe that they hold all the answers. Most studies have shown that adults with ADHD perform significantly differently than controls, although the particular scores which differ vary widely across studies and types of CPT. **Participants and Methods:** In the current study, 30 undergraduates with confirmed diagnoses of ADHD and 54 undergraduates without attention or neurological problems took the Test of Variables of Attention (TOVA) and Conner's Continuous Performance Test – 2nd edition (CPT-2) as part of a larger study.

Results: The scores of students with ADHD were not significantly different from those of students without ADHD on any part of the CPT-2 or TOVA. However, trends for poorer performance by ADHD students were noted on more than half of the scores.

Conclusions: This surprising equivalence between the ADHD and control groups is likely due primarily to differences in the current ADHD sample compared to most studies in the literature, such as ADHD student enrollment in college and use of projected DSM-5 criteria rather than the more stringent DSM-IV criteria. This equivalence is important for clinicians to be aware of in the assessment of college students presenting for ADHD diagnosis, particularly as we prepare for the release of DSM-5.

Correspondence: Elizabeth Andresen, Ph.D., Cleveland Clinic, Mail Code P57, 9500 Euclid Avenue, Cleveland, OH 44195. E-mail: elizabeth.andresen@gmail.com

T.N. ANTONINI, K.M. O'BRIEN, L. TAMM & J.N. EPSTEIN. Effects of ADHD and Marijuana Use on Iowa Gambling Task Performance in Young Adults.

Objective: Both young adults with ADHD and young adults who abuse marijuana evidence poor decision making. Both groups make fewer advantageous choices than controls on the Iowa Gambling Task (IGT), a measure of decision making. However, the combined effects of ADHD and marijuana use on decision making performance are unknown.

Participants and Methods: 129 participants (88 with ADHD, 41 controls) between the ages of 21 and 29 years old were recruited to participate from the original Multimodal Treatment of ADHD (MTA) study. 62 of these participants (42 with ADHD, 20 controls) had a recent history of marijuana use. The remaining 67 participants (46 with ADHD, 21 controls) were classified as non-users. As part of a larger neuropsychological battery, all participants completed Bechara's 100-trial computerized IGT.

Results: Net scores on the IGT were calculated by subtracting the number of advantageous card choices from the number of disadvantageous card choices for 5 blocks of 20 trials. A 2 (ADHD vs. non-ADHD) x 2 (marijuana user vs. non-marijuana user) x 5 (net scores for each block) ANOVA was computed to examine the effects of ADHD and marijuana use on performance across the blocks. Those with ADHD had lower net scores than those without ADHD, $F(1, 644) = 13.60, p = .0002$. Marijuana users had lower net scores than non-users, $F(1, 644) = 5.75, p = .02$. There was no significant main effect of block and no significant interactions.

Conclusions: Results suggest that ADHD and marijuana use each negatively affect decision making. However, they do not appear to interact to produce compounding effects on performance.

Correspondence: Tanya N. Antonini, M.A., University of Cincinnati, 615 Rombach Ave., Apt. 2, Wilmington, OH 45177. E-mail: tanya.antonini@gmail.com

J. BEAN & I. EIGSTI. Anticipatory Fixations as a Marker of Visual Attention: Eye-tracking Evidence for Children with Typical Development, Autism Spectrum Disorders, and ADHD.

Objective: Visual attention abnormalities may influence the development of social abilities in autism spectrum disorders (ASD). However, prior studies yield mixed results: increased or decreased cue engagement ("stickiness;" Landry & Bryson, 2004; Van der Geest, et al., 2001); intact or abnormal cue evaluation (Renner et al., 2006; Wainwright-Sharp & Bryson, 1993). This project tracked visual fixation as a marker of visual attention to clarify previous results.

Participants and Methods: Participants ages 7-17 years with ASD ($n = 19$), ADHD ($n = 12$) and typical development (TD; $n = 21$), matched on age and FSIQ, completed a visual cueing task, with a cartoon face or arrow as the central directional cue. Analyses of eye-tracking data probed for group differences in duration of cue fixation (DCF) and anticipatory fixations (AFs) to the target in cued trials relative to no-cue baseline trials.

Results: There were no group differences in DCF, regardless of cue type (face or arrow), F 's < 1.33 and p 's $> .27$. Participants across groups had similar numbers of AFs on cued and baseline trials, p 's $> .14$. However, there was a trend for a group X condition interaction, such that the ASD group had more AFs to cue versus baseline trials than the TD group, in the right visual field, $p = .06$; TD and ADHD groups had more AFs on baseline trials (a difference that was significant for the ADHD vs. ASD contrast). Both ASD and ADHD groups made more AFs across conditions than the TD group, p 's $< .05$.

Conclusions: Although the ADHD group made the most AFs when there was no cue, the ASD group made the most AFs when a cue was present. These results may suggest that AFs reflect general inattention and

cue engagement, rather than a measure of cue evaluation (i.e., reading the “predictiveness”). These findings provide some limited support for the hypothesis that children with ASD exhibit “decreased engagement.” Findings will be compared to behavioral results. Task limitations and future directions will be discussed.

Correspondence: *Jessica Bean, M.A., Dept. of Child & Adolescent Psychiatry and Behavioral Sciences, The Children’s Hospital of Philadelphia, 2200 Benjamin Franklin Pkwy, Apt E301, Philadelphia, PA 19130. E-mail: jessica.bean07@gmail.com*

A. BEDARD, K.P. SCHULZ, S.M. CLERKIN, B. KRONE, J.M. HALPERIN & J.H. NEWCORN. The Neural Correlates Of Visual-Spatial Working Memory In Youth With And Without ADHD: An fMRI Study Of Brain Activation.

Objective: Visual-spatial working memory (VSWM) refers to the ability to temporarily hold and manipulate visual nonverbal information in mind. Deficits in VSWM have been linked with Attention-Deficit/Hyperactivity Disorder (ADHD), academic difficulty and long-term problems in both employment and quality-of-life. This study investigated the underlying brain circuits involved in VSWM in youth with ADHD as compared to typically-developing children.

Participants and Methods: 19 children, ages 9–15 years, with ADHD, and a well-matched sample of 15 typically-developing youth were scanned using a 3.0 T Siemens Allegra scanner while performing a block design N-Back task. The task was adapted from Chang et al. (2004). Participants had to press if a stimulus was in the middle of the screen (control condition), or remember if a stimulus was in the same location as it was 1 (1back condition), or 2 (2back condition) trials previously. Analysis of brain activation was conducted with SPM8. Individual contrast images were computed for each experimental condition minus the control condition and were entered into group analyses.

Results: The ADHD and control groups performed comparably on the task. Both groups activated the intraparietal sulcal area, precuneus, dorsolateral prefrontal cortex (DLPFC) and anterior cingulate cortex (ACC) during the VSWM task, with greater activation as the working memory load increased (i.e. 2back > 1back). However, youth with ADHD had greater activation of temporoparietal junction during the 1back condition, and greater activation of DLPFC, ACC, and paracentral lobule during the 2back condition than controls.

Conclusions: This differential activation presumably reflects greater mental effort required by the ADHD group to keep objects online, and is in line with findings from animal studies.

Funds were provided by the Klingenstein Third Generation Foundation and the Canadian Institutes of Health Research.

Correspondence: *Anne-Claude Bedard, PhD, Psychiatry, Mount Sinai School of Medicine, Box 1230, One Gustave L. Levy Place, New York, NY 10029. E-mail: ac.bedard@mssm.edu*

O. BOXER, D.A. KAUFMAN, B.A. LANG & R.M. BILDER. Effects of Methylphenidate and Cognitive Training on ADHD Symptoms: A Meta-Analysis.

Objective: Executive functioning (EF) deficits are a prominent risk factor in children with Attention Deficit Hyperactivity Disorder (ADHD). While pharmacological interventions have demonstrated efficacy in reducing behavioral symptoms in these children, little is known about specific strategies to improve EF delays. Nonpharmacological approaches such as cognitive training (CT) have focused on improving WM with the goal of attenuating inattention symptoms; however, it is unknown if CT also reduces behavioral symptoms of ADHD. We utilized a recently developed knowledgebase (KB) to compare the effects of medication or CT on inattention and hyperactivity in children with ADHD.

Participants and Methods: A meta-analysis was conducted to look at the efficacy of CT versus medication as a treatment for inattention and

hyperactivity symptoms in children with ADHD. A total of 10 studies ranging from 2002 to 2010 were analyzed from an existing collaborative KB developed to document evidence-based medicine (EBM) in neuropsychology. Four of the studies implemented a CT intervention, while 6 studies utilized methylphenidate.

Results: Meta-analytic results yielded moderate effect sizes. Methylphenidate resulted in a moderate effect size (ES=0.88) for ADHD total symptom report. Across two dimensions of ADHD, CT demonstrated a larger effect size for inattentive symptoms (ES=1.05) compared to hyperactive symptoms (ES=0.45).

Conclusions: Preliminary results suggest larger effects of CT on symptoms associated with inattention compared to hyperactivity. Moreover, methylphenidate demonstrated moderate improvement in overall ADHD symptoms. These initial findings indicate that CT may play an important supplemental role in the remediation of underlying neuropsychological deficits and inattention in children with ADHD. Furthermore, the ability to quantify effect sizes through an EBM collaborative KB demonstrates its utility to analyze treatment outcomes in neuropsychology and support the medical necessity of neuropsychological services.

Correspondence: *Oren Boxer, Ph.D., neuropsychology, UCLA, Semel Institute for Neuroscience and Human Behavior, 740 Westwood Plaza, Los Angeles, CA 90095. E-mail: oboxer@mednet.ucla.edu*

B. COLEMAN, S.D. MARION, R. GREEN, A. FURROW & A. NOLTE. Does Cogmed Working Memory Intervention Improve Virtual Classroom Attention?

Objective: The role of working memory (WM) in disorders of attention and learning is well established in the literature, some suggesting that low working memory may be a core deficit in AD/HD. Computerized cognitive interventions to improve WM have been developed and shown promise by demonstrating training effects such as improved attention and fluid reasoning. However, debate continues as to whether adaptive training leads to improvement on non-trained tasks. Little, if any, research has demonstrated improvements that generalize to “real life” WM or attention. The current study sought to evaluate the effectiveness of WM training on real-world attention performance.

Participants and Methods: Participants included 10 children (7 male; Ages 6–11, M=9.2) identified as having learning and attention problems. Both before and after completing 5 weeks of WM training, each child was assessed via the Virtual Classroom Continuous Performance Task, a validated measure of sustained attention set within a virtual environment.

Results: Dependent sample t-tests were conducted to evaluate changes between performances. Additionally, effect sizes were calculated using Cohen’s d. Several key areas of attention performance were observed to improve, including total correct responses ($t=-2.35$, $p<.05$, $d=-0.66$), omission errors ($t=2.39$, $p<.05$, $d=0.66$) reaction time ($t=2.99$, $p=.01$, $d=1.03$), and hit variability ($t=2.68$, $p<.05$, $d=0.77$).

Conclusions: Results suggest that WM training led to substantial improvements in sustained attention in a real life scenario (classroom learning). Observing such improvements on ecological valid measures of attention adds to the discussion that computerized WM training may be a viable option to treat attention disorders.

Correspondence: *Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 150 N. Oakland Ave., Pasadena, CA 91101. E-mail: sdmarion@fuller.edu*

A. FEDOR, M. ALOSCO, K. FULCHER & J. GUNSTAD. Does ADHD Increase Risk of Concussion in Student-Athletes.

Objective: An estimated 4 million sports-related concussions occur each year in the United States and recent work has identified risk factors for these injuries. The current study examined the possibility that student-athletes with attention deficit/hyperactivity disorder (ADHD) might be at elevated risk for concussion.

Participants and Methods: 139 NCAA division-I football, basketball, soccer, field hockey, and volleyball athletes (72 males, 67 female) completed baseline assessment of the Immediate Post Concussion Assessment and Cognitive Testing (ImPACT) as part of a larger concussion protocol. Diagnosis of ADHD and history of concussion were both self-reported as part of the ImPACT.

Results: Many athletes (18%) of the current sample reported at least one concussion and 12.3% reported experiencing two or more concussions (max = 4). Of the sample, 10.1% reported a diagnostic history of ADHD. Analysis of covariance adjusting for gender, years of athletic play, and premorbid intelligence revealed athletes with ADHD reported a greater number of past concussions than athletes without ADHD ($F(1, 138) = 5.50, p = .02; M(SD) = .93(.73)$ vs. $.40(.81)$).

Conclusions: The current findings suggest that student-athletes with ADHD may be at elevated risk for concussion. Future studies are needed using more detailed assessments to confirm these findings and clarify mechanisms by which ADHD creates a vulnerability for concussion.

Correspondence: *Andrew Fedor, Kent State University, 238 Kent Hall, Kent, OH 44224. E-mail: afedor1@kent.edu*

M. GEIST, L. JACOBSON, M. MCCURDY, C. CORREA & E. MAHONE. Sluggish Cognitive Tempo: Associations with Processing Speed, Age, and Emotional Symptomatology.

Objective: Sluggish cognitive tempo (SCT) is a construct believed to be associated with inattention. SCT may also overlap with processing speed and mood symptoms. The present study examined the pattern of associations between SCT, mood, and processing speed in clinically-referred youth.

Participants and Methods: Participants included 388 children (67% male; age range 6-16 years, $M=10.41$) referred for neuropsychological evaluation. Measures included parent ratings on the Vanderbilt Parent Rating Scale (mood symptoms), Sluggish Cognitive Tempo (SCT) Scale, and ADHD Rating Scale-IV (ADHDRS-IV), as well as performance on the WISC-IV Processing Speed Index (PSI).

Results: Associations among SCT, mood and PSI differed between younger and older children. Older children (10 to 16 years, $n=202$) were rated as more sluggish and inattentive, but less hyperactive than younger children (under age 10, $n=186$), and demonstrated reduced PSI (all $p<.05$). However, there were no age group differences on mood symptomatology. In the younger group, SCT was associated with PSI and mood (all $p<.01$), with lower PSI scores found in children with higher SCT ratings. For children over 10, SCT was more strongly associated with anxious and depressive symptoms ($r=.385$ and $.354$, respectively) than PSI ($r=-.065$; r -to- z $p<.01$). Exploratory factor analysis of the ADHDRS-IV, SCT, and mood items revealed a different structure across groups. In the older group, anxiety and depression items loaded on one factor, which correlated most with SCT items measuring lethargy ($r=.392$) and least with ADHDRS-IV items assessing hyperactivity ($r=.197$). In the younger group, anxiety and depression items loaded separately, with depression most associated with hyperactivity/impulsivity ($r=.409$) and less correlated with SCT (sluggishness/lethargy, $r=.212$).

Conclusions: In pre-adolescents, parent reports of SCT are associated with actual slowed cognitive performance. In contrast, among adolescents, parent reports of SCT may reflect emerging mood symptoms.

Correspondence: *Megan Geist, Master of Arts, Kennedy Krieger Institute, 1750 E. Fairmount Ave, Baltimore, MD .21231. E-mail: geistm@kennedykrieger.org*

C. CATALE, M. GEURTEN, C. LEJEUNE & M. THIERRY. Perceptual and Motor Inhibition in ADHD: Evidence for a specific impairment?

Objective: Inhibition, one of the core executive processes in executive functioning (Miyake et al., 2000) is generally not considered as an unitary construct (see for example, Friedman & Miyake, 2004; Nassauer & Halperin, 2003). Following the perceptual versus motor dissociation proposed by Nassauer and Halperin (2003), we studied perceptual and motor inhibition in children with Attention Deficit and Hyperactivity Disorder (ADHD).

Participants and Methods: Sixteen 7-12 years old children with ADHD and 30 matched control children were administered a version of the Conflict Resolution task (Nassauer & Halperin, 2003) adapted for children.

In this task, the perceptual inhibition task required the children to respond to the direction of a dog (running towards the left or the right) while ignoring its location (left or right) on a computer screen. In the motor inhibition task, the children had to press a key corresponding to the opposite direction of a centrally running dog.

Results: Comparisons analyses of inhibition performances between ADHD children and matched controlled subjects showed that ADHD children performed significantly less accurately for stimulus-stimulus characteristic conflicts (i.e., perceptual inhibition) than for stimulus-response conflicts (i.e., motor inhibition), which suggests a specific impairment in perceptual inhibition in our group of ADHD children.

Conclusions: In conclusion, this study supports the presence of two forms of inhibition which can be differentiated and specifically impaired in 7- to 12-year-old ADHD children.

Correspondence: *Corinne Catale, University of Liège, Boulevard du rectorat, B33, Liège 4000, Belgium. E-mail: corinne.catale@ulg.ac.be*

A. HARRISON & I. ARMSTRONG. Screening young adults for possible ADHD: Think horses not zebras.

Objective: Clinicians are frequently asked to determine whether a never before diagnosed young adult suffers from Attention Deficit Hyperactivity Disorder. Differential diagnosis in such situations can be difficult for many reasons, including symptom exaggeration. This study reports on data from a university-based ADHD screening clinic. We hypothesized that never before diagnosed students presenting with symptoms of ADHD were unlikely to meet full diagnostic criteria for ADHD, and that other causes for their current symptoms might better explain their presentation.

Participants and Methods: 87 students aged 18-31 (20% graduate students) were referred for a one-hour screening appointment. Comprehensive background information was requested prior to the initial appointment. The screening interview was supplemented by self and observer ratings of ADHD symptoms, evaluation of emotional functioning, performance on the Medical Symptom Validity Test (MSVT) and a computerized vigilance test (TOVA). Students who demonstrated sufficient symptoms were referred for a full psychoeducational assessment.

Results: Although all students reported currently elevated symptoms of ADHD, only 3 met full criteria for the diagnosis. Reasons for their experienced symptoms included: Clinical depression/anxiety; Substance abuse/drug seeking; Lack of study/learning skills; Lower overall intellectual ability; Symptom exaggeration; or a Personality disorder. Students suspected of symptom overendorsement ($N=12$) reported significantly more symptoms of inattention ($p<.05$), hyperactivity ($p<.05$) and overall ADHD symptom ($p<.01$) versus those who passed the MSVT.

Conclusions: Post-secondary students seeking first-time assessments for ADHD are unlikely to meet full criteria for ADHD; clinicians should suspect other possible causes for reported symptoms. Access to historical documentation is of assistance when making this diagnosis.

Correspondence: *Allyson Harrison, Ph.D, Psychology, Queen, Mackintosh-Corry Hall, B100, 68 University Avenue, Kingston, ON K7L 3N6, Canada. E-mail: harrisna@post.queensu.ca*

C.D. HINKLE & S.J. HUNTER. Comparison of Neuropsychological Profiles of Children with Attention-Deficit/Hyperactivity Disorder (ADHD), Reading Disorder (RD), and Comorbid ADHD and RD.

Objective: ADHD and RD are two of the most commonly diagnosed disorders of childhood, each occurring in approximately 5% of the population (APA, 2000). These disorders also co-occur in a sizeable percentage of children. Given their high rate of comorbidity, there has been a surge of interest in better understanding not only the extent to which ADHD and RD co-occur, but why they do so. The current study

seeks to investigate patterns of executive functioning, memory and learning, and reading achievement in older children and adolescents with ADHD, RD, and comorbid ADHD and RD. Additional research is needed in this area to continue to parse the specific neurocognitive patterns that represent these disorders, which will ultimately provide guidance for how to more appropriately accommodate their respective deficits.

Participants and Methods: Seventy-five youth were administered a battery of neuropsychological assessments (WISC-IV, WJ-III-NU, CVLT-C, RCFT). Participants were between 11 and 16 years old. Given that prevalence rates for both ADHD and RD are skewed towards males at approximately a 4:1 ratio, enough data was collected to ensure that males constituted approximately 75% of the sample in each diagnostic category.

Results: MANCOVA were conducted to examine differences between the ADHD, RD, and comorbid ADHD and RD groups on each of the measures of executive functioning, memory and learning, and reading achievement, controlling for GAI. ANCOVA were then conducted as a follow-up measure to test for group differences on individual executive functioning, memory and learning, and achievement components.

Conclusions: Results indicate divergent patterns of neuropsychological functioning across these diagnostic groups with regard to working memory, planning and organization, processing speed, verbal learning, long-term recall, and reading achievement. Specific neuropsychological profiles for each diagnostic group across each of these domains, as well as the clinical and research implications of this study, will be discussed. Correspondence: Clayton D. Hinkle, M.S., Psychology, Illinois Institute of Technology, 744 W. Cornelia Ave. #3E, Chicago, IL 60657. E-mail: claytonhinkle@gmail.com

H.A. KUBAS, E.M. BACKENSON, G. WILCOX, J.C. PIERCY, J.A. CARMICHAEL, K.R. FITZGER & J.B. HALE. Differentiating Frontal-Subcortical Circuit Executive Dysfunction in ADHD Medication Response.

Objective: Using behavioural criteria for attention-deficit/hyperactivity disorder (ADHD) diagnosis leads to neuropsychological profile heterogeneity and variable response to methylphenidate (MPH) treatment among children with ADHD. Documenting MPH effects on “cool” executive/working memory (EWM) and “hot” self-regulation (SR) frontal-subcortical circuit executive functions may optimize ADHD MPH titration practices.

Participants and Methods: Children with behaviourally-diagnosed ADHD (39 males, 17 females; M age = 120.84 months, SD = 30.85) underwent a four week double-blind placebo controlled MPH trial to examine cognitive and behavioural MPH response. With drug condition (baseline, placebo, low dose, high dose) as the within-subjects factor and baseline executive impairment (no apparent, low, moderate, high) as the between-subjects factor, repeated measures MANOVAs were computed for a number of EWM/SR neuropsychological tests.

Results: MPH treatment effects (F range 10.46 to 42.51; p range <.001 to .001) were consistent, with group differences emerging based on baseline EWM/SR impairment (F range 1.00 to 6.14; p range <.001 to .442). Children with no apparent baseline EWM/SR impairment had poor MPH response, while children with moderate or high EWM/SR impairment showed robust MPH response, with performance on tests of working memory (TOMAL Digits Backward), mental flexibility (Trail Making Test-Part B), and inhibition (Conners' Continuous Performance Test-II Commissions) deteriorating on high MPH doses.

Conclusions: In good ADHD MPH responders, the best dose for executive cognition may be lower than the best dose for behavioural control, leading to poor academic achievement when behavioural criteria are used to diagnose ADHD and titrate MPH. If medication titration is based on maximizing neuropsychological functioning, with concurrent behaviour therapy offered to reduce problem behaviour, both academic and behavioural improvements could be realized in children with ADHD. Correspondence: Hanna A. Kubas, Bachelor of Science, University of Calgary, 5212 32 Avenue NW, Calgary, AB T3B0J6, Canada. E-mail: hakubas@ucalgary.ca

M. LOMAN, K. WIJK, M. KREPS & M. GUNNAR. Neuropsychological Functioning and Brain Activity of Post-Institutionalized, Internationally Adopted Adolescents with ADHD.

Objective: Children reared in the deprived environments of institutions (e.g., orphanages) are at increased risk for problems with inattention and hyperactivity. Although these children have been reported to have higher rates of Attention-Deficit/Hyperactivity Disorder (ADHD) diagnoses than would be expected in the general population, it is unclear if ADHD among post-institutionalized (PI) children is different from that among never institutionalized children.

Participants and Methods: This study directly compared the clinical and symptom profile, executive function task and delay aversion task performances, and event-related potentials of 11- to 15-year old internationally adopted PI children with ADHD (PI-A; n =26) to PI children without ADHD (PI-N; n =25) and non-adopted children with ADHD (NA-A; n =19).

Results: PI-As were found to be adopted primarily from Eastern European countries following longer periods of institutionalization than PI-Ns. They performed more poorly on most of the neuropsychological measures of executive function than PI-Ns; although the performance generally did not differ from NA-As. Relative to NA-As specifically, PI-As reported elevated disinhibited social behavior and, among males, demonstrated more aversion to delay, and had smaller overall N2 amplitude associated with a Go/No-go task.

Conclusions: The results suggest that deprivation-related ADHD may have a unique profile from standard ADHD that could be considered a more severe form of ADHD. These differences have potential implications for identification and treatment of ADHD behaviors among PI youth.

Correspondence: Michelle Loman, Ph.D., Medical College of Wisconsin, 9200 W Wisconsin Avenue, Milwaukee, WI 53226. E-mail: mloman@mcw.edu

S. MAGRYS, A. HARRISON & I. ARMSTRONG. Discrimination of ADHD from Heterogeneous Sample on Self-Report Measure.

Objective: Self-report measures are commonly used to help inform diagnosis of adult ADHD. However, the occurrence of self-reported attention symptoms is high in the general population, individuals with psychological disorders and malingerers. Self-report measures should be validated between ADHD and other populations in order to identify scales and cut-off scores that are specifically related to ADHD. The aim of the study was to assess the ability of two Connor's Adult ADHD Rating Scale (CAARS) subscales to discriminate between ADHD and non-ADHD groups.

Participants and Methods: 1068 university students comprised 4 groups: diagnosed ADHD, clinical controls (psychiatric disorder), normal honest individuals and healthy individuals instructed to feign ADHD. Each participant completed the Connors Adult ADHD Rating Scale, which provided scores for two subscales (Inattentive symptoms and ADHD Index).

Results: One-way ANOVAs showed that mean scores for both CAARS subscales were significantly different between groups in a stepwise pattern (descending): faking, ADD, clinical control and normal honest. In Chi square analyses, the probability of being above clinical threshold t -scores was significantly different between groups for both CAARS subscales. The two subscales demonstrated differential results in sensitivity versus specificity. ROC analysis demonstrated that overall discriminability by both subscales was weak in this sample.

Conclusions: All groups were significantly different on both CAARS subscales. Ability to distinguish ADHD using clinical thresholds differed by subscale. The overall ability of these subscales to specifically discriminate ADHD from normal individuals, clinical controls and malingerers was weak. More research is needed to validate self-report measures that are able to reliably identify ADHD in a heterogeneous clinical sample.

Correspondence: Sylvia Magrys, M.Sc., Queen's University, 62 Arch St, Kingston, ON K7L3N6, Canada. E-mail: 7sm47@queensu.ca

T. MEADOWCROFT, E.I. FRANCHOW, N. TOLLEY & Y. SUCHY. ADHD Symptoms Contribute to Unhealthy Coping Independent of Depression and Executive Dysfunction.

Objective: Affect suppression (AS) is associated with psychopathology and emotion dysregulation (Suchy, 2011) and is known to deplete executive resources (Oaksford, Morris, Grainger, & Williams, 1996; Schmeichel, 2007). Conversely, cognitive reappraisal (CR) is linked to good mental health and cognitive flexibility (John & Gross, 2004; Suchy, 2011). Because ADHD is linked to both executive dysfunction and emotion dysregulation, it represents a risk for excessive AS (Tucha et al., 2005), thus increasing the risk for further cognitive and emotional problems. This study investigated contribution of ADHD symptoms to AS above and beyond depression, CR, and cognitive inflexibility.

Participants and Methods: 189 adults aged 18-32 ($M=21.55$; 66% female) with 11-16 years of education ($M=13.68$) completed the Beck Depression Inventory (BDI-II), the Conners Adult ADHD Rating Scale, the Behavior Rating Inventory of Executive Function (Shifting subscale), and the Burden of State Emotion Regulation Questionnaire (a measure assessing the burden of AS and the frequency of CR over the previous two weeks).

Results: In a hierarchical regression, AS was the criterion; BDI-II, CR, and Shifting were entered on Step 1, and ADHD symptoms on Step 2. ADHD contributed significantly above and beyond all other variables [$F_{change}(1,168)=6.9, p=.009$]. In a non-hierarchical model, each variable contributed uniquely to AS (all p 's $<.03$). In a t-test comparing participants scoring above and below a T score of 70 for ADHD symptoms, participants scoring in the clinical range reported significantly more AS, depressive symptoms, and shifting difficulties than non-ADHD participants (all p 's $<.004$), but were comparable on CR.

Conclusions: ADHD symptoms place individuals at risk for excessive AS, independent of other risk factors that are common among ADHD individuals. Although lower frequency of CR also contributes to higher AS, this is not related to ADHD symptoms.

Correspondence: *Emilie I. Franchow, BS, Psychology; University of Utah, 220 E. 3300 S., Apt. 136, Salt Lake City, UT 84115. E-mail: emilie.franchow@psych.utah.edu*

S.C. MURPHY-BOWMAN. Sluggish Cognitive Tempo: Is it Attention, Mood, or Something Else?

Objective: Sluggish cognitive tempo (SCT) has been inconsistently defined, with definitions including elements of inattention, anxiety, and depression. In 2007, the Child Behavior Checklist (CBCL) added a 4-item SCT scale (using existing items) based upon prior studies. Three items were drawn from the Attention Problems scale, while the fourth item was from the Withdrawn/Depressed scale. The present study explored the factor structure of the new CBCL SCT scale when analyzed simultaneously with attention, anxiety, and depression items.

Participants and Methods: Participants included 426 children (304 boys) ages 6-16, referred for neuropsychological assessment. CBCL item-level scores from the Attention Problems, Anxious/Depressed, Depressed/Withdrawn, and SCT scales were included in an exploratory factor analysis (EFA) using maximum likelihood extraction to provide goodness of fit estimates.

Results: Initial EFA identified 7 factors [$\chi^2(269)=487.6, p<.001$]; however, the first 4 factors explained most of the variance (45.3%). A second EFA restricted to 4 factors yielded a comparable fit to the data [$\chi^2(347)=890.4, p<.001$], and identified three latent factors highly consistent with the published CBCL Anxious/Depressed, Attention Problems, and Withdrawn/Depressed scales. The fourth factor was unique and included three SCT scale items (daydreaming, confused, stares) with the fourth SCT item (lethargy) better accounted for by the Withdrawn/Depressed factor. In both the 7-factor and 4-factor models, the three SCT items loaded together and uniquely.

Conclusions: Although the CBCL's published model does not appear to provide adequate fit in this clinical sample, there is evidence to suggest that three items from the published SCT scale describe a unique construct that is separable from mood-related symptoms of anxiety and depression.

Correspondence: *Sarah C. Murphy-Bowman, Psy.D., Neuropsychology; Children's Hospital of Philadelphia, 34th and Civic Center Blvd, Philadelphia, PA 19104. E-mail: smurphy9@loyola.edu*

V. NEEDHAM, X. BONILLA, A. FEDIO & A. PACOS. A Case Study of an Eleven-Year-Old with an Atypical Cluster of Symptoms: ADHD, LD, Autism-Spectrum Disorder, Sensory Integration Disorder, Social Deficits or Other?

Objective: This study described an 11-year-old girl, KJ, with an atypical presentation including attentional, sensory, social, and learning deficits. Conditions specific to this case are a high pain threshold, extreme physical flexibility, social atypicalities, and unconventional learning. This study aims to generate scientific interest through reviewing KJ's presentation in light of current research and could precipitate a discussion regarding differential diagnoses, etiologies, and specific cultural implications, which could lead to improved quality of care.

Participants and Methods: KJ was selected for this case study due to her unique characteristics and potential benefit to the field. The research design included an archival review of her case and a review of relevant literature. Data were obtained through a clinical interview with her mother, behavioral observations, neuropsychological measures and rating scales.

Results: KJ is in a culturally diverse, high-functioning, nuclear family with older siblings. Maternal reports were significant for delayed social development, early motor development, and a high pain threshold. Atypical neuropsychological findings included deficits in executive functioning, working memory, visual attention, and other select cognitive and academic areas. In addition, KJ displayed hyperactivity and atypical social skills. KJ's strengths include her creativity and unconventional thought process.

Conclusions: KJ presented with an atypical pattern of deficits falling into four main categories: attentional, sensory, social, and learning. A review of relevant research supported that her presentation shares characteristics with multiple diagnoses, but is not completely captured by one alone. The lifelong trajectory of her atypical sensory processing suggests a biological component. Further research in this area may lead to a better understanding of the etiology of KJ's symptoms, which may improve the quality of care for this individual and others with a similar symptom profile.

Correspondence: *Valerie Needham, MS, The American School of Professional Psychology, Argosy University, Washington DC, 1550 Wilson Boulevard, Suite #600, Arlington, VA 22209. E-mail: valerie.r.needham@gmail.com*

K.M. O'BRIEN, T.N. ANTONINI, L. TAMM & J.N. EPSTEIN. Performance on the Paced Auditory Serial Addition Test (PASAT) Among Young Adults With ADHD and a History of Marijuana Use.

Objective: Both ADHD and marijuana (MJ) use are associated with neurocognitive deficits in working memory and emotional dysregulation. The present study's objective was to examine the interaction between ADHD and MJ use on measures of working memory and emotional dysregulation.

Participants and Methods: 88 adolescents with ADHD [46 non-MJ users (ADHD+MJ-) and 42 MJ users (ADHD+MJ+)] and 41 typically developing children (21 ADHD-MJ- and 20 ADHD-MJ+) completed the Paced Auditory Serial Addition Test (PASAT). Level 1 of this task requires participants to add 50 consecutive single-digit numbers. The total number of correct additions served as an indicator of working memory. On Level 2, 400 stimuli appeared at a fast event rate. Participants were told they could terminate exposure to the task at any time but would earn money if they persisted. The latency to task termination served as a measure of psychological distress tolerance.

Results: A 2 (MJ+ vs. MJ-) x 2 (ADHD+ vs. ADHD-) ANOVA demonstrated a main effect of ADHD diagnosis, with ADHD+ completing fewer addition problems during Level 1 ($p<.01$). No significant MJ main effect or interactions were observed for correct additions. A survival analysis of task termination showed a significant trend towards an interaction effect with those in the ADHD-/MJ+ group being more persistent on the task than all other groups.

Conclusions: Our findings indicate that MJ users with and without ADHD may differ on psychological distress tolerance possibly suggesting differing pathways to MJ use (e.g., non-ADHD MJ users may be more highly motivated by reward). Alternatively, it may be that those MJ users without ADHD have less working memory impairment and thus experience less frustration with this task and are able to persist longer than those with ADHD.

Correspondence: *Kathleen M. O'Brien, B.A., Psychology, University of Cincinnati, 6611 Greenfield Drive, Cincinnati, OH 45224. E-mail: kateo2004@yahoo.com*

D. PLOETZ, A.M. MORAN, C.E. TYNER, L. JORDAN & S.C. HEATON. Relationship Between Parent-Reported Inattentive Behaviors and Child Performance on Attentional Tests in a Pediatric Clinical Sample.

Objective: Inattentive behaviors are common in pediatric patients because attentional processes are altered by a variety of neurological conditions. The present study is an initial attempt to explore the relationship between parent-report of inattentive behaviors on the Behavioral Assessment System for Children (BASC-2) and child performance on core subtests of the Test of Everyday Attention for Children (TEA-Ch) in a heterogeneous pediatric clinical population (ADHD, TBI, epilepsy, PDD, etc.).

Participants and Methods: 151 children ages 6-15 completed five TEA-Ch subtests. Behavioral ratings of attention problems were obtained from the primary caregiver using the BASC-2 Attention Problems scale. Correlation analyses were conducted to determine the relationship between inattentive behaviors and the presumably associated cognitive functions.

Results: Overall, parents reported "at risk" levels of inattentive behaviors (mean $T=62$) and children performed poorly as a group on tasks requiring divided and controlled attention (mean $SS=6$). However, correlation analyses only revealed a significant negative relationship between parent ratings on the BASC Attention Problems scale and child performance on the TEA-Ch Sky Search subtest. Thus, higher levels of inattentive behaviors were associated with poorer performance on this test of selective attention ($r=-.19, p=.03$).

Conclusions: Overall, the relationship between caregiver report and tests of attention was minimal. Reported inattention from a caregiver was only associated with poorer performance on a subtest of selective attention. Additionally, this sample had primary impairments on tasks of divided and controlled attention. Results suggest that parent report of inattention behaviors may not be useful for identifying those children in need of further cognitive testing. Findings also suggest that parent report of inattentive behaviors may be poorly related to children's attentional performance. Future directions are discussed.

Correspondence: *Danielle Ploetz, University of Florida, 1600 Archer Rd, Gainesville, FL 32611. E-mail: danielle.ploetz@gmail.com*

B. RENNIE, J. HAMMOND, R. MADATHIL, S. HALL, M. BEEBE-FRANKENBERGER & H. SWANSON. Cognitive Abilities in High Achieving ADHD: What Sets them Apart?

Objective: This study examined children at risk for ADHD who demonstrate high achievement in reading or math. In general, ADHD is associated with poor academic outcomes. However, some children with ADHD excel academically - a drastically understudied group. The purpose of this study was to better understand this unique ADHD population.

Participants and Methods: Forty-one children in a school-based community sample, aged 8-9 years old, were identified as high risk for ADHD by teacher ratings on the Conners' Rating Scale ($t > 65$). All students completed the following academic measures: the TOWRE Real Words and the Arithmetic subtest from the WRAT-III. Students also completed tests of fluid reasoning, inhibitory control, verbal and non-verbal working memory, and executive functioning.

Results: Five participants (12%) demonstrated high achievement in reading and seven participants (17%) demonstrated high achievement

in math (high achievement = $SS > 1.5$ SD above the mean). Mean comparisons revealed several areas of working memory that differentiated both high achieving groups from controls, and regression analyses indicate statistically significant findings for both the high achieving groups after controlling for severity of ADHD behavior. A numerical updating task was a significant predictor of both high achieving groups, while a measure of non-verbal fluid intelligence was significant for the math group and an auditory working memory task was significant for the reading group.

Conclusions: Children at risk for ADHD who demonstrate high achievement in reading or math also demonstrate distinct neuropsychological differences. Differences on cognitive variables between high achieving groups and controls as well as the two high achieving groups emerged. These results offer insight into important neuropsychological factors associated with high-achieving ADHD, an understudied population. These findings warrant further investigation into neuropsychological assessment for ADHD.

Correspondence: *Brandon Rennie, Ed.S., School Psychology, University of Montana, 509 west alder st Unit 1, 509 west alder st Unit 1, Missoula, MT 59802. E-mail: brandon.rennie@umontana.edu*

B. RENNIE & R. MADATHIL. Working Memory Across Development in an ADHD Population.

Objective: To examine the cross-sectional differences across the lifespan of individuals with a diagnosis of Attention Deficit/Hyperactivity Disorder (ADHD).

Participants and Methods: This study combines two data sets that utilized the Digit Span subtest from the WISC-III and WAIS-III. Digit Span has been shown to be a reliable, valid, and commonly used measure of working memory, and is highly correlated with the overall working memory index. School-based samples of 33 third graders, traditionally aged college students, and non-traditionally aged college students were administered the Digit Span subtest of WISC-III and the WAIS-III. Given the centrality of the role of working memory deficits as a defining feature in individuals with ADHD, it was hypothesized that deficits in working memory would be exhibited in childhood and persist into early and later adulthood for individuals with ADHD.

Results: Mean standard scores for all three age ranges were plotted. Results indicated that, contrary to our hypothesis, average scores for our working memory measure increased at each age range.

Conclusions: Our findings suggest that although working memory deficits are thought to be an endophenotype for ADHD, these deficits may not remain consistent over time. These findings help us to better understand the relationship between working memory and ADHD and how this relationship may change over time. Theoretical and practical implications will be discussed.

Correspondence: *Renee Madathil, M.A., Psychology, The University of Montana, 707 39th St., Apt 3, Missoula, MT 59803. E-mail: renee.madathil@umontana.edu*

K.S. ROSCH & S.H. MOSTOFSKY. Increased Delay Discounting for Real and Hypothetical Rewards in Children with ADHD.

Objective: Increased delay discounting, or a preference for smaller, immediate rewards over larger, delayed rewards involves the interaction of cognitive and motivational processes implicated in Attention-Deficit/Hyperactivity Disorder (ADHD). This study examined a novel delay discounting task designed for use with children involving rewards and delays experienced in real-time and a hypothetical discounting task. We hypothesized that children with ADHD would show greater delay discounting on both tasks.

Participants and Methods: Participants included children with ADHD ($n=14$) and their typically developing (TD) peers ($n=8$) between the ages of 8-12 years. The game time discounting task involved choices about playing a preferred game (e.g., handheld video game, Legos) immediately for a shorter amount of time (15, 30 or 45 seconds) or playing for a longer amount of time (60s) after waiting. Repeated Measures

ANOVAs with the between-subjects factor of Group (ADHD, TD) and within-subjects factor of Delay (25, 50, 100s) were used to examine delay discounting on the game task. The money discounting task involved 91 choices about receiving money now or later and two of the choices were real.

Results: Participants chose the smaller, immediate reward more often as the delay increased, delay $F(1,20)=44.0$, $p<.001$. The effect of delay varied by group, $F(1,20)=7.2$, $p<.05$, such that children with ADHD chose the immediate reward more frequently when they had to wait for 50s compared to 25s, $p<.05$, whereas control participants chose the immediate reward equally for the shorter delays (25 and 50s) but they chose the immediate reward more frequently for the longest delay (100s) compared to the shorter delays, $ps<.001$. For the hypothetical discounting task, children with ADHD tended to show greater delay discounting, $F(1,20)=3.8$, $p<.07$.

Conclusions: Children with ADHD showed greater delay discounting on a hypothetical task and for real rewards and delays at a moderate delay, whereas this only occurred for the longest delay in the TD group. Correspondence: *Keri S. Rosch, Ph.D., Neurology, Kennedy Krieger Institute, 716 North Broadway, Baltimore, MD 21205. E-mail: ksrosch@gmail.com*

K.S. ROSCH & S.H. MOSTOFSKY. Differential Effects of Reward on Response Inhibition and Variability in Children with ADHD.

Objective: The impact of rewards on cognitive processes has important implications for understanding how motivation and cognition interact in children with Attention-Deficit/Hyperactivity Disorder (ADHD). We examined whether rewards differentially impacted Go/No-Go (GNG) task performance of children with ADHD compared to typically developing (TD) children.

Participants and Methods: Participants included children with ADHD ($n=57$) and their TD peers ($n=60$) between the ages of 8-12 years. Participants completed two GNG tasks during which they were instructed to respond when a green spaceship appeared and to withhold a response when a red spaceship appeared. During the reward GNG task, children earned 10 cents for correct, fast Go's and lost 50 cents for commission errors. Repeated measures ANOVAs with the between-subjects factor of Group (ADHD, TD) and within-subjects factor of GNG Task (No Reward, Reward) were used to examine accuracy and reaction time measures, including ex-Gaussian estimates of RT distributions (μ , σ , and τ). **Results:** Children with ADHD showed a greater reduction in commission errors during the reward task than TD participants, Group \times Task $F(1,15)=5.6$, $p<.05$, such that their performance no longer differed from that of the TD group when performance-based rewards were offered. Children with ADHD also showed a greater reduction in ISV during the GNG reward task compared to the TD group, Group \times Task SDRT: $F(1,115)=4.2$, $p<.05$, and in the exponential portion of the RT distribution, Group \times Task Tau: $F(1,115)=3.6$, $p=.06$.

Conclusions: The finding that performance-based rewards differentially improved response inhibition and ISV in children with ADHD suggests that motivational factors should be considered when examining cognitive dysfunction in ADHD. In addition, rewards may improve the behavior of children with ADHD through these cognitive processes, suggesting a possible mechanism by which behavior modification exerts its effects. Correspondence: *Keri S. Rosch, Ph.D., Neurology, Kennedy Krieger Institute, 716 North Broadway, Baltimore, MD 21205. E-mail: ksrosch@gmail.com*

M. RYAN, L.A. JACOBSON, C. HAGUE, A. BELLOWS, M.B. DENCKLA & E. MAHONE. Rapid Automated Naming in Children with ADHD: An ex-Gaussian Analysis.

Objective: Children with ADHD demonstrate increased intra-subject variability (ISV) on tasks in which stimulus presentation rate is externally controlled. It is unclear whether such variability is observed on self-paced tasks, e.g., Rapid Automated Naming (RAN), or whether RAN inter-item variability uniquely predicts reading performance.

Participants and Methods: Eighty children (45 with ADHD—screened for word reading deficits, 35 controls), ages 9-14, completed RAN and reading fluency measures (TOWRE, GORT-IV, WJ-III). RAN responses were digitally recorded. Inter-stimulus pause time distributions (excluding between-row pauses) were analyzed using traditional (mean, SD) and ex-Gaussian (μ , σ , τ) methods.

Results: Children with ADHD were slower than controls ($p<.05$) on RAN letter naming, oral (GORT-IV), and silent (WJ-III) reading fluency (M, SD, τ). Hierarchical regression revealed that the exponential component of the letter-naming response time distribution (τ) uniquely predicted GORT-IV fluency ($p<.001$, $\Delta R^2=.16$) and TOWRE ($p=.007$, $\Delta R^2=.09$), even after controlling for WISC-IV VCI and ADHD symptom severity.

Conclusions: Children with ADHD (without word-level reading difficulties) are observed to have slowed reading fluency. This “slowing” (especially oral reading) may be due in part to lapses from performance (potentially related to alterations in dopaminergic or noradrenergic functioning), which can be assessed directly using ex-Gaussian methods (especially τ) that capture excessively long response times.

Correspondence: *Lisa Jacobson, PhD, Kennedy Krieger Institute/ Johns Hopkins University School of Medicine, 1750 E Fairmount Ave, Baltimore, MD 21231. E-mail: jacobson@kennedykrieger.org*

L. SEGALA, G. VASILEV, K. BOZGUNOV, R. NASLEDNIKOVA, I. RAYNOV, R. GONZALEZ & J. VASSILEVA. Differential Effects of ADHD on Neurocognitive Impulsivity in Opiate and Stimulant Users.

Objective: Drug addiction is commonly associated with neurocognitive deficits in impulsivity and decision-making. Impulsivity is also a central characteristic of ADHD, which is highly comorbid with drug addiction. The specific aim of this study was to investigate whether symptoms of ADHD would deleteriously affect neurocognitive impulsivity in a sample of mono-substance dependent heroin and amphetamine users in Bulgaria, where polysubstance dependence is relatively uncommon. This allowed us to investigate the unique effects of heroin and amphetamines on cognition.

Participants and Methods: A total of 151 currently abstinent heroin and amphetamine users (82 heroin users and 69 amphetamine users), who met DSM-IV criteria for past heroin or amphetamine dependence completed the Iowa Gambling Task (IGT), a measure of impulsive decision-making / “cognitive impulsivity” and the Stop Signal Task (SST), a measure of response inhibition / “motor impulsivity”. Twenty-three of the participants were classified as ADHD+ (14 heroin users and 9 amphetamine users) and 128 participants were classified as ADHD- (68 heroin users and 60 amphetamine users), based on the standard cutoff score of 46 on the Wender-Utah Rating Scale.

Results: A mixed-model ANOVA revealed a significant interaction between drug type and ADHD, indicating that ADHD+ heroin users performed significantly better on the SST relative to ADHD- heroin users. This finding was not observed in amphetamine users. The presence of ADHD had no effect on the IGT for either heroin or amphetamine users.

Conclusions: The presence of ADHD in our sample of heroin addicts had a beneficial effect on their performance on the SST, which was not observed in the amphetamine group. Current research on impulsivity with heroin addicts has shown impairments on tasks of cognitive impulsivity but research on motor impulsivity has been sparse. Our findings show that the presence of trait impulsivity may have beneficial effects on response inhibition in heroin addicts.

Correspondence: *Laura Segala, M.S., Department of Psychiatry, University of Illinois at Chicago, 1601 W Taylor St, Chicago, IL 60612. E-mail: lsegala@psych.uic.edu*

H. WADSWORTH, B. CLARK, R. MADATHIL & S. HALL. Self-Identification with the Diagnosis of ADHD and its Relationship to Performance on Self-Report and Objective Measures.

Objective: Research has shown that how strongly one identifies with a stereotype can impact their performance on cognitive tests. The goal of the present study was to investigate the relationship between the level of identification with a diagnosis of ADHD and performance on self-report and objective measures commonly used in the diagnosis of ADHD.

Participants and Methods: Participants were college-age adults (18–22 years) with a prior ADHD diagnosis. The level of identification with their diagnosis of ADHD was determined using a Likert-type self-identification scale. Participants were also administered the Conners' Continuous Performance Task (CPT-II) and the Barkley Adult ADHD Rating Scale-IV (BAARS-IV) sections 1–3.

Results: Correlation between scores on the self-identification scale and BAARS-IV were significant ($r=0.75$; $p<0.05$). Correlation between scores on the self-identification scale and CPT-II Omissions were not significant ($r=0.25$; ns). Correlation between scores on the self-identification scale and CPT-II Commissions approached significance ($r=0.54$; ns).

Conclusions: Our results demonstrate a strong relationship between how closely someone identifies with the diagnosis of ADHD and how they report their symptoms on the BAARS-IV. In other words, the more one identifies with the diagnosis, the more symptoms they report. At first glance, this finding may appear intuitive. However, closer inspection reveals that identification may influence self-report scores and serve to inflate them. In contrast, the extent of identification with the diagnosis had no relationship with performance on the CPT-II. These results demonstrate the importance of considering to what extent someone identifies with their ADHD diagnosis. Further investigation into the role of "diagnosis identification" and how that may impact self-report and objective test results is needed.

Correspondence: *Hannah Wadsworth, Psychology, University of Montana, 2204 Landusky Ct., Missoula, MT 59801. E-mail: hannah.wadsworth@umontana.edu*

Learning Disabilities/Academic Skills

E. AUNE, M. BEEBE-FRANKENBERGER & H. SWANSON. Memory Updating Deficits Predict Future Learning Impairments in Children: A Longitudinal Study.

Objective: This study investigated the relationship between children "at-risk" for specific and co-morbid learning disorders by examining underlying cognitive processing and academic achievement deficits using a longitudinal cross-sectional design.

Participants and Methods: Students were selected from a community-based sample of 1st through 3rd graders who were followed for three years (3rd through 5th grades) and annually administered a battery of tests. The sample ($N=266$) was comprised of two co-morbid learning impaired groups with different learning deficit profiles, as well as one group of children with domain specific learning impairments (i.e., reading). One group of children without learning impairments was included as a control group. Learning impaired groups were established using a performance criterion level of > 1 SD below the mean on norm-referenced cognitive and aptitude tests. Assessments utilized in this study included norm-referenced academic achievement, verbal and nonverbal IQ, working memory, phonetic memory, word problem solving, and memory updating tests. Logistic regression models, one-way repeated measures ANOVA, and proportional reduction of error analyses were conducted on learning impaired groups using the control group as an anchor.

Results: Across all learning impaired groups, logistic regression results illustrated the validity of memory updating abilities as a predictor of future learning deficits beyond influences of working and phonetic memory, IQ, and academic aptitude. In addition, children with co-morbid learning impairments demonstrated less improvement in outcome measures over time.

Conclusions: Findings suggest that a cognitive processing deficit, memory updating, differentiates single and co-morbid learning impairments in children over time. This finding has significant theoretical and practical implications.

Correspondence: *Eric Aune, School Psychology, Ed.S., NCSP, University of Montana, 2327 West Vista Drive, Missoula, MT 59803. E-mail: eric.aune@umconnect.umt.edu*

E.M. BACKENSON, J.B. HALE, H.A. KUBAS, J. CARMICHAEL & K. FITZER. Specific Psychosocial Deficits Associated with Learning Disability Subtypes.

Objective: Psychosocial problems in specific learning disabilities (SLD) have been linked to white matter "nonverbal" problems as measured by Performance IQ (PIQ), which collapses visual-spatial and processing speed abilities. Thus, it is unclear which of these abilities is the cause of SLD psychosocial disturbance.

Participants and Methods: Children age 6 to 11 referred for comprehensive psychoeducational evaluations ($N=50$) were subjected to Concordance-Discordance Model (C-DM) for SLD determination. No C-DM, Working Memory SLD, and Processing Speed SLD groups were identified, and subsequent ANOVAs compared group BASC-II psychosocial functioning.

Results: Significant group differences were found for overall Adaptive Skills ($F=5.68$, $p=.006$), Social Skills ($F=3.94$, $p=.026$), Leadership ($F=3.45$, $p=.040$), and Functional Communication ($F=3.68$, $p=.033$) subscales, with the PSI group showing the most severe impairment. Although clinical scale differences were largely nonsignificant, the PSI group showed more ($Mt=68.61$, $SD=13.43$) Withdrawal behaviors ($F=4.98$, $p=.011$) than the No C-DM and WMI groups. The PSI group also showed clinical elevations on Depression ($Mt=69.17$, $SD=19.63$) and overall Internalizing Behavior ($Mt=64.17$, $SD=16.34$) subscales.

Conclusions: Findings support cognitive and psychosocial effects of white matter dysfunction, which causes processing speed deficits in traumatic brain injury and is likely the cause of psychosocial disturbance in "nonverbal" SLD.

Correspondence: *Erica M. Backenson, PsyD, University of Calgary, EDT 538, 2500 University Drive NW, Calgary, AB T2N1N4, Canada. E-mail: erica.backenson@yahoo.com*

S. BENAVIDES-VARELA, F. BURGIO, G. ARCARA, D. LUCANGELI, B. BUTTERWORTH & C. SEMENZA. How do Daily Activities Influence Children's Performance in Number-Related Tasks?

Objective: The aim of this study was to investigate how individual and family customs relate to the children's earliest numerical knowledge and their ability to solve basic mathematical problems in daily contexts. Identifying the variables that influence participants' performance should contribute to improve both theories of mathematical development and mathematics education.

Participants and Methods: A hundred and ten pre-school children (59 females, 51 males; age range: 5.46–6.43y) participated in the study. Children answered (A) a questionnaire of 14 items meant to inquire into their preferred daily activities and to assess their knowledge of number-related information taught by adults (e.g. birthdates, phone numbers, etc.). Participants also completed a battery of experimental tests that examined (B) their basic numerical abilities and (C) their ability to solve math problems in ecological situations. Additionally, parents were interviewed about (D) their own level of education, the family constitution and activities. They also completed a questionnaire (E) meant to measure their awareness of the child's usage of numbers in daily life.

Results: Children's knowledge of number-related factors (A) reliably correlated with (B) (0.39, $p<0.0001$), (E) (0.32, $p<0.001$), and with their ability to solve numerical problems in ecological situations (0.39, $p<0.0001$). Furthermore, the custom to play table games at home was reliably correlated with (A) (0.28, $p<0.01$) and (B) (0.31, $p<0.001$). Children's performance did not correlate with other variables of the questionnaires including the parents' level of education or the SES of the family.

Conclusions: These findings suggest that certain family customs are compatible with early mathematical development. Reinforcing these customs may potentiate the child's numerical abilities, formal math learning, as well as problem solving in daily situations.

Correspondence: *Silvia Benavides-Varela, IRCCS Fondazione Ospedale San Camillo, Via Alberoni 70, Lido Venice 30126, Italy. E-mail: silviabenavides@gmail.com*

N. CADAVID-RUIZ, M.C. QUIJANO, S. JIMÉNEZ & E.M. CÓRDOBA. Cognitive Profile Differences of Colombian Children with Non-specific Reading Disabilities.

Objective: Traditionally, Spanish scientific literature on reading developmental disabilities has focused on the study of dyslexia, leaving aside other type of reading disabilities, such as non-specific reading difficulties. This last disability is of extremely relevance to some Spanish populations, since many of our school aged children from low socio-economic status do not meet dyslexia diagnosis, despite the presence of long lasting reading acquisition difficulties. Particularly, children from low socio-economic status do not meet the criteria of discrepancy between an average to above average intelligence score and a low performance on reading tests. On the contrary, they tend to obtain low IQ and reading scores on neuropsychological assessment.

The present study aims to describe the general cognitive profile of Colombian children aged 7 to 9 years old, with non-specific reading disabilities.

Participants and Methods: Fifty-four children from low socio-economic status, aged 7 to 9 years old, with IQ scores between 80 and 90 and that performed below expected levels for their age in at least two domains of reading skills tests participated in the study. Participants were assessed with measures of phonological awareness, reading and visuo-spatial skills, and IQ test.

Results: Principal component analysis showed that the studied measures explained 54.02% of the total variance. Additionally, PCA showed a difference between the cognitive profile of 7 years old children and 8 and 9 years old children with non-specific learning disabilities. No differences were found by sex.

Conclusions: This results suggest that the reading difficulties of 7-years-old children with poor reading skills depend on a different cognitive profile from that observed on children aged 8 and 9 years old, that not only depend on specific oral language delays but also in other general cognitive skills.

Correspondence: *Natalia Cadavid-Ruiz, PhD, Social Sciences, Pontificia Universidad Javeriana, Calle 18 No. 118- 250, Cali —, Colombia. E-mail: ncadavid@javerianacali.edu.co*

N. CADAVID-RUIZ, M.C. QUIJANO & S. JIMÉNEZ. Differential Outcomes of Implicit and Explicit Learning Strategies for Overcoming Non-specific Reading Difficulties.

Objective: The present study aims to prove the efficacy of two intervention programs based on implicit and explicit learning, developed to enhance the reading abilities of children diagnosed with non-specific reading difficulties.

Participants and Methods: Fifty children, seven to nine years old, from low socioeconomic status, that attend first to fourth grade in schools of Cali (Colombia) and that underperformed in two measures of reading skills, according to the expected population mean, participated in this study.

All children were evaluated with two measures of the scale Evaluación Neuropsicológica Infantil (ENI): phonological awareness and reading skills. Half of the children enter the intervention program based on play and implicit learning (experimental group), while the other half had access to an explicit reading learning strategy and constituted the control group.

Results: Manova analysis showed that children in both the experimental and control group improve their reading skills after participating in their respective intervention program, while there was no significant differences between programs.

Size effect analysis showed that after intervention the experimental group obtained better scores on general cognitive skills, such as speed processing and working memory, while the control group obtained better performances on domain-specific reading skills.

Conclusions: These results suggest that although implicit and explicit learning intervention programs of reading skills may improve this specific cognitive ability of children with non-specific reading difficulties, they may be used depending on the cognitive profile of children, so to ensure a more adjusted intervention to the children's cognitive needs.

Correspondence: *Natalia Cadavid-Ruiz, PhD, Social Sciences, Pontificia Universidad Javeriana, Calle 18 No. 118- 250, Cali —, Colombia. E-mail: ncadavid@javerianacali.edu.co*

P.T. CIRINO, T.D. TOLAR & L.S. FUCHS. Numerosity and Cognitive Predictors of Math Skills in Middle School.

Objective: Numerosity refers to how numbers are represented and processed (Dehaene et al., 2003). One issue is the role of such domain specific skills versus domain general processes (e.g., language, spatial skills, working memory). Relevant language aspects include vocabulary and making/manipulating symbolic associations. Visual/spatial skills are also related to math (Rohde & Thompson, 2007). Working memory is related to academic skills (Engle et al., 1999), including algebra (Tolar et al., 2009). We evaluated numerosity and neuropsychological contributions to a range of math skills, including simple/complex arithmetic operations, fractions, and proportions. We expected both types of contributions to be relevant for these math skills which are important for algebra.

Participants and Methods: Participants were 162 students in Grade 6 who were administered measures of number line estimation, symbolic/nonsymbolic magnitude comparison, language (WJ-III Visual-Auditory Learning; WASI Vocabulary), mental rotation, and working memory. Mathematical measures included math facts (addition, subtraction, multiplication), fractions, and proportions. Regression analyses were used to explore hypotheses.

Results: Most correlations between numerosity/cognitive and mathematics measures were significant. Unique predictors of addition facility included number line estimation ($R^2 = 22\%$); for subtraction, predictors included language and working memory ($R^2 = 17\%$), and for multiplication, number line estimation, symbolic comparison, and working memory ($R^2 = 17\%$). Fractions were predicted by number line estimation and nonsymbolic comparison, and proportions were predicted by language and symbolic/nonsymbolic comparison.

Conclusions: The present study found contributions of both numerosity and neuropsychological functions for a range of math skills. This is the first step to comprehensively evaluate cognitive and arithmetic antecedents to other mathematical skills including algebra, as these students are followed through completion of Algebra I.

Correspondence: *Paul T. Cirino, PhD, Psychology, University of Houston, UH TMC Annex, 2151 W Holcombe Blvd, 224a, Houston, TX 77204-5053. E-mail: pcirino@uh.edu*

C. FRITZ, K. SMITH, R. MORRIS, M. LOVETT, M. WOLF & R. SEVCIK. Rates of Dyslexia and Specific Comprehension Deficits Pre and Post Treatment in Elementary and Middle School Students.

Objective: The DSM-5 has proposed that dyslexia is characterized primarily by decoding difficulties, yet many children with dyslexia also show deficits in reading comprehension (Snowling & Hulme, 2012). It is unclear how rates of reading deficits vary in children with dyslexia across age.

Participants and Methods: Participants were elementary ($n = 191$) and middle school ($n = 271$) students who qualified for a reading intervention based on low-achievement criterion (see description in Morris et al., 2012). All subjects were evaluated before and after a one year phonological reading intervention. Exclusion criteria included: WASI <70 , psychiatric condition. Deficit was defined as a standard score of 85 or less. Children's scores were categorized into deficit groups: decoding only (DO; WJ Basic Cluster score), reading comprehension only (CO; WJ Passage Comprehension), decoding and reading comprehension deficits (DC), and, after treatment, no deficits (ND).

Results: Two chi-square tests of independence were performed to examine the relationship between grade level and deficit type. Prior to treatment, there were no significant associations between the variables $X^2(2) = 3.75, p = .15$. Overall rates collapsed across groups were: DO = 18%, CO = 18%, and DC = 64%. However, after treatment, there

was a significant association between grade and deficit type $X^2(3) = 20.34, p < .001$. Rates by grade (Elem, Middle): DO: 9%, 15%; CO: 7%, 16%; DC: 29%, 34%; ND: 55%, 35%. After treatment, elementary students were more likely to have no deficits compared to middle school students.

Conclusions: Similar rates of deficits were found before treatment with the majority having deficits in both decoding and comprehension. Yet after treatment, there was a significant association between grade and deficit. This seems to be driven by the students who were classified as having no deficits after treatment which was greater for elementary students (ND: 55% of elementary, 35% middle).

Correspondence: *Cortney Fritz, Georgia State University, 870 Inman Village Pkwy NE, Apt 529, Atlanta, GA 30307. E-mail: cortney.fritz@gmail.com*

R. GREEN, B. COLEMAN, A. FURROW & S. DEBOARD MARION. Working Memory Training: Does it Improve Math Performance?

Objective: Studies have shown that there is a link between working memory and mathematical reasoning, and that increased working memory capacity is correlated with increased mathematical reasoning skills. Furthermore, research suggests that deficits in academic progress, including mathematics, can be overcome by intensive working memory training. Cogmed is a working memory training program that consists of a variety of computerized verbal and spatial memory tasks. In the current study, children with working memory deficits engaged in Cogmed training for 30 minutes per day, five days a week for five weeks. To measure math performance, participants were given the WIAT-III before and six months after Cogmed working memory training. It was hypothesized that participants would demonstrate an increase in performance on mathematical tasks on the WIAT-III, including numerical operations, math problem solving, math fluency addition, and math fluency subtraction, after the working memory training.

Participants and Methods: Participants were six children identified as having working memory deficits (5 male; Age, $M = 8.50, SD = 1.64$). As part of a larger battery, participants were given the math subtests of the WIAT-III both before and six months after Cogmed working memory training.

Results: Paired t-tests were conducted to determine differences in time one and time two math performance scores on the WIAT-III. A significant increase in performance was noted for numerical operations ($t = -2.95, p = .03$). However, no significant increase in performance was noted in math problem solving ($t = -2.12, p = .09$), math fluency addition ($t = -.05, p = .96$), or math fluency subtraction ($t = -.74, p = .49$).

Conclusions: These results indicate that Cogmed working memory training may be an effective method for increasing certain math skills in children with working memory deficits. However, more research with larger sample sizes is needed to further investigate the link between Cogmed working memory training and different types of math performance.

Correspondence: *Rachael Green, M.A., Fuller School of Psychology, 557 Flower St., Pasadena, CA 91104. E-mail: rwittern@gmail.com*

M. HODGE, K. GANESALINGAM, S. DREVENSEK, R. SUTHERLAND, M. WILLIAMZ, P. HUTCHINS, N. WADDY, L. LOCKETT, S. HUCK & N. SILOVE. Multidisciplinary Assessment of Reading Difficulties in Children.

Objective: A multidisciplinary (i.e., neuropsychological, language, education, health/well-being) approach to better understand the complexities of children's reading difficulties is rarely reported. This study sought to evaluate such an approach in detecting the factors that are associated with reading difficulties.

Participants and Methods: Data were drawn from a retrospective, cross sectional study. Eighty three children, aged 7-12 years ($n=60$ boys, $n=23$ girls) underwent a multidisciplinary assessment of their reading (word attack, sight word, reading comprehension), neuropsychological

factors (intelligence, attention, memory and executive functioning) and language (receptive and expressive). Parents rated children's executive behaviours in the everyday context. Clinical interview, physical examination and self-report questionnaires were used to assess overall health/well-being.

Results: Intellectual ability was the strongest predictor of sight word reading ($Beta=0.31, p=0.016$). A novel finding was that sustained attention accounted for a significant amount of the variance in sight word reading ($Beta=0.23, p=0.048$) and reading comprehension ($Beta=0.30, p=0.01$), after controlling for intelligence and language. Expressive language skills accounted for a significant amount of the variance in word attack skills over and above intellectual ability ($Beta=0.51, p=0.002$). These results were apparent regardless of comorbid diagnoses, which included attention deficit disorders and anxiety disorder.

Conclusions: Neuropsychological and language factors are associated with different aspects of reading. A multidisciplinary assessment approach is important to determine the complex characteristics of children's reading difficulties and unique contributing factors. This in turn guides the design of individually tailored intervention programs that target not only reading difficulties but also associated neuropsychological, language and health/well-being barriers to learning.

Correspondence: *Marie Antoinette Hodge, DPsych, Child Development Unit, The Children's Hospital at Westmead, Locked Bag 4001, Westmead, NSW 2145, Australia. E-mail: antoinette.hodge@health.nsw.gov.au*

K.M. JANKE, C. CASNAR, F. VAN DER FLUIT, D. HABERMAN, N. BREI, S. HUNTER & B. KLEIN-TASMAN. Concurrent Relations between Early Neuropsychological and Academic Skills in Young Children with NF1 and Typically Developing Peers.

Objective: Neurofibromatosis-1 (NF1) is a phenotypically variable genetic disorder associated with elevated rates of learning disabilities, attention problems, speech and language impairment, and executive functioning deficits. Research investigating the presentation of NF1 in young children is limited. Relations between neuropsychological and pre-academic skills were examined to identify cognitive processes that contribute to early learning difficulties.

Participants and Methods: The sample consisted of 50 children with NF1 and 42 control children aged 3 to 7. The groups did not differ significantly in age, gender distribution, minority representation, socioeconomic status, or maternal education. Each was administered the Differential Ability Scales-II to assess cognitive functioning and pre-academic skills. Select subtests of the NEPSY-II were given to examine visuospatial and fine-motor skills. Parent report measures of attention were also examined.

Results: Significant group differences were seen in performance on measures of early number knowledge and phonological processing ($p < .01$). General intellectual functioning was strongly related to academic performance and accounted for many of the relations between neuropsychological and academic skills in the NF1 group. However, as in the control group, some specific neuropsychological skills continued to relate to foundational reading and math skills even when controlling for overall developmental level. Visuospatial abilities, for example, appear to support early math abilities above and beyond the role of general intellectual functioning.

Conclusions: The results indicate that early learning difficulties are present and can be identified in young children with NF1, and suggest that cognitive screenings should be a routine part of care during early childhood. Additional implications will be discussed. This research was supported by funds from the UWM Research Growth Initiative, University of Chicago CTSA (UL1 RR024999), NF Inc Midwest, NF Inc MidAtlantic.

Correspondence: *Kelly M. Janke, Psychology, Univ Wisconsin- Milwaukee, 2441 E Hartford Ave, GAR 325, Milwaukee, WI 53211. E-mail: kmz@uwm.edu*

K. KAYSER & N. NUSSBAUM. The Relationship Between Neurocognitive Functioning and Spelling Phonology.

Objective: Research demonstrating the interrelationship between reading and spelling, coupled with theories and evidence-based research re-

garding the linguistic and neuropsychological nature of misspellings, suggests that analyses of children's early spelling attempts may capture their understanding of how to decode text. This study aimed to determine the utility of applying a spelling error analysis system to differentiate between reading difficulties resulting from executive dysfunction or language deficits in a sample of children at risk for reading failure. It was hypothesized that there would be a significant relationship between representations of phonetically accurate phonemes in spelling errors and each language and executive functioning (EF).

Participants and Methods: A sample of 82 children aged 6-15 years were administered measures of spelling, language, and EF as part of a more comprehensive battery. Data were collected from Reading Deficit (RD) and ADHD populations given their increased incidence of reading delays and for purposes of capturing various neurocognitive factors contributing to reading difficulties. Regression analyses were used to determine the extent to which language and EF contributed to phonemic equivalency of misspellings.

Results: Hierarchical regression analyses indicated language significantly predicted phonemic equivalency when controlling for age and gender. EF did not significantly contribute to the variability in phonological spelling above and beyond gender, age, and language. However, exploratory analyses revealed ADHD and RD group differences in spelling phonology.

Conclusions: Results clarify the cognitive and linguistic skills relevant to phonological accuracy of spelling. ADHD and RD group differences on phonological spelling performance provide evidence for two distinct underlying cognitive processes affecting spelling and, in effect, reading. Findings have implications for the need to further examine deficits in language and EF affecting children at risk for reading failure.

Correspondence: *Kimberly Kayser, PhD, Advanced Neurobehavioral Health of Southern California, 7550 Eads Avenue, Unit 101, La Jolla, CA 92037. E-mail: kim.kayser@utexas.edu*

R. PERNA, A.R. LOUGHAN, J. HERTZA & S. NORTINGTON. Significant Math Strengths: In Children without Autism Spectrum Disorder?

Objective: When comparing math achievement to Full Scale IQ (FSIQ) scores, most children display a commensurate performance. Literature documenting children with math weaknesses is abundant; however, little research is available regarding children with Hypercalculia (significant math strengths). Of those published, many focus on children with autism spectrum disorder (ASD) due to the rule based and methodical nature of mathematics reportedly intriguing this population (Jones et al., 2009; Wallace, 2008). The current study set out to investigate a range of clinical pediatric populations and their propensity for math strengths. The hypothesis was that a subset of children who were referred for neuropsychological evaluations would have significant strengths in mathematics, but not be limited to the population of ASD.

Participants and Methods: Consecutive pediatric referrals (N=99; 43 girls, 61 boys; mean age of 12.1) with behavioral and/or emotional difficulties completed neuropsychological testing. The group sample had an average FSIQ/GAI and diagnostically included the following populations: ADHD (57), LD (50), emotional/behavioral problems (20), and 10 with ASD.

Results: Thirteen of 99 had a 10+ point advantage in math (None MR) over FSIQ and 5 of 99 had a 15+ point advantage over FSIQ. The children with mathematics significantly above FSIQ had a low average mean IQ (FSIQ=83) and had no other significant or unusual patterns of performance other than also having reading achievement significantly above FSIQ. Of the five children (3 boys, 2 girls) who had a 15+ point advantage in mathematics, 4 had ADHD and none had ASD.

Conclusions: Significant math strengths are not limited to children with ASD. Studying these groups may be helpful in understanding the learning of academic skills and perhaps in helping children who struggle with academic achievement.

Correspondence: *Ashlee R. Loughan, Ph.D., Walton Rehabilitation Hospital, 1355 Independence Dr, Augusta, GA 30901. E-mail: aspicer55@yahoo.com*

A. MANSOUR, A.E. RICHARD, J. MORAN, S. BOWYER & R. LA-JINESS-O'NEILL. MEG Coherence Imaging in Dyslexia: Activation of Working Memory Pathways.

Objective: The study investigated the frequency-dependent synchronous activations of neuronal networks and connectivity in dyslexics and controls during verbal and spatial working memory tasks using MEG coherence analysis.

Participants and Methods: Nine controls (Males = 8; Mean Age = 26) and 7 dyslexics (Males = 5; Mean Age = 24) underwent MEG imaging during 2-back verbal (VWM) and spatial working memory (SWM) tasks. MEG data were analyzed with our Coherence Imaging (CI) technique to identify cortical sources that interact strongly within the following frequencies (0-15, 15-30, 30-45 Hz). Synchronization of neuronal activity was quantified by calculating the coherence between cortical networks from MEG imaged brain activations. For each pair of brain regions (N=1431), a t-test was used to assess for differences in average coherence values between groups using False Discovery Rate to adjust for multiple comparisons. From each t-test, a z-score was computed according to the method of Efron to summarize the difference in coherence between groups.

Results: Of the 1431 region pairs, during SWM, there were 69 region pairs for which dyslexics demonstrated lower coherence across all frequencies, primarily in 1) right frontal connectivity, 2) right fronto-temporal connectivity, 3) left and right frontal connectivity, and in 4) left temporal and right frontal connectivity. Lower coherence was noted in dyslexics at the 1-15 and 30-45 Hz frequency bands during the SWM task. During VWM, dyslexics showed higher coherence at low frequencies (1-15 Hz) and lower coherence at high frequencies (30-45 Hz).

Conclusions: Coherence imaging of working memory in dyslexia revealed weaker connectivity in aberrant SWM networks, suggestive of the underlying pathophysiology within cross-hemispheric frontal and temporal-frontal pathways. Lower coherence was seen in the high frequency gamma band in dyslexics during VWM, with higher, likely compensatory, coherence in the low frequency band.

Correspondence: *Alfred Mansour, Ph.D., Eastern Michigan University, 611 W. Cross St, Ypsilanti, MI 48197. E-mail: amansour@emich.edu*

T.E. MCCOY, L.C. RICHMAN, B. KARLAN, P.C. NOPOULOS & C.A. KIMPTON HEALD. Patterns of Neuropsychological Function in Subgroups of Children with Nonverbal Learning Disability.

Objective: Nonverbal Learning Disability (NLD) has been characterized as a syndrome of developmental deficits in nonverbal cognitive functions, such as: tactile perception; visual perception; complex psychomotor activity; the ability to process novel material; and visual abstract reasoning (Johnson & Myklebust, 1971; Rourke, 1995, 1989). One problem with the diagnosis of NLD is that different symptoms can be related to different brain regions. For example, deficits in visual abstract reasoning and processing novel stimuli are frequently associated with frontal lobe dysfunction, whereas deficits in visual spatial perception and visual motor function are frequently suggestive of right hemisphere dysfunction. The purpose of this study was to compare neuropsychological and academic functioning in subgroups of children with NLD.

Participants and Methods: Ninety-three children with clinical diagnoses of NLD (and higher scores in verbal relative to performance, or nonverbal, cognitive domains) were recruited from a Pediatric Psychology clinic and assigned to one of four a priori subgroups: (a) visual abstract reasoning deficient only (n=13), (b) visual working memory deficient only (n=31), (c) combined visual abstract reasoning and visual working memory deficient (n=23), and (d) neither visual abstract reasoning nor visual working memory deficient (n=26).

Results: Between-group comparisons indicated significant differences in rapid naming of colors, objects, and numbers; visual-motor integration; and visual-spatial reasoning. Poor visual abstract reasoning was associated with poorer performances on measures of visual spatial reasoning and visual-motor integration. Poor visual working memory was associated with poorer rapid automatized naming.

Conclusions: These findings have important implications for the diagnosis and management of children with NLD, and may provide a foundation for investigating possible neural correlates of this poorly understood developmental disability.

Correspondence: *Thomasin E. McCoy, PhD, Psychiatry, University of Iowa, W278 GH, 200 Hawkins Dr, Iowa City, IA 52241. E-mail: mccoxt@healthcare.uiowa.edu*

J. MORRIS, K. VOELLER, J. GITTEN ALOIA & J. RIORDAN. The Effect of Language Deficits on Basic Arithmetic Understanding & Performance.

Objective: To identify features underlying declining performance in math in older students with dyslexia and developmental language disorders (DLD).

Participants and Methods: 14 students with dyslexia/DLD (13M; 1F); (mean age 13.6 + 4.0) of normal IQ (mean 103.8 +/- 14.3). Neuropsychological testing included WISC-III/IV IQ, achievement testing (WJA-3; WRAT3/4) as well as multiple language tests. A subset underwent administration of a semi-structured interview (WINSi Math Assessment) designed to explore the subjects' understanding of basic math concepts.

Results: The mean standard score on math calculation (WJA-3; WRAT3/4) was 92.2 +/- 14.8; 70% showed significantly impaired speed performing simple calculations (<16%tile) on WJA-3 Math Fluency (mean standard score 79.2 +/- 12.4). The students displayed striking difficulty in their ability to associate various math operations (e.g., multiplication as repeated addition; difficulty in writing various operations as math equations; describing the sequence of operations in long division; grasping the relationship of fractions and division).

Conclusions: Although impaired performance in math learning has been described in association with nonverbal learning disability, many older children with dyslexia and DLD also display severe deficits in math. Likely factors involve impaired word finding, auditory working memory, and syntax, which make it difficult for them to retrieve names for numerals and operations, carry out sequences of mental calculations, or formulate verbal strategies necessary for performing sequential calculations. Although deficits are usually (but not always) reflected in their performance on standardized achievement tests, the gaps in their understanding becomes even more obvious when they are asked to demonstrate their knowledge using verbal responses, application of concepts employing manipulatives, or converting math concepts into written equations.

Correspondence: *Joshua Morris, WINSi, 2501 Walnut St. Suite #102, Boulder, CO 80302. E-mail: joshuaawmorris@gmail.com*

K. RAGHUBAR, P.T. CIRINO & M.A. BARNES. Neurocognitive Correlates of Mathematical Processing in School-Aged Children with Spina Bifida and Their Typically Developing Peers.

Objective: Spina Bifida Myelomeningocele (SBM) is associated with high rates of specific math difficulties, and impairments in cognitive abilities purportedly related to math. The present study compared performance on these cognitive processes (i.e., attention networks, working memory, and fine motor skills) and mathematical outcomes in children with SBM. Cognitive processes as mediators of group differences on math outcomes were also examined.

Participants and Methods: Participants included 9.5 year old children with SBM (N = 44) and typically developing children (N = 50). Children completed experimental exact and approximate arithmetic tasks as well as standardized measures of math fluency and math calculations. Cognitive measures included the attention network test, and standardized measures of fine motor skills, verbal working memory, and visual-spatial working memory.

Results: As a group, children with SBM did not have deficits in math fact retrieval. In contrast, children with SBM performed more poorly than typically developing children on approximate arithmetic and standardized measures of math fluency and calculations. Children with SBM

had difficulties with orienting attention but not alerting and executive attention. Impairments were also noted in fine motor skills and working memory. For the mediation analyses, fine motor skills and verbal working memory mediated the relationship of group to estimation accuracy; fine motor skills and visual-spatial working memory mediated the relationship of group to math fluency; and verbal and visual-spatial working memory mediated the relationship of group to math calculations.

Conclusions: Results are discussed with reference to models of attention, working memory, and math cognition. Implications of the role of finger skills and working memory in math learning for children with SBM are also discussed.

Correspondence: *Kimberly Raghubar, M.A., University of Houston, 15 S High St, Baltimore, MD 21202. E-mail: kim.raghubar@gmail.com*

G. SIQUARA, A.M. OLIVEIRA, L. AZEVEDO, N. MOREIRA & J. ABREU. Relationship between Working Memory and Academic Performance.

Objective: The working memory (WM) refers to our ability to store and manipulate information for a period of time. The cognitive model used was the multicomponent Baddeley. There is evidence of extensive relationship between WM and learning. Recent research also suggests that the ability of WM, but not the Intelligence Quotient (IQ) provides better performance in reading, writing and mathematics. The objective was to investigate the relationships between components of WM and academic performance.

Participants and Methods: Participants 77 children between 7-12 years of age (M = 9.47, SD = 1.52) of a school of Salvador – Bahia - Brazil, with 34 females. To evaluate the academic performance were used subtests in reading, writing and arithmetic Academic Performance Test (APT). In the evaluation of the components of working memory were used Backward Digit Span to assess the phonological loop and the Backward Corsi block-tapping test to assess visuospatial sketch. Statistical analysis was conducted descriptive and inferential methods (Correlation Person).

Results: Results showed significant positive correlations between components of WM and tasks APT. Backward Corsi block-tapping and APT showed correlations with the following tasks: arithmetic (r = 0.57, p = 0.00), reading (r = 0.37, p = 0.00), writing (r = 0.43, p = 0.00). The task Backward Digit Span showed correlations with the following tasks APT: writing (r = 0.33, p = 0.00); Arithmetic (r = 0.27, p = 0.01) and Reading (r = 0.28, p = 0.01).

Conclusions: From the results it was possible to identify strong and significant correlations between the phonological loop and visuospatial sketch with the tasks of academic skills. The results showed strong correlations between the Backward Corsi block-tapping and arithmetic task. These data suggest a relationship between the spatial component and the phonological component with math, reading and writing skills. The results indicate the importance of the relation of WM to acquire new academic skills.

Correspondence: *Gustavo Siquara, master's, Psychology, Federal University Bahia, Dina Sfat, n0112, bl. 2 ap. 104, Boca do Rio, Salvador 41710-630, Brazil. E-mail: gustavosiquara@hotmail.com*

H. TANAKA, P. GIMENEZ, J.M. BLACK, T.J. SORIANO, B. EIDE, F. EIDE, R. HENDREN & F. HOEFT. Neurobiological Signatures of IQ-Reading Discrepancy in Average Readers.

Objective: Previous studies have found that low IQ poor readers and IQ-reading discrepant (IQdisc) poor readers show similar behavioral profiles, response to intervention and brain activation patterns, suggesting that low IQ poor readers should receive similar accommodations as those with IQdisc. Advocates suggest that not poor but average readers with IQdisc should also receive accommodation as they are not performing at their IQ potential. This study aims to examine the empirical brain basis of this claim.

Participants and Methods: Forty native English-speaking average readers (word identification, WID \geq 90ss) in the 3rd and 5th grades with

IQ at or above WID (i.e., $IQ - WID \geq 0$). Multiple regression was performed on brain activation induced by a visual real-word rhyme judgment fMRI task with IQdisc “IQ–WID” and WID scores as regressors. Brain activation was also compared between 10 highly IQ-discorrelated average readers ($IQdisc; [IQ - WID] \geq 15, WID \geq 90$) and 7 IQ-matched, non-discorrelated controls ($CON; |IQ - WID| < 8; IQ > 108, WID \geq 90$).

Results: As IQdisc increased, left inferior frontal gyrus (IFG) activation significantly decreased, even after regressing out the effect of reading (WID) scores. Between-group analysis, despite the small sample, showed significantly reduced activation in the same region in IQdisc compared to CON.

Conclusions: Using both individual differences and categorical approaches, we show that IQdisc average readers show reduced brain activation patterns in a brain region known as one of the key neurobiological hallmarks of dyslexia reported in previous fMRI meta-analyses. While previous results (Tanaka, Black, et al. Psychol Sci 2011) showed that phonology-related brain activation in poor readers seems independent of IQdisc, here IQdisc average readers show neurobiological signatures of dyslexia in the left IFG. These results may have implications for educational policies related to IQdisc average readers who currently do not qualify for educational services.

Correspondence: *Hiroko Tanaka, MS, Pacific Graduate School of Psychology at Palo Alto University, 411 E. Indian School Rd., Apt 1083, Phoenix, AZ 85012. E-mail: htanaka@paloutou.edu*

R. WAGNER. A Causal Indicator Model Approach to Identifying Causes of Reading Problems.

Objective: Reading problems have multiple possible origins that span both behavioral and neurobiological levels. For example, there is strong evidence that behavioral measures of oral language and decoding predict performance on measures of reading comprehension. In addition, there is strong evidence that gender and family history are biomarkers of risk for reading problems. What has been lacking is a comprehensive model that integrates multiple sources of information from different levels that can be rigorously tested by its fit to the data. A causal indicator model of reading is presented that is capable of integrating multiple sources of information from multiple levels. A causal indicator model differs from a common factor model in that indicators explain variance in the factor rather than the reverse. For example, risk of having a heart attack is explained by age, presence of a family history of heart problems, and evidence of the presence of arteriosclerosis.

Participants and Methods: A causal indicator model of reading was developed and tested by its fit to data provided by a sample of 95 8th grade students. Multiple measures were obtained of listening comprehension, decoding, and reading comprehension, with gender serving as a biomarker of increased risk of impaired decoding.

Results: The model provided a good fit to the data: $\chi^2(10) = 16.3, p = .09, CFI = .98, RMSEA = .08$.

Conclusions: Causal indicator models represent a promising class of models for integrating behavioral and neurobiological variables of common disorders. The ability to test their fit to the data provides a more rigorous evaluation of explanations of disorders than has previously been the case. The models provide an estimate of both bivariate and unique effects of all variables in the model. Implications for causal indicator models for assessment of reading problems will be discussed.

Correspondence: *Richard Wagner, Ph.D, Psychology, Florida State University, Psychology Department, W. Call Street, Tallahassee, FL 32312. E-mail: rkawagner@psy.fsu.edu*

B.L. WILLIAMS & J.M. FLETCHER. Differentiating Attention Deficit Hyperactivity Disorder and Reading Disability Using the Verbal Selective Reminding Test.

Objective: Previous literature has examined the capacity of the Verbal Selective Reminding Test (VSRT) to differentiate children with learning disabilities in reading and math, and with ADHD. The present study assessed the differences in the performance of children with ADHD, RD, and ADHD/RD on two VSRT measures: Long Term Storage (LTS) and Consistent Long Term Retrieval (CLTR).

Participants and Methods: Participants were 51 children (36 ADHD, 5 RD, and 10 ADHD/RD) selected from an archival database of children evaluated for learning problems. Using ANOVAs, group performance was compared on two measures of the VSRT: LTS and CLTR. The performance of children with ADHD who were medicated during the evaluation was compared to performance of children who were not medicated during the evaluation. We hypothesized that due to their difficulties with inattention, children with ADHD would perform lower than children with RD on both measures. We also hypothesized that children who were medicated during the evaluation would perform higher than children who were not medicated during the evaluation.

Results: Relative to norms, the ADHD/RD group performed far below age expected levels. As predicted, children with ADHD demonstrated poorer performance than children with RD on LTS and CLTR for the VSRT. The comorbid group consistently showed the most severe deficits of the three groups. When comparing the performance of children with ADHD who were medicated during the time of evaluation versus children who were not, there were no significant differences, although mean differences showed higher performance in medicated children.

Conclusions: LTS and CLTR of the VSRT were differentially sensitive to the difficulties with inattention associated with ADHD. Future research should include larger groups of children with RD.

Correspondence: *Baruch Williams, Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204. E-mail: blwilli7@central.uh.edu*

TBI (Child)

B. ANDREWS, M.D. SADY, L. TAMBERRINO, P. YEVOO & G.A. GIOIA. Differences in Symptom Recovery after Concussion based on Mood Disorder History.

Objective: Various premorbid factors have been thought to influence recovery from concussion, but findings have been mixed. Prior mood disorder has been related to increased rates of psychopathology following injury, but less is known about the impact of mood disorder history on recovery trajectories of concussion symptoms.

Participants and Methods: Adolescents (age 13-19y, $M = 15.5, SD = 1.3$), referred for evaluation within 60 days of concussion, and their parents completed symptom ratings at three clinic visits. They also reported presence or absence of preinjury mood disorder (anxiety, depression, or bipolar disorder) and injury characteristics. Participants with mood disorder history ($n = 28$) were compared to those without ($n = 108$), with no differences in sex, race, or injury characteristics between groups. We examined differences between groups in symptom ratings across 3 visits, controlling for retrospective preinjury symptom ratings.

Results: Patients with a history of mood disorder and their parents reported significantly higher emotional symptoms at visit 1, and the recovery trajectories flattened by visit 3, while patients without prior mood disorder continued to improve in all symptoms over time. Parent report indicated a similar pattern of plateaued recovery of visit 3 cognitive symptoms. There were no group differences in self- or parent-reported physical or sleep symptoms.

Conclusions: As hypothesized, concussed patients with a history of a mood disorder had higher emotional symptoms and showed a slower improvement in these symptoms over time compared to those without, even after controlling for preinjury symptom status. Clinical implications include educating patients with mood disorder history about the risk of prolonged symptom recovery, and ensuring that such patients have appropriate emotional support throughout recovery. Future research should examine this phenomenon in younger children, explore differences in other measures of recovery status, and develop appropriate treatments to support recovery.

Correspondence: *Maegan D. Sady, Ph.D., Pediatric Neuropsychology, Children's National Medical Center, 15245 Shady Grove Road, Suite 350, Rockville, MD 20850. E-mail: maegan.sady@gmail.com*

M.D. SADY, C. MCGILL, E.H. GERST & G.A. GIOIA. Standardized Assessment of Cognitive Exertion in mTBI and Non-Injured Children.
Objective: Cognitive exertional effects (CEE; i.e., increasing symptoms) can occur in response to cognitive activities after mild traumatic brain injury (mTBI). This phenomenon has been well described clinically but has not been quantified. This study describes standardized assessment of CEE and establishes reliable change algorithms for clinical use.

Participants and Methods: Uninjured and mTBI (mean days since injury 14.8) participants (age- and gender-matched; $n = 382$ each, age 5-18y, $M(SD) = 13.0(2.9)$) underwent baseline or clinical evaluation, respectively. They rated 4 symptoms (headache, fatigue, concentration problems, irritability) on 0-10 scales (max. total 40) immediately before and after neurocognitive testing. Standardized regression-based (SRB) change score equations were applied to pre- and post-test symptom ratings in uninjured individuals to determine normative reliable change cutoffs. The equations were then applied to ratings in the mTBI group to identify an index of post-concussion CEE.

Results: Pre- to post-test difference score (Exertional Effects Index, EEI) was significantly lower in uninjured [$M(SD) = .6(2.3)$] than mTBI [$M(SD) = 1.9(3.7)$], $p < .001$. One-tailed SRB change scores in the uninjured group indicated that an EEI of three or more points exceeded 90% of the sample, establishing $EEI=3$ as a clinical cutoff. Applying this cutoff revealed that 31% of the mTBI group exceeded this level, a significantly greater proportion, $p < .001$.

Conclusions: Individuals without mTBI generally did not report CEE. However, almost one-third of children and adolescents 2 weeks post-mTBI did. These findings provide quantitative evidence that symptom worsening with cognitive activity is a documentable effect of mTBI. As it is thought that overtaxing an injured brain may prolong recovery, CEE following mTBI should be used in treatment planning and recovery determinations. Future research should examine CEE recovery curves and their relationship to other clinical variables (e.g., test performance, symptom report).

Correspondence: *Maegan D. Sady, Ph.D., Pediatric Neuropsychology, Children's National Medical Center, 15245 Shady Grove Road, Suite 350, Rockville, MD 20850. E-mail: maegan.sady@gmail.com*

G. AVCI, G. HANTEN, J. FABER, A. LLOYD-DAVIES, E.A. WILDE, K. HANTEN, X. LI, M. MACLEOD, L. EWING-COBBS, M. AITKEN, H. MULLINS, Z. CHU, J. HUNTER & H. LEVIN. Selective Learning and Memory Span after Early Brain Injury in Relation to DTI.

Objective: The impact of traumatic brain injury (TBI) on selective learning (SL), the ability to select items to learn from among other items, has been studied very little. Because memory capacity is limited, success in classroom learning, and in everyday activities, depends in part on the ability to selectively recall critical items of an informational set rather than less important items. We used performance measures and diffusion tensor imaging (DTI) to determine cognitive and white matter correlates of SL and memory span after pediatric TBI acquired at an early age (mean age of injury=4.19 years). We correlated fractional anisotropy (FA) and apparent diffusion coefficient (ADC) of the fasciculi connecting the cerebral regions putatively involved in SL to examine brain-behavior relations.

Participants and Methods: 22 participants with a history of TBI and 20 typically-developing participants matched by age, years of education and socioeconomic status were studied. SL was assessed by incentive-based word recall. The measure of SL efficiency (SLE) demonstrated preferential learning of words of higher value as compared to words of lower value. Memory span was measured by average number of words recalled without regard to word value.

Results: No behavioral differences were found in SL, although the TBI group displayed impaired span. No significant correlations were found between FA and SL whereas negative correlation between ADC and SL was reported only for the control group. The correlational analyses between DTI measures and span revealed (1) no significant results for the control group, (2) positive correlations between FA and span and (3) negative correlations between ADC and span in the TBI group.

Conclusions: Different patterns of DTI-related metrics are related to SL and span, which implies that SL and span are independent constructs. The lack of behavioral differences in SL, despite differences in between-groups neural-cognitive relationships has implications regarding neural plasticity.

Correspondence: *Gunes Avci, Ph.D., Baylor College of Medicine, 1709 Dryden Suite 1200, Houston, TX 77030. E-mail: avci@bcm.edu*

M.H. BEAUCHAMP, R. BEARE, M. DITCHFIELD, L. COLEMAN, F.E. BABL, M. KEAN, L. CROSSLEY, C. CATROPPA, K.O. YEATES & V. ANDERSON. Predicting Outcome After Childhood Traumatic Brain Injury: The Role of Susceptibility Weighted Imaging.

Objective: Traumatic brain injury (TBI) sustained during childhood can cause difficulties in a wide range of domains. However, ability to accurately predict the outcome of pediatric TBI remains limited. The advent of advanced neuroimaging techniques shows promise in improving outcome prediction, as they contribute to greater sensitivity in characterizing intracranial lesions underlying many cognitive and functional deficits. In this study, the relationship between lesions identified on susceptibility weighted imaging (SWI) and clinical, cognitive and functional outcomes was investigated following childhood TBI.

Participants and Methods: Participants between 5 and 14 years of age with varying levels of TBI severity (mild, mild complicated, moderate, severe, $n = 106$) underwent SWI on a 3T Siemens scanner on average 1 month post-injury and completed an assessment of intellectual functioning (WASI), processing speed (WISC), and behavioral (CBCL) and adaptive (ABAS) skills 6 months post-injury. Lesions visible on SWI were coded, segmented and compared to those identified on CT and conventional MRI (cMRI).

Results: Detection of any lesions occurred in CT scan in 68%, conventional MRI in 54%, SWI in 86% of cases. SWI detected additional lesions 30% of the time compared to CT and cMRI. More severe TBI was associated with poorer intellectual functioning, greater behavioral problems and lower adaptive functioning. Number and volume of SWI lesions were significantly correlated with clinical variables including Glasgow Coma Score, surgical intervention, length of hospital stay and intubation ($r's = .33-.43$, $p < .001$), as well as with IQ ($r = .23$, $p = .03$). Together, SWI and Glasgow Coma Score accounted for a significant, though small, proportion (6.5%) of the variance in IQ.

Conclusions: SWI is a sensitive technique for detecting brain lesions at all TBI severity levels and shows promise in contributing to prediction of cognitive outcomes in the initial stages post-injury after childhood TBI.

Correspondence: *Miriam H. Beauchamp, PhD, Psychology, University of Montreal, CP 6128 Succursale Centre-Ville, Montreal, QC H3C3J7, Canada. E-mail: miriam.beauchamp@umontreal.ca*

R.Z. BLAHA, A.W. BERNARD, M.W. KIRKWOOD, H.G. TAYLOR, T. STANCIN, T.M. BROWN & S.L. WADE. Factors Influencing Attrition in a Multi-Site Randomized Clinical Trial Following TBI in Adolescence.

Objective: Attrition in longitudinal research negatively affects statistical power, disrupts statistical stability, and can produce unwanted bias. Yet, few pediatric studies have focused explicitly on the topic. We set out to identify factors that influence attrition in a large longitudinal randomized clinical trial examining the efficacy of a web-based family problem solving treatment. We hypothesized that attrition would be greater amongst families with lower median incomes, less education, minority status, adolescents with less severe injuries, and longer time between injury and initial data collection (i.e., latency). We also anticipated that higher reported caregiver and teen satisfaction and engagement in the study would predict better completion.

Participants and Methods: Participants included 132 adolescents aged 12 through 17 years old who had sustained a complicated mild to severe TBI within the previous 6 months, and their families. Data collec-

tion points included baseline and 6-, 12- and 18-month follow-ups. All data collection was completed in the families' homes. Caregiver and teen satisfaction was measured by a brief satisfaction survey. Engagement was defined as time spent by families engaging in independent web-based activities.

Results: Attrition by time point was: 6 mo = 6%, 12 mo = 16%, 18 mo = 25%. Compared with families who dropped out at any point, families who completed had a significantly higher median income ($p < .001$) and more education ($p = .002$) and were less likely to be from a minority group ($p = .05$). In regression analyses with all participants, higher median income was associated with completing more follow-up assessments ($p = .003$). Injury severity, latency, satisfaction, and engagement did not predict attrition.

Conclusions: Our results confirmed previous findings that higher income and parental education protect against attrition. Recommendations for decreasing attrition in pediatric TBI studies and needed future research are discussed.

Correspondence: *Robert Z. Blaha, M.A., Rehabilitation, Children's Hospital Colorado, 13123 E. 16th Ave. B285, Aurora, CO 80045. E-mail: robert.blaha@childrenscolorado.org*

R.J. CASE, N. STARKEY, V. FEIGIN, K. JONES & S. BARKER-COLLO. The Relationship Between Mild Traumatic Brain Injury and Post-Injury Developmental Functioning in Children: 12-month Outcomes from the COBIC Study.

Objective: Traumatic Brain Injury (TBI) in children is a common cause of death and long-term disability that can impact on developmental functioning across multiple domains. However, there has been wide variation in the findings related to pediatric mild TBI. More detailed information about the impact of mild TBI on cognitive and academic functioning in childhood is necessary. The longitudinal COBIC study examined relationships between mild TBI and developmental and academic functioning in children aged 6-12 years, 12-months post-injury.

Participants and Methods: Using WHO criteria, children identified with TBI (N=41) completed a comprehensive series of neurodevelopmental assessments and multi-dimensional questionnaires, spanning emotional, social, behavioural, cognitive and academic functioning. Additional developmental information was obtained from parents and school teachers. Recruited for the purposes of developmental comparison, a matched cohort of children free from TBI (N=41) completed the same measures as the TBI group.

Results: Children who had experienced a mild TBI 12-months previously were significantly more likely than their non-injured peers to demonstrate symptoms of emotional and behavioural disorders. Levels of overall cognitive functioning and academic performance were significantly lower and learning disorder rates were higher in the TBI group than the matched cohort.

Conclusions: The results of the first-stage of the COBIC study suggest that children with mild TBI face increased risk for poor outcomes across multiple domains of development, including cognitive deficits, emotional distress, behavioural problems and learning disorders. While the underlying mechanisms of these psychological symptoms is complex, children who experience mild TBI may represent a subset of children who are at higher risk of experiencing global developmental difficulties. The inter-related nature of these symptoms is discussed and a reconceptualisation of mild TBI as a marker for other developmental difficulties is proposed.

Correspondence: *Rosalind J. Case, MSocSc (Psych), PGDipPsych (Clin), Psychology, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand. E-mail: rcase@waikato.ac.nz*

C.L. CASTILLO, A. FAYAD & S. MILLER. Post-Concussion Syndrome and Psychiatric Emergence: A Female Factor in Pediatric Concussion Recovery?

Objective: Sports-related concussion is a very popular topic, but most of the focus is on cognitive recovery and return-to-play decisions, without emphasis on new psychiatric issues. This preliminary research is pursued to help identify some possible factors impacting concussion recovery in female participants.

Participants and Methods: Of the 17 adolescents who completed a neuropsychological evaluation during the last 2 years for post-concussive syndrome, there were 8 females, 5 of whom had no prior psychiatric treatment but were referred for such following their evaluation due to the significant impact their mood or anxiety was having on their school participation, pain management, and life activities. An additional patient had a premorbid history of mild depression, but following her concussion she experienced an increase in symptoms. All of the 6 female patients were also suffering from headache that ranged from moderate to severe. Information was collected through chart review and clinical interviews with patients and their parents.

Results: Of the 6 female patients, all were driven toward academic excellence and athletic prowess. Five of the patients were given mood disorder diagnoses following their neuropsychological evaluation and one was given a diagnosis of Generalized Anxiety Disorder. All but one of the patients had a significant family history of anxiety, depression, or other mental health difficulties; notably, the patient diagnosed with GAD did not have any known family history of psychiatric diagnoses.

Conclusions: Despite the small sample, this propensity for female athletes to suffer from such significant psychiatric difficulty following concussion is unusual, especially considering that the same pattern was not identified for the male patients evaluated for similar reasons. Females driven toward academic and athletic success may place themselves at greater risk for slower recovery periods given the frustration they experience about their inability to return to their premorbid levels of functioning.

Correspondence: *Christine L. Castillo, PhD, Psychiatry, Children's Medical Center Dallas, 7601 Preston Road, P4300, Plano, TX 75024. E-mail: christine.castillo@childrens.com*

J. COOPER, S. ROSEMA, R. BEARE & V. ANDERSON. Neural Substrates of Autobiographical Memory in Adolescents after Traumatic Brain Injury.

Objective: Little research has focused on the retrieval of autobiographical memories (ABM) in adolescence, yet its development is critical for autonomy. Even less is known about the neural substrates of ABM in this group. Adult studies suggest that the hippocampi and areas of the prefrontal cortex are crucial in the recollection of ABM. Our previous work with children, using a novel test permitting the naturalistic experiencing of real-world events in an incidental fashion, and their subsequent probing in a surprise memory test allowed us to establish that by (mean) age 12, recall of recent autobiographical memories is well developed. The aim of this study was to use this test to investigate the neural substrates of ABM in adolescence and the effect that brain injury has on such abilities.

Participants and Methods: Adolescents who sustained moderate-to-severe paediatric TBI and were between 1-4 years post-injury were asked to think about recent and past personal events during functional magnetic resonance (fMRI) imaging. The novel event related fMRI paradigm was a modification of the naturalistic ABM task and consisted of questions presented visually (i.e. 'remember meeting the researcher'). The participant responses, reaction times and functional imaging data was compared to a group of typically developing age matched controls.

Results: Patients with brain injury had significantly reduced spatiotemporal context and the less specific details that make a personal memory truly episodic and precisely accurate compared to controls ($p < 0.05$).

Imaging analyses using SPM8 revealed a network of areas of activation when recalling personal memories that included a left lateralized network of regions including the hippocampus, medial prefrontal region, anterior cingulate and temporoparietal junction.

Conclusions: There is a network of brain regions involved in autobiographical recall in adolescents. TBI differentially influences the detail and accuracy of personal memory recollection.

Correspondence: *Janine Cooper, PhD, Child Neuropsychology, MCRI, Flemington Road, Parkville, Melbourne, VIC 3070, Australia. E-mail: janine.cooper@mcri.edu.au*

A. GLANG, E. DEBBIE & T. BONNIE. Student Transition re-Entry Program: Connecting Hospitals and Schools following Pediatric Brain Injury.

Objective: Although medical treatment of children and youth with traumatic brain injury (TBI) has improved dramatically in the last decades, long-term treatment of the behavioral, cognitive, and social needs of this population has not kept pace with medical advances. Further, as a function of shortened hospital stays and the chronic nature of problems arising from pediatric TBI, a critical service provider for children and adolescents has become the school. A key factor contributing to providing access to children with TBI to support services in school is communication between the hospitals that treat children for TBI and the schools who educate them.

Participants and Methods: The STEP (Student Transition re-Entry Program) model is a comprehensive hospital-to-school transition protocol that bridges the gap between hospital and school settings. Working through regional coordinators in each state's Department of Education, the STEP model targets appropriate identification and supports for children with TBI in school settings. The efficacy study employed a randomized control trial in which 70 participants from 3 states were randomly assigned to either the STEP or Usual Care condition.

Results: Multivariate analysis of variance were used to examine differences between children who received STEP and children who received Usual Care. Preliminary results suggest that among students who do not receive hospital rehabilitation services, students receiving STEP service were identified significantly more often for special education services and received more services (e.g., speech-language therapy, social-behavioral supports) than students who received Usual Care.

Conclusions: The STEP intervention appears to improve the link from hospital to school previously available only to students receiving rehabilitation services. Hospital and community-based neuropsychologists play an important role in supporting this linkage and in improving access to school-based services for children with TBI.

Correspondence: *Ann Glang, PhD, CBIRT, Teaching Research Institute, Western Or Univ, 99 W. 10th Suite 370, Eugene, OR 97405. E-mail: glanga@cbirt.org*

S. GORMAN, M. BARNES, P. SWANK & L. EWING-COBBS. Working Memory Development Following Pediatric Traumatic Brain Injury: A Longitudinal Analysis.

Objective: The purpose of this study was to investigate the developmental trajectories of verbal and visual-spatial working memory in children following traumatic brain injury, as compared to children with orthopedic injuries, and to determine how age at injury and injury severity affect growth.

Participants and Methods: The sample included 42 children with severe head injury, 13 children with complicated mild-moderate head injury, and 47 children with orthopedic injury. Longitudinal data was collected at 2, 6, 12 and 24 months post-injury. A multivariate approach to individual growth curve modeling was utilized and the data was centered at 12 months post-injury. The working memory measures consisted of verbal and visual-spatial tasks with parallel processing requirements.

Results: At 12 months post-injury, children in all three injury groups with varying age at injury did not differ significantly on verbal or visual-spatial working memory performance. The injury groups did not differ on working memory performance when age at injury was held constant. A significant rate of change by age at injury by injury group interaction for verbal working memory (and a similar pattern for visual-spatial working memory) revealed that children injured at a younger age with more severe injuries demonstrated the slowest working memory growth, but that as age at injury increased, older children with severe injuries exhibited faster growth. A significant positive relation was found between level of performance on verbal and visual-spatial working memory tasks at 12 months post-injury, but not for rate of growth.

Conclusions: This study lends further support to the early vulnerability hypothesis, which suggests that children sustaining traumatic brain injury at a younger age are more vulnerable to cognitive deficits than those injured at older ages. The implications of these results are discussed in relation to assessment and intervention for children with traumatic brain injury.

Correspondence: *Stephanie Gorman, M.A., University of Houston, 3212 Vista del Sur, Albuquerque, NM 87120. E-mail: sgorman85@gmail.com*

L. HARIK, P.R. SWANK, M. PRASAD, H. HANNAY & L. EWING-COBBS. Written Expression Following Pediatric Traumatic Brain Injury In School-Aged Children.

Objective: Despite the significant impact of pediatric traumatic brain injury (TBI) on academic performance, few studies have examined changes in written expression (WE). The present study examined WE one year following hospitalization in children ages 6-15 with moderate to severe TBI (n= 55) or orthopedic injuries (OI; n= 47).

Participants and Methods: WE was measured by the quality of writing samples based on the Thematic Maturity Index from the Test of Written Language. Skills that play either core or supporting roles in the execution of WE were also examined. Core processes included: 1) graphomotor speed, 2) spelling and 3) fine motor speed and coordination and 4) writing fluency. Supporting processes included 1) working memory, 2) processing speed and 3) attention. After covarying age at injury, GLMs were used to examine group differences on all skills. Bootstrap regression analyses were employed to see if core and supporting skills were potential mediators of the effect of TBI on WE.

Results: Children with TBI performed more poorly on WE, all core skills (graphomotor speed, fine motor speed and coordination, writing fluency and spelling), and two supporting skills: processing speed and working memory. No significant effect of group was found on measures of attention; these scores were removed from the mediation analyses. Bootstrap regression analyses revealed that the effect of TBI on WE was significantly mediated by writing fluency. Non-significant mediators included graphomotor speed, fine motor speed and coordination, spelling, processing speed and working memory.

Conclusions: These findings are relevant for intervening with WE difficulties in children with TBI. Most commonly, WE interventions focus on metacognitive strategies such as self-regulation and low-level transcription skills. Emphasizing writing fluency in addition to these already well-established targets for improving WE may provide added benefit in this population. This project was supported by NIH grant R01-NS046308.

Correspondence: *Lindsey Harik, M.A., University of Houston, 3720 W. Alabama St, #2206, Houston, TX 77027. E-mail: linharik@gmail.com*

C.P. JOHNSON, E.C. MAXWELL, J. JURANEK & L. EWING-COBBS. Exploring the Effect of Age at Injury on White Matter Integrity in Pediatric TBI: A TBSS Diffusion Tensor Imaging Study.

Objective: While studies of pediatric traumatic brain injury (TBI) and orthopedic injury (OI) populations using diffusion tensor imaging (DTI) tract-based spatial statistics (TBSS) have identified expected differences in time-related white matter degeneration via changes in fractional anisotropy, it is currently unknown what the effect of age-at-injury is on this pattern of differences. The current study attempts to elucidate age-related variation in white matter changes based on age-at-injury in a pediatric TBI population.

Participants and Methods: 59 participants (32 TBI, 27 OI) between the ages of 5 and 15 received DTI scans at 2 months and 24 months post-injury. 24 month data was submitted to TBSS processing using the FMRIB Software Library (FSL) suite of imaging tools. A general linear model was generated to investigate the main effects of age and group membership, as well as the interaction of group with age on skeletonized FA maps of the brain. Contrast scores were generated using the Threshold-Free Cluster Enhancement procedure.

Results: Results of general linear modeling included expected group differences in FA, with higher OI than TBI values in most regions ($p < 0.01$), as well as age effects in most regions ($p < 0.01$). There was an interaction of age and group in several areas, with notable clusters of difference in the temporal lobe, orbitofrontal region, and cerebellum, with significant implication of major associative fiber bundles, including the superior longitudinal and uncinate fasciculi ($p < 0.05$).

Conclusions: Age related variations in effects on FA may affect the findings of TBSS analyses in TBI study of children. As such, age variables need to be included in comparisons of pediatric TBI and OI/control groups to clarify the effects of injury from age. Future study will include comparison of imaging at 2 and 24 months post-injury with the interaction of age to identify patterns of arrested development of white matter versus Wallerian degeneration of damaged axons in a pediatric population. NIH R01-NS046308

Correspondence: *Chad P. Johnson, PhD, Pediatrics, University of Texas Health Science Center, Suite 1000, Room 10.03, 6655 Travis, Houston, TX 77030. E-mail: Chad.P.Johnson@uth.tmc.edu*

C.L. KARVER, H. MCPHERSON, P. CHIU, H. TAYLOR, K.O. YEATES, N.C. WALZ & S.L. WADE. Hot and cold executive functions following pediatric traumatic brain injury (TBI).

Objective: Recent research has sought to distinguish hot, or emotionally laden, from cold, or non-emotionally laden, executive functions. The Iowa Gambling Test (IGT), considered a hot measure of decision-making and impulse control, is sensitive to post-TBI deficits in adults with limited evidence in children. Using one hot (IGT) and two cold measures (Tower of London- Drexel and DKEFS Verbal Fluency), we aimed to identify that which discriminates children with TBI from a comparison group with Orthopedic Injuries (OI) and examine predictors of performance.

Participants and Methods: Participants included 43 children (mean age = 11.55, SD = .99) with complicated mild to severe TBI (mean GCS = 10.97; SD = 4.46) and 54 with OI (mean age = 11.64, SD = .84). Groups did not significantly differ in time since injury or age at testing [mean months = 75.47 (11.10) for the TBI group and 79.18 (10.93) for OI; $p > .05$]. TBI participants were subdivided by injury severity (complicated mild to moderate or severe).

Results: A borderline significant group difference was found for the Tower of London Total Moves score [$F(2, 94) = 2.61, p = .07$]. Pairwise comparisons revealed that the severe TBI group significantly underperformed the OI group [$t(62) = 2.01, p = .04$]. Controlling for injury status, Processing Speed Index scores significantly predicted Total Moves scores (unstandardized $\beta = .27, t = 2.73, p = .008$); injury-related and demographic factors were non-significant predictors. Non-significant group differences were found when considering the IGT and the DEKFS Verbal Fluency ($p > .05$).

Conclusions: While these results suggest that the Tower of London, a cold measure of planning and problem-solving, is sensitive to severe TBI, we failed to find similar evidence for the IGT or DKEFS Verbal Fluency. Consistent with previous authors, we posit that the IGT may not be appropriate for children who are experiencing continued frontal lobe development. Further research that includes other measures of hot executive functions is necessary. Correspondence: *Christine L. Karver, M.A., Psychology, The University of Cincinnati, Department of Psychology, 1 Edwards Center ML 0376, Cincinnati, OH 45221. E-mail: karvercl@mail.uc.edu*

A. LEVAN & S.D. GALE. Hippocampal Volume, Cognitive Proficiency Index and the CVLT-C: Predictors for Social Reintegration After Pediatric Traumatic Brain Injury.

Objective: To examine whether children with a history of traumatic brain injury (TBI), whose parents judge as having “excellent” or “complete” social reintegration, have larger hippocampal volumes and better neuropsychological test scores on measures of processing speed and memory than children who do not achieve this same level of reintegration.

Participants and Methods: Twenty-five children (17 males; average age=12.6, SD=2.25) with post-acute TBI (mean=3.3, SD=1.6 years post-injury) were evaluated. Children were divided into two social integration groups based on parental ratings. Neuropsychological measures included the California Verbal Learning Test for Children (CVLT-C) and the Cognitive Proficiency Index (CPI), which is based on both the Working Memory and Processing Speed Indices of the WISC-IV. High-resolution 3D T1 scans were acquired from which hippocampal volumes were obtained.

Results: Children judged not to make a complete or excellent social reintegration had significantly smaller hippocampal volumes and worse neuropsychological test performance on the CVLT-C and the CPI. Hippocampal volumes correlated with the child's CPI ($r=.507, p=.01$) and parental ratings of level of social integration ($r=-.505, p=.01$). CPI also correlated significantly with parental ratings ($r=.745, p=.01$).

Conclusions: Preliminary findings demonstrate that factors related to social integration, as reported by parents, were related to total hippocampal volume, CPI, and CVLT-C measures rather than injury severity as measured by the Glasgow Coma Scale. Thus, these factors may predict a child's long-term psychosocial outcome more than injury severity alone.

Correspondence: *Ashley Levan, Clinical Psychology, Brigham Young University, 1423 S. 465 W., Orem, UT 84058. E-mail: Levanaj17@gmail.com*

E.C. MAXWELL, J. JURANEK, P.R. SWANK, M.A. BARNES & L. EWING-COBBS. Math Performance and White Matter Microstructure in Children with Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) results in widespread alteration of macrostructure and microstructure in white matter. Consequently, children with TBI experience a range of academic difficulties including reduced mathematical performance. The current study examined mathematical performance between children with TBI and those with orthopedic injuries (OI) in relation to microstructure in pathways hypothesized to relate to mathematical abilities.

Participants and Methods: Participants (ages 7.4 to 17.7 years) had been hospitalized for TBI ($n = 32$) or an OI ($n = 27$) and completed Woodcock-Johnson III Calculation and Applied Problems subtests and imaging 2 years post injury. Tract-based spatial statistics was implemented to align participants' fractional anisotropy (FA) maps to a standard image. Tracts of interest were the superior longitudinal fasciculus (SLF) and its temporal part (SLFTP), anterior thalamic radiation (ATR), and the uncinate fasciculus (UF). FA from the left SLF, SLFTP, and ATR was expected to account for significant variability in math outcomes.

Results: Relative to the TBI group, children with OI had significantly higher math scores and significantly higher FA, indicating greater integrity in all pathways. Hierarchical regression models predicting math outcomes included demographic and injury variables in the first step. The second and third steps included FA values from each left and right tract, respectively. For Calculation scores, $R^2\Delta$ for step 2 indicated that the left FA of the SLF, SLFTP, and ATR and their interactions with group accounted for significant additional variability. For Applied Problems, $R^2\Delta$ for step 2 was significant for the left FA of the ATR and UF. The right FA did not account for significant additional variability in either math outcome.

Conclusions: Microstructural changes in specific left hemisphere pathways were related to mathematical performance two years after pediatric TBI. This work was funded by the NIH grant R01-NS046308 awarded to LEC.

Correspondence: *Emily C. Maxwell, University of Houston, 4921 Crawford Street, Apt #18, Houston, TX 77004. E-mail: ecmaxwell@gmail.com*

C. MCGILL, M. ANCONA, B. CENTER, A. GRIFFIN, L. PRATSON & G. GIOIA. Symptom Profiles of Children and Adolescents With mTBI and ADHD.

Objective: Children who sustain mTBI can experience physical, cognitive, emotional, and sleep-related symptoms. Additionally, pre-injury characteristics, such as ADHD, may be a risk-factor for prolonged recovery. In this study, the relationship between a child's diagnosis of ADHD and post-injury symptom presentation is explored.

Participants and Methods: One-way ANOVA was used to evaluate post-injury symptoms with the Post-Concussion Symptom Inventory (PCSI) parent and child self-report forms, in 249 (76% male) children, aged 6 to 18 (mean age = 14.13 [2.68]). Children were classified into three groups and matched by gender and age group: 1) mTBI/no ADHD, 2) mTBI/ADHD- non-medicated, or 3) mTBI/ADHD-medicated.

Results: Children with mTBI/no ADHD and mTBI/ADHD-medicated were significantly different than mTBI/ADHD-non medicated on parent PCSI for cognitive (e.g., difficulty concentrating, remembering, following directions, $p < .05$) and emotional symptoms (e.g., more emotional, $p < .05$); no differences were found between the mTBI/no ADHD and mTBI/ADHD-medicated groups. On symptom self-reports, adolescents (age 13 to 18) with mTBI/ no ADHD reported less difficulty concentrating ($p < .05$) than both mTBI-ADHD groups. No significant differences were found between the three groups in the self-report of pre-adolescent children.

Conclusions: Pre-injury characteristics such as ADHD are important when assessing symptoms and managing recovery. Although ADHD can be a risk factor for prolonged recovery, this study demonstrates that children with ADHD do not necessarily experience more severe post-injury symptoms compared to injured children without ADHD. Overall, use of ADHD medications did not modify the symptom profile. This study also highlights the importance of capturing parent-report as part of a thorough clinical evaluation.

Correspondence: *Catherine McGill, Psy.D., Children's National Medical Center, 111 Michigan Ave, NW, Washington, DC 20010. E-mail: catherine.mcgill@hotmail.com*

T.L. MERKLEY, E.A. WILDE, A. LLOYD-DAVIES, M. MACLEOD, G. HANTEN, S. MULLINS, L. EWING-COBBS, M.E. AITKEN, Z.D. CHU, J.V. HUNTER & H.S. LEVIN. Social Communication and Frontotemporal Brain Indices Following Early Pediatric Traumatic Brain Injury.

Objective: Social communication skills are often adversely affected following traumatic brain injury (TBI). Frontal and temporal brain regions have been implicated in social cognition, and these regions are also susceptible to injury in TBI. The current study investigated the relationship between orbitofrontal and temporal pole volumetrics, white matter integrity of the uncinate fasciculus, and parent ratings of communication and socialization skills on the Vineland Adaptive Behavior Scales (Vineland-II) in pediatric TBI participants in the late chronic phase of recovery (mean post-injury interval=9.6 years).

Participants and Methods: Participants included 18 children (ages 9-18) who had a TBI years previously (mean age at injury=3.8 years) and 18 matched controls. T1-W MRI data were analyzed using Freesurfer for cortical volume of orbitofrontal and temporal pole regions. FA and ADC of the uncinate fasciculus were derived using Philips fiber tracking software.

Results: Parents rated children in the TBI group as being less adept at communication and socialization skills. Reduced cortical volume of the temporal pole was observed bilaterally in the TBI group, with a trend for increased ADC in the left uncinate. In the TBI group alone, communication skills were positively associated with orbitofrontal cortical volume bilaterally, left temporal pole cortical volume, and right uncinate FA. Negative associations were found with communication skills and uncinate ADC bilaterally. Socialization skills were negatively associated with uncinate ADC bilaterally. The control group did not demonstrate similar associations between social communication ability and frontotemporal brain indices.

Conclusions: Even after several years of recovery, children who acquired a TBI at a young age may display poorer communication and social skills as compared to their age-matched peers. This may be due in part to reduced white matter integrity of the uncinate fasciculus and volume loss in the temporal pole, which are likely sequelae of TBI.

Correspondence: *Tricia L. Merkley, Physical Medicine & Rehabilitation, Baylor College of Medicine, 1709 Dryden Rd., Ste. 1200, Houston, TX 77030. E-mail: merkleytl@gmail.com*

M.R. NEWSOME, R.S. SCHEIBEL, A.R. MAYER, Z. CHU, E.A. WILDE, G. HANTEN, J.L. STEINBERG, X. LIN, X. LI, T.L. MERKLEY, J.V. HUNTER, A.C. VASQUEZ, H. LU & H.S. LEVIN. How Functional Connectivity between Emotion Regulation Structures Can Be Disrupted: Preliminary Evidence from Youth with Chronic Moderate to Severe Traumatic Brain Injury.

Objective: Outcome of moderate to severe traumatic brain injury (TBI) includes impaired emotion regulation, associated with rostral anterior

cingulate (rACC) and right amygdala; however, functional connectivity between these structures has not been investigated in TBI patients. Further, white matter (WM) volume increases during healthy adolescence and early adult years (Lenroot & Giedd, 2007), and it is unknown how any disruptions to those increases affect functional connectivity. In addition, healthy development of the default mode network has been characterized by networks shifting from local to distributed (Fair et al., 2009), and it is unknown if this pattern is modified after TBI.

Participants and Methods: Seven youth with TBI (mean age 17.7y) and ten typically developing (TD) controls (16.8y) underwent resting state fMRI and completed empathy and impulsiveness measures.

Results: TBI youth demonstrated significantly less functional connectivity from both regions than the TD group and showed smaller right amygdala, and larger left rACC white matter, brain volumes. Relating volumes to connectivity, TBI patients showed greater positive relation between rACC WM volume and rACC connectivity in nearby bilateral medial frontal regions, while the TD group showed a greater positive relation than the TBI group between rACC WM volume and rACC connectivity in more distal cerebellum. Regression of empathy scores onto rACC connectivity revealed a greater positive relationship in the TD group than the TBI group in regions associated with emotion and empathy (postcentral gyrus, inferior parietal lobe).

Conclusions: Functional connectivity between structures involved in emotion regulation can be altered two to three years after TBI in youth. Possibly the TBI group failed to develop distributed functional connectivity due to increased WM pathology and were constrained by more local connections. Reduced empathy experienced by patients after TBI may be associated with reduced functional connectivity between the rACC and these regions.

Correspondence: *Mary R. Newsome, Baylor College of Medicine, Cognitive Neuroscience Lab, 6560 Fannin, Ste 12.59, Houston, TX 77030. E-mail: mnewsome@bcm.edu*

M. OCKEN-HELMEN, A. SESMA, K.J. KENYON & H.W. SESMA. Affective Variables Associated With Attention Performance Following Traumatic Brain Injury.

Objective: Research indicates that internalizing symptoms may be an important factor in mediating recovery from traumatic brain injury (TBI). The purpose of this study was to explore the association between affective symptoms on the Behavior Assessment System for Children, Second Edition (BASC-2) and performance on the Test of Variables of Attention (TOVA) in children with a history of either TBI or attention-deficit/hyperactivity disorder (ADHD).

Participants and Methods: Participants were 125 university pediatric neuropsychology clinic outpatients (27 in the TBI group; 98 in the ADHD group) who consented to have their deidentified clinical data used for research (59% boys; M age = 11.1 yrs, sd = 4.1). Participants completed the BASC-2 parent (TBI N = 26; ADHD N = 97) and self-report (TBI N = 18; ADHD N = 37) as well as the TOVA (TBI N = 24; ADHD N = 68).

Results: Parent report of internalizing symptoms (BASC-2: Internalizing Problems) explained a significant proportion of variance in TOVA omission ($R^2 = .26^{**}$) and commission errors ($R^2 = .43^{***}$) for the TBI group such that more internalizing symptoms were related to more errors. In the ADHD group, parent report of internalizing symptoms was not related to TOVA performance. On self-report ratings, internalizing symptoms in both the TBI and ADHD groups were negatively correlated with omission and commission errors but explained more variance in TOVA omission and commission errors in the TBI group ($R^2 = .42^{**}$, $R^2 = .28^{*}$) than the ADHD group ($R^2 = .19^{*}$, $R^2 = .13^{*}$).

Conclusions: Attention problems post-TBI may be explained in part by internalizing symptoms. Parent-reported internalizing symptoms were related to attention problems in the TBI group but not the ADHD group. While self-reported internalizing symptoms were related to attention in both groups, this association was stronger for children with a history of TBI. Results support the hypothesis that internalizing symptoms are associated with cognitive deficits in prolonged recovery from TBI.

Correspondence: *Megan Ocken-Helmen, Psy.D., University of Minnesota, MMC Box 486, 420 Delaware St. SE, Minneapolis, MN 55455. E-mail: ocke0006@umn.edu*

S. ROSEMA, F. MUSCARA, V. ANDERSON, C. GODREY, S. EREN & C. CATROPPA. Long-term social and psychological outcomes following childhood traumatic brain injury.

Objective: Childhood traumatic brain injury (CTBI) is one of the most common causes of mortality and disability in children and adolescents that impacts on the development of neuropsychological, social and psychological functioning. A disruption of development in these areas often results in long-term problems with interpersonal relationships, participation in leisure and social activities, and employment status. Neuropsychological outcomes have been investigated to a greater extent; nevertheless it seems that social and psychological problems appear to persist longer in comparison to other functional consequences however long-term outcome data is scarce. The aim of this study is to investigate social and psychological outcomes 15 years post injury.

Participants and Methods: 34 TBI participants and 17 healthy controls (mean age 21.3 years, 27 male) were recruited from a larger sample, that was based on consecutive admission to the neurosurgical ward of the Royal Children's Hospital, Melbourne, Australia, between 1993 and 1997. Information about social and psychological functioning was collected via questionnaires and a structural clinical interview at 15 years post-injury. An ANOVA was employed to compare social and psychological functioning between CTBI survivors and their healthy peers.

Results: Participants with CTBI have significantly more psychological symptoms and impaired social adjustment ($p < 0.05$) than their healthy peers 15 years following their injury. CTBI survivors' were found to score lower on social functioning, especially in communication, and higher on psychological symptoms as depression, anxiety and aggression.

Conclusions: Preliminary findings suggest that adolescents and young adults, whom survived a brain injury during childhood, are more at risk of developing social and psychological problems following their transition into adulthood. This may lead to a compromise in their quality of life and well being as an adult.

Correspondence: *Stefanie Rosema, M.Sc, Murdoch Childrens Research Institute, 16 David St, Carlton, TAS 3053, Australia. E-mail: stefanie.rosema@mcri.edu.au*

J. ROSENBERG, C. SALORIO, S. SUSKAUER & B. SLOMINE. Neuropsychological Functioning and Symptom Report after TBI Based on Injury Severity in Children who Require Brief Hospitalization.

Objective: Little research has focused on children with traumatic brain injury (TBI) who require brief hospitalization. This study sought to investigate group differences on measures of attention and executive functioning (EF) and symptom report following TBI in children who required brief hospitalizations based on TBI severity.

Participants and Methods: Eighty-six children with TBI requiring brief hospitalization were evaluated in a neurobehavioral screening clinic (73% male, M age = 11.4 years, M days post-injury at evaluation = 41.0). Participants were categorized into three groups based on head CT findings [normal (group one, $n = 37$), skull fracture only (group two, $n = 9$), intracranial injury (group three, $n = 40$)].

Results: Groups did not differ on age, sex, mother's education or time since injury; however, group one had higher rates of premorbid attention and behavior problems. Group one had lower EF scores compared to group three ($p < 0.05$) and lower attention scores compared to group two ($p < 0.05$). Group three endorsed more sleep symptoms at some point post-injury than group one ($p < 0.05$). There were no group differences regarding the total number of physical, emotional, or cognitive symptoms post-injury; however, group three endorsed higher rates of headache and vomiting symptoms compared to group

one ($p < 0.05$), and group two endorsed higher rates of light sensitivity compared to group one ($p < 0.05$). There were no group differences among the total number of physical, cognitive, emotional, or sleep symptoms still present at the time of evaluation but group two continued to endorse higher rates of light sensitivity compared to group one ($p < 0.05$).

Conclusions: Premorbid attention and behavior may account for neuropsychological differences between groups whereas symptom report may be associated TBI severity (based on CT findings). In general, these symptom differences do not persist several weeks to months following the injuries.

Correspondence: *Jennifer Rosenberg, Ph.D., Neuropsychology, Kennedy Krieger Institute / Johns Hopkins School of Medicine, 1750 E. Fairmount Ave., Baltimore, MD 21231. E-mail: RosenbergJ@kennedykrieger.org*

A.R. SNYDER & R.M. BAUER. A Normative Study of the Sports Concussion Assessment Tool (SCAT-2) in Children and Adolescents.

Objective: Concussion is a complex pathophysiological process that affects domains of everyday functioning including, but not limited to, behavior, emotion, and cognition. Concussion is relatively common in organized sports and recreation, and children are particularly vulnerable due to their common involvement in youth sports and PE activities at a time of continuing brain development. Office-based tools (Sports Concussion Assessment Tool [SCAT2]) are useful candidate measures for incident concussion assessment, but require accurate baseline assessment to maximize utility. The American Academy of Pediatrics (AAP) endorses the use of the SCAT2 by pediatricians to diagnose incident concussions in practice, but no normative data exist for children. The SCAT2 measures several domains of functioning including self-reported symptoms, orientation, cognition, and postural stability (Balance Evaluation Scoring System; BESS) to create a summary performance index.

Participants and Methods: In this study, a community-based approach was implemented to compile baseline performance data on the SCAT2 in 185 children aged 9-18 to create age-graded norms stratified by ethnicity.

Results: Preliminary findings indicate a significant age effect on SCAT2 performance. Older adolescents and teenagers (ages 12-18) scored higher than younger children (ages 9-11). Significant age differences were also found on symptom report and BESS components of the SCAT2. Older children tend to report more symptoms of concussion and to obtain better BESS scores at baseline.

Conclusions: Overall, findings support the SCAT2 as a useful clinical tool for assessing baseline functioning in teenagers, but suggest that clinical utility is limited in children under the age of 11. Specifically, BESS and cognition components of the SCAT2 may be too developmentally advanced for younger children. Ongoing data collection through permanent installation of the SCAT-2 in pediatric practices will contribute to increased reliability and stability of these results over time.

Correspondence: *Aliyah R. Snyder, B.S., Clinical and Health Psychology, University of Florida, 1225 Center Drive, Room 3151, Gainesville, FL 32611. E-mail: aliyahsnyder@php.ufl.edu*

M. STERN, N.C. WALZ, K.O. YEATES, G. TAYLOR & S.L. WADE. Effortful Control Following Early Childhood TBI.

Objective: One component of temperament is effortful control, or the ability to engage in behavioral and cognitive self-regulation. Theoretically, effortful control has many similarities to the neuropsychological construct of executive functioning (EF). Despite growing evidence of the impact of traumatic brain injury (TBI) on EF, we know of no studies that have investigated the impact of early TBI on temperament or effortful control. We hypothesized that young children with TBI would show poorer post-injury effortful control than children with orthopedic injuries (OI).

Participants and Methods: 206 children with either an OI ($N=119$) or moderate to severe TBI ($N=87$) between the ages of 3-7 years, were

recruited to a larger study comparing the effects of TBI to OI on a variety of psychosocial and medical outcomes. Children and their parents completed assessments, including parent report of temperament (Child Behavior Questionnaire), on four occasions: a baseline visit that assessed pre-injury functioning retrospectively, and 6, 12, and 18 months post-injury.

Results: Controlling for demographic factors, the OI and TBI groups did not differ on pre-injury ratings of effortful control. However, parent ratings of effortful control were worse for children in the TBI group in comparison to the OI group at all three post-injury evaluations. Within the TBI group, pre-injury (baseline) effortful control was not correlated with injury severity. However, less effortful control was significantly correlated with greater injury severity at 6 ($r = .32$), 12 ($r = .38$) and 18 months ($r = .30$) post-injury.

Conclusions: Effortful control, while generally conceptualized as a stable trait, does change after children experience a TBI during early childhood. Future research should seek to understand the longer-term impact of early childhood TBI on temperament, the connection between effortful control and academic performance, and the relationship between post-injury temperament and moral behavior.

Correspondence: *Melissa Stern, BMCP, CCHMC, 3166 Sagola Pl, Cincinnati, OH 45209. E-mail: mstern1981@yahoo.com*

S. TLUSTOS, M.W. KIRKWOOD, H.G. TAYLOR, T. STANCIN, T.M. BROWN & S. WADE. Relationship between Social Competence and Functional Outcomes after TBI in Adolescence.

Objective: One of the peak incidence periods for traumatic brain injury (TBI) is during adolescence, a time during which significant brain maturation occurs. Functional impairments at home and school after adolescent TBI may be related to cognitive and behavioral deficits resulting from the direct impact of TBI on developing neural systems or secondary adjustment difficulties. Regardless, greater social competence may be expected to buffer adolescents from functional problems.

Participants and Methods: 102 adolescents aged 12-17 yrs at time of injury (Mage=14.5) with moderate or severe TBI (MGCS=9.8, SD=4.6) participated in this study, part of a longitudinal randomized clinical intervention trial. Only data from the baseline assessment, collected within 6 months of injury, are included. Parents completed a background questionnaire and ratings of social competence (Child Behavior Checklist [CBCL] Social Competence Subscale, Home and Community Social Behavior Scales [HCSBS] Social Competence Scale, and Behavioral and Emotional Rating Scale [BERS]). The Child and Adolescent Functional Assessment Scale [CAFAS] structured interview assessed overall post-injury functional status. Multiple regression analyses explored the relationship between social competence and concurrent functional outcome, in addition to injury characteristics (age at injury, GCS), cognitive abilities (2-subtest WASI, WISC-IV PSI) and demographic information (parental education, SES).

Results: Adolescents with moderate versus severe TBI did not differ on parental ratings of social competence so were combined. Ratings on the HCSBS ($\beta = -0.49$) and CBCL ($\beta = -0.24$, $ps < 0.01$), but not BERS, accounted for unique variance in the prediction of functional outcome, above and beyond traditional injury and demographic variables.

Conclusions: Ratings of social competence account for significant variance in functional outcomes after adolescent TBI. Future analyses will explore the effects of social competence on specific domains of functional outcome.

Correspondence: *Sarah Tlustos, Children's Hospital Colorado, 13123 East 16th Ave, Aurora, CO 80045. E-mail: tlostossj@gmail.com*

C. VAUGHAN, G. TAYLOR, M. KING, B. RAHMAN, M. SADY & G. GIOIA. School Problems Following Sports Concussion. Which Children Are At Greatest Risk?

Objective: Identifying pertinent pre-injury factors, injury characteristics or post-injury status related to adverse school outcomes for children with concussion is important for to help those children in need for support.

Participants and Methods: Data was gathered from 278 children ages 12-18 (mean (sd)=15.1 (1.7); 65% male) seen within 2 months of concussion (mean days since injury = 21.3 (12.5)). Pearson correlation, crosstabs, and stepwise regression were used to examine potential variables associated with school absence and a decline in grades following injury.

Results: There was no association between drop in grades and developmental delays, pre-injury school performance, developmental disabilities, or previous concussions. Higher maternal education and pre-injury symptoms (retrospectively reported) were associated with lower grades. Symptom burden (parent and child reported) and exertional effects following exercise were not related with lower grades, although presence of amnesia/ loss of consciousness and cognitive exertional effects were associated. Using logistic regression, only the presence of cognitive exertional effects was significantly associated with lower grades. History of an IEP/ 504 was the only pre-injury factor related to increased school absences post-injury. Symptom total at time of evaluation, sustaining a non-sport related injury (vs. sport), and having physical/ cognitive exertional effects were post-injury variables positively associated with school absences (days). Parent symptom report had the strongest association with school absences when comparing all significant predictors together. **Conclusions:** Pre-injury factors, injury characteristics, and post-injury status all exhibit a relationship to school absence. Cognitive exertional effects related most strongly to lower grades, while parent report of symptoms related most strongly to days absent from school.

Correspondence: *Chris Vaughan, Psy.D., Division of Pediatric Neuropsychology, Childrens National Medical Center, 15245 Shady Grove Rd, Suite 350, Rockville, MD 20850. E-mail: craughan@cnmc.org*

V. NEEDHAM, C. VAUGHAN, K. PRATSON & G. GIOIA. Return to Play Following Pediatric Concussion.

Objective: In response to recent legislation, children in most states and the District of Columbia are now required by law to have a signed clearance form before returning to sports. In a geographic region with laws requiring a final clearance, we sampled children to see how many had followed the recommended guidelines for licensed medical clearance.

Participants and Methods: Fifty-two patients (54% male, age mean = 14.4, SD = 3.3, min-max = 5.2 - 19.9) were surveyed approximately 5 months after concussion (mean days = 161, SD = 41, min-max = 87-250) following treatment in a concussion clinic. Fifty-two percent of the subjects were injured following sport related concussion.

Results: Seventy-eight percent of eligible subjects reported returning to sports following their injury. As was standardly recommended by the treating clinician, 93% of the sample completed a gradual return to play protocol as recommended by the Zurich Consensus Statement. However, in this sample only 74% reported having received final signed medical clearance despite having returned to sports. Final medical clearance was signed by treating clinicians from the concussion clinic (44%), athletic trainers (30%), and pediatricians (7.1%). Less frequently, a neurologist (4%), neurosurgeon (3%), parent (3%), or psychologist (3%) reportedly signed the final clearance form.

Conclusions: Implementation of state laws has been an important progression in concussion management and youth safety in sports. While many athletes completed standardly recommended guidelines for a gradual return to play in sports, a smaller percentage complied with the law by having signed written final clearance by a licensed healthcare provider before returning to play sports. An increase in awareness and adherence to state and local laws regarding concussion remain a continued need in concussion management to ensure the highest quality of care for future concussion patients.

Correspondence: *Chris Vaughan, Psy.D., Division of Pediatric Neuropsychology, Childrens National Medical Center, 15245 Shady Grove Rd, Suite 350, Rockville, MD 20850. E-mail: craughan@cnmc.org*

S.L. WADE, A. GLANG, H. TAYLOR, M. KIRKWOOD, M. SOHLBERG, T. STANCIN & K.O. YEATES. Interventions for Pediatric TBI: Timing, Targets, and Developmental Considerations.

Objective: The past decade has seen substantial growth in intervention programs for children and youth with TBI with emerging support for

evidence-based practices. The Rehabilitation Research and Training Center for Pediatric TBI Interventions was funded by NIDRR in 2009 to advance the field of interventions for pediatric TBI through a systematic and coordinated approach to development, replication, and dissemination of promising intervention practices.

Participants and Methods: The Center is conducting trials focusing on improving: 1) parenting skills and behavior problems in children 3-9; 2) behavioral functioning in teens 11-18; and 3) attention and executive functions in school-age children. To date, we have enrolled 100 adolescents and 65 young children with TBI.

Results: Overall, families have responded positively to each of the interventions and have expressed high levels of satisfaction with the information and skills that they have learned. Teen self-reports of satisfaction support the feasibility and utility of training in problem-solving and self-regulation skills- either one on one or supported by collaborative training with their families. However, family and adolescent feedback also underscores the importance of intervention timing, the child's developmental level, and the extent of their recovery.

Conclusions: The heterogeneity of child cognitive and behavioral sequelae and caregiver concerns poses challenges for standardized programs and necessitates tailoring to address individual needs. Linkages between treatment providers and schools are also critical, but often lacking in programs focused on child and family adaptation.

Correspondence: *Shari L. Wade, Ph.D., Pediatrics, Cincinnati Children's Hospital Medical Center, 3333 Burnet Ave. MLC 4009, Cincinnati, OH 45229. E-mail: shari.wade@cchmc.org*

TBI (Adult)

K.S. CHIOU, J. SLOCOMB & F.G. HILLARY. Voxel Based Morphometry Examination of Gray Matter Volume and Depression in Moderate and Severe Traumatic Brain Injury.

Objective: Global atrophy of the brain has been documented after moderate and severe traumatic brain injury (TBI). While these reductions in brain tissue volume have been associated with poor cognitive performance after injury, their effect on emotional functioning remains unclear. Depression is commonly experienced after TBI, and its prevalence has been found to be higher in individuals with TBI than in non-injured populations. The depression literature suggests that depression is associated with reduced frontal gray matter (GM), but this relationship has not been well examined in adults with moderate to severe TBI. This study uses voxel based morphometry (VBM) to examine global and local GM characteristics after injury and their relationship to depression. We predict that lower volumes of GM in adults with TBI will be related to more severe symptoms of depression.

Participants and Methods: 29 adults with moderate to severe TBI were recruited. All participants completed the Beck Depression Inventory-II (BDI-II) and received a MRI scan where T1 images were collected. The VBM toolbox for SPM8 was used to calculate whole brain GM volumes. The relationship between total GM volume and BDI-II scores was examined using correlation analyses. BDI-II scores were then entered as covariates of interest in SPM8 to identify specific areas of GM loss related to depression scores.

Results: Correlation analyses showed a significant negative relationship between the amount of global GM volume and scores on the BDI-II ($r = -0.52, p = 0.004$). Results from a correlation analysis in SPM8 showed that reductions in frontal GM gyri and the anterior cingulate were related to higher reported scores (suggesting more severe depression) on the BDI-II.

Conclusions: The association of lower frontal lobe GM volume with higher severity of depression found in our sample of individuals with TBI mirrors findings in non-injured populations. A comparison of GM frontal disruption associated with depression versus other cognitive deficits will be discussed.

Correspondence: *Kathy S. Chiou, MS, Psychology, The Pennsylvania State University, 347 Moore Building, University Park, PA 16802. E-mail: ksc167@psu.edu*

N. DIDEHBANI, M. CULLUM, S. MANSINGHANI, H. CONOVER & J. HART. The Role of Concussions in Depressive Symptom Endorsement for Aging Retired NFL Players.

Objective: While it is known that sports concussions can result from cognitive and/or mood disturbances, few have investigated the enduring effects that may emerge later in life, especially those related to depressive symptoms. The goal of this study was to assess the relationship between a remote history of concussions with current symptoms of depression, and examine specific symptoms endorsed by retired athletes.

Participants and Methods: Thirty retired NFL athletes with a history of concussion and twenty-nine age- and IQ- matched controls without a history of concussion were recruited. All participants completed the Beck Depression Inventory II, Wechsler Abbreviated Scale of Intelligence, and a full neuropsychological battery. The BDI-II was subdivided into a 3-factor model as proposed by Buckley (2001) in order to provide a more detailed analysis of reported symptoms. Concussion history was obtained retrospectively from athletes and informants, and classified using the AAN Practice Parameter guidelines for grading concussion (1997).

Results: Pearson correlations were conducted to assess the relationship between number of concussions and depressive symptoms. Independent t-tests were conducted to compare BDI-II scores between athletes and controls. The number of lifetime concussions and total scores on the BDI-II were significantly correlated ($r = 0.43, p = 0.02$). Upon investigating a 3-factor model of depressive symptoms (affective, cognitive, and somatic) of the BDI-II, the cognitive factor was significantly correlated with concussions ($r = 0.56, p = .002$). In general, NFL players endorsed more symptoms of depression on all 3 Buckley factors (affective, cognitive, and somatic) compared to controls.

Conclusions: The results suggest that athletes having sustained concussions in early adulthood may be at a higher risk for developing depression as they age compared to the general population (particularly cognitive symptoms of depression).

Correspondence: *Nyaz Didehbani, PhD, Center for BrainHealth at the University of Texas at Dallas, 2200 W. Mockingbird Lane, Dallas, TX 75235. E-mail: nyaz.didehbani@utdallas.edu*

S. HANNA, P. KLAS, E. JEFFAY, A. ZANJANI, M. VANDERMEER & K.K. ZAKZANIS. Pre-Injury Income and Return to Work after Mild Traumatic Brain Injury.

Objective: Cumulative research and multiple syntheses of the literature suggest that

neuropsychological impairment following mild traumatic brain injury (mTBI) typically does not persist three months after injury onset. However, a considerable number of patients report persistent impairment beyond this framework for expected recovery. Work in our lab has shown that performance on current neuropsychological tests is a poor predictor of return to work after mTBI. Accordingly, the current study builds on previous findings by looking to pre-injury income as a factor in disability status post-mTBI.

Participants and Methods: Thirty-two litigating patients who sustained a mTBI with subjective complaints related to cognitive functioning more than three months post injury were found to perform credibly on multiple measures of performance validity, met diagnostic criteria for a Cognitive Disorder, but were grouped into those that were unable to return to work because of cognitive impairment (i.e., disabled), and those that did return to work, despite being cognitively impaired (i.e., non disabled).

Results: The analysis revealed a significant between-groups difference, $F(1,31) = 4.818, p = 0.036$. Upon inspection of the means, those that reported that they were unable to return to work post injury had significantly lower pre-injury income than the non-cognitively disabled group. These results were confirmed by a regression analysis where disability was regressed onto reported pre-injury income, $b = -7.56, SE = 3.44, t(30) = -2.20, p = 0.036$, revealing that nearly 14% of the total variability between disability was accounted for by pre-injury income alone.

Conclusions: Consistent with our hypothesis, lower pre-injury income was associated with failure to return to work post-mTBI while greater pre-injury income was associated with successful return to work

Correspondence: *Elyas Jeffay, M.A., University Of Toronto, 1265 Military Trail, Scarborough, ON M3A1A5, Canada. E-mail: eliyas.jeffay@utoronto.ca*

P. KLAS, S. HANNA, E. JEFFAY, A. ZANJANI, M. VANDERMEER & K.K. ZAKZANIS. The Predictive Utility of Neuropsychological Testing in Patients with Mild Traumatic Brain Injury with and without Disabling Cognitive Impairment.

Objective: This study examined the ecological validity of neuropsychological tests in a typical battery by examining the relationship between test performance and the ability to return to work following mild traumatic brain injury (mTBI).

Participants and Methods: Archival data was collected from a random convenience-sample of 45 patients with mTBI who had been undergoing litigation and were referred for neuropsychological assessment due to complaints of cognitive impairment. All patients were free of neurological and psychiatric disorders, including substance abuse and previous head injury. The performance of disabled ($n=20$) and non-disabled ($n=25$) patients on each test of a typical neuropsychological battery was compared using a one-way ANOVA.

Results: No significant differences were found between the disabled and non-disabled groups for the majority of tests employed. However, it was found that performance on the WASI (Similarities and Block Design), Grooved Pegboard (Dominant and Non-Dominant), Digit Span (Total Score), CVLT (Trials 4, 5, List B, Short and Long Delayed Cued Recall) and BVM (Recognition Hits) was significantly poorer in the disabled group ($p<0.05$).

Conclusions: The lack of significant findings in the majority of tests examined suggests a lack of ecological validity with respect to the prediction of vocational status. It is important to take note of the tests that were found to be more predictive for use in clinical settings to inform opinions of diagnoses and prognoses.

Correspondence: *Elyas Jeffay, M.A., University Of Toronto, 1265 Military Trail, Scarborough, ON M3A1A5, Canada. E-mail: eliyas.jeffay@utoronto.ca*

A. ZANJANI, M. VANDERMEER, E. JEFFAY, S. HANNA, P. KLAS & K.K. ZAKZANIS. The Utility of a Novel Virtual Environment Test of Attentional Abilities in Mild Traumatic Brain Injury: A Pilot Study.

Objective: Virtual reality (VR) is one method that has been employed to improve the ecological validity in the examination of cognitive functioning in the context of a neuropsychological assessment. This study examines the sensitivity and efficacy of a novel VR test environment of attention called the Conveyor Belt Task (CBT) in patients who sustained a mild traumatic brain injury (mTBI).

Participants and Methods: The selective, sustained and divided attention subcomponent tasks of the CBT were administered to patients who sustained a mTBI ($n = 5$) and healthy normal controls ($n = 28$) along with traditional neuropsychological tests of selective and sustained (Ruff 2& 7 Selective Attention Test) and divided attention (Symbol Digit Modalities Test [SDMT], Brief Test of Attention and Trail Making

Results: The results of the current study suggest that the CBT had adequate criterion validity and was sensitive to attentional impairments in the mTBI group. The CBT was also found to be sensitive to attentional deficits in the mTBI group as a function of task difficulty, whereby patients performed significantly worse than healthy controls and to a greater extent as difficulty levels on each subcomponent task was increased. Finally, the divided attention subtest of the CBT was found to be positively correlated with the SDMT suggesting convergent validity with respect to divided attention.

Conclusions: The results from this pilot study suggest that the CBT may be an ecologically valid tool capable of elucidating subtle deficits in selective, sustained and divided attention in patients who have sustained a mTBI. Future studies with larger sample sizes are needed to support these findings.

Correspondence: *Elyas Jeffay, M.A., University Of Toronto, 1265 Military Trail, Scarborough, ON M3A1A5, Canada. E-mail: eliyas.jeffay@utoronto.ca*

B. HILL, M. ROHLING, A. BOETTCHER, J. KLINE, R. HOADLEY & M. WOMBLE. Positive Linear Relationship Between Traumatic Brain Injury Severity and Intra-Individual Variability Across a Neuropsychological Battery.

Objective: The current study examined the relationship between Traumatic Brain Injury (TBI) severity using loss of consciousness (LOC) duration and intra-individual variability (IIV) across a neuropsychological battery.

Participants and Methods: Data from 794 individuals (90.9% Caucasian, 74% Male, mean age = 34.6 years, mean education = 12.4 years) who presented for clinical evaluation using the Meyers Neuropsychological Battery and reported LOC associated with a head injury (mean LOC = 4.9 days) were utilized for the following LOC groups: <1 hour, 1 hour-1 day, 1 day-6 days, and >6 days. An overall test battery mean (OTBM) and standard deviation (OTBM SD) was calculated for each individual based on their single battery performance. The OTBM SD was used as the measure of IIV for each subject.

Results: The correlation of OTBM ($M = 40.89$ T, $SD = 7.585$) and OTBM SD ($M = 10.89$, $SD = 2.72$) was $r = -0.72$, $p<.001$. One-way ANOVAs for LOC group and both OTBM and OTBM SD were significant [OTBM $F(3, 790) = 87.571$, $p<.001$ and OTBM SD $F(3, 790) = 56.001$, $p<.001$]. Post-hoc comparisons revealed that all LOC groups except LOC 1 hour-1 day and 1 day-6 days were significantly different for OTBM and all groups were significantly different for OTBM SD. OTBM decreased with increasing TBI severity and OTBM SD increased linearly for each LOC severity group with a 29% increase in IIV from the <1 hour LOC group to the >6 days LOC group.

Conclusions: Our results support that performance inconsistency is a marker of neurologic pathology and that IIV increases in a linear fashion with increasing TBI severity. Additionally, this study demonstrates a novel approach to calculating IIV dispersion across a neuropsychological battery.

Correspondence: *Benjamin Hill, PhD, Psychology, University of South Alabama, 2000 UCOMM, CCP Program, Mobile, AL 36688. E-mail: bdhill@usouthal.edu*

K. MAESTAS, M. SHERER, A.M. SANDER & W.N. HAVINS. Predictors of Anxiety in Persons with Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) is associated with an increased occurrence of generalized anxiety disorder in the post-acute recovery period. However, little is known regarding factors that affect risk for anxiety in these patients. This study expands previous work by examining the impact of demographic and injury characteristics, as well as potentially modifiable factors, including psychological resilience, social participation, and emotional support, in predicting generalized anxiety in persons with TBI.

Participants and Methods: Participants were 121 adults (ages 18-64) with medically documented mild, moderate, and severe TBI who were evaluated an average of 2.8 years post-injury. The General Anxiety Disorder-7 was administered via interview to measure generalized anxiety. Predictor variables included standardized scores on the following computer adaptive tests: Psychological Resilience (TBI-QOL), Participation in Social Roles and Activities (Neuro-QOL), and Emotional Support (PROMIS). Injury characteristics were abstracted from medical records.

Results: Thirty-seven percent of participants reported mild to severe levels of anxiety. Simultaneous multiple regression analyses revealed that psychological resilience ($\beta = -.50$, $p<.001$) made a significant, unique contribution to predicting generalized anxiety. In contrast, age, gender, race/ethnicity, years of education, time to follow commands, time since

TBI, social participation, and emotional support were not predictive of generalized anxiety. The overall model accounted for 35.4% of the variance in generalized anxiety ($p < .001$). Interactions of demographic and injury characteristics with psychological resilience were also examined, and none was significant.

Conclusions: This study offers evidence that greater psychological resilience is associated with less anxiety after TBI. Therapeutic interventions designed to enhance psychological resilience may be beneficial in the prevention and alleviation of anxiety in this patient population.

Correspondence: *Kacey Maestas, Ph.D., Baylor College of Medicine, 2323 S. Shepherd, ste. 907, Houston, TX 77019. E-mail: kacey.maestas@memorialhermann.org*

C.M. MANNINO, C.J. DODSON, C.A. SIDERS, C.L. KERNAN, E. WOO, R.S. SWERDLOFF, C. WANG, R.C. CANTU, K.M. GUSKIEWICZ, D.F. KELLY & M.J. WRIGHT. Cognitive Effects of Hypertension and Concussion in Retired National Football League Players.

Objective: Obesity and hypertension rates are high among retired National Football League (NFL) players; this is possibly due to the cumulative impact of football-related injuries on post-retirement activity level. Given the higher rates of hypertension, retired football players are at risk for cerebrovascular issues and potential cognitive decline greater than that produced by repeated concussions alone. The objective of this study is to determine if hypertension results in cognitive decline independently or in conjunction with repeated sports-concussion in a sample of retired NFL players.

Participants and Methods: Forty seven retired NFL players completed a brief interview, assessment of blood pressure, and a test battery comprised of the Wechsler Adult Intelligence Scale-Third Edition's Digit Span, Symbol Digit Modalities Test, California Verbal Learning Test-Second Edition, Trail Making Test, Rey-Osterrieth Complex Figure Test, tests of verbal fluency (F, A, S & Animals), and the 36-Item Short Form Health Survey (SF-36). Neuropsychological tests were administered per standard protocol and the scores on each test were normed, averaged by domain, and each domain was averaged to compute global cognition scores. The SF-36 was administered and scored per RAND protocol. Systolic and diastolic blood pressures were used to compute hypertension values ranging from 0 (normal) to 3 (stage two hypertension).

Results: Linear regression confirmed that hypertension and concussion history were independent, but not interactive, predictors accounting for about 23% of the variance in global cognition. Also, hypertension was associated with concussion history and physical functioning, pain, and mental health as assessed by the SF-36.

Conclusions: Overall, retired NFL players suffer from high rates of hypertension and this is independently predictive of cognitive decline in this population. Future work should assess potential direct links between football-related injury history and the development of hypertension following retirement.

Correspondence: *Christina M. Mannino, M.A., Psychology, Loma Linda University, 1965 Highland Oaks Drive, Arcadia, CA 91006. E-mail: istinamannino@gmail.com*

C. NORSETH, J. EVANS, E. HANSON, S. ROPACKI & B. BARTNIK-OLSON. The Influence of Language and Mental Flexibility on Cerebral Metabolism Following Mild Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) can result in cognitive, emotional, behavioral, and neurological deficits that can persist more than a year after injury. The current preliminary study used 3D magnetic resonance spectroscopic imaging (MRSI) to determine if prolonged cerebral metabolic alterations occur in individuals with persistent cognitive deficits following mild TBI (mTBI) and if regions of altered cerebral metabolism are associated with changes in cognitive functioning. Understanding the possible relationship between metabolic and cognitive changes may provide a better understanding of why some individuals experience chronic post-concussive symptoms following mTBI and others do not. Therefore, this study aims to determine if MRSI is able to detect potential metabolic changes following mTBI and explore whether or not these changes affect cognitive functioning following mTBI.

Participants and Methods: This study included 13 mTBI subjects and 6 control subjects. Neuropsychological tests administered measured domains including language and executive functioning. MRSI was used to measure cerebral metabolic alterations.

Results: It was found that measures of cognitive functioning were predictive of alterations in cerebral metabolism. Specifically, significance tests suggested that performance on phonemic and semantic language fluency tasks had an influence on the N-acetylaspartate (NAA) to creatine (Cr) ratio (NAA/Cr) within the thalami for mTBI subjects, with little or no impact for controls. Additionally, this same pattern emerged for mTBI subjects on a task of mental flexibility, which predicted the NAA/Cr ratio within the thalami but again was not present for controls.

Conclusions: The findings from the current study suggest that cerebral metabolic changes as measured by MRSI may be different in mTBI patients with chronic post-concussive symptoms when compared to healthy controls. This knowledge may guide future research to explore possible ways to alter cerebral metabolism following mTBI.

Correspondence: *Clint Norseth, BS, Psychology, Loma Linda University, 9629 Shadow Springs Dr, Moreno Valley, CA 92557. E-mail: cnorseth@llu.edu*

J. EVANS, E. HANSON, C. NORSETH, B. BARTNIK-OLSON & S. ROPACKI. The Influence of Neuropsychological Performance on Cerebral Metabolism Following Mild Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) can result in cognitive, emotional, behavioral, and neurological deficits that can persist more than a year after injury. The current preliminary study used 3D magnetic resonance spectroscopic imaging (MRSI) to determine the nature of cognitive impairments and their relationship with chronic metabolic changes in mild TBI (mTBI) patients with chronic post-concussive symptoms. Understanding the possible relationship between metabolic and cognitive changes may provide a better understanding of why some individuals experience chronic post-concussive symptoms following mTBI and others do not. This study aimed to see if potential metabolic changes might explain reported differences in cognitive function between mTBI patients with similar injuries.

Participants and Methods: This preliminary study included 13 mTBI subjects and 6 control subjects. Neuropsychological tests administered measured domains including intelligence, processing speed, abstract reasoning, attention, language, and visual construction. MRSI was used to measure cerebral metabolism.

Results: It was found that measures of cognitive functioning were predictive of alterations in cerebral metabolism. Specifically, significance tests suggested that performance on tasks of non-verbal abstraction and visual construction had an influence on the N-acetylaspartate (NAA) to creatine (Cr) ratio (NAA/Cr) within the frontal white matter for mTBI subjects, with little to no impact for controls. Additionally, this same pattern emerged for mTBI subjects on a task of processing speed, which predicted the NAA/Cr ratio within the thalami but again was not present for controls.

Conclusions: The findings from the current study suggest that cerebral metabolic changes as measured by MRSI may be different in mTBI patients with chronic post-concussive symptoms when compared to healthy controls. This knowledge may potentially guide future research to strive to understand possible ways to alter cerebral metabolism.

Correspondence: *Julia Evans, Loma Linda University, 3116 Ocean Blvd., Corona Del Mar, CA 92625. E-mail: jlkroh@gmail.com*

L.C. OBERMEIT, S. AMAYA, E. WOO, M. SCHMITTER-EDGE-COMBE, J.M. FUSTER & M.J. WRIGHT. Memory for Performed and Observed Activities Following Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) is related to memory deficits for content, but not temporal order memory (TOM), of performed activities. We investigated content, source, and TOM for performed and observed activities following TBI, and examined the relationship between activity memory and functional outcome.

We posited that controls would outperform TBI participants on content and source memory for both activity types, there would be no group differences in TOM, and activity memory would correlate with functional outcome.

Participants and Methods: Eighteen control and 18 TBI participants performed 8 and observed 8 activities. Each activity lasted 2 minutes and was drawn in random order from two lists of equivalent everyday tasks. After activity completion, free recall and recognition discriminability (RD), source memory [(conditional source identification measures (CSIM)], and TOM (ordering of cards with activity descriptions) tests were administered. Functional ability was assessed via the Community Integration Questionnaire (CIQ).

Results: A series of 2X2 mixed ANOVAs were conducted to determine group differences. Spearman's rho was used to determine associations between activity memory and the CIQ. Controls showed superior recall and RD compared to the TBI group. No difference in TOM or CSIM was found. However, both group's CSIM values were near ceiling, thus impeding the assessment of source memory impairment in the TBI group. Neither group's memory varied as a function of activity type. CSIM and RD were associated with social integration in the TBI group.

Conclusions: This study confirms previous work and extends it to show deficits in content, but not TOM, for observed activities in TBI. We also found that activity memory (CSIM & RD) was associated with social integration. These data suggest that remediating activity memory deficits may lead to improved social outcomes for TBI survivors.

Correspondence: *Lisa C. Obermeit, Harbor-UCLA Medical Center, 6595 Reflection Drive Apt. 102, San Diego, CA 92124. E-mail: lisaobermeit@gmail.com*

M.E. O'NEIL, K. CARLSON, L. BRENNER, D. STORZBACH, M. ENSLEY & D. KANSAGARA. Consequences of Mild TBI in Veteran/Military Populations: A Systematic Review.

Objective: Twelve to 23% of service members sustain TBI while deployed to Iraq or Afghanistan (Terrio et al., 2009), most which are mild (MTBI; Hoge et al., 2009). Ten to 20% experience symptoms beyond three months (Ruff, 2005). No recent systematic reviews focus on TBI outcomes in Veterans/military members. Key questions: For Veteran/military populations, what is the prevalence of health problems, cognitive disability, functional limitations, and mental health symptoms that develop or persist following MTBI? Are there pre- or post-MTBI risk/protective factors that affect outcomes for MTBI? What is the resource utilization over time for Veteran/military patients with MTBI?

Participants and Methods: Population: Veterans or members of the military who have experienced MTBI.

Outcomes: Mental/physical health problems, cognitive disability, functional limitations, cost/resource utilization.

Design: Evidence synthesis of systematic reviews, meta-analyses, randomized controlled trials, prospective and retrospective cohort studies, case series, and cross-sectional studies with at least 30 MTBI cases.

Search dates: Inception to June 1, 2012.

Results: Yield: 1829 abstracts, 278 full-text reviewed, 57 included studies. Data synthesis was stratified by quality criteria including MTBI definition, response rate, and sample selection. Abstracted data included population; sample size; time since injury; prior TBI history; and mental/physical health, cognitive, functional, social, and cost/resource utilization outcomes. Quality and abstraction tables will be available at the poster/paper session.

Conclusions: MTBIs in Veterans/military members are associated with different outcomes than in civilians. Future research should use clear MTBI criteria, include pre-injury/comparison group data, and assess time since injury and prior TBI. This report will be used by the VHA TBI Advisory Committee to determine risk for long-term effects of MTBI, inform clinical practice, and prioritize resource allocation for screening and research.

Correspondence: *Maya E. O'Neil, Ph.D., Psychiatry/Medical Informatics and Clinical Epidemiology, Portland VA Medical Center/OHSU, 2131 SW Iowa St, Portland, OR 97239. E-mail: mayaoneil@gmail.com*

S. TUN, M.E. O'NEIL, M. ENSLEY & D. STORZBACH. Neuropsychological Test Performance of Blast-Exposed OEF/OIF Veterans.

Objective: Aim 1: Compare neuropsychological test performance for veterans with and without blast-exposure and mTBI, and civilian controls. Aim 2: Compare performance of deployed Veterans based solely on blast exposure. Aim 3: Examine the effect of PTSD symptoms on test performance for blast exposed and non-blast exposed Veterans.

Participants and Methods: Groups of deployed OEF/OIF Veterans from the Portland VAMC. 1: "No Blast" (NB) group reporting no explosion exposure; 2: "Blast-Exposed Non-mTBI" (BEN) group self-reporting exposure to one or more explosions but no acute mTBI symptoms; 3: "Blast-Exposed mTBI" (bTBI) group self-reporting symptoms consistent with DOD/DVA criteria for mTBI. A fourth civilian (CIV) comparison group was matched for age, gender, estimated pre-injury IQ, and education. Participants completed a semi-structured clinical interview (the MINI), medical record review, psychological assessment battery, and neuropsychological assessment battery including baseline IQ estimation tests and effort testing.

Results: Aim 1: List Learning, Short Delay Free Recall was significantly higher for CIV compared to BEN and bTBI groups and Long Delay Free Recall was significantly higher for CIV compared to bTBI; Name, Address, Phone scores were significantly higher for CIV and NB compared to bTBI; and Digits Forward and Number and Letter C Efficiency scores were significantly higher for CIV compared to bTBI.

Aim 2: Significant differences for List Learning Long Delay Recall, Story Memory Immediate and Delayed Recall, Name Address Phone Delayed Recall, Design Construction, and Category Fluency tests. Results for all tests regardless of significance indicated lower scores for veterans who were blast exposed.

Aim 3: Most test results were non-significant once PTSD was included as a covariate. Only Story Memory Immediate and Delayed Recall remained significant.

Conclusions: Cognitive sequelae are better explained by blast exposure than by mTBI diagnosis, though much of the outcome variance is related to symptoms of PTSD.

Correspondence: *Maya E. O'Neil, Ph.D., Psychiatry/Medical Informatics and Clinical Epidemiology, Portland VA Medical Center/OHSU, 2131 SW Iowa St, Portland, OR 97239. E-mail: mayaoneil@gmail.com*

A.D. PEDERSEN. Relationship between Cognitive Complaints, PTSD symptoms and Neuropsychological Test Performance in Danish Veterans with mTBI.

Objective: The relationship between subjective cognitive complaints (CC), post traumatic stress disorder (PTSD), and neuropsychological test performance (NP) in combat related mild traumatic brain injury (mTBI) is complex and not well understood. The present study is the first investigation of Danish veterans with mTBI. It was hypothesized that CC would correlate positively with PTSD symptoms and negatively with NP.

Participants and Methods: One female and 15 male veterans (age M=26.4 years, SD=4.0, months since mTBI M=13.5, SD=5.0, education M=11.9 years, SD=2.1) with a history of mTBI incurred during service in the International Security Assistance Force in Afghanistan were identified by the Danish Armed Forces Health Services and referred to evaluation at Hammel Neurorehabilitation and Research Center by the Danish Veteran Center. Veterans were evaluated with a comprehensive standardized battery of neuropsychological tests, estimation of intelligence (Danish Adult Reading Test (DART)), and questionnaires assessing CC, PTSD symptoms, and emotional symptoms (Cognitive Failures Questionnaire (CFQ), PTSD Check List (PCL), Symptom Checklist; subscales anxiety, depression and negative affect (SCL-ANX, SCL-DEP, SCL-8), and Perceived Stress Scale (PSS)).

Results: Veterans had relatively high PCL- and CFQ-scores (M=37.2, SD=16.5 and M=48.3, SD=19.1). Results showed a strong and significant positive correlation between CFQ and PCL ($r_s=.77$, $p<.001$). Sim-

ilar correlations were seen between CFQ and SCL-ANX ($r_s=.80$, $p<.001$), SCL-DEP ($r_s=.90$, $p<.0001$), SCL-8 ($r_s=.79$, $p<.001$), and PSS ($r_s=.79$, $p<.001$). There were no significant correlations between CFQ and 18NP test-variables when adjusting for multiple testing. In addition there were no significant correlations between CFQ and DART or time since mTBI. **Conclusions:** Results suggest that cognitive complaints in veterans with a history of mTBI are primarily associated with PTSD symptoms and emotional symptoms and not cognitive dysfunction as measured with neuropsychological tests.

Correspondence: *Anders D. Pedersen, MSc, Hammel Neurorehabilitation and Research Center, Aarhus University Hospital, Voldbyvej 15, Hammel DK-8240, Denmark. E-mail: andped@rm.dk*

S.H. PUTNAM, R.J. SPENCER, S.R. ROSS, N.L. FICHTENBERG & K.M. ADAMS. The MMPI-2 in the Assessment of Pain and Sleep Disturbance in Persistent Head Injury Complainants.

Objective: Pain and insomnia are often reported among individuals following head injury. This project examined the relationship between personality characteristics and measures of pain and sleep disturbance in a chronic pain population.

Participants and Methods: Persistent head injury complainants ($N = 222$) underwent neuropsychological evaluations. All participants completed the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), Multidimensional Pain Inventory (MPI), and Minnesota Multiphasic Personality Inventory – 2 (MMPI-2). Correlations were examined among scores on the MMPI-2 basic clinical and content scales with measures of pain and sleep disturbance.

Results: Total scores on the PSQI and ESS, as well as four indices from the MPI were each significantly related to at least 8 MMPI-2 clinical and 10 of 15 content scales. Specific PSQI indices of latency, duration, and efficiency were related to notably fewer MMPI-2 scales. Multivariate analyses revealed that only Hs uniquely predicted sleep disturbance. Discriminant function analysis (DFA) further identified a multivariate combination of MMPI-2 clinical scales that accurately classified 74.3% of Adaptive Coper and 77.3% of Dysfunctional profiles, as determined by the Multi-axial Assessment of Pain (MAP). When the content scale of HEA was included as the sole predictor in DFA to predict MAP profiles, the resulting model was significant and correctly classified 71.4% of those identified as Dysfunctional and 67.6% of Adaptive Coper.

Conclusions: Chronic pain and sleep disturbance appear to be salient experiences among persons reporting postconcussive symptoms. Overall, MMPI-2 indices were most related to reports of pain rather than sleep disturbance. However, MMPI-2 scales failed to discriminate between Dysfunctional and Interpersonally Distressed profiles.

Correspondence: *Robert J. Spencer, Ph.D., Ambulatory Care (11A), VA Ann Arbor Healthcare, 2215 Fuller Road, Ann Arbor, MI 48105. E-mail: rspencer33@gmail.com*

K.K. ROBERTSON, S. FULLER & M. SCHMITTER-EDGE-COMBE. Examination of Attentional Deficits Following Traumatic Brain Injury.

Objective: This study investigated the multi-faceted construct of attentional deficits following traumatic brain injury (TBI), highlighting performance on a nonsearch visual focused attention task.

Participants and Methods: Participants were 30 individuals with moderate to severe TBI who were tested acutely (i.e., following emergence from PTA) and 30 age and education matched controls. Participants' completed attentional tasks that assessed short-term memory and attention (i.e., a letter-number span task), attention and speeded visuospatial search (i.e., Trails A), and focused attention. The focused attention task was a computerized nonsearch visual selective attention task. Participants were presented with visual displays that contained either two or eight items. Prior to presentation of the visual displays, the location of the target (if present) was cued with a peripheral arrow. Participants were told to focus on the location cued by the arrow and ignore all other information.

Results: Results revealed significant differences between the TBI ($M=39.5$, $SD=13.96$) and control ($M=24.07$, $SD=8.42$) group on Trails A, $t(58)=5.19$, $p < 0.001$. The TBI group ($M=11.27$, $SD=2.69$) also performed more poorly than the control group ($M=13.5$, $SD=2.79$) on the letter-number span task, $t(58) = -3.16$, $p = 0.003$. For the focused attention task, a group by set size ANOVA revealed that the TBI group performed significantly slower than the control group, indicating that it took the TBI participants longer to identify and respond to stimuli. However, similar to the control group, the number of distractors in the visual display did not significantly increase reaction times or error rates for the TBI group, indicating that the TBI participants were able to successfully ignore irrelevant task information.

Conclusions: These results suggest that, in the acute phase of recovery, TBI participants were able to focus attention directed to a target location, but demonstrated deficits on other tests of attention.

Correspondence: *Kayela K. Robertson, B.A., Clinical Psychology, Washington State University, 7009 E. Mansfield, Spokane Valley, WA 99212. E-mail: k.robertson@email.wsu.edu*

P. ZHANG, P. ROSKOS, J.D. GFELLER, J. STOUT, J. BOLZENIUS, K. BRVANT, A. NASSIF & R.D. BUCHOLZ. Structural MRI Abnormalities are Associated with Reduced Cognitive Performance in Individuals with Post-Acute Traumatic Brain Injury.

Objective: The presence of structural abnormality on CT/MRI is often used a diagnostic and prognostic indicator in evaluating acute traumatic brain injury (TBI). Yet, research has shown only modest relationships between CT/MRI findings and early cognitive outcome in TBI. To extend this literature, our study compared individuals with post-acute TBI with identifiable abnormalities on MRI (ABN_TBI; $N=19$) to matched TBI participants with normal imaging (WNL_TBI; $N=19$) and healthy control participants (HC; $N=19$).

Participants and Methods: Neuroimaging and neuropsychological data were collected as part of a larger, ongoing prospective study involving military veterans and civilians with TBI. All participants completed a battery of neuropsychological tests (e.g. Stroop test, WCST-64, and CVLT-II), as well as cognitive paradigms completed during functional neuroimaging (N-Back and Flanker Arrow). Statistical analyses were calculated to compare the groups on demographic variables, injury severity factors, scores from neuropsychological measures, and accuracy and reaction time measures from functional neuroimaging paradigms.

Results: Results showed that the ABN_TBI group had more severe initial injuries; however, there were no significant differences between TBI groups on demographic (age and gender) or current disability and orientation variables (DRS and COAT scores). Relative to the WNL_TBI and HC groups, the ABN_TBI group exhibited significantly lower scores on several memory and executive functioning tests (CVLT-II and WCST-64). However, the two TBI groups did not differ significantly on many of the neuropsychological tests or the Flanker Arrow and N-back paradigm measures.

Conclusions: These findings suggest that anatomical abnormalities detected with MRI during the post-acute phase of TBI are associated with reduced memory and executive functioning. More generally, the findings contribute to existing literature showing modest relationships between imaging abnormality and cognitive outcome in TBI.

Correspondence: *P. Tyler Roskos, PhD, Neurosurgery, Saint Louis University, 1320 South Grand Blvd., St. Louis, MO 63104. E-mail: roskospt@slu.edu*

N. SESTITO, N.J. PASTOREK, B.I. MILLER, S.M. LIPPA, J. ROMESSER, J. LINCK, J.F. BENGGE, A. SIM, N.M. WISDOM & K.L. MAESTAS. Detection of Symptom Exaggeration on the Neurobehavioral Symptom Inventory.

Objective: Elevated rates of symptom endorsement following mild traumatic brain injury (mTBI) are not uncommon. Unfortunately, commonly

used post-concussive symptom scales such as the Neurobehavioral Symptom Inventory (NSI) are without embedded validity measures to screen for potential over-endorsement. The goal of this study is to determine whether a cutoff score could be developed on the NSI to identify possible symptom exaggeration in a population with a history of deployment-related mTBI.

Participants and Methods: Data collected from 115 Operation Enduring Freedom/Operation Iraqi Freedom veterans with deployment-related mTBI histories were examined using receiver operating curve (ROC) analyses. Dichotomized performance on the MMPI-2 embedded Symptom Validity Scale (FBS) and the Word Memory Test (WMT) were utilized in separate analyses as criterion standards of symptom invalidity. A cutoff score of ≥ 26 on the FBS was used as an indicator of symptom exaggeration (Boone, 2007).

Results: When using the FBS as the criterion standard, results indicated that an NSI total score cutoff of ≥ 64 yielded sensitivity of 38% with specificity of 95%. The same cutoff score produced similarly high specificity of 94% with sensitivity of 22% when using pass or failure on the WMT as the criterion standard.

Conclusions: The current results indicate that total score on the NSI can be a useful tool in determining the presence of possible response bias. Two ROC analyses using different criterion standards for symptom validity both indicated that a cutoff score of ≥ 64 had the best possible sensitivity to detect symptom exaggeration while minimizing the likelihood of false positive errors. Identification of such embedded symptom validity indicators is critical given the high rate of response bias in mTBI populations and the common use of postconcussive symptom inventories to monitor symptoms after mTBI in clinical practice. A benefit of utilizing a cutoff score is that the original measure can be used without the addition of validity items.

Correspondence: *Nicole Sestito, Ph.D., Mentis Neuro Rehab, 1010 Kelly Way, El Paso, TX 79902. E-mail: nicole.sestito@gmail.com*

M. SULLAN, T. BERGQUIST & M. YUTSIS. Satisfaction with Cognitive Rehabilitation Delivered Via the Internet in Persons with Acquired Brain Injury.

Objective: We examined whether satisfaction with cognitive rehabilitation delivered via the Internet in persons post onset of moderate to severe acquired brain injury (ABI) is correlated with an increased level of functioning and decrease in activity limitations.

Participants and Methods: 15 adults (8 males and 7 females) on average 43 years old (range 22 to 63) and at least one year post-onset of a medically documented moderate to severe ABI, and their caregivers, were assessed at three points during the study. Survivors were given measures of activity limitations (Neurobehavioral Functioning Inventory [NFI] Depression and Memory subscales), vocational status (Vocational Independence Scale [VIS]), and treatment satisfaction questions. Family members were also asked to rate participant's activity limitations on the NFI.

Results: Consistent with previous research, the vast majority of participants (>87%) were satisfied with treatment. There were no significant differences between the treatment and control groups in vocational status and activity limitations. Combining groups, patients reported less memory difficulties on the NFI Memory Scale between baseline and final assessment ($Z=-2.11, p=.04$). Treatment satisfaction accounted for 25% of additional variance in predicting lower family ratings of mood difficulties after final assessment ($p<0.03$). Greater satisfaction with treatment was positively correlated with greater employment rate after treatment on the VIS ($r=.63, p=.02$). Greater treatment satisfaction was also associated with lower family ratings of memory and mood difficulties on the NFI after final assessment ($r=-.59, p=.03; r=-.58, p=.03$).

Conclusions: Results suggest that treatment satisfaction in persons with ABI is related to less activity limitations and maintaining employment after cognitive rehabilitation delivered via the Internet.

Correspondence: *Molly Sullan, Mayo Clinic, 5955 E 10th Ave, Apt 501, Denver, CO 80220. E-mail: mollysullan@gmail.com*

K. HARPER, C.G. WONG, L.J. RAPPORT, M.A. LUMLEY, R.A. HANKS & S. MEACHEN. Emotional Expression and Well-Being in Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) survivors and their significant others face the chronic stress of living with cognitive and physical impairments related to TBI, which takes a toll on well-being. Expressing emotion is viewed as beneficial to well-being: short-term gains accrue in increased understanding, relief of emotional upset and reduced physiological activity, whereas long-term gains accrue by avoiding chronic, enhanced physiological reactivity to stress. This study examined the influence of TBI on the relationships between emotional expression and health.

Participants and Methods: Sixty people with moderate to severe TBI and 63 significant others (SOs) of TBI survivors participated. Emotional expression was assessed via linguistic analysis (Linguistic Inquiry and Word Count) and observation ratings of a speech task in which participants described stressful aspects of TBI recovery. Outcomes were subjective well-being, including psychological distress, life satisfaction, and for TBI participants, functional independence assessed via significant other ratings.

Results: Both verbal emotional expression and observations of emotions predicted well-being; yet, the pattern differed between groups. For TBI participants, using negative emotion and cognitive process words was adversely related to outcome, but talking about positive emotions, interpersonal interactions, and biological processes (e.g., health and pain) had favorable relationships with outcome. Also, expressing insight about stressful aspects of recovery was associated with distress and low life satisfaction, whereas avoiding problems or showing acceptance predicted low distress and high life satisfaction. For SOs, expression of anger and focus on biological processes were markers for distress. Additionally, focus on biological processes by SOs was inversely related to ratings of functional independence for TBI participants.

Conclusions: Interventions aimed at facilitating healthy emotional expression may be helpful for people with TBI and their families.

Correspondence: *Kaja Telmet Harper, Ph.D., Rehabilitation Institute of Michigan, 30248 Winthrop Dr., Madison Heights, MI 48071. E-mail: KTelmetHarper@aol.com*

Symposium 8: Episodic Memory and Aging: Contributions from Brain Imaging Studies

Chair: Michael Yassa

3:15–4:45 p.m.

M.A. YASSA, C.E. STARK, Y. STERN, E. KENSINGER & W. JAGUST. Episodic Memory and Aging: Contributions from Brain Imaging Studies.

Symposium Description: Brain imaging studies have made significant strides in improving our understanding of neurocognitive aging in humans. Examining how the brain ages, both successfully and unsuccessfully, is crucial for understanding age-related cognitive decline and determining how to improve cognitive outcomes. This endeavor also allows us to delineate behavioral and neural phenomena that are most predictive of pathological progression to Alzheimer's disease. Although aging affects all cognitive domains to an extent, episodic memory is one domain that appears differentially vulnerable to the effects of age. It is also the first cognitive capacity to deteriorate in the course of Alzheimer's disease. This symposium will focus specifically on age-related changes in episodic memory. The speakers in this symposium will discuss the contributions of neuroimaging studies (fMRI, MRI, DTI, PET) to studying individual differences with age in episodic memory. The questions at hand are: (1) What are the neural substrates of episodic memory deficits with age? (2) What changes in the brain are considered "adaptive" and may serve to preserve episodic memory abilities in older adults? (3) Which neuroimaging signals are the most sensitive to picking up individual differences with age? and (4) How can the science of neurocognitive aging inform our understanding of dementia risk?

Yaakov Stern will discuss the role of neuroimaging studies in understanding aging and episodic memory, and highlight novel uses of fMRI to investigating reference ability neural networks. Craig Stark will discuss high-resolution neuroimaging studies of the medial temporal lobe and age-related changes in hippocampal pattern separation. Elizabeth Kensinger will discuss age-related changes in emotional memory. Bill Jagust will discuss the use of amyloid imaging to investigate age-related cognitive changes.

Correspondence: *Michael A. Yassa, Ph.D., Psychological and Brain Sciences, Johns Hopkins University, 3400 N. Charles St., Ames 216A, Baltimore, MD 21287. E-mail: yassa@jhu.edu*

C. STARK. Pattern separation, episodic memory, and aging.

The hippocampus has often been associated with episodic memory. One potential mechanism for this is a computation known as pattern separation. By transforming similar representations into highly dissimilar representations, pattern separation has been hypothesized to be required for the rapid storage of arbitrary information without interference (a requirement of episodic memory and the related concept of source memory). Several computational models have stressed the hippocampus' role in pattern separation (and, specifically, the dentate gyrus subregion of the hippocampus). Here, I will describe the relationship between episodic memory and pattern separation. I will go on to show how there is now clear evidence of pattern separation in the dentate gyrus and CA3 fields of hippocampus in both the human (using BOLD fMRI) and rodent (using electrophysiology and immediate early gene expression). I will also show how aging disrupts pattern separation both behaviorally neurally as: 1) activity in the DG/CA3 is disrupted with age, 2) microstructural DTI shows a degradation of the perforant path input to the DG/CA3, and 3) functional connectivity shows a degradation of coherence between the EC and the DG/CA3. Together, these suggest that a disruption of the DG/CA3 circuit and a concomitant loss of pattern separation ability is an important aspect of age-related episodic and source memory loss.

Correspondence: *Craig Stark, 213 Qureshey Research Lab, Irvine, CA 92697. E-mail: cestark@uci.edu*

Y. STERN, J. STEFFENER, Y. GAZES & C. HABECK. Examining Age-Related Changes in Episodic Memory Using Reference Ability Neural Networks.

Performance across the age span on large batteries of diverse cognitive tests can be parsimoniously represented by a set of four reference abilities (RAs): episodic memory, fluid ability, perceptual speed, and vocabulary. Salthouse et al. argued that a productive and efficient approach to cognitive aging research is to try to understand how aging impacts performance of these general RAs, rather than on specific tasks. Using analytic approaches that parallel those used to analyze behavioral cognitive data, we are using fMRI of 12 tasks to identify networks of brain activity associated with each of the RAs across adulthood. These "reference ability neural networks" (RANNs) are hypothesized to represent the neural network that underlie the common cognitive demands of these reference abilities. The study of RANNs has the potential of contributing to a paradigm shift in research on the neural bases of age differences in cognition by emphasizing the broad and replicable aspects common to several tasks rather than the possibly idiosyncratic features of individual tasks. In this presentation we focus on the derivation and validation of the RANN for episodic memory. We examine its topography and expression across the age range, in an effort to understand age-related episodic memory changes.

Correspondence: *Yaakov Stern, 630 W 168th St, P&S Box 16, New York, NY 10032. E-mail: ys11@columbia.edu*

E.A. KENSINGER, E. ALLARD, J.H. FORD & C.M. LECLERC. Effects of Age on the Encoding and Retrieval of Emotional Memories. Emotional events often are more likely to be remembered than non-emotional events, and emotional memories can be associated with dif-

ferent phenomenological qualities than other memories. Although many of the effects of emotion on memory remain as adults age — emotional events continue to be remembered better and with a richer vividness and sense of detail — there are important differences in the processes that support young and older adults' emotional memories and in the characteristics of their emotional memories. In this talk, I will review evidence for age differences that arise in the way that information is initially encoded, emphasizing age differences in the way that regions of the prefrontal cortex, amygdala, and hippocampus work together as individuals sustain attention on emotional information and elaborate on its meaning. I also will discuss recent evidence for age differences in the processes engaged during the retrieval of emotional memories, emphasizing that age differences in emotional memory are related both to the way emotional events are initially experienced and also to the way those events are later re-experienced at the time of retrieval.

Correspondence: *Elizabeth A. Kensinger, Boston College, Chestnut Hill, MA 02467. E-mail: elizabeth.kensinger@bc.edu*

W. JAGUST. Amyloid Imaging, Memory, and Aging.

The ability to image fibrillar, aggregated forms of the A-beta protein that is the constituent of the amyloid plaque associated with Alzheimer's disease (AD) has transformed research in cognitive aging. Older adults can now be characterized on a variety of factors, including memory performance, and on a host of neural measures such as brain volumes and glucose metabolism, and these variables can be compared in individuals with and without evidence of brain A-beta deposition. This talk will review findings using these approaches in the study of normal aging. In a group of cognitively normal individuals, we have evaluated both baseline and longitudinal change in cognitive function. This approach has permitted the evaluation of the relationship between A-beta and cognition. An interesting finding to emerge from these analyses is that while there are subtle changes in memory that are related to A-beta, individuals without evidence of A-beta also show pronounced memory decrements when compared to young people. That is, age-related differences in cognition cannot simply be attributed to the presence of A-beta. On the other hand, longitudinal change in memory is more strongly related to A-beta, with individuals classified as "amyloid positive" declining faster than those who are amyloid negative. These studies also demonstrate interaction effects between measures of brain volume and A-beta, such that those with evidence of both atrophy and A-beta decline faster than those with only A-beta. There are also different relationships between patterns of atrophy and cognitive function in those harboring A-beta compared to those without A-beta. In amyloid negative cases, declines in executive function and visual memory are related to atrophy in frontostriatal systems, while in those with A-beta, cognitive change is related to atrophy in medial temporal lobes.

Correspondence: *William Jagust, Helen Wills Neuroscience Institute, 132 Barker Hall, Berkeley, CA 94720. E-mail: jagust@berkeley.edu*

Symposium 9: Cognitive Impairment and Disability in Mood Disorders Across the Lifespan

Chair: Sara Weisenbach

Discussant: Meryl Butters

3:15–4:45 p.m.

S. WEISENBACH, S.A. LANGENECKER, S. MCCLINTOCK, E. BRICENO, S. WEISENBACH, K. RYAN & M. BUTTERS. Cognitive Impairment and Disability in Mood Disorders Across the Lifespan.

Symposium Description: Much progress has been made in the last decade in considering the impact of mood disorders on cognitive functioning and disability. It is now understood that Major Depressive Disorder (MDD) and Bipolar Disorder (BD) follow characteristic patterns

of cognitive impairment with underlying abnormal neural functioning. This symposium will present recent research into the kinds of cognitive problems that younger and older patients with mood disorders experience, as well as cerebral functional abnormalities underlying these difficulties using fMRI. Dr. Langenecker will open the symposium with a depiction of the importance of considering trait, state, scar, and burden effects when studying cognition in mood disorder and will present findings from a study aimed toward early identification of risk intermediate phenotypes in MDD. Dr. McClintock will describe the cognitive profile typically associated with MDD in younger and older adults and the impact of moderators (i.e., depression severity and subtype) of cognitive functioning in MDD. Ms. Briceno will review studies of emotion processing dysfunction in mood disorders across the lifespan, including findings from behavioral and fMRI studies, with a primary focus on MDD. Dr. Weisenbach will demonstrate findings of memory and executive functioning deficits, and underlying neural substrates using fMRI, among a sample of older adults with MDD. Dr. Ryan will show the impact of cognitive functioning and clinical factors on work status and underemployment in BD patients. Dr. Butters will conclude with a summary of the findings presented and a discussion of implications for the field. This series of talks will educate neuropsychologists about the cognitive and functional problems (and the underlying neurobiology) experienced by younger and older patients with mood disorders and will provide suggestions for future research as it relates to early identification, differential diagnosis, prognosis, and treatment response.

Correspondence: *Sara Weisenbach, Ph.D., University of Michigan Medical School, 2101 Commonwealth Blvd., Suite C, Ann Arbor, MI 48105. E-mail: sarawrig@med.umich.edu*

S.A. LANGENECKER, K.A. RYAN, D.F. MARSHALL, L.B. GABRIEL, A.L. WELDON, M.T. KASSEL, N. CRANE, S.L. WEISENBACH & J. ZUBIETA. Strong Reliability for Intermediate Phenotypes in the Multifaceted Investigation of the Neurobiology of Depression Subtypes (MINDS) Study.

Background

A major initiative of NIMH is the early identification of risk intermediate phenotypes (IPs) for psychiatric disorders and tracking their impact and progression. Focus on active disease states has thwarted precise study of these IPs and their stability over time. The present study, after having considered developmental, state, scar, and chronic burden effects, is designed to better identify neurobiological IPs by enrolling 70 individuals remitted from MDD, early in the course of illness in late adolescence compared to 60 healthy controls. First steps are to identify the stability of IPs over a four week period with measures of executive functioning and emotion processing.

Methods

Thirty-four subjects have been enrolled, including 12rMDD, 18 HC, and 4 excluded due to insufficient depression severity/episodes.

Results

Reliability for the Facial Emotion Perception test, including accuracy and response time for all emotions was modest ($r = .59$, $p = .02$ and $r = .63$, $p = .01$). For the Parametric Go/No-go test, accuracy and response time for Go events had strong reliability ($r = .81$, $p < .01$, $r = .83$, $p < .01$, respectively), whereas accuracy for No-Go events did not have significant reliability ($r = .18$, $p = .49$). There was a significant improvement in accuracy for identifying emotions over 4 weeks ($p = .02$, $d = .65$), but no change in response time in identifying faces ($p = .51$, $d = .15$), Go Accuracy ($p = .87$, $d = .02$), No-go Accuracy ($p = .50$, $d = .21$), or Go Response time ($p = .40$, $d = -.12$).

Conclusions

The initial results suggest modest to strong reliability and minimal learning effects for most candidate IPs. Evaluation of and comparison after collecting additional subjects may aid in obtaining more accurate estimates. Studying individuals with risk for recurrence of illness at the critical nexus is advantageous in defining and refining IPs and selecting treatment targets for secondary prevention, with ready translation into clinical settings.

Correspondence: *Scott A. Langenecker, 1601 W Taylor St, Chicago, IL 60612. E-mail: slangenecker@psych.uic.edu*

S.M. MCCLINTOCK. Association between Major Depressive Disorder Characteristics and Neurocognitive Function in Adults and Elderly Adults.

Major depressive disorder (MDD) is a heterogeneous neuropsychiatric disease that is prevalent in adult and elderly adult populations. The clinical course and characteristics (depression severity, depressive symptoms, depressive subtype) of MDD can vary between persons, and are associated with differential effects on neurocognitive functions. Indeed, during the course of a major depressive episode, including periods of clinical response and remission, some cognitive inefficiencies may be present. Further, despite substantial methodologic differences between studies, most research suggest that MDD in adults and elderly adults is associated with decreased processing speed, poor attention, impaired memory, and executive dysfunction. Consequently, the combination of MDD with cognitive impairment results in significant functional limitations. As such, further information is warranted to better understand the intricacies of the complex relationship between MDD and neurocognitive function across the adult lifespan. This presentation will 1) discuss MDD psychiatric diagnostics, 2) review effects of MDD on neurocognitive function in adults and elderly adults, 3) discuss effects of depression severity and subtype on neurocognitive function, and 4) synthesize available information and provide future recommendations for neurocognitive and MDD research.

Correspondence: *Shawn M. McClintock, UT Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390-8898. E-mail: shawn.mcclintock@utsouthwestern.edu*

E.M. BRICENO, L.J. RAPPORT, L.A. BIELIAUSKAS, K.A. RYAN, K.A. NIELSON, M. MCINNIS, J. ZUBIETA, S.L. WEISENBACH & S.A. LANGENECKER. Emotion Processing Dysfunction in Depression: Overview, Psychometric Properties, and Key Considerations.

A rapidly emerging area of study in neuropsychology is emotion processing. In psychiatric disorders, emerging evidence suggests that emotion processing deficits may precede episodes of mood disorders and linger after resolution of acute episodes, with potential for additional accumulation of burden as the illness becomes chronic. Understanding the nature, psychometric properties and consequences of these difficulties can lead to more effective and personalized treatments and carryover into related disorders, with use in differential diagnosis. This talk will review work by our group and others that addresses emotion processing dysfunction in mood disorders, with a primary focus on Major Depressive Disorder (MDD). Work by our group utilizes a facial emotion categorization task, which requires rapid and explicit categorization of facial emotions, completed both apart from and during fMRI. There is evidence for modest, replicable difficulties in emotion perception in mood disorders. This includes those across the age span, and both men and women. Our group has found emotion processing deficits in MDD, during depressed states of Bipolar Disorder, in Cushing's disease (CD), but not in anxiety disorders. There is evidence for exacerbation of emotion processing difficulties in younger women and in older adults with MDD. Younger woman with MDD and patients with CD exhibit extensive fronto-limbic hyperactivity while performing this task. Internal and test-retest reliability are sound. Normative data in over 300 healthy adults across the adult age span are reported. Study of emotion perception difficulties in those with mood disorders, and also including in patients with acute or invasive disruptions to brain regions supporting emotion perception, are a new frontier in neuropsychological assessment. It is important to understand and expand upon our knowledge of the psychometric properties of emotion processing instruments of this type.

Correspondence: *Emily M. Briceno, 1490 Bemidji, Ann Arbor, MI 48103. E-mail: emilybriceno@gmail.com*

S.L. WEISENBACH, B. CORNETT, M. MANN, B. HAASE, E. AVERY, H. KALES, J. HEIDEBRINK, J. ZUBIETA & S.A. LANGENECKER. Frontostriatal and Hippocampal Network Dysfunction Among Older Adults with Major Depressive Disorder.

Memory loss and executive dysfunction are common among individuals with late life depression (LLD). While prefrontal dysfunction may account for a portion of the memory difficulties experienced by patients with LLD, there may also be a unique contribution of hippocampal dysfunction to poor memory. The current study aimed to 1) investigate performance changes in executive functioning and memory among a large sample of older adults with LLD; and 2) Examine disruption to frontostriatal and hippocampal pathways during fMRI challenge in a smaller sample of patients with LLD. Study 1 (neuropsychological study) participants included 48 older adults with LLD and 60 never-depressed controls (HC). Study 2 (neuroimaging study with fMRI) participants included 11 LLD and 13 HC. In Study 1, participants completed a continuous performance task requiring sustained attention and inhibitory control, as well as the California Verbal Learning Test-2 (CVLT). In Study 2, participants underwent a sustained attention task and a semantic list learning task during fMRI. In Study 1, the LLD group demonstrated less accuracy on a portion of the continuous performance task relative to the HC group. They also performed more poorly across all levels of the CVLT (all $p < .05$). In Study 2, during the sustained attention task, the LLD group demonstrated activation in more lateral regions of the prefrontal cortex, while activation in the HC group was more medial. The LLD group also activated a greater number of prefrontal and caudate regions relative to the HC group ($p < .05$, corrected). During encoding of word lists, LLD patients demonstrated less left hippocampal activation overall ($p < .05$, corrected). Patients with LLD perform more poorly on measures of executive functioning and verbal memory. They also demonstrate differential patterns of prefrontal, caudate and hippocampal activation during fMRI. Findings are discussed in regard to neuroendocrine and cerebrovascular substrates of LLD.

Correspondence: *Sara L. Weisenbach, 2101 Commonwealth Blvd., Suite C., Ann Arbor, MI 48105. E-mail: sarawrig@med.umich.edu*

K. RYAN, A. VEDERMAN, M. KAMALI, D. MARSHALL, A. WELDON, M. MCINNIS & S. LANGENECKER. Emotion Perception and Executive Functioning Predict Work Status in Euthymic Bipolar Disorder.

Bipolar Disorder (BD) is a debilitating disorder with episodic symptoms. Those in the euthymic state continue to have inter-episode symptoms and persistent cognitive problems. Furthermore, functional recovery lags behind recovery from clinical symptoms and may still be incomplete when acute mood symptoms have subsided. Identifying significant predictors of disability, including persistent neuropsychological dysfunction, is of recent interest as a way to devise targeted clinical treatment plans for those with greater risk. One poorly captured area of functional recovery concerns employment, despite BD being the 6th leading cause of disability world-wide. The current study examined impact of cognitive functioning and clinical factors on work status and underemployment in a sample of BD patients. 156 Euthymic-BD and 143 controls (HC) were divided into working/not-working groups. Clinical, health, social support, and personality data were collected, and 8 cognitive factors were created from neuropsychological testing. The HC outperformed the BD groups on seven of eight cognitive factors ($p < .04$). The working BD group outperformed the not working BD group on 4 cognitive factors comprised of tasks of processing speed, emotional processing, and set shifting. Emotional processing ($p = .014$) and the executive tasks ($ps = .004, .005$) were predictive of BD work status, after accounting for number of mood episodes. Four of the cognitive factors accounted for 14% of the variance in work status among the BD participants ($p = .025$). Patients with BD who are unemployed or unable to work exhibit greater difficulties processing emotional information and on executive tasks that comprise a set shifting or interference resolution component as compared to BD patients who are gainfully employed, independent of other factors. Treatments should target these areas of cognitive functioning as contributing factors to improve overall functional recovery.

Correspondence: *Kelly Ryan, 2101 Commonwealth Blvd, Suite C, Ann Arbor, MI 48105. E-mail: karyan@umich.edu*

**Paper Session 6:
Pediatrics/Autism/LD/Memory Training and
Executive Functions**

Moderator: Michael Larson

3:15–4:45 p.m.

E.L. WODKA, L. KALB & P. MATHY. Predictors of Speech in Severely Language-Delayed Children with Autism Spectrum Disorder.

Objective: To examine the prevalence and predictors of language attainment in children with Autism Spectrum Disorder (ASD) and severe language delay. We hypothesize greater autism symptomatology and lower intelligence among children who do not attain phrase/fluent speech, with nonverbal intelligence and social engagement emerging as the strongest predictors of outcome.

Participants and Methods: Data used for the current study were from 535 children with ASD who were at least 8 years of age ($M = 11.6$ years, $SD = 2.73$) and did not acquire phrase speech before age 4 participating in the Simmons Simplex Collection. Logistic and cox proportionate hazard regression analyses examined predictors of phrase and fluent speech attainment, and age at acquisition, respectively.

Results: A total of 372 children (70%) attained phrase speech and 253 (47%) children attained fluent speech at or after age 4. No demographic or child psychiatric characteristics were associated with phrase speech attainment after age 4, while slightly older age and increased internalizing symptoms were associated with fluent speech attainment. In the multivariate analyses, higher nonverbal IQ and less social impairment were both independently associated with the acquisition of phrase and fluent speech, as well as earlier age at acquisition. Stereotyped behavior/repetitive interests and sensory interests were not associated with delayed speech acquisition.

Conclusions: This study uses the largest sample to date to examine the relationship between key deficits associated with autism and attainment of phrase and/or fluent speech following a severe language delay, providing information to guide therapeutic targets and developmental expectations. We highlight that many severely language-delayed children with autism may attain phrase or fluent speech at or after age 4. These data also implicate the importance of evaluating and considering non-verbal skills, both cognitive and social, when developing interventions and setting goals for language development.

Correspondence: *Ericka L. Wodka, Ph.D., Center for Autism, Kennedy Krieger Institute, 3901 Greenspring Ave., Baltimore, MD 21211. E-mail: wodka@kennedykrieger.org*

H.F. ØSTGÅRD, G.C. LØHAUGEN & J. SKRANES. Neuropsychological profile in young adults born small-for-gestational-age at term.

Objective: Some studies have shown that being born small-for-gestational-age (SGA) at term is related to reduced intellectual capacity, learning difficulties and poor school performance. Earlier findings have been diverted, and there are few longitudinal studies with a comprehensive neuropsychological test battery. The aim of this study is to look at how young adults born SGA perform on a variety of neuropsychological tests, to see whether they have problems of specific or general origin.

Participants and Methods: We did a population-based follow-up study at age 19 of 59 term-born SGA (birth weight < 10th centile, mean: 2915g) and 81 controls (birth weight > 10th centile, mean: 3707g). One participant in the SGA group was excluded on the basis of a cerebral palsy diagnosis.

A standardized neuropsychological test battery was used to assess several functions. We compared groups on each individual test, and also on a z-score level where tests were divided into seven functions: auditory memory, visual memory, language, attention, executive functions, visual-motor integration and motor skills.

Results: The SGA-group performed significantly poorer than controls ($p < 0.01$) on several tests. These were tests assessing auditory memory, motor skills and some tests assessing executive functions and attention. The groups did not differ in visual memory tasks, language functions and several other attention/executive tasks. At the zum-score level, the SGA group only had significantly lower scores ($p < 0.01$) on auditory memory and motor skills.

Conclusions: Our results suggest that young adults born SGA have specific neuropsychological difficulties. The overall impression is that they have problems with auditory learning, motor coordination, and they are slower at performing and initiating tasks compared to controls. This might further suggest that children born SGA can be in need of special education in school.

Correspondence: *Heidi F. Ostgård, Psychologist, Department of Laboratory Medicine, Children's and Women's Health, Norwegian University of Science and Technology, Postboks 8905, Trondheim 7491, Norway. E-mail: heidi.f.ostgard@ntnu.no*

J.B. HALE, H.A. KUBAS, K.R. FITZER, E.M. BACKENSON, J.A. CARMICHAEL, G.L. HARRISON & S.J. MACOUN. Operationalizing a Neuropsychological Process Approach for Specific Learning Disabilities Identification.

Objective: Specific learning disabilities (SLD) identification and intervention remains controversial. A neuropsychological processing strengths and weaknesses approach makes heuristic and clinical sense given statutory, regulatory, and legal precedents.

Participants and Methods: Children referred for comprehensive evaluations were examined for Concordance-Discordance Model (C-DM) SLD eligibility, which was contrasted with ability-achievement discrepancy (AAD) and school district multidisciplinary SLD criteria. Forced-entry multiple regression with WISC-IV cognitive predictors of WJ-III achievement subtests were computed for the sample ($N = 144$). Results were contrasted with separate regression equations for those who did not meet C-DM criteria, and C-DM determined SLD subtypes who had working memory (WM), processing speed (PS), or executive (EX) deficits explaining their reading and math SLDs.

Results: Crosstab comparisons for C-DM groups, AAD, and district criteria for reading and math revealed greater agreement for C-DM and district criteria than other comparisons. Regression analyses for the heterogeneous total sample revealed significant cognitive predictors of reading and math achievement (F range 2.32 to 5.52; p range $< .001$ to $.015$, R^2 range .156 to .315), but achievement variance accounted for was much greater when No C-DM (R^2 range .315 to .590), and WM (R^2 range .439 to .917), PS (R^2 range .274 to .676), and EX (R^2 range .234 to .709) C-DM groups were examined separately. Further, standardized beta weights were different for SLD subtypes in the prediction of different reading and math subtests.

Conclusions: WISC-IV predictive validity for WJ-III achievement improves when homogenous SLD subtypes are identified according to a neuropsychological processing approach using C-DM criteria. Differences in beta weights suggests different neuropsychological processes are relevant for SLD subtypes, which could lead to individualized intervention for children with C-DM determined SLD.

Correspondence: *James B. Hale, University of Calgary, 106 Royal Elm Way, Calgary, AB T3G5P7, Canada. E-mail: halejb@ucalgary.ca*

K. HERMANSEN GRUNEWALDT, J. SKRANES, A. BRUBAKK & G.C. LØHAUGEN. Positive Long Term Effect after Computerized Working Memory Training in Very Low Birth Weight Children at Pre-school Age.

Objective: Working memory (WM) is defined as our ability to temporarily store and at the same time manipulate information on-line over short periods of time. Deficits in WM have been reported in preterm born children and are associated with cognitive, behavioural and academic problems. Our aim was to evaluate if use of a software based computer program have long term positive effects on verbal and visual WM, learning/memory and behaviour in preterm born children at preschool age.

Participants and Methods: This is a prospective, randomized study that included 20 preterm children, born at the St. Olav University Hospital in Trondheim. Mean birth weight was 1099g (SD 311), mean gestational age 28.8 weeks (SD 2.8) and mean age at intervention was 5.8 years (SD 0.5). The children used the Cogmed JM computer program for 10-15 min. each day, 5 days a week for a 5-week period. The children were assessed before training, 4 weeks and 8 months after completing the training. Non-trained WM were assessed with standard neuropsychological tests of verbal and visual WM, generalization effects were assessed by NEPSY and a questionnaire regarding ADHD was completed by the parents.

Results: Results regarding the 4 weeks follow up have previously been presented, showing positive effects on non-trained WM and learning tasks after training. Preliminary data at 8 months follow up shows that the children had a persisting positive effect and a continued improvement on tasks regarding visual and auditory attention, phonological awareness and visual as well as verbal memory. Non-trained WM tasks showed improvement while ADHD scores did not change significantly with time.

Conclusions: Computerized WM training in VLBW pre-schoolers seems to have persisting positive effects at 8 months follow up. The training effect did not decline over time as test-results continued to improve. Our study indicates that preterm born children benefit from WM training and that this intervention could be considered for use before they start school.

Correspondence: *Kristine Hermansen Grunewaldt, MD, Dept of Lab. Medicine, Children's and Woman's Health, Norwegian University of Science and Technology, Trondheim, Blussvollsbakken.15, Trondheim 7052, Norway. E-mail: kristine.grunewaldt@ntnu.no*

J.E. KARR, M.A. GARCIA-BARRERA & R.W. KAMPHAUS. Modeling Longitudinal Invariance of Executive Functions in Children.

Objective: Using the Behavioral Assessment System for Children (BASC), a recently derived behavioral screener may offer a practical and empirical method for assessing frontal-lobe executive functions, measuring four latent executive constructs: problem solving, attentional control, behavioral control, and emotional control. The study involved two additive aims: (a) to replicate the screener derivation (Garcia-Barrera et al., 2011) in a novel sample and (b) to test the model for longitudinal invariance, demonstrating reliable measurement across time.

Participants and Methods: The sample included 1237 (52% Female) participants with ages ranging from 6 to 11 years old. Participants were tracked longitudinally across three years with five waves of BASC assessments. New participants were recruited at each wave to compensate for attrition and to increase sample size. Following Garcia-Barrera et al. (2011), 25 executive-related BASC items were isolated to assess (a) model fit using confirmatory factor analysis and (b) invariance using configural, weak, strong, and strict models. The metrics for model fit and invariance were the Comparative-Fit Index (CFI) and the change in model fit (Δ CFI), respectively.

Results: The screener derivation produced strong Cronbach's α values for each factor (α values = .80-.91). The confirmatory factor analysis produced expected model fit for the four factor model (CFI = .972). The invariance analyses indicated nonsignificant change between the configural and strict models for each factor (Δ CFI = .0001-.0003, criterion $> .001$).

Conclusions: As predicted, the four factor model replicated in this new sample, further supporting the quality of this behavioral screener as a measure of these four higher-order factors. In addition, the longitudinal invariance observed indicated the reliability of the screener at consistently detecting latent executive variables, offering a practical alternative to more complicated tests to assist with the early detection of executive impairment.

Correspondence: *Justin E. Karr, University of Victoria, University of Victoria Department of Psychology, P.O. Box 3050, Victoria, BC V8W 3P5, Canada. E-mail: jkarr@uvic.ca*

**Poster Symposium:
Naturalistic Assessment of Everyday Abilities in
Healthy Older Adults and Individuals with Mild
Cognitive Impairment and Dementia**

3:30–4:30 p.m.

**Dementia (Subcortical, Specific Disorders,
MCI, etc.)**

M. SCHMITTER-EDGECOMBE, T. GIOVANNETTI, M. SCHMITTER-EDGECOMBE, A.M. SEELYE, D.C. MARSON & E.L. GLISKY. Naturalistic Assessment of Everyday Abilities in Healthy Older Adults and Individuals with Mild Cognitive Impairment and Dementia.

Symposium Description: Neuropsychologists are often asked to predict everyday functioning from cognitive test performance. However, many standardized neuropsychological tests measure specific cognitive domains (e.g., retrospective memory) using isolated tasks (e.g., story recall) in an artificial environment (e.g., clinic). Correspondence between cognitive resources tapped under such strict administration conditions and those that occur in more open-ended real-world situations has been repeatedly questioned. In this symposium, we examine the contribution of naturalistic assessment to our understanding of the relationship between cognitive abilities and everyday functioning in healthy older adults and individuals with mild cognitive impairment and dementia. To date, much of our understanding of everyday activity completion in the aging and dementia populations has come from proxy measures of real-world functioning including self-report, informant-report and performance-based behavioral simulation measures. This symposium will highlight work which uses more open-ended naturalistic tasks to understand everyday functioning in aging, MCI and dementia populations. Research will be presented that examines errors in everyday activity completion, everyday multi-tasking situations, and the ability of individuals with MCI and dementia to respond to automated prompts delivered in a naturalistic setting. The relationship between naturalistic assessment, neuropsychological test performances and other methods for assessing functional status will be discussed. The contributions of this work to the development of more naturalistic, ecologically valid functional status measures will also be highlighted. The presentations will be followed by commentary by Dr. Betty Glisky and a question and answer session.

Correspondence: *Maureen Schmitter-Edgecombe, Washington State University, Department of Psychology, Washington State University, Pullman, WA 99164-4820. E-mail: schmitter-e@wsu.edu*

M. SCHMITTER-EDGECOMBE, C. PARSEY, C. MCALISTER, A. WEAKLEY & D. COOK BEST. Functional Impairment and Cognitive Correlates in Aging and Mild Cognitive Impairment.

Understanding the association between cognitive correlates and functional impairment is important for intervention and for predicting everyday difficulties. In this presentation, the speaker will discuss data from studies that used direct observation methods to examine the everyday functional abilities of younger adults (YA), healthy older adults (OA), and individuals with mild cognitive impairment (MCI) and dementia. Participants' performance of eight scripted everyday activities (e.g., water plants) was coded for omission and substitution errors and for irrelevant and inefficient actions. In comparison to YAs ($N = 44$) and healthy OAs ($N = 92$), omission errors (e.g., failure to retrieve an item) were significantly more common in the MCI group ($N = 58$), and became even more pronounced with dementia ($N = 36$). Substitution errors (e.g., using an alternative object or approach) were only prominent in dementia, while inefficiencies occurred in all of the older adult groups. When completing a complex task that required multi-tasking, prioritizing, organizing, initiating and completing eight subtasks to prepare for a day out, in comparison to YAs ($N = 50$), healthy OAs ($N =$

50) took longer and were less efficient and more poorly sequenced the subtasks. Compared to age and education matched OAs ($N = 38$), the MCI group ($N = 38$) required more time to complete the complex task and demonstrated poorer task accuracy, with more subtasks performed incompletely and inaccurately. A consistent theme emerged suggesting that inefficiencies in the everyday task performances of OAs were related to executive functioning abilities, while memory deficits contributed to the more significant errors of omission and incomplete and inaccurate performances in the MCI population. The relationship between the direct observation measures and other proxy measures of real-world functioning (e.g., informant report, behavioral simulation measures) will also be discussed.

Correspondence: *Maureen Schmitter-Edgecombe, Department of Psychology, Washington State University, Pullman, WA 99164-4820. E-mail: schmitter-e@wsu.edu*

D. MARSON. Towards Naturalistic Assessment of Function in Cognitively Impaired Older Adults: Lessons from Laboratory Studies of Financial Capacity.

Accurate assessment of everyday function is a critical aspect of the diagnostic process for ascertaining and distinguishing MCI from dementias like Alzheimer's disease (AD). Over the past 25 years, functional assessment in dementia has shown a continuing evolution, from early patient/informant rating forms, to increasingly sophisticated performance based psychometric measures, to clinician interview approaches, and also to associated neuropsychological predictor models. These laboratory based methods have formed the scientific foundation for more recent efforts, represented within this symposium, to develop more ecologically valid, "naturalistic" assessments of older adult function in real life settings. In this presentation, the speaker will illustrate this developmental trajectory using the construct of financial capacity and four different empirical assessment approaches used in his own laboratory: informant report, psychometric performance, clinician interview, and neuropsychological predictor models. Empirical data from the NIA funded COINS-2 study of financial capacity in patients with MCI and AD will briefly illustrate each approach. The speaker will then discuss the relationship of these existing laboratory and clinic based assessment approaches to emerging new "naturalistic" technologies for assessing function in dementia. The advantages and disadvantages of these existing and new approaches of functional assessment will be compared and contrasted, and future directions of functional research in dementia outlined.

Correspondence: *Daniel Marson, SC650, Department of Neurology, UAB, 1720 7th Avenue South, Birmingham, AL 35294. E-mail: dmarson@uab.edu*

A.M. SEELYE, M. SCHMITTER-EDGECOMBE & D. COOK. Technology Based Prompting for Instrumental Activities of Daily Living (IADLs) in Healthy Aging, Mild Cognitive Impairment (MCI), and Dementia.

Observation of IADLs in a naturalistic environment is a novel approach to enhance our understanding of difficulties that occur and the amount and type of prompting assistance needed by older adults with cognitive impairment. We applied cognitive rehabilitation principles to develop a graded hierarchy of automated prompts to assist with complex IADLs in a naturalistic setting. Progressive levels of assistance were provided, starting with the lowest level needed to adjust performance. Across healthy aging, MCI, and dementia, we examined the number and type (verbal indirect, direct, multimodal) of prompts required when errors occurred during IADLs in a smart home testbed. Individuals with multi-domain MCI ($N=30$) made more errors and required more prompts than individuals with single-domain MCI ($N=23$) or healthy older adults ($N=50$). Similar to single-domain and healthy older adult groups, the multi-domain MCI group responded well to the indirect prompt, which simply helped orient back to task. In a second study, a group of healthy old-old adults ($75+, N=38$), required more prompts than a young-old

group (60-74, N=81), who required more prompts than a middle-age group (45-59, N=33). All groups responded well to the indirect prompt. In a study of 15 individuals with dementia, participants required prompting beyond the indirect cue 70% of the time. On more complex activities, dementia participants often became confused and were unable to respond to the prompts. Data show that in healthy aging and MCI, the fundamental need for prompts was related to either age or degree of cognitive impairment, but the level of prompting was not. Participants who were older or who had more cognitive impairment made more errors and needed to be cued more often than there was a problem, but once cued, were able to repair the problem and get back on track. However, our dementia participants needed cueing to notify them of the problem and direct instruction to assist them in correcting the error.

Correspondence: *Adriana M. Seelye, 9220 Reagan Road, San Diego, CA 92126. E-mail: adri_z@hotmail.com*

T. GIOVANNETTI, D.A. DRABICK, D.J. LIBON, S.C. SELIGMAN, M. IAMPIETRO, G.A. SEIDEL & C. SETER. Everyday Action Impairment in Dementia: Person-specific Error Profiles.

Recent studies of everyday action impairment in dementia have shown different cognitive and neuroanatomical correlates for commission errors (i.e., inaccurate task steps) versus omission errors (i.e., excluded task steps). We used latent class analysis (LCA) to determine if action errors meaningfully distinguished groups of participants with dementia. We hypothesized that at least two groups, differing on omissions and commissions, would be identified. 175 participants (Mage=77.87; M edu=12.26) with mild-moderate dementia (MMSE=22.89) were videotaped performing the Naturalistic Action Test (NAT), a performance-based test of everyday action. NAT errors were classified as omission, addition (i.e., off-task action), or one of three commissions (perseveration, sequence, object substitution). LCA models of these five error types were run; a one-class model was tested followed by models with more classes. Statistical indicators (Bayesian Information Criteria [BIC] 3879.81; sample size-adjusted BIC 3810.15; Bootstrap Likelihood Ratio Test $p < .01$; Vuong-Lo-Mendell-Rubin Likelihood Ratio Test $p < .05$) indicated a three-class model best fit the error data. The classes differed in total errors and error distributions, with Class 1 ($n=119$) showing the fewest errors (M Errors=9.88) and an error distribution of 38% omission, 49% commission, and 13% addition. Class 2 ($n=24$; M Errors=21.71) and Class 3 ($n=34$; M Errors=24.58) showed more errors and distinct error distributions. Class 2 showed many commissions (43%) and additions (30%); Class 3 showed a majority of omissions (74%). Follow-up analyses of the MMSE showed that Class 1 ($M=23.19$) differed from Class 3 ($M=21.73$); there were no other differences (Class 2 $M=22.89$). Groups of dementia participants significantly differed according to their everyday action error profile. These results highlight the potential for performance-based evaluations to identify person-specific targets for interventions to improve functional outcomes.

Correspondence: *Tania Giovannetti, Weiss Hall, Psychology, 1701 N 13th Street, Philadelphia, PA 19122. E-mail: tgio@temple.edu*

**Poster Session 8:
Alzheimers/Medical Disorders/TBI**

3:30-4:30 p.m.

Dementia (Alzheimers)

K.M. BAERRESEN, J.S. MILLER, D. YEH, K.J. MILLER, E.R. HANSON, J. KIM, L.M. ERCOLI, P. SIDDARTH & G.W. SMALL. Neuropsychological Instruments Predicting Conversion to Mild Cognitive Impairment and Probable Alzheimer's Disease.

Objective: We examined which neuropsychological variables (memory, executive, language) are more likely to predict an individual's cognitive decline (i.e., normal to MCI, MCI to AD).

Participants and Methods: A sample of non-decliners ($N=109$) compared to those who convert ($N=24$) in cognitive status (i.e., MCI or AD) with a mean age of 61.44 ($SD=11.29$) was examined. Univariate binary logistic regression was performed to test the predictive values of Buschke Selective Reminding Test (Total, Delay, Recognition), Rey-Osterrieth Complex Figure (Copy, 3-minute Delay, Retention), Trail Making Test B, COWAT (Animals) and Boston Naming Test. Multivariate analyses were built based on the univariate findings after applying the bonferroni correction.

Results: Nonsignificant predictors after applying the corrected alpha were not entered into the multivariate models (e.g., Boston Naming Test, COWAT, etc.). The first model compared non-decliners to those who converted to MCI, $\chi^2(4, N=76)=33.030, p < .001$, and was able to distinguish between non-decliners and those that converted to MCI. Although the univariate analyses yielded some tests as significant predictors of conversion (Buschke [Total, Delay], ReyO Retention, & Trails B), once entered in the multivariate model, the ReyO Retention was the only significant predictor ($OR=0.93, p=0.005$). The second model compared the non-converters to those who did convert to probable Alzheimer's disease; Buschke (Total, Delay, Recognition) and ReyO (Copy, Delay) predicted conversion, $\chi^2(5, N=130)=33.088, p < .001$. Although the univariate analyses yielded some tests as significant predictors of conversion (Buschke, [Total, Delay, Recognition] & ReyO [Copy, Delay]), once entered in the multivariate model, the Buschke Delay was the only significant predictor ($OR=0.54, p=0.017$).

Conclusions: Clinically, these findings suggest 1-2 measures may be adequate in predicting cognitive decline, and may be important for clinicians/researchers to monitor.

Correspondence: *Kimberly M. Baerresen, M.A., Psychology, Loma Linda University, 11130 Anderson Street, Suite 106, Loma Linda, CA 92350. E-mail: kbaerresen@llu.edu*

J. BEN-AMI, B. IZAGUIRRE, P. MCLAUGHLIN, B. LIN, M. MAURER, L.G. APOSTOLOVA, J. RINGMAN, K.D. TINGUS, M.J. WRIGHT & E. WOO. The Roles of Semantic and Serial Clustering in Everyday Functioning in Mild Cognitive Impairment.

Objective: Executive and memory skills play important roles in activities of daily living (ADLs). In addition, strategy use enhances memory recall. Semantic clustering is a more effective strategy relative to serial recall. In the present study we examined whether the type of strategy used during a memory task predicted everyday functioning in mild cognitive impairment (MCI). **Participants and Methods:** Healthy older adults ($n = 35$) and individuals with MCI ($n = 77$) were administered the California Verbal Learning Test-II. Measures of semantic (learning and long delayed recall trials) and serial (learning trials) clustering were obtained. In addition, participants' significant others completed the Functional Activities Questionnaire (FAQ), an informant-based questionnaire regarding ADLs. For each group, hierarchical regressions were used to determine whether memory strategy use (serial or semantic clustering) predicted ADLs.

Results: For the healthy controls, semantic and serial clustering were not associated with everyday functioning. In contrast, greater serial clustering predicted deficiencies in everyday functioning in the MCI group. Specifically, serial clustering at learning predicted poorer abilities to pay bills, use the stove, prepare a meal, and keep track of events, as well as overall functional ability. Additionally, reduced semantic clustering during the long delay predicted increased difficulty in keeping track of events.

Conclusions: MCI participants who relied more on a serial recall strategy had greater difficulties in multiple aspects of everyday functioning. These results suggest that the use of memory strategies uniquely impact everyday functioning in individuals with MCI.

Correspondence: *Ellen Woo, UCLA, 10911 Weyburn #200, Los Angeles, CA 90095. E-mail: ewoo@mednet.ucla.edu*

B. IZAGUIRRE, J. BEN-AMI, P. MCLAUGHLIN, M. RAJAGOPAL, A. HE, L.G. APOSTOLOVA, J. RINGMAN, K.D. TINGUS & E. WOO. The Cognitive Foundations of Memory Strategy Use in Mild Cognitive Impairment.

Objective: Serial clustering is a strategy in which information is recalled based on presentation order. In contrast, semantic clustering is a

more effective strategy in which individuals recall words by organizing them into their superordinate categories. This strategy has been considered to have an executive component in healthy adults. We explored the roles of attention, memory, and executive abilities in memory strategy use in MCI.

Participants and Methods: Healthy older adults ($n = 35$) and individuals with MCI ($n = 76$) were administered the California Verbal Learning Test-II, and measures of serial (learning trials) and semantic (learning and recall trials) clustering were obtained. For each participant, attention, memory, and executive composite scores were also calculated. Hierarchical regressions were used to determine whether these composites predicted memory strategy use (serial or semantic) in each group.

Results: Age and education were not related to memory strategy use for either group. Compared to the healthy controls, the MCI group showed reduced serial and semantic clustering and had lower composite scores across cognitive domains. For the controls, attention, memory, and executive abilities did not predict memory strategy use. For the MCI group, only memory skills predicted the use of semantic clustering at delayed recall.

Conclusions: These findings indicate that memory plays an important role in the ability to utilize an effective strategy during delayed recall in MCI. Interestingly, executive skills did not predict strategy use.

Correspondence: *Ellen Woo, UCLA, 10911 Weyburn #200, Los Angeles, CA 90095. E-mail: ewoo@mednet.ucla.edu*

J. EPPIG, C. NIEVES, G. WICAS, A. TART-ZELVIN, L. BENJAMIN, T. GIOVANNETTI, C.C. PRICE, M. LAMAR, L. DELANO-WOOD, R. AU, M.W. BONDI & D.J. LIBON. Alzheimer's disease with Vascular Co-Morbid Features I: An Empirically-Driven Cluster Analysis Approach.

Objective: Recent research in Mild Cognitive Impairment (MCI) has demonstrated the presence of three distinct neuropsychological subtypes (amnesic, dysexecutive, mixed) upon cluster analyses. Using a similar cluster technique, patients with Alzheimer's disease (AD) and Alzheimer's disease with vascular co-morbid features (AD/ VaD) were examined to test the hypothesis that comparable amnesic, dysexecutive, and mixed subgroups could be derived.

Participants and Methods: A two-step cluster analysis was applied to 171 AD/ VAD patients that were administered a neuropsychological protocol of executive control ('FAS' & Boston Revision of WMS Mental Control subtest), language ('animal' fluency & Boston Naming test), and declarative memory tasks (Philadelphia Verbal Learning Test).

Results: Three groups were derived: an amnesic group ($n = 49$, 28.70%), a dysexecutive group ($n = 51$, 29.80%), and a mixed group ($n = 71$, 41.50%). The groups did not differ in age or education. Amnesic patients scored higher ($M23.73$, $SD2.21$) on the MMSE than mixed patients ($M21.92$, $SD3.01$, $p < .003$). The cluster analysis revealed that mixed/ amnesic patients were comparable on memory testing, but displayed worse performance than dysexecutive patients ($p < .001$). The mixed/ dysexecutive groups performed similarly on executive tasks, but scored lower than amnesic patients ($p < .001$). On language testing mixed patients performed worse than both the amnesic and dysexecutive groups ($p < .001$).

Conclusions: Similar to recent MCI research, a majority of dementia patients present with a mixed neuropsychological profile. Mixed patients resemble the amnesic group on memory testing and the dysexecutive group on executive performance. The mixed group also displays greater impairment on language tasks than both amnesic and dysexecutive patients. Future research should explore the relationship between cluster-determined neuropsychological profiles and relative distributions of underlying neuropathology (i.e. plaques, neurofibrillary tangles, vascular disease, etc.).

Correspondence: *Joel Eppig, B.A. in psychology; Neurology; Drexel University College of Medicine, 777 N 27th Street, Philadelphia, PA 19130. E-mail: joel.eppig@temple.edu*

J. EPPIG, C. NIEVES, G. WICAS, A. TART-ZELVIN, L. BENJAMIN, T. GIOVANNETTI, C.C. PRICE, M. LAMAR, L. DELANO-WOOD, R. AU, M.W. BONDI & D.J. LIBON. Alzheimer's disease with Vascular Co-Morbid Features II: Further Neuropsychological Comparison of Cluster-Derived Subgroups.

Objective: Previous research clustered patients with Alzheimer's disease (AD) and Alzheimer's disease with vascular co-morbid features (AD/VaD) into three subtypes. The current study further characterizes the neuropsychological profiles of these groups.

Participants and Methods: 171 AD/ VAD patients classified as amnesic (28.70%), dysexecutive (29.80%), or mixed (41.50%) were compared on tests of working memory, processing speed, visuoconstruction, concept formation, and episodic memory.

Results: On verbal (Backwards Digit Span) working memory tasks mixed patients performed better than dysexecutive patients ($p < .003$), but equivalent to amnesic patients for serial recall. Amnesic patients scored better than dysexecutive patients ($p < .001$). Visual (Object Span) serial recall was equal among mixed/dysexecutive patients and mixed/amnesic patients; the amnesic group scored higher than dysexecutive patients ($p < .001$). In the domain of processing speed, Mental Control time to completion was equivalent for mixed/ dysexecutive patients, though amnesic patients outperformed other groups ($p < .001$). No differences were observed on WAIS-III Digit Symbol/ Copy. Total clock drawing errors were equal for mixed/dysexecutive patients; amnesic patients generated fewer errors compared to other groups ($p < .001$). Within group, amnesic patients made more WAIS-III Similarities inset vs. out-of-set errors ($p < .001$), dysexecutive patients made more out-of-set vs. inset errors ($p < .001$), and mixed patients produced equal numbers of inset/ out-of-set errors. On verbal serial list-learning mixed/amnesic patients were equivalent for number and prototypically of cued recall intrusions; dysexecutive patients scored better on both metrics compared to the other groups ($p < .009$).

Conclusions: Mixed patients mainly resemble the dysexecutive group on working memory, processing speed and visuoconstruction output, and the amnesic group on episodic memory tests. These measures should be incorporated into standard clinical assessments for dementia.

Correspondence: *Joel Eppig, B.A. in psychology; Neurology; Drexel University College of Medicine, 777 N 27th Street, Philadelphia, PA 19130. E-mail: joel.eppig@temple.edu*

C.M. FIGUEROA, K.E. HAZLETT, K.A. NIELSON, J.L. WOODARD, J. SMITH, M. SEIDENBERG, S. DURGERIAN, N.C. HANTKE, M.A. SUGARMAN, C.D. KAY, C.C. KANDAH, A.L. NORMAN, M.A. LANCASTER, M.A. MATTHEWS & S.M. RAO. Predictive Ability of Intraindividual Variability in Healthy Elders at Risk for Alzheimer's Disease.

Objective: Intraindividual variability (IIV) of cognitive task reaction time (RT) increases with age and is associated with slower and poorer cognitive performance. It has further been found to distinguish between intact and cognitively impaired healthy individuals but has not been assessed in healthy elders at risk for Alzheimer's disease (AD) or in mild cognitive impairment (MCI).

Participants and Methods: Eighty-seven apolipoprotein-E (APOE) genotyped older adults (Male $n = 35$; Mage = 73; Medication = 14.5 years) performed a task assessing semantic and episodic memory and a neuropsychological battery. Group comparisons were made by age (young-old [age 62 to 73, $n = 45$], old-old [age 74 to 85, $n = 42$]) and risk for AD: No Risk ($n = 31$), intact $\epsilon 4+$ ($n = 39$), and MCI diagnosed using Petersen criteria ($n = 17$). MCI participants were also predominantly $\epsilon 4+$. Mean RT and coefficient of variance (CV) via Hultsch's method were used to measure IIV as predictors in logistic regression (LR).

Results: LR models were weak in predicting age, but episodic CV for correct rejections was a significant factor with mean episodic RT a trend factor. Predicting No Risk and $\epsilon 4+$ groups was not significant for mean RT alone, but the addition of semantic and episodic CV yielded significant prediction attributable to CV ($R^2 = .16$). Prediction of No Risk vs. MCI showed significant prediction by mean RT that was significantly enhanced by the addition of CV ($R^2 = .43$).

Conclusions: IIV is a valid indicator of group membership among healthy, cognitively intact individuals at genetic risk for the development of AD, and individuals with MCI. IIV enhanced ability to differentiate between MCI and healthy participants and between persons at-risk and not-at-risk for AD. Thus, IIV appears to be a sensitive to cognitive impairment as well as impending cognitive decline.

Correspondence: *Christina M. Figueroa, Bachelor of Science, Clinical Psychology, Marquette University, 604 N. 16th Street, Milwaukee, WI 53201. E-mail: christina.figueroa@marquette.edu*

T. FORD, A.I. FORD, H. DODGE & B. GIORDANI. Predictive Validity of Yearly Cognitive Screening to Autopsy-confirmed Cases of Alzheimer's Disease.

Objective: Predictive validity of dementia screening instruments is of utmost importance but data from pathology-confirmed dementia cases is rarely presented. We analyzed results of the cognitive questionnaire from the Health and Retirement Study (Ofstedal, Fisher, & Herzog, 2005), which requires only approximately 10 minutes to administer via telephone.

Participants and Methods: Our sample included 110 responses nested within 30 older adults who were tested annually for 9 years. Participants in this sample had consented to brain autopsy and were pathology-confirmed to have Alzheimer's disease or have no significant brain abnormality. Two-level HLM growth model analysis of longitudinal, Rasch-modeled, AHEAD data was conducted to distinguish between autopsy groups on initial status and rate of change in AHEAD scores over time.

Results: This study found significant differences in initial status of test scores for autopsy groups when the linear growth model analysis was conducted separately with the time variable centered at Years 5-7, with the largest differences in groups coming in Year 7 (-.934 logits less for Alzheimer's group). Further, the entire sample exhibited significant average decline in scores over time (-.164 logits per year), with a marginally but significantly higher rate of decline among the Alzheimer's group (-.346 logits decline per year, $p < .10$). Age and sex were not found to be significantly related to either initial status or rate of change in test score.

Conclusions: Results of this analysis support the validity of the HRS cognitive screening in correctly identifying participants with confirmed Alzheimer's dementia.

Correspondence: *Alicia I. Ford, Psychology & Behavioral Sciences, Louisiana Tech University, PO Box 3163, Ruston, LA 71272. E-mail: aford@latech.edu*

D. GANDINI, F. PETERS, I. ROULEAU & S. JOUBERT. On The Relation Between Face Perception And Cerebral Anatomy In Alzheimer Disease.

Objective: One of the central face processing is the capacity to encode configural information; this corresponds to the spatial relations between attributes of the face (e.g., distance between mouth and nose). The importance of configural information is illustrated by the inversion effect (IE), consisting in a discrepancy of discrimination and recognition performances when items are presented upside-down (Yin, 1969). This effect is specific to face processing. In patients suffering from Alzheimer disease (AD), the IE is present when there is no rotation between the target face and the test face; furthermore, their performances are optimal when faces are presented in front view (Adduri & Marotta, 2009). These results suggest an impairment in AD patients to process configural information. So, the goals of this study were twofolds : (a) to determine if early face processing was deleted or spared in AD, and (b) to study the relationships between face perception and cerebral anatomy in AD.

Participants and Methods: To do so, 12 early AD patients (mean y.o. : 75 +/- 7.7; mean MMSE : 25.6 +/- 2.9) were assessed with two experimental tasks, manipulating : (a) the effect of category : they had to match faces and cars, and (b) the effect of distance between face attributes : they had to match faces which the space between eyes (horizontal axis) or between eyes and forehead (vertical axis) were modified. AD patients were also scanned during a 30 min-session structural MRI.

Results: The results showed that participants exhibited an IE, as well as face or car items. Moreover, they made more errors when they matched faces modifying on vertical axis. Finally, these performances were related to volumetry and cortical thickness of cerebral regions implied in face perception (e.g., fusiform gyrus area).

Conclusions: Overall, this suggests that the encoding process of configural information is impaired in AD patients. These deficits seemed to be explained by an early damage of the ventral visual way.

Correspondence: *Delphine Gandini, Post-doc, CRIUGM, 4565 Chemin Queen Mary, Montreal, QC H3W 1W5, Canada. E-mail: delphine.gandini@criugm.qc.ca*

J.M. GRABYAN, P.J. MASSMAN, W. ALVERSON & R.S. DOODY. A Simple Method for Enhancing Prediction of Longitudinal Decline in Instrumental Activities of Daily Living in Alzheimer's Patients.

Objective: Appropriate planning for the future functional decline of patients with Alzheimer's disease (AD) is very important. An easy-to-utilize, reliable method for predicting progression of deficits in instrumental activities of daily living (IADL) would have great clinical utility. It was hypothesized that an estimate of the rate of IADL decline prior to a patient's first assessment for AD would enhance prediction of subsequent longitudinal IADL decline.

Participants and Methods: Subjects were 618 patients with a diagnosis of probable AD enrolled in the Baylor College of Medicine Alzheimer's Disease and Memory disorders research database who had a baseline visit and at least one annual follow-up visit (up to ten total). Lawton's IADL scale scores were obtained based on informant report. Estimations of illness duration prior to enrollment were made using standardized methods. A rate of pre-progression IADL decline was then calculated and used to predict IADL change over time (IADL at baseline - expected 'normal' IADL / estimated duration).

Results: Mixed effects regression analyses revealed that the IADL pre-progression estimate significantly predicted longitudinal decline of IADL scores ($p < 0.001$), even when other significant covariates available at baseline (age, baseline MMSE scores) were included in the predictive model.

Conclusions: The easily calculated estimate of the rate of IADL decline prior to the initial visit clearly improved prediction of subsequent observed progression of IADL deficits in AD. Therefore, this IADL pre-progression estimate appears to be a valid, useful tool for assisting clinicians, patients, and family members in anticipating future IADL decline and the accommodations that might be needed. Follow-up studies will examine the relationship between this method of predicting IADL progression and neuropsychological decline .

Correspondence: *Jonathan M. Grabyan, M.A., University of Houston, 7490 Brompton, Apt 279, Houston, TX 77025. E-mail: jgrabyan@gmail.com*

R. CHASSE, T. BENZINGER, E. GRANT, N. CAIRNS, A. FAGAN, J. MORRIS & J. HASSENSTAB. Using Biomarkers and Neuroimaging to Detect Early Cognitive Decline in Preclinical AD: the SuperNorms Study.

Objective: Use of normative data in the neuropsychological assessment of dementia is limited by the quality of normative datasets. Normative samples may be contaminated with individuals who have preclinical Alzheimer's disease (AD) and are already experiencing subtle cognitive decline. Means drawn from these samples may be artificially low, reducing the sensitivity to detect impairment.

Participants and Methods: We used widely accepted AD biomarkers including amyloid imaging (PET PIB), cerebrospinal fluid (A β 42), and hippocampal volumes in 161 individuals (ages 65-89) enrolled in ongoing studies of aging and dementia to identify clinically normal (CDR 0) individuals who were free of 'positive' biomarkers (n=95) and individuals who had one or more positive biomarker (n=66). We then used the biomarker free group to classify a second cohort that enrolled as

healthy controls but either died without neuropathology of AD (n=14) or who died with AD neuropathology (n=28). Scores at the visit prior to their clinical diagnosis of AD (CDR \geq 0.5) were analyzed in order to determine if our super-normative database could potentially enhance the early detection of AD.

Results: Clinically normal individuals with one or more positive AD biomarkers performed significantly worse on several cognitive tests, after controlling for age, including associative encoding (p=.02), narrative recall (p=.01), and digit-symbol coding (p=.04). Classification accuracy for AD at the visit prior to clinical diagnosis was remarkably poor using a variety of different normative cutoff scores (-1, -1.5, & -2 standard deviations). The best predictive value for diagnosing AD was using a -1.0 SD cutoff, where 89% of the AD group had at least 1 value below the cutoff, but only 27% of the control group was correctly classified.

Conclusions: Our results suggest that using normative cutoff scores, even those derived from an exceptionally robust control group free of any AD biomarkers, are ineffective at detecting the earliest stages of AD. Correspondence: Jason Hassenstab, PhD, Washington University in St. Louis, 4488 Forest Park, Suite 130, St. Louis, MO 63108. E-mail: hassenstabj@wustl.edu

N. HAUGRUD, M. CROSSLEY, M.E. O'CONNELL & D. MORGAN. Individuals Diagnosed With Preclinical and Early Stage Alzheimer's Disease Produce Fewer Low Frequency Words on a Semantic Verbal Fluency Task.

Objective: To investigate the impact of amnesic mild cognitive impairment (aMCI) and Alzheimer's disease (AD) on the semantic network through comparison of typicality of exemplars produced during a speeded verbal fluency task (Animal Naming) by individuals diagnosed with aMCI, AD, and healthy older adults (control group).

Participants and Methods: Healthy older adults (N = 26) were compared to patients diagnosed with aMCI (N=14), and AD (N=22) by an interdisciplinary team. Participants orally produced animal names in a speeded 60 second trial. Control participant data were used to produce frequency scores for each exemplar and average exemplar frequency scores were calculated for each participant as a measure of typicality.

Results: As expected, using univariate ANOVA, the control group produced the most total words, followed by the aMCI and AD groups. The AD group also produced significantly lower typicality scores than the control group, indicating the AD group generated fewer infrequent category exemplars. There was a trend for the aMCI group to produce more infrequent words than the AD group, but less infrequent words than the control group.

Conclusions: This study indicates individuals diagnosed with AD produce fewer words and fewer atypical category members on the Animal Naming task. Results are consistent with previous studies noting AD groups generate fewer atypical members of categories (Marczinski & Kertesz, 2006; Sailor et al., 2004), and show a disrupted semantic network for animals (Chan et al., 2001; Hernandez et al., 2008). The semantic structure for more typical animal exemplars appears intact in early AD; however the semantic structure supporting less typical animals is impaired, and this decline begins in the earliest stages of the disease. Animal naming exemplar typicality could be valuable for early diagnosis of AD.

Correspondence: Nicole A. Haugrud, Bachelor of Arts, honors, Psychology, University of Saskatchewan, 2106 Brunswick Street, Halifax, NS B3K2Y8, Canada. E-mail: nicole.haugrud@usask.ca

K.E. HAZLETT, C.M. FIGUEROA, K.A. NIELSON, S. DURGERIAN, J.L. WOODARD, J. SMITH, M. SEIDENBERG, N.C. HANTKE, M.S. SUGARMAN, C.D. KAY, C.C. KANDAH, A.L. NORMAN, M.A. LANCASTER, M.A. MATTHEWS & S.M. RAO. Longitudinal Change in Parahippocampal Cortical Thickness as a Function of Cognitive Decline and Genetic Risk for Alzheimer's Disease.

Objective: Cortical atrophy is a marker of Alzheimer's Disease (AD). Decreased cortical thickness (CT) is prominent in the medial temporal

lobe, specifically the parahippocampal gyrus (PHG). CT measures may be more sensitive to AD-related atrophy than regional volumes. Studies of CT suggest that carriers of the apolipoprotein-E $\epsilon 4$ (APOE- $\epsilon 4$), a risk factor for AD, have greater initial CT than non-carriers, but show a steeper decrease in CT with age. Longitudinal studies assessing CT changes in persons at genetic risk for AD are lacking, hence the purpose of this study.

Participants and Methods: 60 healthy older adults (75% female; Mage = 73yrs; Medu = 14.9yrs) underwent 3T fMRI at baseline, 18 months, and 4.5yrs. Four groups were created based on cognitive decline and APOE- $\epsilon 4$ status (n): Stable/ $\epsilon 4$ - (26), Stable/ $\epsilon 4+$ (12), Decline/ $\epsilon 4$ - (10), and Decline/ $\epsilon 4+$ (12). Cognitive decline was defined as a reduction of ≥ 1 SD from baseline to 18-months on one or more outcome indices (DRS-2 Total, RAVLT 1-5, RAVLT Delayed Recall). Cortical thickness was measured from T1-weighted SPGR images using FreeSurfer (v5.1).

Results: ANCOVA (covarying age) was conducted for PHG CT. Greater CT at baseline and 18 months was evident in both $\epsilon 4+$ groups. A CT increase across time was seen in the Stable/ $\epsilon 4$ - group (p=.033), while a significant decrease was seen only in the Decline/ $\epsilon 4+$ group (p=.003), from 18-months to 4.5 years. Group differences in CT were seen in left PHG CT, but not right (p < .000).

Conclusions: This longitudinal study revealed greater CT at baseline in APOE $\epsilon 4+$ participants at baseline, followed by significant loss of CT with cognitive decline. In contrast, $\epsilon 4+$ participants whose cognition was stable over 4.5 years also demonstrated stable PHG CT. These results suggest left PHG CT may be sensitive to cognitive decline, specifically in $\epsilon 4$ carriers, but that the $\epsilon 4$ allele alone is not associated with PHG atrophy or cognitive decline.

Correspondence: Kathleen E. Hazlett, Master of Science, Psychology, Marquette University, 604 N. 16th Street, Cramer Hall 317, Milwaukee, WI 53233. E-mail: kathleen.hazlett@marquette.edu

S. HORNING, R.J. MELROSE & D. SULTZER. Insight in Alzheimer's Disease and its Relation to Psychiatric and Behavioral Disturbances.

Objective: Individuals with Alzheimer's disease (AD) often have impaired awareness or a lack of insight, as defined as the overall ability to appreciate skills, cognitive deficits, and engage in reasonable future planning. Previous research has documented a relationship between depression and insight in AD, such that greater insight has been associated with a higher degree of depression. However, little is known about the relationship between insight and other psychiatric or behavioral problems common in this disease. The present study aimed to address this gap.

Participants and Methods: This study included 107 outpatients who met the NIA/Alzheimer Association criteria for probable AD. Instruments included the Neurobehavioral Rating Scale, the Apathy Evaluation Scale, and the MMSE. A series of hierarchical regression analyses were conducted to determine the impact of insight on depressed mood, anxiety, psychosis, apathy, agitation, and behavioral retardation in AD patients after controlling for cognitive functioning.

Results: Overall, insight was found to significantly predict depressed mood, anxiety, and apathy, while controlling for the effect of global cognition. Greater insight was found to be associated with anxiety and depressed mood (F[1, 102] = 4.80, p = .03 and F[1, 102] = 6.00, p = .02). In contrast, less insight was associated with greater apathy (F[1, 49] = 6.64, p = .01). Level of insight was not found to significantly predict agitation/disinhibition (F[1, 101] = 0.49, p = .49), behavioral retardation (F[1, 101] = 0.60, p = .44), or psychosis (F[1, 101] = 0.78, p = .38) after controlling for cognition.

Conclusions: Based on the findings, insight appears to be differentially related to mood symptoms and apathy within AD, such that patients with more insight are more depressed, while patients with less insight are more apathetic. This suggests that assessment of insight in AD may assist clinicians in distinguishing between depression and apathy in order to provide the most appropriate treatments and intervention.

Correspondence: Sheena Horning, Psychology, West Los Angeles VA Healthcare Center, 11301 Wilshire Ave., Los Angeles, CA 90073. E-mail: Shorning@uucs.edu

N.C. KAISER, G.J. LEE, P. LU, M. MATHER, J. SHAPIRA, E. JIMENEZ, P.M. THOMPSON & M.F. MENDEZ. Proverb Test Performance and Neuroanatomical Correlates in Frontotemporal Dementia and Early-onset Alzheimer's disease.

Objective: Patients with behavioral variant frontotemporal dementia (bvFTD) may be particularly impaired in proverb interpretation compared to individuals with early-onset Alzheimer's disease (EOAD); yet nearly no studies to-date have examined this comparison. We used the Delis-Kaplan Executive Function System (D-KEFS) Proverbs subtest to assess between-group differences in performance for abstract conceptualization and semantic knowledge as well as tensor-based morphometry (TBM) to map the association between regional brain volume and proverb performance.

Participants and Methods: 11 bvFTD and 10 EOAD patients completed the D-KEFS Proverb Test. Raw and age-adjusted normed data for multiple choice responses were analyzed, using independent samples t-tests. TBM was applied to 3D T1-weighted MRI scans. Mean jacobian values within select regions of interest were computed to provide a numeric summary of regional volume, and voxel-wise regression was performed, yielding 3D statistical maps of the association between tissue volume and Proverb scores.

Results: AD patients performed better on this test when compared to FTD patients. Specific differences were documented with respect to correct concrete responses (FTD>AD); correct abstract responses (AD>FTD); incorrect phonemic responses (FTD>AD); and common as well as uncommon proverb interpretation (AD>FTD). Imaging analyses indicated significant correlations with left orbitofrontal and bilateral anterior temporal lobe volume across dementia groups, adjusted for age. After additionally controlling for dementia diagnosis, the anterior temporal lobe region remained significant (left>right).

Conclusions: These findings highlight relative difficulty in FTD in being able to rise above a concrete or literal level of linguistic interpretation. Such deficits are associated with left anterior temporal atrophy, which may represent deterioration of semantic knowledge.

Correspondence: *Natalie C. Kaiser, Ph.D., Neurobehavior, Greater Los Angeles VA Healthcare Center, 11301 Wilshire Blvd., Bldg. 401, Room A232 Mail Code 116AF, Los Angeles, CA 90073. E-mail: Natalie.Kaiser@va.gov*

R.P. KESSELS & L. JOOSTEN-WEYN BANNINGH. Controlled Evaluation of a Non-Pharmacological Intervention for Patients with Mild Cognitive Impairment and Their Significant Others.

Objective: Patients with Mild Cognitive Impairment (MCI) are likely to develop Alzheimer dementia, but pharmacological interventions have to date not been successful. We present the results of a controlled non-pharmacological intervention specifically developed for MCI patients and their partners, combining cognitive behavioral therapy, psychoeducation and cognitive rehabilitation.

Participants and Methods: 93 patients with MCI participated, mean age 70.1 (SD=7.1), MMSE 25.7 (SD=3.4), and 84 significant others. 30 patients and 27 partners were first assigned to a waiting-list control group. The intervention was a 10-session group program (partly separate for patients and partners) that addressed themes such as the label MCI, memory training, and wellbeing. Distress level was assessed with the GDS, acceptance and helplessness by the ICQ and wellbeing with the RAND-36. A subsample was re-examined 6-8 month after treatment (47 patients, 47 controls), but this part of the study was uncontrolled.

Results: MCI patients improved on acceptance after treatment ($p<0.05$), but not on distress, helplessness and wellbeing. No significant changes were found in the significant others, but qualitative analyses suggested improvement in insight and coping. Follow-up assessment showed that the improved acceptance was maintained in the MCI patients, and insight increased ($p<0.001$). In both patients and partners, helplessness and wellbeing were worse ($p<0.05$), and caregiver burden increased in the partners ($p<0.05$).

Conclusions: The effects of this MCI group intervention are small, yet promising. Specifically, MCI patients profited from a heightened

acceptance that was still present at follow-up. Moreover, a positive effect on awareness of the memory problems was found in the MCI patients at follow up. Unfortunately, over time well-being decreased and helplessness increased in the MCI patients and their caregivers. This stresses the need for continued support in patients and significant others.

Correspondence: *Roy P. Kessels, PhD, Radboud University Nijmegen, PO Box 9104, Nijmegen 6500 HE, Netherlands. E-mail: r.kessels@donders.ru.nl*

N.A. KIEWEL, S. TIAN & P. MASSMAN. Predictive Utility of an ADAS-cog Pre-Preprogression Rate in Patients with Probable Alzheimer's Disease.

Objective: Rates of progression in Alzheimer's disease (AD) are heterogeneous, thus predicting rate of decline could be beneficial for care planning purposes. Previous research has demonstrated that a pre-progression rate using the MMSE significantly predicted subsequent rate of decline on several cognitive and functional measures (Doody et al., 2010). The aim of the present study was to examine the predictive utility of an ADAS-cog pre-progression rate.

Participants and Methods: Participants included 368 probable AD patients (252 females, 116 males) who were followed annually by the Baylor College of Medicine AD and Memory Disorders Center. At the initial visit, the mean age was 74.15 (SD = 7.28), mean education was 14.29 (SD = 3.30), mean MMSE score was 22.75 (SD = 4.49), and mean ADAS-cog score was 18.66 (SD = 8.35). Participants were followed for an average of 3.81 years (SD = 1.72). A pre-progression rate using baseline ADAS-cog scores and a physician's estimate of illness duration was calculated for each participant: (ADAS-cog - age-based ADAS-cog normative value)/duration. Data were analyzed using mixed model regression (with covariates including age, sex, education, and CDR-Sum of Boxes) in order to assess the incremental predictive utility of the ADAS-cog pre-progression rate on subsequent rate of change on a variety of standardized cognitive and functional measures.

Results: Results indicated that the ADAS-cog pre-progression rate did not significantly predict subsequent rate of decline on any of the cognitive or functional measures examined (p 's > .05).

Conclusions: Contrary to previous research using an MMSE pre-progression rate, the ADAS-cog pre-progression rate did not provide additional predictive utility regarding rate of decline after controlling for initial level of dementia severity and other covariates. The clinical implications of these results are discussed.

Correspondence: *Nicole A. Kiewel, MS, Psychology, University of Houston, 126 Heyne Building, University of Houston, Houston, TX 77204-5022. E-mail: nicole.kiewel@gmail.com*

R. IDA, T. NADER, M. LACY & M. GOLLA. The Effects of Depression on Executive Functioning in a Geriatric Dementia Population.

Objective: Depression and dementia are commonly diagnosed in the elderly and both are often associated with executive impairment (Lockwood, Alexopoulos, & van Gorp, 2002; Kastenschmidt & Kennedy, 2011, Alzheimer's Association, 2012). Better understanding of the effects of depression on executive functioning can help guide treatment interventions (Cui, Lyness, Tu, King, & Caine, 2007). The present study examined the relationship between depression and executive functioning in older adults presenting to a memory center.

Participants and Methods: Two hundred and fifty-six consecutive patients seen at a university based memory clinic completed the Mini Mental Status Examination (MMSE), the Geriatric Depression Scale (GDS) and several executive tasks: Trail Making Test (A & B), Wisconsin Card Sorting Test (WCST), Controlled Oral Word Association Test (COWAT) and Clock Drawing test as part of a larger assessment. The mean age of the sample was 78.6 (SD=6.62) with an average of level of education of 13.61 years (SD=3.48) and an estimated average intellect (WRAT-IV M = 98.95, SD=16.88). Seventy percent were woman and sixty-eight percent were African American.

Results: The GDS failed to correlate with any of the executive tasks: TMT-A $p=.37$; TMT-B $p=.49$; WCST-PR $p=.40$; COWAT $p=.10$ and Clock $p=.09$. In contrast, the MMSE exam correlated with all executive tasks ($p=.000$).

Conclusions: The current findings suggest that depression seen in patients presenting to a geriatric memory center may be more related to overall cognitive impairment than acute mood state. This provides further support for the recent finding that depression with executive impairment may be a risk factor for dementia and Alzheimer's disease (Joan Vilalta-Franch, et al. 2012). The role of age and education factors on assessment of depression, along with future studies will be discussed. Correspondence: *Robert Ida, M.A., Illinois School of Professional Psychology, Schaumburg, IL, 1617 Waterville Lane, Schaumburg, IL 60194. E-mail: robert.ida33@gmail.com*

N. MAHENDRA. Recall Of Short Stories Versus Routes By Persons With Dementia.

Objective: The purpose of this study was to compare the immediate and delayed recall of stories and routes by persons with dementia.

Participants and Methods: 25 persons with dementia (21 with AD, 4 with vascular dementia) were administered immediate and delayed recall tasks using two types of stimuli — short stories and actual demonstrations of a route. These tasks were completed in the context of administering the Rivermead Behavioral Memory Test (RBMT-2; Wilson, Cockburn, & Baddeley, 2003). Participants' hearing and vision abilities were screened, followed by using the Dementia Rating Scale (DRS-2; Jurica, Leitten, & Mattis, 2001) to assess global cognitive status.

Results: Results of this study revealed a striking double-association showing that persons with dementia recalled routes significantly better than they recalled stories at immediate and at delayed recall intervals. A non-parametric chi-squared test was used to compare numbers of participants who had zero scores on story and route recall versus participants who had perfect scores. Chi-squared test analyses revealed a statistically significant difference ($X^2 = 15.121$, $p = 0.0017$) in recall performance of routes versus stories. There was some variability in performance across recall tasks, among our study participants. For instance, 2 of the 25 participants with more moderate dementia were unable to successfully recall any component of the route learning task at immediate recall.

Conclusions: These results strongly validate that dementia impacts declarative memory systems more profoundly than it does nondeclarative memory systems. These findings also suggest the importance of assessing both episodic and procedural recall in persons with dementia, to more fully understand spared and impaired abilities, as well as to document restorative potential.

Acknowledgment: This study was part of a larger grant, awarded to the author, by the Alzheimer's Association.

Correspondence: *Nidhi Mahendra, Ph.D., Communicative Sciences & Disorders, California State University East Bay, 47307 Rancho Higuera Rd, Fremont, CA 94539. E-mail: mahendranidhi@gmail.com*

N. MAHENDRA, K. FREMONT, E. DIONNE & R. WILHEIM. Making Music: Quantifying Communicative and Affective Outcomes of a Music-based Intervention for Dementia Residents.

Objective: The purpose of this presentation is to report the outcomes of a music-based intervention on the communication and affect of persons with moderate dementia, as well as their self-reported social validation of the intervention.

Participants and Methods: This intervention was implemented in a dementia unit over 12 weeks, following a two-week baseline. It was part of a quality improvement project to develop and implement evidence-based interventions for persons with moderate dementia.

Eight persons with moderate Alzheimer's dementia participated in this study. Participants' hearing and vision function was screened, cognitive status assessed (using the Montreal Cognitive Assessment), and charts studied prior to initiating the intervention.

Specific outcomes tracked over time related to nonverbal communication (e.g. foot/hand tapping), verbal communication (e.g. singing along, spontaneous comments), observed affect, and social validation. Participant performance was tracked live and from video recordings each session. A novel study component was an emphasis on staff training and environmental modification to ensure sustainability of this intervention, after the research study concluded.

Results: The efficacy of the intervention was demonstrated clearly in significantly more on-task communicative behaviors, observed improved positive affect, more engagement and less disengagement, and residents' social validation statements (e.g. We need this - it makes us think).

Conclusions: Key components that led to intervention success were semantic organization of themes related to music; structured repetition; session format consistency; use of large-font song sheets and original soundtracks; and rigorous outcomes assessment. We will provide data on the degree of intervention sustainability, achieved by facility staff, over 8 weeks after study conclusion. Information will be provided on the training, materials, and direct assistance provided to staff to give context to our sustainability data.

Correspondence: *Nidhi Mahendra, Ph.D., Communicative Sciences & Disorders, California State University East Bay, 47307 Rancho Higuera Rd, Fremont, CA 94539. E-mail: mahendranidhi@gmail.com*

E. MAK, R. CHIN, T.L. NG, H.C. WEE, D. YEO & H. SHAHUL. Anosognosia in a Singaporean cohort of persons with cognitive impairments.

Objective: Loss of insight of cognitive deficits is a common phenomenon in patients with Alzheimer's disease (AD). There is also a lack of consensus regarding the prevalence of impaired insight among patients with Mild Cognitive Impairment (MCI). We aim to investigate the clinical and behavioral associations with anosognosia in AD and MCI patients.

Participants and Methods: 88 participants (30 controls, 21 MCI, and 37 AD), each accompanied by a caregiver, were assessed with the anosognosia questionnaire (AQ-D) and a psychiatric evaluation. An index of anosognosia was computed as the difference between the Informant AQ-D and the Patient AQ-D. Disease severity was evaluated with the MMSE, while other assessments included the Apathy Evaluation Scale and Geriatric Depression Scale (GDS). Distress on caregivers was assessed using the Caregiver Burden Scale.

Results: ANOVA test revealed differences in anosognosia across the AD, MCI, and control groups [$F(2, 84) = 27.58$, $p < 0.001$]. Tukey post-hoc comparisons showed significant differences of anosognosia between all groups (AD > MCI > Control). Anosognosia showed positive correlations with age ($r = 0.32$, $p = 0.004$), apathy ($r = 0.55$, $p < 0.000$), and negative correlation with MMSE ($r = -0.60$, $p < 0.000$). We calculated a stepwise regression analysis with anosognosia index as the dependent variable, and age, gender, education MMSE, GDS, as the independent variables. Results demonstrated overall significance [$R^2 = 0.41$, $F(1, 61) = 41.8$, $p < 0.000$], with only MMSE ($\beta = -.64$, $p < 0.000$) contributing significantly to the variance in anosognosia scores.

Conclusions: Our study showed that anosognosia worsens with disease severity, and is associated with age, and apathy. Moreover, the finding of increased anosognosia in the MCI group relative to healthy controls suggests that a loss of insight could precede further cognitive dysfunctions. These findings may potentially contribute towards early diagnosis and hold practical relevance for the management of patients with cognitive impairments. Correspondence: *Elijah Mak, BA Psychology, Singapore General Hospital, 56 Choa chu kang north 6 #16-36, Singapore 689577, Singapore. E-mail: foomak@buffalo.edu*

A. MARTYR & L. CLARE. Executive Function And Activities Of Daily Living In Alzheimer's Disease: A Correlational Meta-Analysis.

Objective: The assessment of executive function (EF) and activities of daily living (ADL) are important elements in the diagnosis of Alzheimer's disease. Following a comprehensive search in three databases, a correlational meta-analysis investigated the association between tests of EF and ADL in Alzheimer's disease.

Participants and Methods: Forty-nine studies met the inclusion criteria and a total of 3,630 participants were included, the majority of whom were diagnosed with Alzheimer's disease. A random-effects meta-analysis was used to investigate the association between ADL ability and seventeen tests of EF, three tests of attention and working memory and a test of cognitive status (Mini-Mental State Examination; MMSE). The association between EF and ADL ability was further investigated in relation to four different methods of assessing ADL and one specific ADL, driving.

Results: Most of the individual tests, including commonly used tests of EF such as the Clock Drawing Test, Letter Fluency and the Trail Making Test Part B, showed a significant moderate association with ADL. Significant moderate associations were found between EF and all four methods of assessing ADL ability. Driving ability was also moderately associated with EF. No tests of EF were significantly moderated by age or MMSE score. Increasing age was found to influence informant-rated ADL, with a trend for performance-based ADL ability, suggesting that generally age had a greater impact on ADL than on scores on tests of EF.

Conclusions: Overall, the meta-analysis suggests a consistent moderate association between ADL and EF, supporting the growing evidence for a link between ADL and executive dysfunction in early dementia.

Correspondence: *Anthony Martyr, School of Psychology, Bangor University, Brigantia Building, Bangor LL57 2AS, United Kingdom. E-mail: a.martyr@bangor.ac.uk*

R.J. MELROSE, L.E. NATTA, D. HARWOOD, M. MANDELKERN & D.L. SULTZER. Hypometabolism in Attention Networks in Alzheimer's Disease: an FDG-PET Study of the Stroop.

Objective: Patients with Alzheimer's Disease (AD) show poor attention. Cognitive models suggest alerting, or sustained attention is associated with fronto-parietal cortex. Orienting, or directing and disengaging is associated with temporoparietal cortex. Executive attention is associated with anterior cingulate-insular cortex. Considering AD is characterized by hypometabolism of temporoparietal cortex, the purpose of this study was to identify the neural correlates of attention in AD.

Participants and Methods: Seventy participants with AD completed FDG-PET scanning and the Golden Stroop. COLOR and WORD conditions were conceptualized as measuring directed and sustained attention. The interference effect (INT) was defined as measuring executive attention. Using SPM2, we correlated FDG-PET data with the COLOR, WORD, and Color-Word (CW) conditions. To assess INT, we correlated FDG-PET with CW, covarying for WORD and COLOR. Results were considered significant at the voxel level ($p < .001$ uncorrected, extent 50 voxels).

Results: Patients were mild/moderately demented (mean, sd: MMSE=20.3, 5.4) and impaired on the Stroop (Word=56.9, 21.6; Color=32.6, 14.6; CW=11.8, 9.7). WORD was positively correlated with metabolism of bilateral inferior/superior parietal lobules (IPL/SPL) and right occipital lobe. COLOR additionally correlated with right middle frontal gyrus (MFG), right posterior cingulate, right temporal lobe, and left occipital lobe. CW correlated with metabolism of right frontal pole, right MFG, right insula, and bilateral IPL/SPL. INT correlated with metabolism of right anterior cingulate and insula.

Conclusions: In AD, poor attention is reflective of parietal lobe hypometabolism that is typical of the disorder. In addition, deficits in executive attention are not simply due to parietal dysfunction, but reflect compromise to frontal-insular regions implicated in conflict resolution. These findings highlight the complexity of attention in AD, which may explain the heterogeneity of this ability in early stages of the disease.

Correspondence: *Rebecca J. Melrose, PhD, Brain Behavior and Aging Research Center, VA Greater Los Angeles Healthcare System, 11301 Wilshire Blvd., 116AE, Los Angeles, CA 90073. E-mail: rmelrose@ucla.edu*

D.C. MOGRABI, R. BROWN, C. SALAS & R. MORRIS. Implicit reactivity to failure in tasks in Alzheimer's disease.

Objective: Despite lack of awareness about task performance being a common feature of Alzheimer's disease, clinical anecdotes have suggested that patients may show emotional or behavioural responses to the experience of failure, an aspect which has been little explored experimentally. The current study investigated emotional reactions to success or failure in tasks which systematically control performance levels.

Participants and Methods: Novel computerized tasks were developed which exposed participants to systematic success or failure, the first a reaction time task and the second involving memory functioning. The level of failure was designed to be no worse than that experienced by patients with Alzheimer's disease on conventional neuropsychological procedures. Awareness of performance was measured by comparing estimation of performance with actual performance. Emotional reactivity was measured using self-report questionnaires and by rating filmed facial expressions. 23 people with early Alzheimer's disease were compared to 21 normal control participants.

Results: Relative to controls, people with Alzheimer's disease exhibited impaired awareness of performance, but they showed comparable differential reactivity to failure relative to success tasks, both in terms of self-report and facial expressions.

Conclusions: This finding suggests that normal emotional reactions can occur in response to task failure, despite lack of apparent awareness of failure. This result has implication for the assessment and management of people with early dementia and the effects of failure on mood during neuropsychological assessment.

Correspondence: *Daniel C. Mograbi, PhD, Psychology, King's College London, De Crespigny Park, London SE5SAF, United Kingdom. E-mail: daniel.mograbi@kcl.ac.uk*

D.A. NATION, C.E. WIERENGA, L.R. CLARK, S.I. DEV, N.H. STRICKER, A.J. JAK, D.P. SALMON, L. DELANO-WOOD, K.J. BANGEN, T.T. LIU & M.W. BONDI. Cortical and Subcortical Cerebrovascular Resistance in Alzheimers Disease and MCI.

Objective: To investigate cerebrovascular resistance (CVR) as a potential measure of cerebrovascular dysfunction in Alzheimer's disease (AD), we compared probable AD patients to mild cognitive impairment (MCI) and normal control (NC) participants on subcortical and cortical CVR. We also examined the relationship between CVR and cognition, as well as white matter lesion (WML) volume.

Participants and Methods: Seventy-six participants (12 AD, 23 MCI, and 41 NC) were compared on mean arterial pressure (MAP) and CVR within regions-of-interest comprising subcortical structures important for cognition (i.e., thalamus, caudate) and cortical structures previously found to show reduced regional cerebral blood flow (CBF) in AD (i.e., medial temporal lobes, inferior parietal lobes, posterior cingulate, precuneus). Regional CVR was assessed by correcting regional CBF, measured using arterial spin labeling MRI, with brachial artery MAP values ($CVR = MAP/CBF$). Voxel-wise analysis was used to explore CVR differences in other brain areas.

Results: Relative to both NC and MCI groups, AD patients displayed elevated CVR within the thalamus ($p = .01$ and $.0004$, respectively) and caudate nucleus ($p = .047$ and $.003$, respectively), after controlling for age, gender, education, and APOE genotype. In addition, voxel-wise analyses controlling for age and gender revealed 11 significant clusters of CVR elevation in AD relative to NCs and 2 subcortical clusters of CVR elevation relative to MCI. Global cognition was correlated with CVR within the thalamus ($r = -.42$, $p < .0001$) and caudate ($r = -.33$, $p = .004$), and caudate CVR was correlated with WML volume ($r = .46$, $p = .002$).

Conclusions: Subcortical CVR is elevated in AD relative to both MCI and normally aging individuals, and correlates inversely with cognition and WML volume. Findings suggest CVR may represent a sensitive index of vascular dysfunction in AD.

Correspondence: *Daniel A. Nation, Ph.D., Psychiatry, VA San Diego Healthcare System / University of California San Diego, School of Medicine, 3350 La Jolla Village Dr., 151B, San Diego, CA 92161. E-mail: dnation@ucsd.edu*

K.A. NIELSON, J.L. WOODARD, K.E. HAZLETT, C.M. FIGUEROA, M. SEIDENBERG, J. SMITH, S. DURGERIAN, N.C. HANTKE, M.A. SUGARMAN, C.D. KAY, C.C. KANDAH, A.L. NORMAN, M.A. LANCASTER, M.A. MATTHEWS & S.M. RAO. Episodic Memory, Hippocampal Activation During Encoding, and Eventual Cognitive Decline in Elders: the Importance of Correct Rejections.

Objective: Episodic memory (EM) decline is a frequent facet of cognitive aging, and excessive episodic memory decline is a foundational symptom of Alzheimer's disease (AD). This impairment has often been associated with structural or functional changes in the hippocampus that may presage impending AD. However, one aspect of EM rarely considered is the correct rejection of foils, which is a reflection of both memory and executive processes (e.g., inhibition, source memory). We examined EM for famous names in healthy, cognitively intact elders, some of whom cognitively declined over the course of 18 months. We hypothesized that correct rejections could predict decline better than general accuracy (e.g., hits).

Participants and Methods: 99 healthy, cognitively intact older adults underwent cognitive testing at baseline and 18 months, APOE $\epsilon 4$ genotyping and fMRI. Cognitive decline was defined as ≥ 1 SD reduction from baseline on one or more index: Rey AVLT Delayed Recall, Trials 1-5 Sum, Mattis DRS-2 Total. EM was measured during fMRI with an encoding run of 60 names (30 famous/30 non-famous) and retrieval of 120 names (60 old/60 new) 20 min later.

Results: At baseline, the Declining subjects had poorer EM that was specific to the correct rejection of new famous names (EMCR). Bootstrapped logistic regression also showed that EMCR and $\epsilon 4$ effectively predicted future cognitive decline ($R^2 = .12$, C-index = .67); various measures of EM (hits) were not effective predictors. Further, hippocampal activation during encoding of the names primarily mediated the relationship between EMCR and cognitive decline.

Conclusions: EMCR from a brief famous name task, along with APOE $\epsilon 4$ inheritance, is sensitive in identifying those with impending episodic memory decline. This finding may be due to the heavy executive control required in EMCR to correctly identify an inherently familiar famous name as "new." Importantly, hippocampal dysfunction precipitating cognitive decline appears to be effectively indexed by EMCR.

Correspondence: *Kristy A. Nielson, Ph.D., Psychology, Marquette University, P.O. Box 1881, Milwaukee, WI 53201-1881. E-mail: kristy.nielson@marquette.edu*

S. OLESON & C. MURPHY. Genetically at risk ApoE $\epsilon 4/4$ and ApoE $\epsilon 3/4$ individuals with possible AD and odor identification task performance.

Objective: Individuals carrying one $\epsilon 4$ allele of the apolipoprotein E (ApoE) gene are at risk for Alzheimer's Disease (AD), while individuals with two copies of the $\epsilon 4$ allele demonstrate an even higher risk for developing AD. Furthermore, ApoE $\epsilon 4/4$ homozygotes diagnosed with probable AD begin to show symptoms at an earlier age, exhibit increased amyloid plaques, and display increased rates of cognitive decline relative to heterozygous $\epsilon 3/4$ ApoE carriers. All of these factors suggest there are differences in severity and progression of AD as a function of possessing one versus two $\epsilon 4$ alleles. Given that odor identification tasks are particularly sensitive to cognitive status associated with AD, the current study sought to examine differences in odor identification performance in $\epsilon 3/4$ and $\epsilon 4/4$ carriers diagnosed with possible AD.

Participants and Methods: 34 individuals (17 $\epsilon 4/4$ carriers and 17 $\epsilon 3/4$ carriers) matched on age and gender, and diagnosed with possible AD were given the San Diego Odor Identification test, the Boston Naming Test, and the Mini Mental States Examination (MMSE). Differences between the two groups were assessed with analyses of variance (ANOVA).

Results: Individuals homozygous for the $\epsilon 4$ allele performed significantly worse on the odor identification task ($F=13.502$; $p=.001$), compared to the heterozygous group, while neither group significantly differed in scores on the Boston Naming Test or the MMSE ($p>.11$).

Conclusions: These results give insight into how the existence of two $\epsilon 4$ alleles may differentially affect performance in those at risk for AD, and suggest the potential utility of including olfactory tasks for greater sensitivity and specificity in the diagnosis of AD.

Supported by NIH grant AG004085-25 to CM. We gratefully acknowledge the UCSD ADRC for subject recruitment (P50 AG005131-28) and the SDSU Lifespan Human Senses Laboratory for patient testing.

Correspondence: *Stephanie Oleson, San Diego State University, 8810 Pipestone Way, San Diego, CA 92129. E-mail: stephanieoleson@sbglobal.net*

T. OWASHI, G. MINEGISHI, H. TANAKA, Y. ISHIBE & I. KUDO. Association between MMSE subscale and hippocampal volume in elderly people.

Objective: Mini-Mental State Examination (MMSE) has shown some cutoff score with good sensitivity and specificity for the detection of dementia; however, several studies suggested the cutoff score may be differ among the education level. On the other hand, Voxel-based Specific Regional analysis system for Alzheimer's Disease (VSRAD) has developed as an adjunctive diagnostic tool for early Alzheimer-type dementia. The aim of the present study was to evaluate which domain of MMSE influences the hippocampal volume in elderly people.

Participants and Methods: The first visiting outpatients aged 65 years or more ($n = 168$, females = 162, average age = 77.3 years) were assessed retrospectively. Psychiatrists designated by the Health, Labor and Welfare Ministry diagnosed the patients, and MMSE was assessed by psychologists. The number of patients with dementia, mild cognitive impairment (MCI), and the others was 84, 17, and 67, respectively. The severity of hippocampal atrophy was assessed using the VSRAD system. Linear regression model was used to estimate the effect on MMSE subscales and items controlling for age and body mass index.

Results: The average of MMSE total score was 18.18 in dementia, 25.53 in MCI, and 24.57 in others. Among the subjects, 85 patients (females = 55) were assessed by VSRAD. There was no significant difference of VSRAD between males and females. VSRAD score was positively correlated with age ($.217$; $p=0.047$) and negatively correlated with time orientation ($-.249$; $p<0.001$), delayed memory ($-.233$; $p=0.034$), and drawing ($-.237$; $p=0.031$). There was no significant correlation between VSRAD score and the total score of MMSE ($p=0.057$). Stepwise regression procedure showed that the drawing domain of MMSE was significantly associated with VSRAD ($p=0.004$).

Conclusions: Among the MMSE, domain of drawing showed significant association with severity of hippocampal atrophy in elderly people. Visuospatial cognitive function may strongly influence the pathology of dementia and volume of hippocampus.

Correspondence: *Toshimi Owashi, M.D., Ph.D., Psychiatry, Showa University Fujigaoka Hospital, 1-20 Fujigaoka, Aoba-ku, Yokohama 227-8501, Japan. E-mail: owashisan@googlemail.com*

J. SESTITO, T. GIOVANNETTI & D.J. LIBON. Individuals with Dementia Make More Errors Toward the End of Everyday Tasks: Evidence for the "Titanic Effect."

Objective: Investigators have referred to Fuster's model of the temporal organization of behavior to explain the decline in test performance over time in people with various MCI and dementia subtypes. The term "Titanic Effect" has been used to characterize the unusually steep decline in test performance on verbal fluency and mental control tests by individuals with marked executive dysfunction. We explored this phenomenon in everyday tasks by tracking action errors over the time course of several tasks.

Participants and Methods: 17 participants (M MMSE = 22.88) diagnosed with dementia were videotaped while performing three tasks: make a cup of instant coffee with cream and sugar, wrap a gift for a small child, and pack a lunchbox with a sandwich, drink and a snack. Target-Related distractor objects were presented alongside target objects for all tasks. We coded instances when a distractor object was touched

(Touch), as well as errors that involved the use of a distractor (Use) or the inaccurate performance of a task step (Other; e.g., spatial errors, tool omission, etc.). To explore performance decline across time, each task was divided into three epochs of equal time, and errors were summed for each epoch separately.

Results: Participants showed an increase in Use errors across the 3 task epochs (M epoch 1 = 0.35; M epoch 2 = 1.29, M epoch 3 = 1.47. The increase in errors from epoch 1 to epoch 3 was statistically significant [$F(1, 16) = 12.24, p = .003$]. This effect was not observed for Touch behaviors, and Other errors were too infrequent for analysis.

Conclusions: Interference from distractors increased over the course of a task, even though participants remained active and engaged in the task (i.e., touch behaviors remained constant). This suggests the “Titanic Effect” is relevant for everyday functioning in dementia; functional outcomes may be improved by the strategic application of intervention strategies or caregiver supervision toward the end of a daily activity, when errors may be more likely.

Correspondence: *Tania Giovannetti, PhD, Psychology, Temple University, Weiss Hall, 6th floor, 1701 N 13th Street, Philadelphia, PA 19122. E-mail: tgio@temple.edu*

J. SHERMAN, S. FLYNN, C. HENDERSON, J. WHITLOCK, C. CORDELLA, A. COSTIGAN, S. MANCUSO, J. GIAR & B. LUST. Do Language Changes Differentiate Prodromal Alzheimer's disease (AD) from Healthy Aging?

Objective: Previous evidence suggests significant language changes may characterize preclinical AD (e.g., Garrard et al. 2004, Snowdon et al. 2000). Generally, studies have not provided controlled comparisons across normal young and older adults with those who may be pre-clinically AD. Moreover, studies primarily focus on lexical changes, indicating word retrieval problems; few assess language syntax. This leaves open the issue of whether there are critical changes in syntax in prodromal AD. We ask if changes in spoken language syntax characterize prodromal AD and whether these changes differ from those in healthy older and younger adults.

Participants and Methods: Through a multi-institutional collaboration and shared calibrated experimental designs, methods and materials, we compared 15 subjects with Mild Cognitive Impairment (MCI) (age range: 68-82 years), 14 Healthy aging (65-80), and 10 Young adults (21-27) on linguistic and cognitive tasks.

In the linguistic tasks, subjects repeated 36 sentences varied in syntactic form (simple coordinate compared to more complex relative clauses) and semantic plausibility, controlled for lexical frequency and length.

Results: Results, analyzed through logistic-linear mixed models with binomial error assumption and a logit link function indicate that only the MCI group significantly differed in performance on coordinate vs. relative clause sentences and did so only in the semantically implausible condition. Performance on the linguistic task did not correlate with working memory (Brown-Peterson test, e.g. Caza & Belleville 2008) in any group, suggesting that a working memory deficit does not account for the finding. Error analyses indicate that lexical retrieval deficit is not the sole source of deficit in MCI performance.

Conclusions: Our results suggest difficulty relating syntax and semantics in MCI language. These findings suggest a potential new clinical tool for language assessment in prodromal AD in addition to common clinical measures, e.g. naming and fluency.

Correspondence: *Janet Sherman, Ph.D., Mass General Hospital, 1 Bowdoin Square, 7th Floor, Boston, MA 02114. E-mail: JSHERMAN@PARTNERS.ORG*

W. SONG, C.D. KAY, C. KANDAH, J.L. WOODARD & M. SEIDENBERG. General and Specific Semantic Knowledge for Person Identity in Alzheimer's Disease.

Objective: Semantic memory impairment in Alzheimer's disease (AD) is characterized by greater loss of specific compared to general information. Person identity semantics is particularly impaired in AD and is

typically characterized by poorer performance for older memory than recent memory. To date, there is limited investigation of the relationship between specificity of semantic knowledge and age of memory. The current study compared an AD group and healthy controls (HC) for different levels of semantic knowledge (categorical, associative, and attribute) for famous names from the recent (2000-2010) and remote (1950-1970) intervals.

Participants and Methods: Twenty-one AD subjects (M age = 78 years) and 21 HC subjects (M age = 71 years) completed a forced choice recognition task for categorical, associative, and attribute knowledge for 20 remote and 20 recent famous names. Famous names were grouped into the two time epochs based on normative data. Only names correctly recognized by the participant were included in the analyses.

Results: A mixed design MANCOVA (controlling for age) produced a significant three way interaction of group x epoch x semantic knowledge ($p < .05$). The AD group showed less semantic knowledge than the HC group for all three semantic knowledge levels ($p < .001$), and categorical knowledge was significantly better than either associative or attribute knowledge for both groups ($p < .005$). However, the group difference (AD < HC) for attribute knowledge was more pronounced than the difference for categorical knowledge for both recent and remote famous names.

Conclusions: Remote memory impairment in AD showed a time-limited temporal gradient at all levels of semantic knowledge. However, specific (attribute) person identity semantic knowledge is more impaired in the AD group than general categorical knowledge regardless of memory age.

Correspondence: *Woojin Song, University of Michigan, 2101 Commonwealth Blvd. Ste C, Ann Arbor, MI 48105. E-mail: woojinsong@gmail.com*

C. SUMIDA, A. STICKEL, L. HASSE & C. MURPHY. Odor Identification in Normal Older Adults: the Influence of Statin Use.

Objective: Background: A number of studies have suggested that statin therapy is associated with a lower risk of developing dementia, specifically Alzheimer's disease (AD). In contrast, other studies evaluating statin therapy for mild to moderate AD patients found no significant difference between patients and controls on various cognitive assessments. With a projected 16 million American older adults developing AD by 2050, the identification of preventative and early detection measures is of crucial importance. One potential measure that might be considered for inclusion in a neuropsychological battery of tests targeting AD is odor identification because of its association with the progression of AD pathology and the risk of developing mild cognitive impairment symptoms.

Objective: To determine whether older adults who are using a statin differ from those who are not using a statin in performance on an odor identification test.

Participants and Methods: To address this issue, groups of older adults using statins ($N = 14$, mean age = 71.86) and not using statins ($N = 15$, mean age = 70.83) were compared on the San Diego Odor Identification Test while controlling for olfactory threshold, Boston Naming Test and age.

Results: Older adults who were using statins identified significantly more odors than those older adults who were not using statins.

Conclusions: The results suggest that for older adults statin use may be associated with a lower risk of olfactory cognitive impairment. Supported by NIH grant R01-AG04085-25 (CM).

Correspondence: *Catherine Sumida, San Diego State University, 1783S Agumiel Rd., San Diego, CA 92127. E-mail: casumida@yahoo.com*

C.E. JACKSON, J. DAVIS, C. GROVER & G. TREMONT. Adult-Child and Spouse Dementia Caregivers Differ in Basic ADL Assistance and Perceived Burden.

Objective: The literature exploring dementia caregiver burden remains inconclusive regarding the role of functional decline on perceived bur-

den, particularly as it might apply to different caregiver types. We examined differences between spouse and adult-child caregivers regarding the frequency of caregiver time spent assisting patients with basic activities of daily living (ADL; e.g., toileting) and caregiver self-reported burden, as measured by the Zarit Burden Inventory (ZBI).

Participants and Methods: Two-hundred nineteen dementia caregivers enrolled in a telephone intervention study and completed the Zarit Burden Inventory and Lawton-Brody IADL/ADL Questionnaire (Family rating form) as part of their baseline assessment. Baseline patient assessment included the Clinical Dementia Rating scale (CDR), and Dementia Rating Scale-II (DRS-II).

Results: Adult-child caregivers reported spending significantly more days per month assisting with basic ADL ($M = 15.25$, $SD = 13.51$) compared to spouse caregivers ($M = 11.25$, $SD = 13.82$; $t(215) = -2.14$, $p = .033$). They also reported greater perceived burden ($M = 42.48$, $SD = 13.41$) compared to spouse caregivers ($M = 34.47$, $SD = 13.72$; $t(214) = -4.31$, $p < .001$). After co-varying for measures of disease severity (CDR total score, and DRS-II age and education corrected scaled score) and days per month aiding with ADL, there remained a significant difference between groups, such that adult-child caregivers reported greater perceived burden compared to spouse caregivers ($F(1, 195) = 6.19$, $p < .001$).

Conclusions: Adult-child caregivers report a greater frequency of ADL caregiving, as well as greater perceived burden, independent of the care recipient's disease stage, compared to spouse caregivers. These results support the argument that spouse and adult-child caregivers experience caregiving differently and may require unique support and interventions. Correspondence: *Colleen E. Jackson, M.S., Neuropsychology Program, Rhode Island Hospital, 593 Eddy St., Physicians Office Building, Providence, RI 02903. E-mail: colleen_jackson@brown.edu*

G. TREMONT, B. SPRINGATE, G.D. PAPANDONATOS, P. KELLEY, J. GRACE, L. FRAKEY & B.R. OTT. Prediction of Conversion from Mild Cognitive Impairment to Dementia with the Telephone-Administered Minnesota Cognitive Acuity Screen (MCAS).

Objective: Mild cognitive impairment is associated with increased risk of Alzheimer's disease, although predicting who will develop the disease is challenging. The Minnesota Cognitive Acuity Screen (MCAS) is a brief multi-domain, telephone-administered test, which has sensitivity for detecting MCI. This study examined whether the MCAS is effective in identifying individuals with MCI who convert to dementia.

Participants and Methods: Participants were 49 individuals diagnosed with amnesic MCI. They underwent a baseline in-office neuropsychological, neurologic, and neurodiagnostic work-up and were administered the MCAS an average of 21.49 days ($SD=18.80$) later. Participants underwent repeat in-office exams up to three times over an average of 25.40 months ($SD=11.98$). Dementia determination was made by consensus conference.

Results: 21 individuals converted to dementia over the follow-up period (43%), with the average time to conversion of 24.33 months ($SD=11.83$). Comparisons of converters (C) and non-converters (NC) revealed a trend toward poorer baseline scores on the MCAS orientation, naming, and verbal fluency subscales and DRS-II total (NC $M=132.92$, $SD=6.68$ vs. C $M=128.71$, $SD=9.13$) and HVLT-R total learning (all $p < .1$). ROC analysis using predicted probabilities based on MCAS subscale scores, age, and education showed 91% sensitivity and 75% specificity for distinguishing Cs from NCs ($AUC=.84$) whereas DRS-II subscale scores revealed 62% sensitivity and 62% specificity ($AUC=.62$).

Conclusions: Results suggest that the telephone-based MCAS appears effective in identifying individuals with MCI who convert to dementia over an approximate two-year period. In this study, the MCAS performed better than a frequently used dementia screening test. Overall, the MCAS has potential as an effective screening tool for diagnosing and monitoring memory disorders. Future research should replicate these findings in a new sample to provide the most accurate reflection of its predictive utility.

Correspondence: *Geoffrey Tremont, Ph.D., Psychiatry & Human Behavior, Brown Medical School, Rhode Island Hospital, 593 Eddy Street, Providence, RI 02903. E-mail: gtremont@lifespan.org*

L.M. ARIZA-SERRANO, S. WEINTRAUB, A.B. ZAHEED & T.D. GEFEN. Visual Target Cancellation in Primary Progressive Aphasia With Alzheimer Or Frontotemporal Neuropathology.

Objective: Primary Progressive Aphasia (PPA) is a dementia syndrome characterized by selective language deterioration, with initial sparing of memory and other cognitive functions. Dementia of the Alzheimer type (DAT) often initially manifests as episodic memory loss with symptoms in other domains, including visuospatial dysfunction. Despite this clinical difference, 30-40 percent of PPA patients have post mortem Alzheimer's disease (AD) neuropathology while the remainder show one or another form of frontotemporal lobar degeneration (FTLD). We conducted a retrospective study to investigate if visual target cancellation test performance could distinguish between patients with clinical diagnoses of DAT or PPA and between PPA patients with AD or FTLD neuropathology at post mortem.

Participants and Methods: Retrospective data analysis was conducted on visual target cancellation test performance in 284 participants in a research registry (NC=168; DAT=69; PPA=47). Of 21 PPA patients with post mortem studies, eleven had AD neuropathology (PPA/AD) and ten had FTLD neuropathology (PPA/FTLD). Search time, accuracy and visual search strategy were analyzed.

Results: ANOVA showed a significant difference between completion times on the cancellation test among all clinical groups ($p < 0.0001$), with the DAT group slower than either of the other two groups and the PPA group slower than the healthy control group. DAT patients made significantly more errors than PPA patients ($p < 0.0001$) who did not differ from controls on this variable. Errors were also more frequent in PPA patients with AD neuropathology than in those with FTLD ($p = 0.032$).

Conclusions: The clinical diagnosis of DAT and the post mortem diagnosis of AD neuropathologic change are associated with an increased number of visual search errors. Visual search errors may thus assist in the antemortem differentiation of PPA patients with AD neuropathology from those with FTLD neuropathology.

Correspondence: *Sandra Weintraub, PhD, Cognitive Neurology and Alzheimer's Disease Center, Northwestern Feinberg School of Medicine, 320 E. Superior, Searle 11-467, Chicago, IL 60611. E-mail: sweintraub@northwestern.edu*

J.L. WOODARD, K.A. NIELSON, M. SEIDENBERG, J. SMITH, S. DURGERIAN, M.A. SUGARMAN, A.L. NORMAN, M.A. LANCASTER, M.A. MATTHEWS, C.C. KANDAH, C.D. KAY, C.M. FIGUEROA, K.E. HAZLETT & S.M. RAO. Use of Automated Hippocampal Subfield Segmentation for Predicting Probability of Cognitive Decline in Healthy Older Adults.

Objective: Previous work by our group has suggested that a combination of Apolipoprotein E (APOE) $\epsilon 4$ status, baseline total hippocampal volume, and fMRI activation during a famous name recognition task predicts cognitive decline over 18 months. Here, we investigated whether regional hippocampal subfield segmentation using an automated algorithm (Freesurfer 5.1) can enhance prediction of cognitive decline in healthy older adults in combination with fMRI and genetic information.

Participants and Methods: Ninety-six cognitively healthy adults aged 65 years and over underwent APOE genotyping and neuropsychological assessment at baseline and after 18 months. Cognitive decline was identified on the basis of a >1 SD decline on at least one of the neuropsychological measures. Freesurfer 5.1 was used to quantify total and segmented (subfields CA1, CA2+CA3, CA4+dentate gyrus, subiculum, and pre-subiculum) hippocampal volume using baseline structural MRI. Regions of activation from task-activated fMRI during famous name recognition loaded on a single component using principal components analysis.

Results: Logistic regression analyses tested models containing combinations of APOE $\epsilon 4$ status, fMRI activation, total hippocampal volume

and individual subfield volumes. Addition of each subfield volume to APOE $\epsilon 4$ status and fMRI activation resulted in excellent fitting models relative to simpler models. However, the accuracy of individual subfield volumes ($C=.76$ to $.82$, $R\text{-squared}=.25$ to $.37$) was not substantially better than total hippocampal volume ($C=.82$, $R\text{-squared}=.36$) for predicting the probability of 18-month cognitive decline.

Conclusions: Automated measurement of segmented hippocampal volumes does not appear to provide a significant advantage beyond total hippocampal volume for prediction of probability of cognitive decline in healthy older adults. Individually, both approaches are equally effective predictors of decline when combined with fMRI and genetic information. Correspondence: *John L. Woodard, Ph.D., Psychology, Wayne State University, 5057 Woodward Ave., 7th Floor, Detroit, MI 48202. E-mail: john.woodard@wayne.edu*

J.Y. ZHU, S. VANDERMORRIS & F.I. CRAIK. Digit Symbol Substitution as a Marker of Asymptomatic Alzheimer's Disease.

Objective: The purpose of this study was to examine cognitive markers of preclinical Alzheimer's disease (AD) in light of 2011 NIA clinical criteria that incorporate a fuller spectrum of cognitive aging. Many studies suggest episodic memory measures are the most robust predictors of MCI to AD conversion, followed by those of executive function. It is plausible that the earliest markers of AD are not consistent at every stage of the disease process. Specifically, cognitive predictors may differ in the preclinical stage that precedes MCI. Therefore, a case-control design was employed using longitudinal data to investigate the cognitive profile of individuals with incident AD at the last time-point before MCI diagnosis (i.e., last classification as "normal" cognition).

Participants and Methods: Cases were selected from the National Alzheimer's Coordinating Center (NACC) database by querying individuals who progressed from normal to MCI to probable AD diagnosis ($N=106$), and excluding individuals with major neurologic or psychiatric comorbidities (final $N=80$). Normal controls ($N=80$) were matched on age, education, gender, race, and visit number.

Results: Group comparisons revealed statistically significant differences on Logical Memory Delayed (Cohen's $d=1.05$) and Immediate ($d=.95$), Verbal Fluency (Vegetables $d=.65$, Animals $d=.52$), WAIS-R Digit Symbol ($d=.50$), Boston Naming ($d=.37$) and Trails B ($d=.35$). There were no significant differences on Digit Span and Trails A. Results persisted after controlling for depressive symptoms.

Conclusions: Consistent with emerging literature, this study demonstrated that individuals with preclinical MCI/AD showed significantly poorer performance on measures of memory, language, and executive functioning. Interestingly, WAIS-R Digit Symbol task was also significantly lower in the preclinical group. This novel finding suggests processing speed may be a cognitive marker of asymptomatic AD. Alternatively, or in combination, Digit Symbol may be sensitive to early changes in associative memory.

Correspondence: *Joyce Zhu, BA, Rotman Research Institute, Baycrest, 3560 Bathurst St, Toronto, ON, ON M6A 2E1, Canada. E-mail: jzhu@research.baycrest.org*

Medical/Neurological Disorders/Other (Adult)

M. ALOSCO, M. SPITZNAGEL, N. RAZ, R. COHEN, L.H. SWEET, L.H. COLBERT, R. JOSEPHSON, M. VAN DULMEN, J. HUGHES, J. ROSNECK & J. GUNSTAD. Obesity Interacts with Cerebral Hypoperfusion to Exacerbate Cognitive Impairment in Older Adults with Heart Failure.

Objective: Cerebral hypoperfusion frequently accompanies heart failure (HF) and contributes to cognitive impairment in this population. Obesity is frequently comorbid to HF and independently associated with cognitive impairment and hypoperfusion in other samples. We examined the association between obesity and cognitive performance among older adults with HF and whether obesity and cerebral hypoperfusion interact to exacerbate cognitive dysfunction in this population.

Participants and Methods: 99 patients with HF (67.46 ± 11.36 years) completed neuropsychological testing that assessed attention/executive function, memory, and language abilities. Cardiac function was assessed through impedance cardiography and cerebral blood flow velocity was measured by transcranial Doppler sonography. Mean cerebral blood flow velocity of the ACA, MCA, and PCA was computed to characterize global cerebral perfusion. The participants were weighed and measured to calculate body mass index (BMI).

Results: Obesity was common, as 37.4% of participants had a BMI >30 . Hierarchical regression analysis showed lower cerebral blood flow velocity was independently associated with reduced performance on tests of attention/executive function ($\beta = .28$, $p = .02$) and memory ($\beta = .26$, $p = .04$). Elevated BMI was also associated with reduced attention/executive function ($\beta = -.28$, $p = .02$) and language test performance ($\beta = -.28$, $p = .02$) after controlling for medical and demographic characteristics. A significant interaction between CBF-V and BMI indicated that a combination of hypoperfusion and high BMI had an adverse influence on attention/executive function in HF patients ($\beta = .22$, $p = .04$).

Conclusions: The current findings suggest that cerebral hypoperfusion and obesity have a synergistic, negative influence on cognitive performance in persons with HF. Future studies should examine whether weight loss may alleviate cognitive dysfunction by attenuating the negative effects of hypoperfusion associated with HF.

Correspondence: *Michael Alosco, B.A., Kent State University, 4710 Waterford Circle, Stow, OH 44224. E-mail: malosco@kent.edu*

M. ALOSCO, J. GUNSTAD, B.A. JERSKEY, U.S. CLARK, J.J. HASENSTAB, X. XU, A. POPPAS, R.A. COHEN & L.H. SWEET. Left Atrial Size Is Independently Associated With Cognitive Function.

Objective: The etiology of vascular cognitive impairment is not entirely clear, though impaired cardiac function resulting in cerebral hypoperfusion and subsequent cerebrovascular disease (CVD) are important contributors. Left atrial (LA) diameter is easily attainable from echocardiograph and may provide key insight into cognitive function given its sensitivity to the severity of cardiac dysfunction (i.e., systolic and diastolic functioning). Yet, the independent association of LA size with neurocognitive outcomes is not well understood.

Participants and Methods: 50 older adults (64.50 ± 9.41 years) recruited from outpatient cardiology clinics and local advertisements underwent magnetic resonance imaging and were administered the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Whole brain volume consisted of the sum of frontal, temporal, parietal, and occipital lobe. Echocardiogram quantified LA diameter.

Results: Hierarchical regression revealed that greater LA size was associated with reduced performance on the following RBANS composites even after adjusting for demographic and medical characteristics (i.e., ejection fraction and medical comorbidity) known to be associated with cognitive function in CVD: language ($\beta = -.45$, $p = .03$), delayed memory ($\beta = -.45$, $p = .02$), total index ($\beta = -.39$; $p = .04$), and a trend for immediate memory ($\beta = -.32$, $p = .095$). Separate partial correlations adjusting for intracranial volume and medical and demographic variables showed no associations between LA diameter and whole brain volume ($p > .05$).

Conclusions: Our findings indicate that LA diameter is independently associated with cognitive function. LA diameter is readily accessible from echocardiograph and may provide clinical utility in the identification of patients at risk for cognitive decline. Prospective studies are needed to elucidate underlying mechanisms between LA diameter and cognition. Correspondence: *Michael Alosco, B.A., Kent State University, 4710 Waterford Circle, Stow, OH 44224. E-mail: malosco@kent.edu*

L.J. ALTMANN, E. STEGEMÖLLER, J.P. WILSON, A.A. HAZAMY, M.S. OKUN, A. HASSAN & C.J. HASS. The Contribution of Multi-Tasking Ability to Activities of Daily Living in Parkinson's Disease. **Objective:** Performance of Activities of Daily Living (ADLs) declines with decreased cognitive ability and increased depressive symptoms.

However, performing ADLs also requires multi-tasking to manage the demands of concurrent (dual) tasks. Dual task performance in Parkinson's disease (PD) is significantly impaired relative to matched healthy adults. We hypothesized that the magnitude of dual task effects on an unrelated motor task would predict ADL scores in PD.

Participants and Methods: Twenty-four participants with mild-moderate PD pedaled on a stationary bicycle with and without concurrent cognitive tasks. The 14 cognitive tasks were chosen from 6 cognitive domains: speed, controlled processing, visual processing, memory, executive function, and complex language. Mean dual task effects (DTEs) on cycling (i.e., percent change from baseline) were calculated across tasks. Mattis Dementia Rating Scale (DRS) and the Beck Depression Inventory (BDI) were also given. Hierarchical, regression was used to predict UPDRS-ADL scores.

Results: Cycling speeds were faster during 13 of 14 cognitive tasks than at baseline, leading to positive DTEs. DRS and BDI were presented in the first step of the hierarchical regression, accounting for 26% of variance. In the second step of the regression, DTEs on cycling accounted for an additional 19% of the variance. The full model accounted for 45% of the variance in UPDRS-ADL scores.

Conclusions: Consistent with previous findings, cognitive ability and depressive symptoms predicted ADL scores. Moreover, the magnitude of dual task benefits on cycling also accounted for significant unique variance in ADLs. Unexpectedly, participants whose cycling speed improved the most during concurrent cognitive tasks (positive DTEs) also presented with the most impaired ADLs, and those with normal (negative) DTEs had intact ADLs. Thus, exaggerated, anomalous responses while multi-tasking may contribute significantly to impaired performance of ADLs in PD.

Correspondence: *Lori J. Altmann, PhD, Speech, Language & Hearing Sciences, University of Florida, 336 Dauer Hall, Box 117420, Gainesville, FL 32611-7420. E-mail: laltmann@ufl.edu*

D. KELLY, L. BOXLEY & L. BIELIAUSKAS. The Effect of Psychiatric Comorbidity on Sleep Quality in a Veteran Population.

Objective: The independent effects of depression and PTSD on sleep disturbance have been well established (Picchioni et al., 2010); however the potential additive effect of comorbid diagnoses remains unclear. This study examines the relationship between sleep disturbance and symptoms of depression, symptoms of PTSD, and comorbid symptoms of depression and PTSD.

Participants and Methods: A neuropsychological battery was administered to 135 consecutively recruited veterans referred to a VA polytrauma clinic [age 35.0 (13.1)]. Measures included the Hospital Anxiety and Depression Scale (HADS), the PTSD Checklist-Military Version (PCL-M), and the Insomnia Severity Index (ISI). Veterans were grouped into four categories: no distress, depressive symptoms only (HADS-Depression >8), PTSD symptoms only (PCL-M >49), or significant symptoms of both depression and PTSD. Using ANOVA and item analysis, relationships between the groups were compared to characterize potential differences in sleep quality.

Results: One-way ANOVA demonstrated that individuals reporting both depression and PTSD reported significantly greater sleep disturbance than those reporting no distress ($p < .000$) or only depressive symptoms ($p < .003$). There was not a significant difference in sleep symptoms between those reporting symptoms of PTSD and those reporting symptoms of PTSD and depression ($p = .18$), however qualitative review of individual ISI items revealed that individuals reporting symptoms of both depression and PTSD consistently endorsed more symptoms of sleep disturbance than all other groups.

Conclusions: Symptoms of PTSD were strongly associated with sleep disturbance across measures of sleep quality and satisfaction. Comorbid symptoms of depression and PTSD produced higher scores on measures of sleep, however this difference was not statistically significant. It is possible that this relationship may strengthen in the context of greater statistical power.

Correspondence: *Laura Boxley, Ph.D, VHA Ann Arbor, 2215 Fuller Road, Ann Arbor, MI 48103. E-mail: lauraboxley@gmail.com*

L. BRENNAN, M. SCHULTHEIS, A. TART-ZELVIN, E. WHIPPLE, A. DARIN & A. SIDEROWF. Effects of Dopaminergic Therapy on Everyday Functional Tasks in Parkinson's Disease.

Objective: Dopaminergic medications are the most commonly used treatment in improving motor symptoms of Parkinson's disease (PD). Research indicates that dopaminergic medications may also improve cognition in PD; however, it is unclear whether gains in cognition translate to performance on everyday functional tasks. The present study sought to elucidate the effects of dopaminergic therapy on everyday functional tasks such as financial and medication management.

Participants and Methods: Thirteen PD participants completed performance-based functional assessments (Direct Assessment of Functional Status; DAFS) both "on" and "off" dopaminergic therapy. Functional variables included financial tasks (e.g., balancing a checkbook) and medication management tasks (e.g., organizing a pillbox for the week). The "on" assessment required no change in regular medication schedule, and the "off" assessment required discontinued medication therapy for a 24 hour period prior to testing.

Results: A repeated-measures analysis of variance indicated significant differences in the effects of dopaminergic medication condition ("on" versus "off") on the DAFS medication management tasks, $F(1, 12) = 6.17, p = .03, \eta^2 = 0.34$. Dopaminergic medication condition did not have significant effects on the DAFS financial management tasks.

Conclusions: The present study indicates that dopaminergic medication therapy may improve performance on some complex everyday functional tasks, indicating that positive effects of medication therapy on cognition extend to everyday functioning. The DAFS medication management tasks are more complex than the financial tasks; future research should investigate the role of task complexity regarding the nature of functional gains on dopaminergic therapy in PD.

Correspondence: *Laura Brennan, M.S., Psychology, Drexel University, 1505 Race Street, Philadelphia, PA 19102. E-mail: laura.brennan29@gmail.com*

P.M. DEAN, B. MOKRI, D.F. BLACK, R.J. WITTE & M.M. MACHULDA. Frontotemporal Brain Sagging Syndrome: A Case Presentation.

Objective: Frontotemporal Brain Sagging Syndrome (FBSS) is a specific presentation of a cerebrospinal fluid (CSF) leak that can mimic neurodegenerative disorders; yet this can be a reversible condition. Patients present with orthostatic headaches, neurological symptoms, and cognitive and behavioral changes. The mechanism by which FBSS causes dysfunction may be attributable to the displacement of structures placing pressure on cranial and cervical nerves and physical compression of frontal, temporal, and midline structures as the brain rests on the skull floor. To date, published studies primarily highlight the behavioral changes to a greater extent than the cognitive dysfunction.

Participants and Methods: We present a case of a 58 year-old woman with orthostatic headache, motor impairments, a 3 year history of cognitive changes, and 18-month history of progressive behavioral decline.

Results: The neurocognitive profile suggested disruption of processes mediated by the frontal lobes. She was disinhibited, exhibited utilization behaviors, and displayed behaviors not appropriate to the situation. Her neuropsychological pattern along with her behavioral presentation provided support for a mild dysexecutive syndrome. Without imaging, her profile would be suspicious for a disorder along the Frontotemporal Lobar Degeneration spectrum. Neuroimaging showed the characteristic appearance of CSF hypotension including a sagging brain, cerebellar tonsillar ectopia, crowded foramen magnum, distorted tectum, and compressed interpeduncular cistern. The patient underwent a bi-level epidural blood patch which provided immediate improvements in her headache, resolution of behavioral dysfunction, and reported improvements in cognition.

Conclusions: Gaining an understanding of this syndrome has significant implications in the field because of its propensity to mimic neurodegenerative disorders with its insidious onset and progressive course. Moreover, its responsiveness to interventions can greatly improve patients' quality of life..

Correspondence: *Pamela M. Dean, Ph.D., Mayo Clinic, 200 First Street SW, Rochester, MN 55902. E-mail: pamela.m.dean@gmail.com*

E.C. EDMONDS & S.Y. MUSIL. Delirium with Catatonia in a Patient with Bilateral Idiopathic Basal Ganglia Calcification: Neuropsychological Aspects.

Objective: Idiopathic basal ganglia calcification is a neurodegenerative disorder characterized by calcium deposits in the basal ganglia, thalamus, and dentate nuclei of the cerebellum. It can be associated with progressive neurological, psychiatric, and cognitive symptoms. While catatonia is often viewed as a symptom of a primary psychiatric disorder, it can also be associated with basal ganglia disorders.

Participants and Methods: We present a 61-year-old male patient with 16 years of education who presented with acute mental status changes. CT scan showed extensive calcifications in bilateral basal ganglia, dorsal thalamus, and dentate nuclei. His cognition fluctuated during his hospital stay and he experienced episodes of catatonia that responded to Ativan. The patient underwent neuropsychological evaluation 3 weeks into his hospitalization, as his delirium was resolving, and at 3 months post-discharge.

Results: The patient's first evaluation revealed profound executive dysfunction, characterized by deficits in working memory, mental flexibility, planning, problem-solving, set-shifting, and abstract reasoning. Perseveration, confabulation, stimulus-bound behavior, and poor insight were also noted. His ability to perform almost all other cognitive tests was impaired. At follow-up, the patient had experienced no further episodes of catatonia or delirium. His cognition was greatly improved and he performed within normal limits in all domains except executive functions, where he had residual, mild problems with problem-solving and set-shifting.

Conclusions: Although catatonia is not typically associated with delirium, idiopathic basal ganglia calcification in this patient may have predisposed him to develop catatonia during his delirium. This case illustrates the constellation of neuropsychiatric symptoms that can be seen in idiopathic basal ganglia calcification, and the exacerbation of symptoms that can occur in the context of a superimposed delirium.

Correspondence: *Emily C. Edmonds, Ph.D., Behavioral Sciences, Rush University Medical Center, 1645 W. Jackson Blvd., Suite 400, Chicago, IL 60607. E-mail: emilycedmonds@gmail.com*

S.A. EDWARDS-HAMPTON, A. MADAN, T. TURNER, K. BARTH, J. BORCKARDT, D. KOCH, I. WILLNER & A. REUBEN. Age-Related Cognitive Functioning in Liver Transplant Candidates.

Objective: End stage liver disease (ESLD) is associated with cognitive dysfunction. There has been a historical bias against older individuals with ESLD with regard to suitability for transplantation given the known cognitive changes that occur with age. The purpose of this exploratory study was to evaluate the relationship between age and cognitive functioning in a sample of liver transplant candidates.

Participants and Methods: The study sample consisted of 108 adult (age = 52 (11)), outpatient liver transplant candidates, who presented at a large academic medical center for a pre-transplant evaluation between January 1, 2008 and December 31, 2009. As part of routine clinical practice, participants underwent a standard medical work-up with a transplant hepatologist. A clinical interview and a standardized battery of neuropsychological tests were administered by a transplant psychologist. Patient medical records were abstracted through a retrospective chart review.

Results: Multiple-single subject *t*-tests indicated that the sample exhibited cognitive dysfunction across neuropsychological measures consistent with minimal hepatic encephalopathy, $p < 0.05$. Stepwise linear regression analyses indicated that advanced age predicted higher performance on Similarities ($t(1) = 2.85, p = .005$) and Information ($t(1) = .18, p = .047$) subtests of the WAIS-III, while controlling for years of education and illness severity. No other significant age effects were identified.

Conclusions: Findings from the study contraindicate the assumption that increasing age imparts additional cognitive liability in liver trans-

plant candidates. Older age is associated with better abstract reasoning and crystallized intelligence. Such assets may bear upon treatment adherence and engagement with medical care. As a retrospective analysis, results may be confounded by age-based selection bias by referring physicians. Future research should examine the potential for baseline neurocognitive reserve in affecting short- and long-term transplantation outcomes.

Correspondence: *Shenelle A. Edwards-Hampton, PhD, Division of Bio-Behavioral Medicine, Medical University of South Carolina, 3320 Conservancy Lane, Charleston, SC 29414. E-mail: edwards.shenelle@gmail.com*

R.L. ERICKSON, C.Y. YOUNG, L.K. PAUL & W.S. BROWN. WAIS-III Index Scores in Individuals with Agenesis of the Corpus Callosum.

Objective: Individuals with Agenesis of the Corpus Callosum (ACC) can have a normal, or even above-normal, FSIQ. However, to better understand the impact of reduced interhemispheric interactions on cognitive capacities, this study examined relative differences in WAIS-III index scores (i.e., VCI, POI, WMI, PSI).

Participants and Methods: Thirty-two individuals with complete or partial ACC were included in this study (mean age 29.10 +/- 10.70; 7 partial; 11 females), all with overall intelligence in the normal range (FSIQ > 78; mean FSIQ = 97, VIQ = 96, PIQ = 97). To identify consistent patterns of relative cognitive strengths and weaknesses, the four index scores were analyzed using a within-subject's repeated measures ANOVA, with post-hoc paired-comparisons.

Results: The repeated-measures ANOVA of index scores showed an overall significant effect ($F(3,23) = 3.71, p = .026, \eta^2 = .33$) suggesting a significant pattern of index scores in ACC. PSI was significantly lower than the other index scores, most significantly different from POI ($t(25) = 3.37, p = .002$). With respect to each individual's mean index score, 28% had a significantly lower PSI and 31% had a significantly elevated POI.

Conclusions: These analyses suggest that callosal absence in individuals with ACC is manifest in relative weaknesses on tasks that are most reliant on motor and mental processing speed (i.e., Symbol Search, Coding), as compared to tasks involving nonverbal, fluid reasoning (i.e., Picture Completion, Block Design, and Matrix Reasoning). This outcome is consistent with the finding reduced processing speed in ACC on a test of color-word interference (Marco et al. 2012).

Correspondence: *Warren S. Brown, Ph.D., Fuller Graduate School of Psychology, Travis Research Institute, 180 N. Oakland Ave, Pasadena, CA 91101. E-mail: wsbrown@fuller.edu*

A. FEDOR, S. GARCIA, M. SPITZNAGEL, G. STRAIN, M.J. DEVLIN, R. WING, R.A. COHEN, R.H. PAUL, R.D. CROSBY, J.E. MITCHELL & J. GUNSTAD. Patient Reports of Cognitive Problems are not Associated with Neuropsychological Test Performance in Bariatric Surgery Candidates.

Objective: Recent work shows that cognitive impairment is common in bariatric surgery candidates and associated with poorer outcomes. As baseline comprehensive neuropsychological assessment is not available for all patients at all sites, many care providers ask patients to self-report their level of cognitive dysfunction. However, the accuracy of patient self-report of cognitive impairment has not been empirically examined.

Participants and Methods: 81 bariatric surgery candidates were recruited from the parent Longitudinal Assessment of Bariatric Surgery (LABS) project. Each participant completed self-report measures of cognitive functioning and neuropsychological measures of memory and other cognitive abilities.

Results: Cognitive impairment was common, with up to 22% of bariatric surgery patients exhibiting impairment on objective testing. However, analyses found no association between subjective report of cognitive function and objective performance on neuropsychological testing. Persons with a history of major depressive disorder reported experiencing greater cognitive impairment ($r(68) = .31, p = .01$).

Conclusions: These findings suggest that bariatric surgery candidates have little insight into their current level of cognitive function. Future work is needed to confirm these findings and identify objective measures of cognitive function that are brief and sensitive to impairment in this population. Correspondence: *Andrew Fedor, Kent State University, 235 Kent Hall, Kent, OH 44224. E-mail: afedor1@kent.edu*

J. FESTA, M.A. PAVOL, Y. CHEUNG, X. CHEN, R.L. GRUBB, W.R. CLARK, W.J. POWERS, K. SLANE, R.M. LAZAR & R.S. MARSHALL. Tests of processing speed are associated with quality of life in carotid occlusion: Analysis from the RECON trial.

Objective: Cognitive dysfunction in patients with carotid occlusive disease is well established but the relationship between cognitive domains and QOL in carotid disease is unknown. We sought to determine the neurocognitive functions that had the greatest association with quality of life.

Participants and Methods: We examined the relationship between cognitive functioning and quality of life in 89 patients enrolled in the Randomized Evaluation of Carotid Occlusion and Neurocognition trial. Enrolled patients had symptomatic carotid artery occlusion: subjects diagnosed with dementia were excluded. We used a battery of standardized neuropsychological measures and the Stroke Specific Quality of Life Scale (SSQOL) to examine the relationship between neurocognition and QOL. Cognitive composite scores were derived from age-adjusted z-scores. We used linear regressions for demographic, stroke severity, and cognitive measures, with SSQOL as the outcome variable. Multivariate linear regression was used with cognitive scores and the SSQOL, adjusting for significant factors.

Results: Patients had mild to moderate cognitive dysfunction on the neurocognitive battery with an unadjusted average z-score of -1.34 SD below normative means on a cognitive composite score. A high composite z-score was associated with a high total SSQOL score ($p=0.002$), even after adjusting for depression and stroke severity ($p=0.005$). Exploratory post-hoc analyses showed that tests assessing processing speed were independently significant. In addition, the composite cognitive score was associated with 75% of the SSQOL subscales.

Conclusions: Processing speed had the greatest impact on QOL in patients with carotid occlusion across the most domains. Examination of the SSQOL subscales and neurocognitive results suggests a lack of insight into cognitive functioning in patients with carotid occlusion. Quality of life may be particularly sensitive to changes in processing speed rather than focal stroke deficits such as aphasia or neglect.

Correspondence: *Joanne Festa, PhD, Neurology, St. Luke's-Roosevelt Hospitals, 425 West 59th Street, Suite 6A, New York, NY 10019. E-mail: jfesta@chpnet.org*

S. GARCIA, M.L. ALOSCO, M. SPITZNAGEL, R. COHEN, N. RAZ, L. SWEET, L. COLBERT, R. JOSEPHSON, J. HUGHES, J. ROSNECK & J. GUNSTAD. METs Independently Associated with Cognitive Performance in Heart Failure Patients Enrolled in Cardiac Rehabilitation.

Objective: Reduced cognitive performance is common in persons with heart failure (HF). Cardiovascular fitness is a known contributor to cognitive function in many patient populations, but has not been examined in HF. The current study examines the relationship between fitness as measured by metabolic equivalents (METs) and cognition as well as their correlation with common clinical estimates of fitness.

Participants and Methods: Forty-one HF patients enrolled in cardiac rehabilitation completed a standardized exercise stress test protocol to establish METs, a brief neuropsychological battery, the 2-minute step test (2MST), and a series of medical history and self-report questionnaires.

Results: Maximum METs demonstrated incremental predictive validity for attention ($\beta = .41, p = .03$), executive function ($\beta = .37, p = .04$), and memory ($\beta = .46, p = .04$). Partial correlations accounting for key medical and demographic characteristics revealed greater METs was associated with the 2MST ($r(32) = .41, p = .02$) but not with the Duke Activity Status Index (DASI) ($r(32) = .24, p = .17$).

Conclusions: The current findings indicate that current fitness levels measured by METs are independently associated with cog-

nitive function in older adults with HF. Results also showed that METs was closely associated with one office-based measure of fitness (2MST), but not another (DASI). Prospective studies are needed to clarify the mechanisms linking fitness and cognitive function in HF as well as clinical implications.

Correspondence: *Sarah Garcia, Kent State University, 144 Kent Hall, Kent, OH 44242. E-mail: SGarcia6@kent.edu*

S. GARCIA, M. SPITZNAGEL, R. COHEN, L. SWEET, L. COLBERT, R. JOSEPHSON, J. HUGHES, J. ROSNECK & J. GUNSTAD. Greater Dairy Intake Associated with Poorer Executive Function in Heart Failure.

Objective: Past work shows an inconsistent relationship between dairy intake and cognitive function in healthy older adults. We examined the relationship between dairy consumption, cognitive dysfunction, and cerebral blood flow in a sample of older adults with heart failure (HF) to better clarify their association in this population at high risk for adverse neurocognitive outcomes.

Participants and Methods: A total of 86 older adults with HF (70.39 ± 9.51 years; 33.1% female) underwent neuropsychological testing, transcranial doppler (TCD) sonography to quantify cerebral blood flow, and a 2-minute step test to estimate current HF severity. Participants also completed self-report questionnaires including a brief dairy intake form.

Results: Partial correlations between the dairy consumption questionnaire and neuropsychological tests were conducted adjusting for heart failure severity. Results showed significant correlations between the dairy questionnaire and executive function ($r = -.26, p = .01$). Trends in the same direction were noted for language performance ($r = -.18, p = .09$) and attention ($r = -.18, p = .08$). Despite this, no significant correlations were found between dairy intake and TCD indices of blood flow velocity.

Conclusions: Results suggest that higher quantities of dairy was associated with lower executive functioning in persons with HF. Several possible explanations for these findings exist, including that higher levels of high-fat dairy may exacerbate cognitive dysfunction in this population. Prospective studies employing objective measures specific to high and low fat dairy are needed to clarify this possibility.

Correspondence: *Sarah Garcia, Kent State University, 144 Kent Hall, Kent, OH 44242. E-mail: SGarcia6@kent.edu*

A. GREMILLION, D.G. NEMETH, C. SONGY, A. KHURSHID & J.R. HAMILTON. Residual Sequelae from Pituitary Craniopharyngioma Removal: A 15 Year Saga.

Objective: A 23 year old, 5'1", 270 lb, single female, was referred by a state rehabilitation service agency for a Comprehensive Neuropsychological Evaluation to determine the residual effects of a 1997 non-cancerous Pituitary Craniopharyngioma Removal at age 9, after which a brain cyst developed. A 2003 craniotomy repaired a cerebral spinal fluid (CSF) leak and a blood vessel bleed. A temporal artery biopsy was performed in 2005. Residual medical problems included: Diabetes Insipidus; Hypothyroidism; Diabetes-Mellitus, Type 2; Brain Cyst; Neuropathic Autonomy; Chronic Inflammation/Chronic Migraines; Mitral Valve Prolapse; Anxiety/Depression; Sleep Apnea; Visual Impairment; Obesity; and Amenorrhea. No neuropsychological evaluation/intervention was conducted since 1997.

Participants and Methods: Specialists, consulted since 1997, included: Primary care, Endocrinology, Neurology, Neurosurgery, Cardiology, Gynecology, Ophthalmology, Otolaryngology, and Psychiatry. Headache treatment included Botox, DHE injections, and Relpax. Other medications included: DDAVP, Synthroid, Metformin, Gabapentin, Naproxen, Metoprolol ER Succinate, Sertraline, Generess, Fe, and Dihydroergotamine.

Results: Employment positions ended because of Multi-tasking and Processing Speed difficulties. Two 2010 suicide attempts occurred. Gastric Bypass Surgery (GBS), denied by insurance, will be paid by a benefactor. Intervention plan: Sertraline - discontinued; post GBS - add Nuedexta; add Provigil; Improve growth hormone levels; Pain management and pre-GBS preparation by Clinical Psychology; Post GBS Neurorehabilitation.

Conclusions: The initial surgery was in 1997, yet 2012 was the first time a Comprehensive Neuropsychological Evaluation was done. She had been floundering educationally and emotionally for 15 years. The family received little guidance; one failure after another was experienced and self-esteem was damaged. She no longer desired to live. Now meaningful intervention has renewed hope for a brighter future.

Correspondence: *Darlyne G. Nemeth, Ph.D., M.P., M.P.A.P., The Neuropsychology Center of Louisiana, LLC, 4611 Bluebonnet Blvd, Ste. B, Baton Rouge, LA 70809. E-mail: dgnemeth@gmail.com*

J. JONES, C. JACOBSON, M. MURPHY, M.S. OKUN & D. BOWERS. Differential Effects of Hypertension and Hypotension on Executive and Memory Status in Non-Demented Parkinson's Disease Patients.

Objective: Parkinson's disease (PD) is a degenerative disorder affecting frontal-subcortical systems, and resulting in cognitive decline. While multiple predictors of cognitive status have been identified in PD, the role of comorbid status is less clear. This study investigated the role of comorbidities in multiple cognitive domains among non-demented PD patients. We hypothesized that hypertension would negatively influence cognitive domains that are primarily frontally mediated.

Participants and Methods: A convenience sample of 341 PD patients underwent a neuropsychological assessment, including the Dementia Rating Scale (DRS) and tests of working memory, language, verbal memory, processing speed, and executive function. Patients were excluded based on a DRS score below the 5th percentile. Composite scores were computed for each of the five cognitive domains. A medical chart review was conducted to determine the presence of comorbidities. Hierarchical regression analyses were computed to determine the relationship between comorbidities and cognitive domains, controlling for measures of PD severity.

Results: PD severity detrimentally influenced performance in all cognitive domains. The presence of hypertension was independently associated with worse executive function and delayed verbal memory among PD patients. Conversely, the presence of hypotension was associated with better executive function. Exploratory analyses indicated that co-occurrence of hypotension with hypertension in the same individuals seemed to exert a "buffering" effect on cognition.

Conclusions: Our findings provide support that vascular comorbidities contribute to frontal-executive and memory status. Thus co-occurrence of PD and hypertension exerted a "double hit" on executive functions and may contribute to differential patterns of decline. One unexpected finding related to differing effects of hypertension and hypotension. Possible mechanisms underlying these differential effects will be discussed. Correspondence: *Jacob Jones, MS, CHP, University of Florida, 3901 SW 20th ave apt 206, Gainesville, FL 32607. E-mail: jacob.jones126@ufl.edu*

J.E. KAMPER, A. HINKLE, A. MARTINEZ, G. RECTS, S. TERZYAN, E. HANSON, H. MORRELL & S. ROPACKI. Health, Cognitive, and Psychosocial Predictors of Neuropsychological Status in Cardiac Patients.

Objective: Cardiovascular Disease (CVD) is the overall leading cause of mortality in the United States. Studies have identified cognitive deficits in CVD patients that affect their ability to adhere to treatment and thus reduce their quality of life. However, there have been few studies examining the relative influence of common and potentially modifiable predictors of cognitive performance in this vulnerable population. The goal of the current study is to reduce patient morbidity by identifying predictors of cognitive status that may be used as targets for intervention in cardiac rehabilitation programs.

Participants and Methods: Male and female heart patients (N = 41; 21% female; Mean age = 64.24, SD = 14.57) were recruited during the intake process of a cardiac rehabilitation program. All participants completed a comprehensive neuropsychological battery. Performance in each of 8 cognitive domains was regressed on previously identified predictors of intellectual functioning in heart patients, including health-related and psychosocial predictors, as well as cognitive reserve. Data were analyzed using hierarchical linear regression.

Results: Cognitive reserve variables, especially premorbid IQ, best predicted neuropsychological status across a variety of domains (including attention, immediate memory, working memory, phonemic fluency, and executive functioning). Health factors were most influential on delayed and working memory, while psychosocial variables such as depression contributed to delayed memory abilities. Premorbid IQ was the strongest individual predictor of neuropsychological status, followed by depression and anxiety.

Conclusions: It is evident that factors from multiple domains affect the neuropsychological status of heart patients. Although the influence of premorbid IQ and other static variables is substantial, targeting relatively changeable variables such as hypertension, cholesterol, and depression may lead to better cognitive outcomes and improved quality of life in heart patients.

Correspondence: *Joel E. Kamper, M.A., Psychology, Loma Linda University, 48331 Country Circle, Farmington Hills, MI 48331. E-mail: joelkamper@gmail.com*

E. KOZORA, D.B. ARCINIEGAS, E. DUGGAN, S. WEST, M. BROWN, A. BURLESON & C.M. FILLEY. PASAT Performance and White Matter Abnormalities in Systemic Lupus Erythematosus (SLE).

Objective: Working memory deficits in patients with systemic lupus erythematosus (SLE) are common even in the absence of overt neuropsychiatric (NP) disorders. Few studies have evaluated working memory performance and neurometabolite profile using magnetic resonance spectroscopy (MRS) in SLE.

Participants and Methods: The Paced Auditory Serial Addition Test (PASAT), a measure of working memory, was administered to 73 SLE patients without overt NP activity. In addition to the total score (correct responses), dyads (correct consecutive responses), chunking (correct response after skipped response) and cognitive fatigue (decrease in number of correct scores over time) scores were calculated. The ratio of choline/creatine (Ch/Cr) was determined in right and left frontal normal-appearing white matter (WM) using MRS.

Results: Twenty-nine percent of the subjects were impaired on the PASAT. Total PASAT score was inversely correlated with right and left frontal WM Ch/CR ($p=0.004$ and 0.034 respectively). Left frontal WM Ch/CR was correlated with percent chunking ($p=0.01$) and inversely correlated with total and percent of dyads ($p=0.007$ and 0.02 respectively). Right frontal WM Ch/CR correlated with percent chunking ($p=0.04$) and inversely correlated with total and percent dyads ($p=0.02$ and 0.03 respectively). There were no relationships between cognitive fatigue and left or right frontal WM Ch/CR. Longer disease duration was associated with higher left WM Ch/CR ($p=0.01$).

Conclusions: A subset of SLE patients was impaired on the PASAT. Decreased total PASAT score and fewer dyads correlated with higher left frontal microstructural WM damage on MRS, whereas cognitive fatigue did not. This performance pattern suggests that early WM damage interferes with working memory in SLE. These observations also provide further insight into the neurobiological basis of mild cognitive dysfunction related to microstructural WM injury.

Correspondence: *Elizabeth Kozora, PhD, National Jewish Health, 1400 Jackson Street, Room M107g, Denver, CO 80206. E-mail: kozorae@njhealth.org*

M. LABELLE, T. DANG-VU, J.Y. MONTPLAISIR & A. ZADRA. Effects of Sleep Deprivation on Inhibitory Processes in Adult Sleepwalkers.

Objective: Somnambulism is characterized by variable behaviors occurring after incomplete awakenings from NREM sleep. Although sleepwalkers' general sleep architecture is preserved, many patients complain of excessive daytime sleepiness and sleepwalkers have been found to be at increased risk for automobile accidents. Excessive daytime sleepiness has been linked to impaired vigilance in various populations but this association has not been investigated in sleepwalkers. We report the first study of cognitive functioning in sleepwalkers after normal sleep and following sleep deprivation.

Participants and Methods: Participants were nine sleepwalkers and nine normal controls matched for age, sex and education. Sleepwalkers were referred to our clinic by their treating physician and met ICSID-II diagnostic criteria. All subjects underwent whole night polysomnography (PSG) and, 1 week later, a 25h sleep deprivation (SD) protocol with daytime recovery sleep. The Continuous Performance Task (CPT) was administered the morning after their normal PSG as well as following their SD. Response latencies, as well as errors of omission and commission were investigated.

Results: There was no significant difference in response latency between groups or test periods. A significant night effect for errors of omission [$F(1,16) = 8.27, p = .011$] as well as for errors of commission [$F(1,16) = 12.30, p = .003$] showed that both groups made more errors in the SD condition. There was a significant interaction effect whereby sleepwalkers committed more errors of commission than did controls in the SD condition [$F(1,16) = 4.84, p = .043$].

Conclusions: Although SD impaired vigilance in both groups, the overall level of impairment was not significantly worse in sleepwalkers. However, sleepwalkers' greater number of commission errors following SD suggests increased impulsivity in these patients. SD may affect inhibitory processes in sleepwalkers related to underlying pathophysiological mechanisms.

Correspondence: *Marc-Antoine Labelle, Université de Montréal, 1290a St-Zotique, Montréal, QC H2S1N7, Canada. E-mail: marc-antoine.labelle@umontreal.ca*

M.M. LUBOMSKI-HALFACRE, K. ALTERESCU, E. MURRAY, J. TWAITE, K. SCORPIO, G. SALIM, K.R. SAVAGE, 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.

Objective: Parkinson's disease (PD) is associated with emotional expression deficits, which affect social interactions. However, few treatments address the social impact of these deficits. The current study examines the influence of a voice treatment (LSVT; Ramig et al., 1995) on facial mobility (FM), social engagement (SE; assessed through facial expression), and emotional experience (EE) in individuals with PD compared to healthy controls (HCs). LSVT was predicted to increase all three variables.

Participants and Methods: Participants were 39 individuals with PD (69% male) and 14 demographically-matched HCs (62% male). PD participants were randomly assigned to three groups: 12 received voice therapy (LSVT), 14 received speech articulation therapy (ARTIC; Spielman et al., 2012), and 13 received no treatment. Participants produced emotional (happy, sad, angry) and neutral monologues from the New York Emotion Battery (Borod et al., 1992), which were evaluated by 18 trained raters (50% male) for FM (amount of muscle movement in the face) and SE (how much the rater wanted to interact with the poser). After each emotional monologue, participants indicated the overall intensity of their feelings during the monologue (EE-O), the accuracy with which they produced the monologue (EE-A), and the intensity of their emotional feelings right after the monologue (EE-I).

Results: A Group (4) x Gender (2) x Time (2) x Emotion (4) ANOVA was performed. The LSVT group improved on FM, EE-I, and EE-O from pre- to post-treatment, whereas the other three participant groups did not. Gender differences were also found, with women displaying higher FM and EE-I overall and higher SE on angry monologues at pre-treatment. Finally, there were significant effects of Emotion for FM, SE, and all EE variables.

Conclusions: Findings suggest that LSVT may be a useful treatment to increase facial movement and emotional experience in PD patients. Clinically, enhanced emotional experience may be useful in improving mood disorders that are often co-morbid with PD.

Correspondence: *Michelle M. Lubomski-Halfacre, Ph.D., Psychology, Queens College and The Graduate Center of The City University of New York, 16 Royal Crest Drive, Apt. 5, Marlborough, MA 01752. E-mail: TLubomski@aol.com*

Z. MELIKYAN, Y. MIKADZE & A. POTAPOV. Verbal and Visual Memory in Mild and Moderate TBI Patients 1, 3 and 6 Months After the Injury.

Objective: Prevalent types of brain trauma - mild and moderate TBI - often lead to long-lasting cognitive deficits. Memory disturbances are among most frequent complaints reported by this group of patients. In the current study we used quantitative approach to A.R. Lurian qualitative tests in an attempt to better characterize the structure of memory impairments in mild and moderate TBI.

Participants and Methods: 42 adults (27 male, 15 female), 19-62 years old with mild (23 patients) and moderate (19 patients) TBI were tested within 1, 3 and 6 months after trauma. Testing included visual and verbal memory tests from scored A.R. Lurian neuropsychological battery. Changes between 1 - 3 and 3-6 months post-injury were analyzed using ANOVA. Statistically significant results ($p < 0.05$) are reported.

Results: In visual memory changes are more pronounced between 1 and 3 then 3 and 6 months post-injury. Between 1 and 3 months of injury number of figures recalled in 1st, 2nd, 3rd, and delayed recall has significantly increased. Frequency of certain errors - omissions of entire figures, perseverations, wrong order of the recalled figures, omissions of the details from the recalled figures has decreased significantly. Between 3 and 6 months only number of figures in 1st recall has increased significantly and number of perseverations has significantly decreased. In verbal memory changes are more pronounced between 3 and 6 months of injury: number of words in delayed recall has increased significantly, frequency of certain errors - intrusions of synonyms and homonyms, perseverations, wrong order of the recalled words has significantly decreased. Between 1 and 3 months of injury only number of intrusions of homonyms has significantly decreased.

Conclusions: Changes in visual memory are more pronounced in 1-3 months post-injury and almost reach ceiling at 3 months. It takes longer for verbal memory to improve - significant changes are seen 3-6 months after the injury.

Correspondence: *Zara Melikyan, PhD, MSU, 11-5 Mokhovaya str., Moscow 125009, Russian Federation. E-mail: zmelikyan@yahoo.com*

L.A. MILLER, M. SPITZNAGEL, J. HUGHES, J. ROSNECK & J. GUNSTAD. Executive Function/Attention Predicts Memory Performance in Older Adults with Heart Failure.

Objective: Cognitive impairment is common in heart failure (HF) and reduced memory performance is frequently observed. However, memory deficits in HF could result from vascular, neurodegenerative, or a mix of pathological processes. The aim of the current study was to examine the impact of frontal systems function on memory performance in an effort to clarify the nature of memory deficits in this population.

Participants and Methods: Older adults with HF ($n = 90$; mean age = 67.73 ± 9.07 years; 26% female) completed neuropsychological measures of memory (CVLT) and executive function/attention (TMT, FAB, LNS, and SCWT), as well as a measure of cardiovascular fitness (2-minute step test).

Results: Composite scores were created for the cognitive domains based on normative data. Hierarchical multiple regression was used to determine the amount of variability accounted for in memory performance by executive function/attention. After controlling for cardiovascular fitness, executive function/attention was a significant predictor of memory ($\beta = 0.33, t(87) = 3.16, p < .01; \Delta R^2 = 0.10, F(1,87) = 9.96, p < .01$) and accounted for 10.3% of unique variance. Partial correlations controlling for cardiovascular fitness indicated TMT-A ($r = .21$), FAB ($r = .33$), and LNS ($r = .29$) were significantly and positively correlated with memory performance.

Conclusions: The current findings suggest that the memory impairment observed in HF appears to be at least partly attributable to reduced executive function/complex attention. Such findings suggest an important contribution of frontal systems function to memory performance among individuals with HF. Prospective studies that more precisely examine the nature of memory deficits in HF are much needed, as a better understanding of the etiology of memory deficits in HF will likely aid in optimal differential diagnosis and better guide treatment recommendations.

Correspondence: *Lindsay A. Miller, MA, Psychology, Kent State University, Kent Hall, Kent, OH 44242. E-mail: lmille92@kent.edu*

M.C. MÖLLER, A. BARTFAI, C. NYGREN DE BOUSSARD, A. FLÖTER RÅDESTAD & J. CALISSENDORFF. Fatigue and Cognitive Functions in Newly Diagnosed Graves' Disease.

Objective: Thyrotoxicosis is an autoimmune disease due to elevated thyroid hormones and consequently increased metabolism. The most common form of thyrotoxicosis among patients in working age is autoimmune Graves' disease (GD). This disease causes a wide variety of both physiological and psychiatric symptoms but cognitive dysfunction has seldom been addressed in studies on Graves' disease. Even more sparse are investigations on fatigue even though complaints of fatigue are common among these patients. The aim in this study was to investigate if subjective fatigue as well as cognitive fatigue was present among patients with untreated GD; if these symptoms are related to hormonal changes, depression, sleep disturbances or to cognitive dysfunction, possible related to cognitive fatigue.

Participants and Methods: Thirty four patients (mean age: 39.2 ± 9.8) with newly diagnosed untreated disease and 31 healthy controls (mean age 36.7 ± 8.8) were investigated. Neuropsychological tests and questionnaires were used to assess fatigue (WAIS-III Digit Symbol Test) and other neuropsychological functions.

Results: The patients experienced significantly more self-rated fatigue and 50 % of the patients suffered from cognitive fatigue compared to 19 % in the controls. Patients also performed less well on tests of learning, memory and executive functions. Depression was associated to self-rated fatigue but not to cognitive fatigue. High free T3 levels were also associated with faster performance speed and better incidental learning and executive functions and high self rated everyday consequences of fatigue. Smokers had lower T3 levels than non smoking patients.

Conclusions: The results indicate that patients with untreated GD suffer from fatigue and other cognitive dysfunctions and high T3 levels are associated with elevated cognitive processing speed but more self-rated fatigue.

Correspondence: *Marika C. Möller, MA, Department of Clinical Sciences, Karolinska Institutet and Centre for Clinical Research Sörmäländ, Uppsala University, Kullberg'ska hospital, Ger/rehab section, box 110, Kartrineholm 64122, Sweden. E-mail: marika.moller@dll.se*

C. MOORE, M.D. GRANT, W. KREMEN, C.E. FRANZ, T. ZINK, M. PANIZZON, M. LOGUE & M.J. LYONS. Processing Speed in Diabetic Men With and Without Erectile Dysfunction.

Objective: Slowed processing speed is one of the most common cognitive deficits reported in diabetes. It is also believed to be an important mediator of age-related cognitive impairment. Thus, early identification of slowed processing speed is critical. One health condition to monitor in that regard is Erectile Dysfunction (ED). ED is a medical condition strongly predictive of cardiovascular disease (CVD) in diabetic men, and also has been linked to slowed processing speed in a non-clinical sample. ED is prevalent in diabetes (~60-70%), and severity of ED in diabetic men correlates with endothelial dysfunction and atherosclerosis. The purpose of this study was to determine whether diabetic men with ED have slower processing speed than diabetic men without ED.

Participants and Methods: As part of an ongoing longitudinal study (Vietnam Era Twin Study of Aging), 60 diabetic males (aged 51-60) completed an extensive neuropsychological battery. Only men without overt CVD (heart attack, heart failure, heart surgery, stroke, peripheral vascular disease) were included in the sample. ED was assessed by the International Index of Erectile Function.

Results: After controlling for age, education, and traditional CVD risk factors, there was a significant relationship between ED and processing speed such that ED was associated with slower speed ($t=-2.60$, $df=58$, $\text{cohen's } d=.68$). ED was more predictive than conventional vascular variables such as smoking, high cholesterol, BMI, and hypertension.

Conclusions: ED is a common problem in diabetes, and our results suggest that the presence of ED may be indicative of slower processing speed. Intriguingly, ED was more predictive of performance than other traditional indicators of vascular health. Our results underscore the importance of early diagnosis of ED in the treatment of diabetes.

Correspondence: *Caitlin Moore, Boston University, 177 Franklin St. Apt #3, Cambridge, MA 02139. E-mail: csmoore@bu.edu*

K. RAGHUBAR, L.A. JACOBSON & T. ZABEL. Parent- and Self-Ratings of Self-Management Skills in Young Adults with Spina Bifida.

Objective: Accurate self-assessment of self-management skills is an important component of transition to adulthood in spina bifida (SB), and there is evidence of increased agreement between parent- and self-report of behavior once individuals with SB reach young adulthood. To better inform transition planning, we examined self-report and parent-report ratings in young adults with SB living independently or remaining with parents.

Participants and Methods: Twenty-six young adults with SB (age range: 18 - 29 years), and their parent completed an online questionnaire (Kennedy Krieger Independence Scales-SB Version [KKIS-SB]). The self-report and parent report KKIS-SB have 10 shared items, assessing executive functioning components of general (e.g., wakes up on time, completes morning hygiene routine) and SB specific self-care skills (e.g., initiates catheterization on time/independently, looks for pressure sores).

Results: Young adults with SB living independently rated their self-management skills higher than young adults with SB living at home with parents. In contrast, parent ratings of self-management skills were similar for young adults with SB living independently and for those living with parents. Self-ratings and parent-ratings were moderately correlated for young adults with SB living at home ($r = .67$, $p < .05$), but were not significantly correlated for young adults with SB living independently ($r = .38$, ns).

Conclusions: Although young adults living independently would presumably be more functional and independent in their self-care skills, this is supported by self-report but not parent ratings. Ratings of young adults living at home show agreement with parent ratings, providing evidence for accurate self-assessment in these young adults. Discrepancy between parent- and self-report of self-management skills in young adults with SB living independently merits additional investigation with regard to validity of self-management assessment.

Correspondence: *Kimberly Raghobar, M.A., University of Houston, 15 S High St, Baltimore, MD 21202. E-mail: kim.raghobar@gmail.com*

T. CAREY, L. SCHWARZ & J. NIEHOFF. The Relationship between Cognitive Status and Psychosocial Assessment in Hepatic Transplant Candidates.

Objective: Most organ transplant programs require patients to undergo an evaluation with a mental health professional. As a part of these assessments, cognitive and psychosocial factors are often taken into consideration. The present investigation is focused particularly on liver transplant patients, a population in which cognitive impairment is common. The purpose of this study is to elucidate the relationship between cognitive impairment and relevant psychosocial factors (such as social support, psychological health, lifestyle, and understanding of the transplant process).

Participants and Methods: The charts of 42 transplant candidates diagnosed with liver disease of various etiologies were examined. Of this group, the primary etiology is alcoholic cirrhosis (42.8%). Other etiologies included, for example, hepatitis C, NASH, and alpha-1 deficiency. Neurocognitive data included the Wechsler Test of Adult Reading (WTAR), the Repeatable Battery for the Assessment of Neuropsychological Evaluation Status (RBANS), the Psychosocial Assessment of Candidates for Transplantation (PACT), Beck Anxiety Inventory (BAI), and the Beck Depression Inventory-Second Edition (BDI-2).

Results: The combined sample IQ was within the average range (WTAR predicted mean FSIQ=99.78, SD=10.52). The sample demonstrated overall low average global neurocognitive functioning as assessed by the

RBANS Total Index score (mean=83.00, SD=15.95). Overall, the sample evidenced mild symptoms of anxiety (BAI mean=10.87, SD=10.60) and minimal symptoms of depression (BDI-2 mean=11.45, SD=8.41). Examination of correlations between cognitive and psychosocial ratings revealed a significant relationship between the RBANS Attention Index and the PACT understanding the transplant process and follow-up domain.

Conclusions: These results suggest that in liver transplant patients attentional impairment may be a factor contributing to difficulties with understanding the surgical procedure including risks and benefits.

Correspondence: *Lauren Schwarz, PhD, Neurology & Psychiatry, Saint Louis University, 1438 South Grand Blvd, St. Louis, MO 63104. E-mail: lschwa15@slu.edu*

G.A. SEIDEL, M. FANNING, B. CIAUDELLI, S. WELDEN, M.A. ACKER, T.F. FLOYD & T. GIOVANNETTI. Characterizing Cognition in Older Adults with Cardiac Disease.

Objective: In contrast to the extensive literature investigating the effects of cardiac surgery, the baseline cognitive functioning of cardiac patients has been poorly characterized. In a large sample of older adults with cardiac disease, we examined performance on several cognitive tests using age-based norms and identified patterns of impairment across measures.

Participants and Methods: 234 older adults ($M_{age} = 75.1$) with aortic stenosis and/or coronary artery disease were recruited through cardiology services. Participants were not demented and were not seeking neuropsychological services for cognitive difficulties. All were administered the MMSE and measures of episodic memory (Hopkins Verbal Learning Test, HVLIT; Rey-Osterrieth Complex Figure Test, RCFT) and executive functions (Verbal Fluency, FAS; Trails B; Mental Control; Digits Backwards).

Results: Compared to age-based norms, a substantial percentage of participants performed in the impaired range ($Z \leq 1.33$) in HVLIT Delayed Recall (17.9%), HVLIT Discriminability Index (23.0%), FAS (17.4%), Trails B (19.8%), and Mental Control (35.5%). In contrast, relatively few participants were impaired in the MMSE (5.1%), RCFT Delayed Recall (4.6%), RCFT Percent Retained (6.0%), or Digits Backwards (9.1%). An analysis of participants' individual performance across all 8 measures revealed several distinct profiles, with performance best characterized by circumscribed executive dysfunction in 41.1% of participants, by circumscribed episodic memory deficits in 9.7%, a mixed presentation in 8.7%, and no impairment in 40.6%.

Conclusions: A large percentage of older adults with cardiac disease showed cognitive impairment that was not detected with the MMSE. A person-centered pattern analysis showed most participants exhibited a dysexecutive profile, with smaller, separate groups showing memory deficits reflecting an anterograde amnesia or a mixed profile. These results suggest the importance of comprehensive neuropsychological evaluations for older patients with cardiac disease.

Correspondence: *Gregory A. Seidel, M.A., Psychology, Temple University, 1701 N. 13th St., Weiss Hall, Philadelphia, PA 19122-6055. E-mail: gregory.seidel@temple.edu*

I. SZATKOWSKA, P. BOGORODZKI, E. PIATKOWSKA-JANKO, L. GAWRYS, A. PILACINSKI, R. ANDRYSIAK, R. KULINSKI, L. KROLICKI & A. FRIEDMAN. Altered Cortical Thickness in Parkinson's Disease.

Objective: Parkinson's disease (PD) is an aging-related neurodegenerative disorder characterized by several motor symptoms and diverse cognitive problems. Although PD initially affects subcortical regions, the cortex also shows neuronal loss in the course of the disease. However, PD-related pattern of cortical damage remains unclear, in part because of methodological issues such as the limitations of Voxel Based Morphometry. In the present study, we applied cortical-surface based techniques to obtain a better picture of PD-related corticomorphometric patterns.

Participants and Methods: Twenty-two nondemented volunteers with mild idiopathic PD [mean age: 57.2±7.3 years (range: 41–68), mean education: 13.4±3.2 years (range: 10–18), 9 males] and 13 matched

healthy control subjects [C group; mean age: 57.4±6.2 years (range: 47–66), mean education: 15.5±3.1 years (range: 10–19), 5 males] participated with informed consent and approval of Medical University of Warsaw. T1-weighted images were acquired with the GE Signa EXCITE 1.5T MRI scanner. Using the Freesurfer software, surface-based analysis was done to find changes in cerebral cortical thickness in patients with PD.

Results: Compared to healthy controls, patients with PD showed significant cortical thinning in the frontal pole and inferior temporal area in the right hemisphere.

Conclusions: The results suggest that mild PD is associated with specific cortical alterations, which could account for cognitive deficits that can arise even at relatively early stages of the disease. Future studies are needed to find behavioral correlates of these alterations.

This work was supported by a grant (NN402457138) from the Polish Ministry of Science and Higher Education.

Correspondence: *Iuona Szatkowska, Department of Neurophysiology, Nencki Institute, 3 Pasteur Street, Warsaw 02-093, Poland. E-mail: i.szatkowska@nencki.gov.pl*

A. TART-ZELVIN, K. PATRICK, L. BRENNAN, J. EPPIG, M. SCHULTHEIS & D. LIBON. A Process Approach to Verbal Fluency Performance in Parkinson's Disease – Evidence for Derailed Temporal Gradients.

Objective: Impaired temporal gradients (precipitously declining performance over time) on mental search tasks have been shown in patients with dementia and MCI (Eppig et al, 2012; Lamar et al, 2002). Little research has examined this phenomenon in those with Parkinson's disease (PD); moreover, the effect of dopaminergic medication (DM) on mental search tasks is unknown. This study used a similar process approach to examine derailed temporal gradients in PD patients.

Participants and Methods: Letter ('FAS') and Animal Fluency ('Animals') were administered to 13 non-demented PD patients (on and off DM) and 34 healthy controls (HC). For PD patients, the "on" testing involved no change in regular DM schedules while "off" testing required they discontinue DM for the 24-hours prior to testing.

Results: A Repeated Measures Factorial ANOVA revealed a significant interaction effect of patient type (PD, HC) and Fluency Type (FAS, Animals) on decline of output across four 15-second epochs, $F(1, 45) = 9.02, p = .004$. Post-hoc paired samples t-tests revealed that for HC, decline in performance across epochs was significantly more severe on Animals ($M = -9.10, SD = 4.36$) than FAS ($M = -5.94, SD = 3.16$), $t(33) = 3.89, p < .001$, but slopes for PD patients did not statistically differ based on fluency type, $t(12) = -1.16, p = .27$. Total Verbal Fluency output did not statistically differ based on patient type, $t(45) = .35, p = .73$. Total output and decline across epochs did not differ for PD patients based on medication ($ps > .27$). On FAS, PD patients showed a more severe decline in performance across epochs ($M = -8.45, SD = 2.34$) than HC ($M = -5.94, SD = 3.15$), $t(45) = 2.60, p = .01$. However, slopes did not differ between PD patients and HC on Animals, $t(45) = 1.47, p = .15$.

Conclusions: These data suggest no significant effect of DM on mental search tasks; however, a derailed temporal gradient typifies letter fluency performance in PD. Underlying neurocognitive networks should be examined. Correspondence: *Ariana Tart-Zelvin, B.A., Department of Psychology, Drexel University, 316 S. 43rd Street, Apt. #3, Philadelphia, PA 19104. E-mail: atartz@gmail.com*

J.C. WERTHEIMER, B. ERICH, L. ANDERSON, M. NUNO & J. FITZGERALD SMITH. Speech Characteristics in Individuals with Parkinson's Disease with and without Deep Brain Stimulation: Implications for Neuropsychologists.

Objective: Speech problems in Parkinson's Disease (PD) manifest in cognitive-linguistic, sensory, muscular, and respiratory changes. Deep Brain Stimulation (DBS) has been found to adversely impact speech in PD patients. Speech characteristics related to functional and psychosocial outcomes for these patients require further delineation, highlighting implications for DBS therapy and expectation management.

Objectives: To examine speech characteristics in PD patients as it relates to 1. a DBS group and a Non-DBS group, 2. a Younger and Older PD group, and 3. earlier disease duration (Early PD group) and advanced disease duration (Advanced PD group).

Participants and Methods: Using cross sectional research design, 757 PD patients (DBS group, N=287; STN=83%, GPI=12%, Thalamus=5%; Non-DBS group, N=470) completed The Voice Handicap Index, and a questionnaire designed to assess speech characteristics in PD.

Results: 79% of the DBS group versus 39% of the Non-DBS group characterized their speech problem severity as moderate to severe. Hypophonia was the most frequently endorsed speech problem for both groups. Slurred speech was the symptom most impacted by DBS ($p<.001$). The DBS group also endorsed greater problems with festinating speech, rapid speech, initiating speech, monotone voice, stuttering, and swallowing. Covariance analyses controlling for age and disease duration revealed higher ratings across all domains on the Voice Handicap Index for the DBS group ($p<.0001$), and they communicated and socialized less often due to speech difficulties. The Advanced PD group (vs. Early PD group) experienced greater difficulties across most speech functions. No differences were found between Younger and Older PD groups.

Conclusions: Speech disturbance is prevalent in PD. DBS seems to have a differential impact on speech characteristics and influences functional communication and socialization. Implications and recommendations are discussed.

Correspondence: Jeffrey C. Wertheimer, Ph.D., Physical Medicine and Rehabilitation, Cedars-Sinai Medical Center, 8700 Beverly Blvd., Suite 7215, Los Angeles, CA 90048. E-mail: Jeffreywertheimer@yahoo.com

Y. BOGDANOVA, M.M. VALMAS, M. DIAZ-SANTOS, S. NEAR-GARDER & A. CRONIN-GOLOMB. Alexithymia and Apathy in PD: Neurocognitive Correlates.

Objective: Non-motor symptoms such as neuropsychiatric and cognitive dysfunction are common in Parkinson's disease (PD) but the relation between such symptoms is poorly understood. This study focused on alexithymia, an impairment of affective and cognitive emotional processing, as there is evidence for its interaction with cognition in other disorders.

Participants and Methods: Twenty-two non-demented PD patients and 22 matched normal control adults (NC) were administered rating scales assessing neuropsychiatric status, including alexithymia, apathy, and depression, and a series of neuropsychological tests.

Results: As expected, PD patients showed more alexithymia than NC, and there was a significant association between alexithymia and disease stage. Alexithymia was associated with performance on non-verbally mediated measures of executive and visuospatial function, but not on verbally mediated tasks. By contrast, there was no correlation between cognition and either depression or apathy ratings.

Conclusions: Our findings demonstrate a distinct association of alexithymia with non-verbal cognition in PD, implicating right hemisphere processes. The results also showed differentiation between alexithymia and other neuropsychiatric symptoms (apathy and depression) in regard to PD cognition. Correspondence: Yelena Bogdanova, PhD, Psychiatry, Boston University, Psychology Research (151-A), 150 South Huntington Avenue, Boston, MA 02130. E-mail: bogdanor@bu.edu

A.C. ZANINOTTO, K.R. CAMPANHOLO, M.D. BARBOSA, C.N. FARIAS, S.A. HAJJ, D.F. MAZO, L.C. D ALBUQUERQUE, A.Q. FARIAS & M.C. DE LÚCIA. Cognitive function and mood disorder in patients with and without hepatitis C virus infection in the waiting list for liver transplantation.

Objective: Patients with end-stage liver disease, regardless of its etiology, commonly complain of difficulties in attention, concentration and memory. Hepatitis C virus (HCV) enters brain cells, especially astrocytes, and chronic infection has been implicated in those manifestations. Our aim was to compare cognitive function and depression symptoms in HCV and non-HCV infected patients with cirrhosis.

Participants and Methods: 150 patients waiting for liver transplantation were assessed for eligibility in this prospective study. Inclusion criteria were seropositivity for HCV-RNA by real-time PCR, alcohol drinking less than 20g/day and no history of hepatic encephalopathy. Eight-one patients were excluded, leaving 69 patients for analysis. Enrolled patients were divided into two groups: HCV (n=20) and non-HCV (n=49). All patients underwent a stringent protocol for assessing cognitive function (symbol digit, stroop color, trail making, Hopkins verbal learning, grooved pegboard, digit span, verbal fluency, clock drawing tests) and depression symptoms (Beck depression inventory; BDI)

Results: Cognitive functions impairment was found in both HCV and non-HCV groups, but patients with hepatitis C infection had a worse performance on episodic verbal memory delay recall testing when compared with non-infected patients ($p=0.0001$). No significant difference was observed between groups in executive functions, visual spatial organization and processing speed. However, both groups had a worse performance when compared to normative data. No significant difference was observed in depression symptom scores in HCV infected patients when compared with those seronegative counterparts.

Conclusions: Although both groups of patients with advanced liver disease (i.e. cirrhosis) had cognitive impairment and depression symptoms, patients with hepatitis C infection had worse performance in verbal memory testing.

Correspondence: Ana Luiza C. Zaninotto, master, Divisão de Psicologia, Universidade de São Paulo - FMUSP, Rua Dr. Eneas de Carvalho Aguir 155, terreo., São Paulo 05403-000, Brazil. E-mail: ana.zaninotto@yahoo.com.br

TBI (Adult)

A.C. ZANINOTTO, M.D. NÚÑEZ, B. BALDIVIA, V.P. GUIRADO, F. FELTRIN, C. LEITE, A. FERREIRA, J. MANOEL & M.C. DE LÚCIA. Performance on Verbal Fluency tasks in Traumatic Diffuse Axonal Injured patients .

Objective: Assess executive functioning in Traumatic Diffuse Axonal Injury (TDAI) patients on verbal fluency (VF) components - mental flexibility, attention, shifting sets- 6 and 12 months after trauma compared to control group (CG).

Participants and Methods: Eighteen TDAI patients aged M= 30 (SD=9.26) were compared to CG (n=17) aged M=32 (SD=7.94) through semantic (animals) and phonemic (FAS) VF tasks. Results were analyzed considering number of words recalled, errors, intrusions, clustering and switching components. DAI group was evaluated 6 months (DAI 1) and 13 months (DAI 2) after TBI.

Results: Analyses were conducted using Student T -test (FAS), Mann-Whitney (clustering and switching) and Wilcoxon test (TDAI 1 vs TDAI 2 groups). The TDAI I group showed worse performance in FAS total and A letter in comparison to the CG ($p<0.05$). However comparing TDAI 1 and TDAI 2 groups in FAS task there was a tendency to significance in total words ($p=0.08$) and clustering ($p=0.09$). The analysis of semantic components of VF showed that CG had a higher number of switching than TDAI1 ($p<0,05$) and it was found increased total number of words generated over time (TDAI2>TDAI1; $p<0,05$).

Conclusions: Six months after TDAI, patients generated fewer words and showed reduced switching at VF test, but this pattern did not persist one year after TDAI. This result suggests that the natural course of TDAI reveals impairment in VF tasks 6 months after trauma but a similar performance pattern with control group after one year. Moreover, it suggests that VF tasks are sensitive to assess cognitive executive domains on TDAI patients.

Correspondence: Ana Luiza C. Zaninotto, master, Divisão de Psicologia, Universidade de São Paulo - FMUSP, Rua Dr. Eneas de Carvalho Aguir 155, terreo., São Paulo 05403-000, Brazil. E-mail: ana.zaninotto@yahoo.com.br

Y. BOGDANOVA, K. STAVITSKY, S.M. KARK, S. DELUCA, G. LAFLECHE, T.A. BROWN & M. VERFAELLIE. Sleep Quality and its Relation to Cognitive Function in Veterans with Self-reported Blast-induced mTBI.

Objective: Sleep disturbance is a frequent post-deployment problem in OEF/OIF veterans. This study examined sleep quality in blast-exposed OEF/OIF veterans with cognitive complaints, with the goal of examining the contribution of mTBI and PTSD to sleep disturbance, and the relationship between sleep quality and cognitive performance.

Participants and Methods: Thirty blast-exposed OEF/OIF veterans with mTBI (n=18) and without TBI (n=12) were administered standardized neuropsychological and neuropsychiatric measures. Sleep was assessed using a self-report questionnaire (PSQI) and actigraphy.

Results: Participants with mTBI reported marginally worse sleep than those without TBI; there were no differences on actigraphy measures. PTSD symptoms were also significantly associated with PSQI scores, but not actigraphy. Hierarchical regression indicated that PTSD symptoms were more strongly associated with self-reported sleep disturbance than was mTBI. Self-reported sleep quality, but not actigraphy, was significantly associated with composite scores of memory and executive function. Adding mTBI and PTSD as predictors of cognitive scores did not enhance model fit.

Conclusions: Our results indicate that both PTSD and mTBI are associated with self-reported sleep problems. Further, subjective report of sleep disturbance is associated with reduced cognitive function. Inconsistencies between self-report and actigraphy measures indicate the importance of examining both measures. Further research is needed to evaluate whether a subjective sense of fatigue may play a greater role in this population than behavioral indices of sleep.

Correspondence: *Yelena Bogdanova, PhD, Psychiatry, Boston University, Psychology Research (151-A), 150 South Huntington Avenue, Boston, MA 02130. E-mail: bogdanor@bu.edu*

A.N. CLARK, L. HARIK, K.L. MAESTAS & A.M. SANDER. Relationship Of Post-Concussive Symptoms To Participation Outcomes At 3 Months Following Mild Traumatic Brain Injury.

Objective: The purpose of this study is to investigate the contribution of post-concussive symptoms to participation outcomes three months following mild traumatic brain injury (mTBI).

Participants and Methods: 172 persons with mild TBI (78.5% male; mean age=33.16; mean years of education=10.57) recruited from consecutive admissions to the emergency department of a Level 1 trauma center in southeast Texas and followed in the community three months post-injury. Over half of the sample was Hispanic and 24% were African American. At the 3 month follow-up assessment, post-concussive symptoms were assessed via items on the Hi-Fi Problem Checklist. Participation outcomes were measured by the Craig Handicap Assessment and Reporting Technique- Short Form (CHART-SF) occupational and social integration subscales, and the Community Integration Questionnaire. A series of hierarchical multiple regression models were used to investigate the contribution of post-concussive symptoms to participation outcomes at 3 months post-injury, controlling for age, education, injury severity, pre-injury productivity, and litigation status.

Results: After accounting for age, education, injury severity, pre-injury productivity, and litigation status, post-concussive symptoms accounted for a significant proportion of variance in CIQ-Total score ($R^2=.124$, $p<.01$), and CHART-SF occupation score ($R^2=.230$, $p<.01$). Post-concussive symptoms did not account for a significant proportion of variance in CHART-SF social integration scores.

Conclusions: A greater number of post-concussive symptoms at 3 months post-injury was associated with decreased participation outcomes, including reduced overall community integration and productivity/occupation (participation in work, school, hobbies). These results suggest that improved management of post-concussive symptoms may have a beneficial impact on participation outcomes.

Correspondence: *Allison N. Clark, PhD, Physical Medicine & Rehabilitation, Baylor College of Medicine, Brain Injury Research Center, TIRR Memorial Hermann, 2323 S. Shepherd, Ste. 907, Houston, TX 77019. E-mail: anclark@bcm.edu*

J.M. GULLETT, R.M. BAUER & D.B. FITZGERALD. Predictors of Pre-deployment Intellectual Ability in OEF/OIF Veterans with Mild Traumatic Brain Injury and Post-Traumatic Stress Disorder.

Objective: To determine whether the North American Reading Test (NART) is a valid predictor of pre-morbid intellectual ability in veterans with a history of mild Traumatic Brain Injury (mTBI) who are experiencing chronic symptoms of depression and Post Traumatic Stress Disorder (PTSD).

Participants and Methods: Participants consisted of 41 veterans of Operation Iraqi Freedom and/or Operation Enduring Freedom who experienced blast-related injury during deployment and are suffering from chronic symptoms of PTSD and depression. All participants were free of radiological abnormalities on structural imaging (T1, T2, FLAIR) and exhibited adequate effort on formal testing. A multiple regression analysis was performed to determine the extent to which reported losses of consciousness as well as the presence of psychological distress post-deployment affect the ability of the NART to predict pre-morbid intelligence as measured by the Armed Forces Qualification Test (AFQT).

Results: The NART is a strong predictor of pre-deployment ability as measured by the AFQT ($p<.001$, $R^2 = .673$) and the frequency of reported Loss of Consciousness and psychological distress experienced do not have a significant effect on the relationship between the NART and the AFQT.

Conclusions: The NART provides an accurate measure of pre-morbid ability in OEF/OIF veterans with a history of mild Traumatic Brain Injury who are experiencing chronic symptoms of psychological distress. Correspondence: *Joseph M. Gullett, B.S., Clinical and Health Psychology, University of Florida, Health Science Center, PO Box 100165, Gainesville, FL 32610. E-mail: gullettj@phhp.ufl.edu*

M. HARRIS, K. THOMPSON & M. TOMMERDAHL. Quantitative Sensory Testing in Sports-Related Concussion: A Pilot Study.

Objective: Evaluation of sensory functioning is useful in the assessment of cognitive dysfunction. Although much research has examined the relationship between sports-related concussion and cognitive functioning, little research has examined sensory functioning quantitatively after concussion. The current study attempted to determine if Quantitative Sensory Testing (QST), a unique set of tactile sensory-based assessment tools, can be used to characterize and differentiate athletes who have suffered sports-related concussions from non-concussed athletes.

Participants and Methods: Student-athletes, aged 18-22, participating in a university varsity athletic program in North Carolina were recruited through their athletic training center. Routine baseline cognitive testing, including QST, was conducted as part of mandatory requirement for participation in various sports teams. QST used a portable tactile stimulator, with a 10-20 minute battery of protocols designed to measure information processing speed, lateral inhibition, adaptation, feed-forward inhibition, and synchronization. Athletes who had suffered concussions during play were identified by team physicians and evaluated by athletic trainers, and QST was conducted 1-2 days after concussion. QST results from 32 concussed and 120 non-concussed athletes were analyzed using multivariate statistics.

Results: Sensory test scores were analyzed with principal component analysis. Hotelling's t-square statistic comparing concussed and non-concussed participants on the resulting components was significant at $p < 0.001$, suggesting a different profile of sensory performance for concussed vs. non-concussed individuals.

Conclusions: Results from this pilot study indicate that QST is sensitive to the effects of sports-related concussion. QST has significant potential as an objective, quantitative marker of tactile sensory ability and cognitive functioning. Future studies will examine use of QST for evaluating the effects of concussion and tracking recovery.

Correspondence: *Matthew Harris, M.A., California School of Professional Psychology at Alliant, 726 Edinborough dr, Durham, NC 27703. E-mail: MHarris2@alliant.edu*

W.M. HIGH, D.J. ZGALJARDIC, J. HARP, C. GILKISON, R.J. URBAN & B. MASEL. Long-Term Effect of Growth Hormone Replacement Therapy on Cognition after Traumatic Brain Injury.

Objective: Growth hormone deficiency (GHD) is common following moderate to severe traumatic brain injury (TBI). The objective of this study was to examine the effect of long-term rhGH treatment in persons who are growth hormone deficient (GHD) following moderate to severe TBI.

Participants and Methods: We have previously reported (High et al. 2010) a randomized, double-blind, placebo controlled study of 23 persons with moderate to severe TBI. Twelve subjects were treated with rhGH for one year; 11 were treated with placebo. Neuropsychological testing was conducted at baseline, 6, and 12 months. The group treated with rhGH improved on information processing speed, verbal memory, and finger tapping compared to the placebo group. In this study, a subgroup (n=11) of the original 12 participants receiving active rhGH was treated and followed for an additional year. Neuropsychological performance at 24 months was compared to 12 months. In addition, participants randomized to the placebo condition for the first year were offered rhGH open label during the second year of the study. A total of 21 patients (12 from the first year treatment group; 9 from the second year treatment originally placebo group) were treated with rhGH for one year.

Results: The group treated with active rhGH for 24 months showed no additional gains in cognitive performance compared to performance at 12 months. On some measures, the gains moderated somewhat from year 1 to year 2 but the gains in cognitive performance were generally maintained. For the combined larger group of 21 patients (12 from the first year treatment group; 9 from the second year treatment originally placebo group), the same gains in information processing speed and verbal memory observed in the original published double-blind study were also observed in this larger open label study.

Conclusions: Treatment with rhGH may result in gains in information processing speed and verbal memory in persons who are GHD following TBI.

Correspondence: *Walter M. High, PhD, Physical Medicine and Rehabilitation, University of Kentucky, 2050 Versailles Rd, Lexington, KY 40515. E-mail: walter.high@uky.edu*

J.N. IKANGA, T.A. LYNCH & D.R. DRASNIN. CT Findings, Somatic Complaints and Anxiety Predict Performance on Visual Attention as Measured by Trail Making Tests.

Objective: Some studies have found no significant difference in neuropsychological outcome between patients who had positive versus negative findings on CT. This study examines whether various demographic and clinical factors predict attentional dysfunction post-motor vehicle accidents (MVA). We hypothesized that anxiety, somatic concerns, and positive CT findings will predict decreased performance on visual attention tasks.

Participants and Methods: Subjects were 110 patients (52.7% male/47.3% female, mean years of education= 13.1, SD = 2.4, FSIQ = 99.3, SD =12.9) over 18 years of age (mean = 41.0, SD=12.2) with a mean of 10.7, SD=18.2 years since MVA. Patients were evaluated with CT of the brain: 47 positive and 63 normal findings. Outpatient neuropsychological evaluations were performed by a neuropsychologist and trained technicians. Hierarchical multiple regressions were conducted to determine which of several independent variables (age, gender, time since MVA, CT findings, WASI FSIQ, Anxiety and Somatic Complaints Scales of the Personality Inventory Assessment) were predictive of attentional functioning.

Results: TMT-A's regression results indicate an overall model of three predictors (CT, somatic complaints, and anxiety) that significantly pre-

dict performance on a measure of visual scanning speed attention after MVA, $R^2 = .216$ R^2 adjusted=.145, $F(4, 100)=296.158$, $p=.003$. This model accounted for 21.6% of variance in visual scanning speed attention. TMT-B's regression results indicate an overall model of three predictors (CT, somatic complaints, and anxiety) that significantly predict performance on a measure of visual divided attention, $R^2 = .222$ R^2 adjusted=.152, $F(4, 100)=272.005$, $p=.002$. This model accounted for 22.2% of variance in visual divided attention after MVA.

Conclusions: CT findings, PAI somatic complaints and anxiety scales were found to predict performance on TMT-A & B. These findings suggest that the effects of brain injury on visual attention are exacerbated by psychological distress.

Correspondence: *Jean N. Ikanga, MA, Psychology, University of Detroit Mercy, 4001 W McNichols Rd, Lansing Reilly Hall, Detroit, MI 48221. E-mail: jeanikanga@yahoo.com*

S. JIVANI, M.J. LARSON, J.A. DEMERY, N.K. DIXIT, R.O. HOPKINS, M.N. DIRINGER & R.E. HANLON. Do APACHE-II Scores, an Index of ICU Illness Severity, Predict Cognitive Outcomes Following Severe TBI?

Objective: The Acute Physiology and Chronic Health Evaluation (APACHE-II) score is a widely used intensive care unit (ICU) measure to detect illness severity and mortality in the first 24 hours of patient admission. Traditional measures of traumatic brain injury (TBI) severity have been criticized for poor accuracy in prediction of post-injury cognitive outcomes. Thus, we aimed to evaluate the use of the APACHE-II score as an accurate predictor of post-TBI cognitive outcome.

Participants and Methods: Participants initially included 20 individuals with severe TBI admitted to a neurological intensive care unit (NNICU), and who subsequently completed a neuropsychological evaluation during the first year post injury in an outpatient neurorehabilitation program. Cognitive tasks included measures of learning, memory, executive functions, visuospatial skills, language, and motor functioning. Multiple regression analyses were used with indices of neuropsychological functioning as the dependent variables and ICU length of stay, lowest Glasgow Coma Scale (GCS), and lowest APACHE-II score as predictor variables.

Results: Regression analyses showed significance only for the dependent variable of learning, ($R^2=.61$, $p<.05$). Domains of memory and fine motor skills showed positive trends ($R^2>.57$, $p=.07$). There were no significant associations with executive functions, language, or visuospatial abilities ($R^2>.07$, $p<.92$). For learning, APACHE-II score was the only significant predictor variable ($Beta=-.59$), GCS and length of ICU stay were not significant predictors ($Betas>.78$).

Conclusions: APACHE-II score was significantly associated with learning after controlling for ICU length of stay and GCS, but was not associated with the additional domains of neuropsychological functioning. A larger sample may also show significant relationships with the domains of memory and motor skills. Future research on the APACHE-II score in predicting cognitive outcomes following TBI is warranted.

Correspondence: *Sanam Jivani, Clinical Psychology, Brigham Young University, 14925 Ox Cart Lane, Draper, UT 84020. E-mail: sanam47@gmail.com*

A. DARDAGANI, A. GIAZKOULIDOU & M. KOSMIDIS. Self-awareness and Neuropsychological Status After Traumatic Brain Injury.

Objective: We explored the relationship between the neuropsychological profile of individuals with a traumatic brain injury (TBI) and their level of self-awareness.

Participants and Methods: We recruited individuals with TBI through hospital records. Of 110 called, 42 agreed to participate and met inclusion criteria: (a) no history of neurological or psychiatric disease; (b) time post injury over 6 months; (c) age range: 18-55; (d) at least 12 years of education. Average time since injury for our sample was 3.3 (SD=2.5) years. None of our participants was in litigation, nor had any been in cognitive rehabilitation. Our neuropsychological battery com-

prised tests measuring memory, attention, working memory, fluency, executive functioning, language, abstract reasoning and visuospatial perception. We measured level of self-awareness with the Self-Awareness of Deficits Interview (SADI; Fleming, Strong, & Ashton, 1996), examining self-awareness of deficits, of functional implications, and of the ability to set realistic goals.

Results: Regression analysis showed a positive linear relationship between overall neuropsychological performance and both level of education ($R^2=.266$, $p=.001$) and premorbid intelligence ($R^2=.457$, $p<.001$), with better performance among those with greater educational attainment and higher premorbid intellectual ability. Pearson's correlations – when partialing out the effect of level of education – suggested a negative association between overall performance ($R^2=-.575$, $p<.001$) and level of self-awareness. That is, poor performance was associated with poor of self-awareness, and vice versa. Additionally, executive ability correlated with awareness of functional implications, whereas attention correlated with all three aspects of self-awareness (awareness of deficits, functional implications, ability to set realistic goals).

Conclusions: Self-awareness after TBI appears to be affected directly by impairment in controlling and monitoring processes such as executive ability and attention.

Correspondence: *Mary Kosmidis, PhD, School of Psychology, Aristotle University of Thessaloniki, University Campus, Thessaloniki 54124, Greece. E-mail: kosmidis@psy.auth.gr*

T. KUHN, J.M. GULLETT, D.B. FITZGERALD & R.M. BAUER. Self Report Measures of Psychological Distress as Predictors of Cognitive Performance in Mild Traumatic Brain Injury.

Objective: To determine the influence of psychological distress and quantitative measures of neurologic insult on cognitive performance in mild Traumatic Brain Injury.

Participants and Methods: Participants were 40 OEF/OIF veterans who incurred blast-related mild TBI. Participants underwent structural MRI and were administered a full neuropsychological test battery. Peripheral and subcortical grey matter, white matter and total intracranial volume were collected for each participant using FSL SIENAX software. Participants were screened for and excluded based on T1, T2 and FLAIR neuroradiologic abnormalities (e.g. diffuse white matter damage, tumor, leukoaraiosis). All participants put forth adequate effort on neuropsychological testing. Statistical analyses were performed to determine the impact of psychological and neurological variables on cognitive performance.

Results: After controlling for age, no quantitative measures of brain volume significantly correlated with self-reported psychological distress, neurocognitive performance, or reported loss of consciousness. Self-reported symptoms of depression on the Beck Depression Inventory, Second Edition were significantly correlated with performance across learning trials ($p<.002$, $R^2 = -.499$) and in the long delay free recall condition ($p<.001$, $R^2 = -.546$) of the California Verbal Learning Test, Second Edition as well as on Trail Making Test, Part A ($p<.007$, $R^2 = .443$) and non-dominant hand condition of Grooved Pegboard Task ($p<.002$, $R^2 = .411$).

Conclusions: Self report measures of psychological distress are stronger predictors of processing speed and delayed memory reduction than quantitative indices of brain volume or self-reported loss of consciousness.

Correspondence: *Taylor Kuhn, M.S., University of Florida, 317 SW 54th Dr, Gainesville, FL 32607. E-mail: tkuhn@phhp.ufl.edu*

D. MARSON, R. MARTIN, T. NOVACK, K. TRIEBEL & L. DREER. Neurocognitive Predictors of Financial Capacity In Traumatic Brain Injury.

Objective: To develop longitudinal cognitive models of financial capacity (FC) in patients with traumatic brain injury (TBI) recruited from an inpatient brain injury rehabilitation unit.

Participants and Methods: Participants were 20 healthy controls, and 24 adults with moderate to severe TBI assessed at baseline (30 days post

injury) and again at 6 months post-injury. Participants were administered the Financial Capacity Instrument (FCI) and a neuropsychological test battery. Univariate correlation and multiple regression procedures were employed to develop cognitive models of FCI performance in the TBI group at baseline and 6 month follow-up.

Results: Three cognitive predictor models were developed. At baseline, measures of mental arithmetic/working memory and immediate verbal memory predicted baseline FCI performance ($R^2=.72$). At 6 month follow-up, measures of executive function and mental arithmetic/working memory predicted 6 month FCI performance ($R^2=.79$), and a third model found that these two measures at baseline predicted 6 month FCI performance ($R^2=.71$).

Conclusions: Multiple cognitive functions are associated with initial impairment and partial recovery of FC in patients with moderate to severe TBI. In particular arithmetic, working memory, and executive function skills appear critical to recovery of FC in TBI. The study results represent an initial step towards developing a neurocognitive model of FC in patients with TBI.

Correspondence: *Daniel Marson, JD, PhD, Neurology, University of Alabama at Birmingham, SC650, Department of Neurology, UAB, 1720 7th Avenue South, Birmingham, AL 35294. E-mail: dmarson@uab.edu*

A. MATEVOSYAN, L. DELANO-WOOD, O. ALHASSOON, E.B. LANNI, N.K. LUC, R. KIM, S. SORG, M.W. JACOBSON, A.J. JAK, M.J. MELOY, K.L. HANSON & D.M. SCHIEHSER. Neuropsychological Predictors of Quality of Life in Veterans with Mild to Moderate Traumatic Brain Injury.

Objective: Individuals with mild to moderate traumatic brain injury (TBI) frequently report poor quality of life (QoL). However, the relationship between QoL and the neuropsychological symptoms associated with TBI is currently unknown. The purpose of this study was to determine whether cognitive, mood, and TBI symptoms predict QoL in OEF/OIF veterans with a history of TBI.

Participants and Methods: Thirty-four OEF/OIF veterans with TBI (mean age=29.8; mean months since injury=48.9) completed a comprehensive neuropsychological evaluation and measures of psychiatric status (anxiety, depression, and post-traumatic stress disorder [PTSD]). The World Health Organization Quality of Life Measure-Abbreviated Version (WHOQOL-BREF), which measures Physical, Psychological, Social, and Environmental QoL, was also administered.

Results: Reduced overall QoL as well as the subscales of Social, Psychological, and Environmental QoL were associated with poorer Letter Fluency (D-KEFS) performance; lower Social QoL was related to worse verbal recall and recognition (CVLT-II); and poorer Physical QoL was related to reduced verbal learning (all p 's<.05). All aspects of QoL correlated with depression, anxiety, and PTSD symptoms (all p 's<.01), but were not related to age, education, number of TBIs, or loss of consciousness. Stepwise regressions revealed that depressive symptomatology was the best predictor of overall and all subcomponents of QoL (all p 's<.001), while verbal learning was an additional significant predictor of Physical QoL ($p=.01$).

Conclusions: Findings revealed that, while neuropsychiatric symptoms are important factors in QoL, cognitive functions, specifically those related to executive function (phonemic fluency) and verbal learning/memory, also play a critical role in QoL. These results underscore the importance of better understanding cognitive and neuropsychiatric factors that contribute to poor QoL in veterans with TBI, and they support the need for comprehensive systematic screening and treatment of this vulnerable population. Correspondence: *Adelina Matevosyan, Alliant International University, San Diego, 6622 Olcott St, Tujunga, CA 91042. E-mail: adelinamatevosyan@gmail.com*

J.M. MONTI, M.W. VOSS, A. PENCE, E. MCAULEY, A.F. KRAMER & N.J. COHEN. History of Mild Traumatic Brain Injury is Associated with Reduced Neural Integrity and Memory Impairment Later in Life.

Objective: Head trauma is a risk factor for memory dysfunction later in life. While previous work has centered on the effects of mod-

erate-to-severe brain injuries, recent evidence suggests that even a mild traumatic brain injury (mTBI) is not a transient injury and may interact with aging to produce decrements in memory later in life. This study sought to understand the neural basis of this memory deficit.

Participants and Methods: Young and middle-aged-to-older adults who sustained mTBI prior to the age of 25 were compared with age- and education matched control subjects on several neuropsychological tests of memory. Additionally, participants completed a face-scene relational memory task in conjunction with functional magnetic resonance imaging, and underwent several other MRI scans to collect further indices of brain integrity.

Results: Middle-aged-to-older adults with a head injury in their remote past demonstrated impaired memory on tasks critically dependent on the hippocampal system. Further, this memory deficit was accompanied by reduced neural activity in cortical regions important for declarative memory and implicated in Alzheimer's disease, including the medial and lateral parietal lobe and prefrontal cortex.

Conclusions: These findings replicate previous work indicating that a history of mTBI can lead to mnemonic dysfunction later in life. Additionally, the results identify for the first time contributing neural substrates of this impairment, and suggest a link between brain injury and subsequent decrements in brain integrity usually associated with Alzheimer's disease.

Correspondence: *Jim M. Monti, MA, Psychology; University of Illinois, Urbana-Champaign, 603 E. Daniel St, Champaign, IL 61820. E-mail: jimmonti@gmail.com*

K. PAGULAYAN, N. SWENSON, E. PETRIE & E. PESKIND. Predictors of FrSBe Scores Among Veterans with Repeated Blast-Related mTBI.

Objective: To evaluate the relationship between neuropsychological test performance, PTSD symptoms, and self-reported symptoms of frontal dysfunction among OIF/OEF Veterans with a history of repeated blast-related mTBI.

Participants and Methods: Participants were 25 OIF/OEF Veterans; 15 with a history of repeated blast-related mTBI (mTBI group; average of 13.73 blast exposures, range 2-100) and 10 with no history of blast-related mTBI (non-mTBI group). Groups were comparable for age and premorbid IQ. All participants completed the Frontal Systems Behavior Scale (FrSBe), Wisconsin Card Sorting Test (WCST), Trail Making Test Part B (TMTB), and the PTSD Symptom Checklist (PCL-M). T-tests and a series of stepwise regression analyses were conducted. Dependent variables for the stepwise regressions were change in FrSBe scores (pre-post injury); independent variables were total score on the PCL-M, WCST Perseverative errors, and time to complete TMTB.

Results: On the FrSBe, the mTBI group reported significantly more symptoms post-injury relative to pre-injury ($p < .01$) overall and on all 3 subscales. The mTBI group also endorsed significantly more symptoms than the non-mTBI group overall and on 2 of 3 FrSBe subscales (Apathy and Disinhibition) ($p < .01$). Stepwise regression analyses for the FrSBe total score and 3 subscales were significant ($p < .01$). PCL-M and TMTB were significant predictors for the Disinhibition subscale ($R^2 = .76$), Executive Dysfunction subscale ($R^2 = 0.58$), and Total score ($R^2 = 0.78$). For the Apathy subscale, the PCL-M, TMTB, and WCST were all significant predictors ($R^2 = 0.87$).

Conclusions: In individuals with a history of repeated blast-related mTBI, change in self-reported symptoms on the FrSBe (pre vs. post injury) is related to both PTSD symptoms and performance on neuropsychological measures. This finding adds to the literature regarding the etiology of persisting cognitive difficulties in this population, and suggests that these symptoms may not be attributable to PTSD alone.

Correspondence: *Kathleen Pagulayan, VA Puget Sound, 1660 S Columbian Way (S-116-6E), Seattle, WA 98108. E-mail: farkat@u.washington.edu*

L. PRATSON, J. SCHMIDT, J. BLACKBURN, J. MIHALIK, K. GUSKIEWICZ & C. GIOIA. An In-Vivo Biomechanical Study of Collegiate Football Players: The Inter-Instrument Reliability of the X2Impact Mouthpiece and the Head Impact Telemetry System.

Objective: Understanding the neuropsychological effects of concussions would be facilitated by knowledge of the forces transmitted to the brain. Until now, the measurement of in-vivo head impact biomechanics has been confined to helmeted sports. The advent of the X2Impact mouthpiece accelerometer presents the possibility in non-helmeted sports, expanding our potential understanding of the biomechanics underlying neuropsychological dysfunction. The purpose of this study was to examine the inter-instrument reliability between the X2Impact mouthpiece accelerometers and the Riddell Head Impact Telemetry (HIT) system in measuring head impact magnitude, frequency and location in division I collegiate football players.

Participants and Methods: Head impact data from ten Division I male varsity football players were concurrently collected using the X2Impact and HIT Systems over a portion of the fall 2011 season, with reliability measured using intraclass correlation coefficients (ICC).

Results: Poor to fair reliability was found for measures of impact severity (peak linear acceleration, peak rotational acceleration) and location (azimuth, elevation) between the X2Impact and HIT Systems (ICC2,1 range: 0.032-0.46). Further examination revealed a number of flaws in the X2Impact mouthpiece, including the inability to accurately report time of impact.

Conclusions: Low correlation coefficients were found between the two impact measures, which may not represent the true inter-instrument reliability of the X2Impact mouthpieces due to the inability to match specific impact data. Based on these preliminary findings, the X2Impact mouthpiece accelerometer should not be considered for onfield use as a reliable device for measuring impact biomechanics. Further improvements and in-vitro laboratory validation testing of the X2Impact mouthpiece is recommended before its in-vivo application or correlation to neuropsychological function.

Correspondence: *Lincoln Pratson, Children's National Medical Center, Suite 350, 15245 Shady Grove Rd, Rockville, MD 20850. E-mail: lpratson@cnmc.org*

A. RABINOWITZ, C. VARGAS & P. ARNETT. Sensory Symptoms and Neuropsychological Test Performance in Sports-Related Concussion.

Objective: Sensory disturbance, a common concussion symptom, has known effects on neuropsychological performance. The present study sought to examine the influence of sensory symptoms on cognitive performance in concussed college athletes. It was hypothesized that self-reported sensory and cognitive symptoms would predict performance on tests employing sensory stimuli.

Participants and Methods: 92 athletes were evaluated following concussive injury with a post-concussion symptoms scale (PCSS) and neuropsychological (NP) test battery, including ImpACT. Athletes were grouped according to: presence (N=25) or absence (N=67) of sensory symptoms ("sensitivity to light" or "sensitivity to noise") and presence (N=19) or absence (N=73) of cognitive symptoms ("difficulty remembering things" or "difficulty concentrating"). Groups were compared on NP tests employing sensory stimuli.

Results: The sensory symptoms (SS) and cognitive symptoms (CS) groups had higher PCSS scores than non-sensory symptoms (NSS) and non-cognitive symptoms (NCS) groups, suggesting greater overall symptom severity in these athletes ($t = 9.2$, $p < 0.001$ & $t = 6.4$, $p < 0.001$ respectively). PCSS total score was controlled for in subsequent analyses. MANOVA revealed a trend towards poorer performance on NP tests for SS compared with NSS athletes ($F = 2.0$, $p = 0.06$). Correlations between severity of sensory symptoms and NP test performance showed a significant correlation between SDMT performance and severity of visual symptoms ($r = 0.41$, $p < 0.05$). A separate MANOVA compared CS and NCS athletes, and revealed no effect of group on NP test performance ($F = 1.0$, $p = 0.41$).

Conclusions: These results provide support for the hypothesis that post-concussion sensory symptoms interfere with cognitive test performance. Self-reported cognitive symptoms were not associated with NP performance, suggesting that some concussion related cognitive deficits are mediated by sensory disturbance.

Correspondence: *Amanda Rabinowitz, Ph.D., Neurosurgery, University of Pennsylvania, 2944 Cambridge St., Philadelphia, PA 19130. E-mail: rabinowitz.a@gmail.com*

K. RIDLEY, T.Z. KEITH, W.N. MERCER & M. MARKLE. Cognitive Factors Underlying Verbal Learning and Memory Impairments After Traumatic Brain Injury.

Objective: The purpose of the present study was to investigate the leading views regarding the cognitive mechanisms thought to explain impairments in verbal learning and memory subsequent to traumatic brain injury (TBI). Specifically, this study sought to clarify whether verbal learning and memory impairments after TBI were primarily influenced by the central executive component of working memory or by speed of processing. The way in which processing speed influences verbal learning after TBI was also examined.

Participants and Methods: A sample of 70 post-acute care TBI patients aged 16 to 65 were administered a comprehensive neuropsychological battery. Latent variable structural equation modeling (SEM) was used to analyze the data and examine the relative effects of both processing speed and working memory on verbal learning and memory after TBI. Relevant demographic data and injury severity were also controlled statistically in the model.

Results: As hypothesized, SEM analyses revealed that verbal learning and memory impairments after TBI were primarily explained by working memory, after accounting for the relative contributions of processing speed in the model. The direct effect of processing speed on verbal learning and memory was not significant when working memory was taken into account in the model. Rather, the effects of processing speed on verbal learning were largely indirect through working memory.

Conclusions: Results of the present study provide additional insights into the primary cognitive factor underlying verbal learning and memory difficulties in TBI patients, supporting the direct and significant impact of working memory in verbal learning processes. Additionally, processing speed was found to exert its influence on verbal learning primarily indirectly, by influencing the central executive component of working memory. Current findings have implications for targeting remediation efforts and directing approaches to memory rehabilitation.

Correspondence: *Kristen Ridley, Ph.D., Texas Child Study Center, 1600 West 38th St, Suite 212, Austin, TX TX. E-mail: kristen.ridley@utexas.edu*

M. ROSSETTI, K.G. DENNY, L.S. BLACKWELL, E. WIDERSTROM-NOGA, H.L. KATZEN, K.L. ARHEART, A. MATHEW, J. AD- COCK, I. BABAKHANYAN, V. GOVIND, B.E. LEVIN & A.A. MAUD- SLEY. The Relationship Between Thalamic Metabolites, Attention, and Pain in Mild TBI.

Objective: Pain and executive dysfunction are well documented in traumatic brain injury (TBI). Recent findings have implicated thalamic projection fibers as an underlying etiology. This study explored whether proton magnetic resonance spectroscopy (MRS) observed metabolites in the thalamus could be linked to working memory and affective distress associated with pain in a sample of subjects with mild TBI.

Participants and Methods: Thirty mTBI subjects (mean age= 28.2, sd= 8.8) and eighteen controls (mean age= 29.8, sd= 7.2) underwent neuropsychological testing that included measures of attention/working memory and perception of pain (WAIS-IV Digit Span and the Multidimensional Pain Inventory- Affective Distress Subscale). mTBI subjects were assessed on average at 36.5 days post injury (sd=21.56). Volumetric MRS was used to measure brain metabolite values in the thalamus for for N-acetyl aspartate (NAA), total-Choline (Cho), and their ratio (Cho/NAA).

Results: Group differences in Cho/NAA were evaluated using an AN-COVA, controlling for age and education. Results revealed significant bi-lateral increase in Cho/NAA in the thalamus of mTBI subjects compared to controls ($p = 0.002$). Within the mTBI group, partial correlations (ad-justing for age and education) indicated significant relationships between bilateral Cho/NAA with attention/working memory ($r = -0.460$, $p = 0.016$) and subjects' affective distress associated with pain ($r = -0.515$, $p = 0.006$).

Conclusions: These findings demonstrate that the MRS-observed brain metabolite alterations in the thalamus that occur as a result of mTBI are associated with changes in executive function and pain related affective distress. This investigation supports the use of MRS as a sensitive tool to link changes in brain metabolites with select cognitive and behavioral changes frequently reported in TBI.

Correspondence: *M. Agustina Rossetti, M.S., Neurology, University of Miami, 1150 NW 14th Street, 1337, Miami, FL 33136. E-mail: mrossetti@med.miami.edu*

D.M. SCHIEHSER, M.M. BURKE, K.M. OBTERA, L.M. DELANO- WOOD, S. LESSIG, D.D. SONG & J. FILOTEO. History of TBI Ex-acerbates Cognitive Decline in Parkinson's Disease.

Objective: Preliminary evidence suggests that a history of traumatic brain injury (TBI) is a risk factor for developing Parkinson's disease (PD). However, few studies have investigated the association between TBI and neuropsychological functioning in the context of PD, and thus, the cross-sectional and longitudinal effects of TBI on cognition in PD patients remain largely unknown.

Participants and Methods: We evaluated 18 PD patients with a history of TBI (PD+TBI) and 18 demographically- and PD-characteristi-cally matched PD controls without a history of TBI (PD-TBI) at base-line and at 2 year follow-up. The Mattis Dementia Rating Scale (MDRS) was used as a measure of overall cognition, attention, inhibition/perse- veration, visuospatial functioning, conceptualization, and memory.

Results: PD+TBI and PD-TBI subgroups did not differ on motor func- tioning or disease stage at baseline or follow-up. A mixed model ANOVA revealed no significant main effects for group or time, and no differences in cognitive profiles between PD+TBI and PD-TBI at baseline. However, interaction effects were significant, indicating that the PD+TBI sub- group declined more rapidly on the MDRS total score and the MDRS subscales of Inhibition/Perseveration and Memory than the PD-TBI sub- group. A trend for greater decline on the MDRS Attention subscale was also evident in the PD+TBI group compared to the PD-TBI group.

Conclusions: Despite similar PD symptom profiles and comparable rates of disease progression over time, PD patients with a history of TBI evidenced greater decrements in cognitive functioning compared to those without a history of TBI. The results suggest that TBI exacerbates cog- nitive decline in PD and underscores the importance of considering TBI history in this population.

Correspondence: *Dawn M. Schiehser, Ph.D., Psychiatry, UCSD/VAS- DHS, Mailbox 151B, VA San Diego, 3350 La Jolla Village Drive, La Jolla, CA 92161. E-mail: dschiehser@ucsd.edu*

N. SESTITO, K.A. O'BRIEN & T.L. VERAMONTI. The Impact of Time Since Acquired Brain Injury on Functional Outcome Follow- ing Post-Acute Brain Injury Rehabilitation Treatment.

Objective: Previous research has demonstrated that rehabilitation pro- grams decrease the supervision needs and functional limitations of in- dividuals recovering from brain injury, as well as increase community participation upon discharge. Although the benefits of early interven- tion have been established, the current study aims to explore how time since injury (TSI) at the time of admission influences these outcomes in individuals with acquired brain injury who participated in three differ- ent treatment trajectories within a post-acute brain injury rehabilitation (PABIR) program. While many prior studies dichotomized TSI, the cur- rent study utilizes TSI as a continuous variable.

Participants and Methods: A total of 200 individuals with an acquired brain injury participated in either the residential (RP), outpatient (OP),

or combined program (CP) at a neurorehabilitation facility. Multiple regression analyses were run for each of the three programs, with level of functioning at admission included as a covariate. Scores at discharge on the Supervision Rating Scale (SRS), Disability Rating Scale (DRS), and the occupational composite score from the Craig Handicap and Reporting Technique-Short Form (CHART-occ) were used as dependent variables.

Results: T-tests showed that all groups improved on each measure from admission to discharge (all $p < .001$). Across regressions, TSI account for a significant proportion of the variance in only DRS in the RP group ($p = .001$) and SRS in the CP group ($p = .01$).

Conclusions: Despite the two isolated significant results, TSI did not account for a significant proportion of the variance in other outcome variables (all $p > .06$). These results are positive in terms of patient care and suggest that meaningful gains can be made regardless of time post injury. While it is ideal to receive treatment as early as possible, PABIR treatment may be effective in treating individuals with brain injury regardless of TSI. Correspondence: Nicole Sestito, Ph.D., *Mentis Neuro Rehab, 1010 Kelly Way, El Paso, TX 79902*. E-mail: nicole.sestito@gmail.com

C. SIDERS, B. BIRATH, A. MENDEL, A.L. WONG, C.L. KERNAN, E. WOO, R.S. SWERDLOFF, C. WANG, R.C. CANTU, K.M. GUSKIEWICZ, D.F. KELLY & M.J. WRIGHT. Characterization of Verbal Memory Following Repeated Concussion in Retired Professional Football Players.

Objective: Our goal was to determine the memory deficit profile associated with repeated sports concussions.

Participants and Methods: We administered the CVLT-II to 53 former NFL football players who were retired for an average of 20.09 years ($SD = 10.91$) that suffered an average of 7.18 ($SD = 8.89$) football-related concussions. We used the Item Specific Deficit Approach (ISDA) to assess encoding, consolidation, and retrieval deficits.

Results: Although the rate of memory impairment in our sample was relatively mild, a hierarchical regression with encoding, consolidation, and retrieval entered in the order of their temporal occurrence accounted for 51% of the variance in participants' long-delay free recall on the CVLT-II. The model was primarily driven by encoding deficits ($r^2 = .42$). Consolidation deficits accounted for a smaller, but significant portion of the variance in long term free recall on the CVLT-II ($r^2 = .08$). Retrieval deficits did not contribute to the model.

Conclusions: The results suggest that memory impairment associated with repeated sports-related concussion is characterized by encoding and consolidation difficulties. This deficit profile is very similar to that observed in moderate-to-severe traumatic brain injury survivors.

Correspondence: *Craig Siders, Ph.D., Harbor-UCLA Medical Center, 1124 W. Carson St., Torrance, CA 90502*. E-mail: siderscraig@gmail.com

N.D. SILVERBERG, R.T. LANGE, J.R. BRUBACHER & G.L. IVERSON. The Good-Old-Days Bias after Mild Traumatic Brain Injury and Orthopedic Injury.

Objective: After a mild traumatic brain injury (MTBI), some patients retrospectively underestimate symptoms they had prior to their injury (e.g., headaches, fatigue, and forgetfulness), in what is termed the "good-old-days bias." The mechanism underlying this effect remains unclear, and may be multifaceted. The purpose of this study was to compare the good-old-days bias in patients with MTBI versus orthopedic injury.

Participants and Methods: Participants with MTBIs ($N = 103$; 12% complicated MTBIs) and trauma controls with orthopedic injuries ($N = 65$) were recruited from an urban Emergency Department and completed retrospective and current symptom ratings on the British Columbia Postconcussion Symptom Inventory (BC-PSI) at approximately six weeks post injury. Participants were classified as having Postconcussional Syndrome (PCS) based on ICD-10 criteria. A demographically-matched healthy control group ($n = 91$) reported current symptoms on the BC-PSI.

Results: Pre-injury symptom ratings in the MTBI group as a whole were similar to trauma controls ($p = .98$, Cohen's $d = .04$), but somewhat lower

than healthy controls ($p = .08$, $d = .30$). The interaction between diagnosis (MTBI/TC) and post-injury symptomatic status (+/- ICD-10 PCS) on pre-injury symptom reporting [$F(1, 164) = 3.21$, $p = .08$] revealed a trend for lower pre-injury BC-PSI scores in highly symptomatic MTBI participants ($n = 77$) than highly symptomatic trauma controls ($n = 30$; $d = -.43$). In other words, trauma controls who reported greater current symptoms also tended to report greater pre-injury symptoms (i.e., possibly identifying them as pre-existing), whereas this was less true for those with MTBIs.

Conclusions: The PCS was associated with a good-old-days bias effect in MTBI participants but not in trauma controls. A general bias to regard the past favorably or an adverse psychological impact of a negative event (MTBI or otherwise) likely cannot fully explain this finding. Those with MTBI and PCS may have over-attributed all current symptoms to the injury.

Correspondence: *Noah D. Silverberg, University of British Columbia, Rehab Research Lab, 4255 Laurel St, Vancouver, BC V5Z 4R2, Canada*. E-mail: noah.silverberg@vch.ca

S. SORG, L. DELANO-WOOD, D.M. SCHIEHSER, N. LUC, E. LANNI, A.J. JAK, K.L. HANSON, M.J. MELOY, D.A. NATION, M. JACOBSON, L.R. FRANK, J. LOHR & M.W. BONDI. Processing Speed and Memory Deficits in Veterans with Mild to Moderate TBI: Associations with Anterior White Matter Integrity.

Objective: High rates of mild to moderate traumatic brain injuries (TBI) are reported in veterans of the Iraq and Afghanistan wars. The long-term neuropsychological outcome of these injuries and their relationship with cerebral white matter microstructure is unclear. Using diffusion tensor imaging (DTI) tractography, this study investigated the effects of TBI on a sample of veterans in terms of cognition and white matter integrity.

Participants and Methods: Thirty-eight veterans with TBI and 17 veteran normal control (NC) participants completed neuropsychological and psychiatric testing with adequate effort and underwent a DTI scan an average of 4 years following their TBI event(s). Fractional anisotropy (FA), a measure of white matter integrity, was extracted from 7 white matter tracts.

Results: TBI participants had higher depression and PTSD scores than the control group and completed fewer years of education. Controlling for age, education, depression, and PTSD symptoms, ANCOVA revealed that TBI participants performed worse than NCs on a memory composite ($p = .02$, $\eta^2 = .11$) and on a test of psychomotor processing speed ($p = .02$, $\eta^2 = .11$), whereas the two groups did not differ on an executive function composite ($p = .37$, $\eta^2 = .02$) or on a measure of attention ($p = .56$, $\eta^2 = .01$). The TBI group evidenced lower FA in the left cingulum bundle ($p = .01$, $\eta^2 = .13$) and in the genu of the corpus callosum ($p = .03$, $\eta^2 = .09$). Partial correlations adjusting for age and education showed significant positive associations between psychomotor processing speed and FA in the left cingulum ($r = .38$, $p = .04$), genu ($r = .50$, $p < .01$) and body of the corpus callosum ($r = .52$, $p < .01$), and left posterior internal capsule ($r = .45$, $p = .01$).

Conclusions: Results suggest that the cognitive consequences of TBI may be enduring in veterans, and may be associated with poorer performance in memory and processing speed. Findings further suggest that slowed processing speed may be a consequence of TBI-related damage to anterior white matter pathways.

Correspondence: *Scott Sorg, UCSD, 9500 Gilman Drive, La Jolla, CA 92093*. E-mail: ssorg@ucsd.edu

D.F. TATE, M. REID, G. YORK, D. COOPER, C. VELEZ, C. ALMENDAREZ, F. LEAL, R. AMADOR, J. KENNEDY, C. FRANKLIN, D. ROBIN & J. LEWIS. Functional relevance of cortical thickness abnormalities in U.S. service members following blast related mild traumatic brain injury: A pilot study.

Objective: Though cortical abnormalities have been demonstrated in moderate and severe traumatic brain injured (TBI) patients, there have been no studies examining cortical changes following blast related mild TBI (mTBI). The purpose of this study was to determine the effects and functional relevance of blast mTBI on cortical thickness.

Participants and Methods: Twelve U.S. service members (SM) with mTBI acquired through blast injury were compared to 11 active duty

formerly deployed demographically matched control SM without TBI. All participants underwent MRI examination and the T1 weighted anatomic images were processed using FreeSurfer suite of tools. Cortical thickness maps were compared between groups and examined for relationships with time since injury (TSI) in the mTBI group. Utilizing a large database of functional imaging results (BrainMap), significant cluster coordinates were used to define regions of interest (ROI). Behavioral profile charts were then derived for each ROI indicating the behaviors most consistently associated with the specific ROI.

Results: Group comparisons controlling for age demonstrated several significant clusters of cortical thickening for the blast injured SM. After multiple comparisons correction (False Discovery Rate (FDR)), two left hemisphere (LH) clusters remained significant (superior temporal (ST) and superior frontal (SF) gyri). No clusters were significantly correlated with TSI after FDR correction. Behavioral analysis for the ST and SF clusters demonstrated 6 and 9 significant sub-domains ($z\text{-score} > 3.0$) respectively. The ST was associated with audition and several language tasks while the SF was associated with working memory, language, and attention tasks.

Conclusions: Though requiring additional replication, results from this study suggest that there is utility in examining cortical thickness in mTBI. Furthermore, the combination of imaging tools and methods has the potential to define unique ROIs and functional correlates that can be used to design future studies.

Correspondence: *David F. Tate, Ph.D., Neurology; DVBIC, SAMMC, San Antonio, TX 78234. E-mail: dftatephd@mac.com*

M. TROYANSKAYA, N.J. PASTOREK, R.S. SCHEIBEL, N.J. PETERSEN, H.K. HENSON, A.M. WALDER & H.S. LEVIN. Factors Contributing to Perceived Changes in Resiliency in OEF/OIF Service Members and Veterans.

Objective: Resiliency, defined as the ability to cope effectively with stress, is both modifiable and related to treatment outcome. The goal of the

current study is to identify psychosocial and deployment-related factors, including deployment-related mild traumatic brain injury (mTBI) that are associated with perceived changes in resiliency in Operation Enduring Freedom / Operation Iraqi Freedom (OEF/OIF) service members and veterans from pre- to post-deployment.

Participants and Methods: Eighty-eight returning OEF/OIF service members and veterans who had been exposed to blast and reported symptoms consistent with mTBI were studied. An additional 48 individuals who had been deployed but were never exposed to blast and had no history of TBI were included as a control group. Four psychosocial and deployment-related variables were selected: change in educational status from pre-deployment to the time of assessment, time since deployment, severity of combat exposure, and history of deployment-related mTBI. The Connor-Davidson Resilience Scale (CD-RISC) was used to assess current and pre-deployment resilience and the Combat Exposure Scale (CES) was used to estimate intensity of combat exposure. Additional demographic and injury related information were also collected.

Results: The groups did not differ in age, Barona Intelligence Quotient (IQ), or time since injury. A restricted regression model including combat intensity, change in education, and time since injury accounted for 11.4 % of the variance in resiliency change scores, with combat exposure demonstrating the only significant association; mTBI history accounted for an additional 2.7% of the variance.

Conclusions: Severity of combat exposure and mTBI history are associated with a reduction in resiliency in returning soldiers and veterans. Given that diminished resilience is related to such negative outcomes as increased substance abuse, suicide attempts, and other psychiatric difficulties, identification of factors that modify resilience is critically important.

Correspondence: *Maya Troyanskaya, MD, PM&R, Baylor College of Medicine, 1709 Dryden Rd # 1200, Houston, TX 77030. E-mail: mayat@bcm.edu*

SATURDAY MORNING, FEBRUARY 9, 2013

CE Workshop 9: Adult Neuropsychological Outcomes of Childhood Disorders

Presenter: **Celiane Rey-Casserly**

7:20–8:50 a.m.

C. REY-CASSERLY. CEWorkshop 9: Adult Neuropsychological Outcomes of Childhood Disorders.

Children with complex medical and neurological disorders are surviving in increasing numbers into adulthood. Advances in medical management and interventions have changed prognoses for children with systemic or central nervous system disorders. Late effects of disease and treatment emerge over time and in many instances unanticipated issues arise. This workshop will review medical disorders of childhood (such as congenital heart disease, solid organ transplantation, chronic kidney disease, childhood cancer, and low birth weight) and recent advances in care, discuss specific neuropsychological outcomes, and address lifespan issues related to the transition to adult-oriented health care and adult trajectory.

Learning Objectives:

- 1) describe the neuropsychological late effects of medical diseases of childhood
- 2) implement a developmental approach to managing the transition to adulthood
- 3) understand the lifespan and societal impact of medical and neurological disorders in childhood

Correspondence: *Celiane Rey-Casserly, Department of Psychiatry, Children's Hospital/Harvard Medical School, x, Boston, MA x. E-mail: celiane.rey-casserly@childrens.harvard.edu*

CE Workshop 10: Simple Tools for the Evidence-Based Practitioner and How to Use Them in Daily Practice

Presenter: **Gordon Chelune**

7:20–8:50 a.m.

G. CHELUNE. CEWorkshop 10: Simple Tools for the Evidence-Based Practitioner and How to Use Them in Daily Practice.

Evidence-based clinical neuropsychology can be defined as “a value-driven pattern of clinical practice that attempts to integrate the ‘best research’ derived from the study of populations to inform clinical decisions about individuals within the context of the provider’s expertise and individual patient values with the goal of maximizing clinical outcomes and quality of life for the patient in a cost-effective manner while addressing the concerns and needs of the provider’s referral sources.” A key component of this definition is a pattern of routine clinical practice that integrates research derived from the study of groups to inform clinical decisions about individuals. This workshop will provide participants with several simple and readily available tools for extracting relevant information from test manuals and research reports on patient populations, how to create simple prediction equations for evaluating the significance of a patient’s observed test scores, how to evaluate this information in terms of test operating characteristics (e.g., how to interpret odds and risk ratios, likelihood ratios, and other base-rate information), and most importantly how to apply these data derived from patient groups to individual patients in daily practice.

Learning Objectives:

1) Create prediction equations from basic summary data (means, standard deviations, and correlations) and routinely use these to determine the significance level of a patient's observed test scores

2) Extract base-rate information from published reports and apply this information to a patient's observed test scores to determine the test operating characteristics for those test scores

Correspondence: *Gordon Chelune, Neurology, University of Utah, Ctr. for Alzheimer's Care, Imaging & Research, 650 Komas Dr., Ste 106A, Salt Lake City, UT 84108. E-mail: gordon.chelune@hsc.utah.edu*

Symposium 10: Neuroinformatics: The Design of Neuropsychology for the 21st Century

Chair: Vinoth Jagaroo

9:00–10:00 a.m.

V. JAGAROO, R.M. BILDER & W. BOSL. Neuroinformatics: The Design of Neuropsychology for the 21st Century.

Symposium Description: Recent decades have been marked by the “omics” revolution. The proliferation of bioinformatics in the biomedical sciences has produced powerful disciplines such as genomics. The enabling function conferred by bioinformatics has meant that multidimensional, heterogeneous data environments could now be deciphered. Tools for data capture, databasing, data mining, data modeling, ontology building, etc., have started to tame the complexity biomedical data. Bioinformatics in the neurosciences is termed neuroinformatics, and it is now integral every avenue of neuroscience.

There has been a growing voice for neuroinformatics (NI) in neuropsychology. The hallmarks of NI are being seen across the discipline — from clinical assessment to descriptions of neural systems. While such work is rapidly gaining attention, it remains the work of a small circle of neuropsychologists. Yet it is inevitable that neuropsychology in the 21st will be fundamentally realigned, with NI poised to influence every facet of the field. NI must play a critical role if neuropsychology is to reach the point where advances in neuroscience, genomics and neurotechnology can inform both brain-behavior relationships and clinical diagnosis in a meaningful way, and if the results are to be integrated with broader medical practice through emerging national medical information systems.

This symposium discusses: (1) The current status of NI in neuropsychology, using examples of NI application in the field. Issues that neuropsychology must engage if it is to optimally employ NI are also raised. (2) How finer mapping of cognitive constructs (e.g. working memory) to neural systems is enabled by multi-leveled analyses, linked through NI; and how resulting neural systems-based descriptive frameworks can revise taxonomy for mental disorders. (3) How NI, with special reference to new EEG technology, can reveal subtle cognitive markers, and how such data can inform the diagnoses of neurocognitive disorders.

Correspondence: *Vinoth Jagaroo, Ph.D., Comm. Disorders and Psychiatry, Emerson College & BU School of Medicine, 216 Tremont Street, 9th flr., Boston, MA 02116. E-mail: jagaroo@bu.edu*

V. JAGAROO. The Current Status of Neuroinformatics in Neuropsychology, Critical Goals and Crucial Decisions.

NI in neuropsychology has led to exciting research avenues. It has also brought new challenges tied to cognitive constructs, cognitive ontology, data sharing, etc. This presentation will describe the empowering frameworks for neuropsychology brought by NI, and will also highlight formative issues that neuropsychology must recognize and resolve as it steps onto the NI platform.

Areas in neuropsychology marked by successful application of NI will be discussed. They include: (a) automated assessment — database-linked

assessment tools, and why high-throughput assessment platforms are essential to the linking of cognition to neural mechanisms; (b) investigative and assessment tools finely tuned to neuropsychological disorders such as aphasia and spatial neglect, and how these informatics platforms can bridge syndromes with their respective neural models; (c) the emerging discipline of neural prosthetics with focus on experimental brain interface devices, and how neurally extracted data can drive models of neurocognitive processes; and (d) cognitive phenomics — the mapping of cognitive features within a relational framework that seeks linkage between all levels in the complex associations between genotypes and phenotypes.

Accurate assessment of cognition depends on accurate definitions of cognition. While NI can help refine neurocognitive taxonomy, it also necessitates precision in terminology and construct validity. How should cognitive and neural processes be descriptively refined to the point that they can be parsed into data fields for databases? What utility do cognitive markers hold in this initiative? These critical issues will be introduced (and will be elaborated by the second symposiast). Other issues such as data sharing and data privacy in the informatics context, and proprietary control of neuropsychological tests, will be described, together with what neuropsychology can take from other omics disciplines towards resolving these issues.

Correspondence: *Vinoth Jagaroo, Emerson College, CSD, 120 Boylston Street, Boston, MA 02116. E-mail: jagaroo@bu.edu*

R.M. BILDER. Revising the Taxonomy of Mental Disorders: Neuroinformatics and Neural Circuit Description Frameworks.

Systematic efforts are underway to address major flaws in the current diagnostic taxonomy of mental disorders, fostering hope that a new nosology might be based on brain biology. The NIMH Research Domains Criteria (RDoC) initiative aims to redefine mental illness leveraging information that spans molecular to behavioral levels of analysis. Major effort is still needed to forge multilevel conceptual and measurement models capable of representing knowledge within and across these levels. The development of these models can help prevent premature concept definition and reduce the risk of replacing the current taxonomy with dimensions and/or categories that manifest little incremental biological validity. To create useful models we need to define concepts, relations among concepts, and links to supporting evidence. Some methods already enable representation of concepts and measures at the levels of behavioral and basic biological processes, but a major gap at the level of neural circuitry must be bridged to link basic biological and behavioral levels.

This presentation describes a schematic framework for representation of “working memory” concepts and evidence across multiple levels of analysis — including the neural circuit level — and illustrates how this can clarify the aims of individual research projects and enable integration of diverse efforts on RDoC and related initiatives. Through this example, an illustration will be provided for how neuropsychological processes and functional domains can be clarified so as to serve and be served by neuroinformatics frameworks.

Correspondence: *Robert M. Bilder, UCLA School of Medicine - Semel Institute, 740 Westwood Plaza, Los Angeles, CA 90095. E-mail: RBilder@mednet.ucla.edu*

W. BOSL. Neuroinformatics, EEG Advances, and the Emerging National Health IT Infrastructure.

Rapid advances in the neurobiology of mental disorders provide the link between mental health and general health, but these advances are difficult to integrate into diagnostic criteria for mental and neurological disorders. Among the emerging informatics approaches geared to solving this problem are new advances in electroencephalograph (EEG) technology. EEG has long been an important tool for neuropsychology but EEG is now making a comeback due to an array of technological advances — in EEG hardware, software, and algorithms that tap complex signal features.

Wireless EEG devices are emerging as a standard functional brain-measurement tool, driven by a commercial market for brain computer interfaces and rapid advances in nonlinear data processing. Integration of EEG with other psychometric and mental health-related measures offers an opportunity for clinical research and application that may take advantage of the explosive growth in this brain imaging modality.

As medical information systems are increasingly woven into the fabric of healthcare systems, it is essential for neuropsychology to adopt modern informatics tools and create appropriate decision support algorithms if the field is ever to reach the point where advances in neurotechnology and advances in neurobiology can be integrated with psychometric and neuropsychological testing within the context of holistic medical practice. This will require that neuroinformatics emerge from a specialized focus of a few neuropsychologists into a discipline that is broadly and deeply integrated into neuropsychological practice and research and recognized as a part of modern medical information systems.

This presentation will describe clinically useful technology for analyzing brain function, how advanced informatics methods can be used to extract psychiatric biomarkers from measurements of brain activity; and how such data can be integrated with health information technology systems.

Correspondence: *William Bosl, Childrens Hospital (Infomratics, Enders 150.5, 300 Longwood Ave, Boston, MA 02115. E-mail: william.bosl@childrens.harvard.edu*

Symposium 11: New Directions in Using Neuro-imaging to Understand Neuropsychological Late Effects across the Lifespan in Pediatric Cancer

Chair: Donald Mabbott

Discussant: Maureen Dennis

9:00–10:00 a.m.

D. MABBOTT, H. CONKLIN, D. MABBOTT, K. KRULL & M. DENNIS. New directions in using neuro-imaging to understand neuropsychological late effects across the lifespan in pediatric cancer.

Symposium Description: Curative therapies for pediatric cancer can have devastating irreversible effects on the brain. In particular, cranial radiation remains a critical component of treatment for malignant brain tumors and some hematological malignancies, but is associated with brain injury, neurovascular changes, epilepsy, endocrine disturbance, hearing deficits and neuropsychological impairment. Neuropsychological late effects include intellectual declines and specific deficits in attention, information processing speed, and working memory. There is considerably less information on the biological origins of this neuropsychological morbidity. CNS damage – particularly white matter injury – has been documented following cranial radiation. To ameliorate the cognitive morbidity of the growing number of pediatric cancer survivors, particularly those treated with cranial radiation, it is necessary to understand the relations between underlying CNS damage and neuropsychological deficits. In this symposium we will focus on novel research and approaches in using neuro-imaging in late effects research. Our three talks will focus on: (a) the relations between MRI imaging of white matter damage and impaired working memory in brain tumor patients treated with conformal radiotherapy (Dr. Heather Conklin), (b) neuropsychological outcome and PET imaging markers of injury in adult survivors of childhood ALL and medulloblastoma (Dr. Kevin Krull), and (c) using MEG to examine disrupted neural activation in patients treated with cranial radiation for posterior fossa tumors (Dr. Donald Mabbott). Our intent is that this symposium will describe emerging trends in using novel neuroimaging approaches in evaluating brain health and addressing neuropsychological dysfunction in survivors of paediatric cancer across the lifespan.

Correspondence: *Donald Mabbott, The Hospital for Sick Children, 555 University Avenue, Toronto, ON L6M 1C9, Canada. E-mail: donald.mabbott@sickkids.ca*

H.M. CONKLIN, J.M. ASHFORD, W.E. REDDICK, J.O. GLASS, L.M. JACOLA, R.J. OGG & T.E. MERCHANT. The Relationship between Working Memory Abilities and White Matter Integrity in Childhood Brain Tumor Survivors.

Objectives: We previously identified working memory deficits among childhood brain tumor survivors who received conformal radiation therapy (CRT). There is accumulating evidence to suggest treatment-related reductions in cerebral white matter may represent a primary mechanism underlying the emergence of cognitive late effects. In this study, the functional impact of white matter changes following CRT was investigated using structural magnetic resonance imaging (MRI). **Methods:** Childhood brain tumor survivors treated with CRT (25 males, 25 females; age=13.18 ± 2.88 years; age at irradiation=7.41 ± 3.41 years) completed measures of working memory (computerized self-ordered search tasks and digit span). Parents completed the Behavior Rating Inventory of Executive Function. MRI exams were performed on a 1.5 Tesla whole-body imager using contrast. An automated MRI segmentation technique was used to assess white matter volumes by brain region (left and right, anterior and posterior). **Results:** Pearson correlations revealed significant associations between relative cerebral white matter volumes and performance-based working memory measures ($r=.24-.37$, $p<.05$) but not parent report of working memory. When analyzed by gender, correlations were only significant for females despite reduction in sample size ($r=.41-.56$, $p<.05$). Associations by brain region were distributed with evidence for both anterior and posterior contributions but greater right hemisphere involvement. **Conclusions:** Current findings suggest disruption to cerebral white matter is a core process conveying risk for cognitive late effects following CRT for pediatric brain tumors. Gender differences in cerebral myelination may help explain greater risk for female survivors. Future work with more advanced imaging (e.g., diffusion tensor imaging, myelin water fraction) may better isolate vulnerable white matter pathways to facilitate refinement in treatment delivery and development of neuroprotective interventions.

Correspondence: *Heather M. Conklin, 262 Danny Thomas Place, Memphis, TN 38105. E-mail: heather.conklin@stjude.org*

C. DOCKSTADER, E. BOUFFET, S. LAUGHLIN, F. WANG & D. MABBOTT. Neural correlates of delayed visual-motor performance in children treated for brain tumours.

BACKGROUND: Children treated with cranial-spinal radiation (CSR) for brain tumours suffer substantial brain injury and exhibit a particularly high correlation between the degree of injury and cognitive deficits. However the pathophysiology underlying impaired cognitive performance in this population is unknown. We wished to investigate the characteristics of neuronal function during visual-motor task performance in a group of children who were treated for brain tumours of the posterior fossa (PF).

METHODS: We used Magnetoencephalography (MEG) to investigate neural function during two visual-motor reaction time tasks of varying cognitive load. We asked whether the power or speed of brain rhythmicity was related to slowed visual-motor performance in 20 patients treated with CSR and 13 healthy controls. Relative power of brain rhythmicity during task performance was calculated for the delta (0.5-3 Hz), theta (4-7 Hz), alpha (8-12 Hz), beta (13-29 Hz), and gamma (30-100 Hz) frequency bandwidths.

RESULTS: Compared to controls, children treated with CSR showed significantly less gamma rhythms during the simple visual-motor task ($p < 0.05$). In control participants gamma power was potentiated when cognitive load increased ($p < 0.001$). This gamma increase was not observed in the patient group between the two tasks ($p > 0.4$). Reduced gamma power specifically predicted slowed reaction times for both controls ($r = -0.48$) and patients ($r = -0.51$).

CONCLUSION. Our results suggest that radiation injury may result in a paucity of fast-wave brain rhythms (gamma) that is exacerbated with increased cognitive demand. This ceiling effect for cortical rhythmicity may underlie impaired information processing in children treated with CSR. Our findings may provide insight into how the temporal neural dynamics of information processing may transgress into cognitive impairment following neurological insult in children treated with CSR.

Correspondence: *Donald Mabbott, 555 University Avenue, Toronto, ON L6M 1C9, Canada. E-mail: donald.mabbott@sickkids.ca*

K.R. KRULL, S. MINOSHIMA, T.M. BRINKMAN, M.N. EDELMANN, L.L. ROBISON, M.M. HUDSON & B. SHULKIN. Regional Brain FDG PET in Adult Survivors of Childhood Cancer Treated with Cranial Radiation.

Cranial radiation (CRT) is associated with neurocognitive dysfunction in childhood cancer survivors. We examined associations between neurocognition and regional brain metabolism, as measured by fluorodeoxyglucose positron emission tomography (FDG-PET). Fifty-six survivors of acute lymphoblastic leukemia (ALL) or medulloblastoma (MB) were randomly selected from a large cohort treated with CRT (19 ALL survivors with 18Gy, 19 ALL survivors with 24Gy and 18 MB survivors with 35Gy whole brain). At a mean [range] age of 27.3 [22.3-37.4] years, and 21.9 [12.7-32.8] years since diagnosis, survivors had neurocognitive testing and brain FDG-PET. Predefined ROI analysis and voxel-based correlations with function were performed. Compared to national norms, survivors had lower performance in multiple domains, including verbal intelligence ($p < 0.001$), focused attention ($p < 0.006$), working memory ($p < 0.001$), verbal fluency ($p < 0.02$) and cognitive flexibility ($p < 0.001$). Metabolic activity in temporal brain regions was positively correlated with verbal intelligence ($\rho = 0.37$, $p < 0.02$) and working memory ($\rho = 0.38$, $p < 0.02$). Metabolic activity in the basal ganglia was negatively associated with cognitive flexibility ($\rho = -0.45$, $p < 0.005$) and activity in the thalami was associated with verbal fluency ($\rho = -0.43$, $p < 0.008$). This pattern of neurocognitive impairment associated with lower cerebral and higher subcortical metabolic activity remained consistent when associations were examined in the ALL groups alone. Compared to ALL survivors, MB survivors had lower metabolic activity in parietal cortex and cerebellum, but higher activity in basal ganglia. Metabolic activity in the basal ganglia also differed between ALL groups, with higher activity in the 24Gy CRT group ($p < 0.04$). Results suggest that adult long-term survivors of childhood cancer with CRT-associated impairment have increased activity in subcortical brain regions, possibly due to decreased regulatory input from cortical structures.

Correspondence: *Kevin R. Krull, 262 Danny Thomas Place, MS 735, Memphis, TN 38105-3678. E-mail: kevin.krull@stjude.org*

**Paper Session 7:
TBI-Pediatrics and Adults**

Moderator: Mary Newsome

9:00–10:00 a.m.

M. SHERER, K.L. MAESTAS, A.M. SANDER, N.J. PASTOREK & W.N. HAVINS. Factors that Predict Self-reported PTA Duration in Persons with Medically Documented TBI.

Objective: Given the difficulty in obtaining prospectively measured post-traumatic amnesia (PTA) duration on persons with traumatic brain injury (TBI), clinicians and researchers may rely on patient self-report to determine PTA duration. This study examined factors that affect accuracy of patient self-reported PTA duration (SR-PTA).

Participants and Methods: Participants were 91 persons with medically documented TBI for whom prospectively measured PTA duration (Pro-PTA) was available. Participants were interviewed an average of 3.2 years post-injury to obtain SR-PTA.

Results: The 91 participants ranged in age from 18 to 64 years and had a median of 13 years of education. 66% were male and 42% were non-White. Emergency Department Glasgow Coma Scale (GCS) scores indicated that 20 (22%) sustained severe TBI, 9 (10%) moderate TBI, and 30 (33%) mild TBI while GCS was not available for one participant and 36 (35%) were medically sedated or intubated so that complete GCS scores could not be determined. Responses to the Personal Health Questionnaire – 9 (PHQ-9) depression scale indicated that 23 (25%) reported moderate to severe depression. A multivariable linear regression analysis using age, sex, education, time since injury, cognitive impairment, depression (yes/no), symptom validity (yes/no), and Pro-PTA as predictors indicated that SR-PTA was predicted by depression and Pro-PTA. After adjustment for other predictors, participants estimated that they had 3.2 days of PTA for each actual day and depressed participants estimated that they had 83 more days of PTA than non-depressed participants. Note that even non-depressed participants substantially overestimated PTA duration.

Conclusions: Participants were generally not able to accurately report PTA duration when interviewed a substantial time post-injury. Participants who were depressed based on a self-report measure were especially inaccurate. Findings indicate that patient self-report may not be a valid method for estimating PTA duration or determining TBI severity.

Correspondence: *Mark Sherer, Ph.D., Research, TIRR Memorial Hermann, 1333 Moursund, Houston, TX 77573. E-mail: Mark.Sherer@memorialhermann.org*

Z.R. DORSEY, A.T. SCHMIDT, C.R. HANTEN, X. LI, E.A. WILDE, Z.D. CHU & H.S. LEVIN. Disruption of White Matter Pathways Involved in Emotional Processing After Pediatric Traumatic Brain Injury: A Diffusion Tensor Imaging Study.

Objective: Previous research demonstrates that children with traumatic brain injuries (TBIs) exhibit changes in how they process basic emotional information. Brain structures that may contribute to emotion processing have not been thoroughly explored in this population, especially white matter connections between regions. The current investigation examines the relationship between diffusion tensor imaging (DTI) metrics, including fractional anisotropy (FA) and apparent diffusion coefficient (ADC) and 3-month post-injury performance on a task of emotion prosody recognition and a control task of phonological discrimination.

Participants and Methods: 91 children participated in the study, who sustained either a moderate to severe TBI ($n = 45$) or a orthopedic injury (OI) ($n = 46$). The OI group acted as a comparison group, to control for risk factors predisposing children to injury. Both groups were assessed cognitively at baseline, 3, 12, 18 and 24 months, and underwent MRI scans at 3 and 18 months. Each time, participants were given an Emotional Prosody task, and were rated with the Socioeconomic Composite Index. Fiber tracking was done on areas commonly associated with emotional prosody.

Results: Behavioral findings included group differences in prosody recognition, with children with TBI impaired relative to those with OI. Brain-behavior findings within OI participants confirmed relationships between several significant white matter tracts in emotional prosody performance. The TBI group demonstrated few strong brain behavior relationships. The lack of clear relationships in the TBI group are discussed in terms of the likely disruption to cortical networks secondary to significant brain injuries.

Conclusions: In all cases, greater white matter integrity correlated positively with higher performance. Also, emotional prosody appeared more sensitive to disruption than other forms of emotional processing, which suggests that efforts to rehabilitate basic emotional processes may be especially beneficial in the initial months post-TBI.

Correspondence: *Zachary R. Dorsey, Baylor College of Medicine, 1709 Dryden, Houston, TX 77030. E-mail: zrdorsey@bcm.edu*

E. CHAMARD, M. LASSONDE, H. LUKE, J. TREMBLAY, Y. BOULANGER, L. DE BEAUMONT & H. THÉORET. Sports-related concussions in female athletes: Neurometabolic and microstructural alterations.

Objective: Sports-related concussions are a major public health concern affecting between 1.6 and 3.8 millions of individuals every year in

the USA. While there are generally no visible anatomic alterations using traditional neuroimaging methods (MRI, CT), neurometabolic and microstructural alterations have been reported in the chronic phase following a sports-related concussion in male athletes. However, no study has investigated long-term alterations following a concussion in female athletes, despite worse outcomes in women athletes compared to men athletes.

Participants and Methods: In this study, we investigated neurometabolic and microstructural alterations following a concussion by comparing ten female concussed athletes and ten control female athletes of the same age and education, using magnetic resonance spectroscopy (MRS) and diffusion tensor imaging (DTI). Concussed athletes were scanned at least 7 months post-concussion (mean 18.9 months) in a 3T Siemens scanner.

Results: While no between-groups differences were found for self-reported symptoms, MRS data revealed a significant decrease of myoinositol (mI/Cr) in the hippocampi as well as in the primary motor cortices (M1). DTI analysis using Tract-Based Spatial Statistics (TBSS) showed no difference in fractional anisotropy (FA) while increases in mean diffusivity (MD) in concussed athletes was detected in large white matter tracts including the forceps minors, inferior/superior longitudinal fasciculi, inferior fronto-occipital fasciculus, cingulum, uncinata fasciculus, anterior thalamic radiations, and corticospinal tract. Moreover, a region of interest approach (ROI) for the corpus callosum revealed a significant decrease in FA in the segment containing fibers projecting to the primary motor cortex.

Conclusions: This study demonstrates persistent neurometabolic and microstructural alterations in asymptomatic female concussed athletes. Correspondence: *Emilie Chamard, University of Montreal, 2747 Edouard-Montpetit (app 14), Montreal, QC H3T 1J6, Canada. E-mail: emilie.chamard@umontreal.ca*

M.R. PRASAD, P. SWANK & L. EWING-COBBS. Long-Term School Outcome in Children with Moderate and Severe Traumatic Brain Injury.

Objective: School outcomes have been found to be unfavorable for children with moderate and severe traumatic brain injuries (TBI). School-aged children with moderate and severe TBI have been found to have high rates of grade retention. Children who sustained moderate and severe TBI in early childhood have also been found to have high rates of grade retention at long-term follow-up. This study evaluated the relation of age at injury and time since injury on school performance in children with moderate and severe TBI.

Participants and Methods: As part of a prospective, longitudinal study on outcome from TBI in childhood, school records were obtained from 79 children who sustained moderate to severe TBI between the ages of 2 months and 15 years. School records were collected at 2 or 5 years post injury. Any alteration to the general curriculum such as grade retention or classroom accommodations was coded as poor school performance.

Results: School performance was used as the outcome measure in a logistic regression model. Age at injury was not significantly related to school performance. However, a significant interaction between time since injury and injury severity was found ($p=.04$). Children who sustained severe TBI were more likely to have poor school performance than children with moderate TBI two years post injury. At 5 years post-injury, the two groups were comparable in school performance with both having high rates of grade retention and school support services ($p=.001$).

Conclusions: These findings indicate that children with severe TBI, regardless of age at injury and time since injury, have a high rate of poor school performance. By 5 years post-injury, children with moderate TBI had comparable school performance to children with severe TBI. These findings suggest that as children with moderate TBI develop, there is greater functional impairment in school performance. Better identification of educational issues soon after injury is needed for children with TBI. Correspondence: *Mary R. Prasad, Ph.D., Children's Learning Institute, UT Health-Houston, 7000 Fannin, Suite 2401, Houston, TX 77030. E-mail: mary.r.prasad@uth.tmc.edu*

**Poster Symposium:
Comprehensive Neurorehabilitation for TBI**

9:00–10:00 a.m.

Cognitive Intervention/Rehabilitation

T. ASHMAN, T. TSAOUSIDES & J. CANTOR. Comprehensive Neurorehabilitation for TBI.

Symposium Description: This symposium will present theoretical foundations and practical applications of comprehensive neurorehabilitation for TBI. First will be an overview of the historical evolution of neurorehabilitation for TBI which forms the conceptual foundation of comprehensive day treatment (CDT) interventions. Next, a discussion of Executive Plus, a current model of CDT which was empirically evaluated in two randomized controlled trials (RCTs). Executive Plus integrates theories of cerebral function and organization, cognitive-behavioral and learning theory, and incorporates techniques from neurorehabilitation, psychotherapy, and psychoeducation. The model is based on three theoretically and empirically derived assumptions: 1) impaired executive functioning is related to poor problem-solving ability; 2) emotional dysfunction interferes with problem-solving ability; and 3) problem-solving and emotional control that are mediated by attention. Building on decades of clinical research, Executive Plus directly and simultaneously addresses impairments in both foundational (i.e., attention) and higher-order (i.e., executive functions) cognitive processes through remediation (i.e., restoration of function) and compensation (i.e., strategy training). Core components of this model include problem-solving training, emotional regulation, and attention training in both individual and group formats. Finally, analyses from two completed RCTs of Executive Plus will be presented: comparing Executive Plus to standard CDT, at a dose of 5 days per week, 5 hours per day, ($N=77$), and a wait-list control study, at a dose of 3 days per week, 3 hours per day, ($N=55$). The analyses will review changes in neuropsychological, emotional and functional domains following these interventions. In addition to these analyses, we will review the lessons learned, knowledge gained, and remaining research questions that were identified in the first RCT that informed the implementation of the second RCT.

Correspondence: *Teresa Ashman, PhD, Rehabilitation Medicine, NYU Langone Medical Center, 222 East 80th Street, 9B, New York, NY 10075. E-mail: teresa.ashman@nyumc.org*

T. TSAOUSIDES. Comprehensive Neurorehabilitation: Theoretical Foundations.

Description of the theoretical concepts that have guided comprehensive neurorehabilitation in the past and present empirical support for these concepts to treat individuals with TBI. The presentation will focus on how comprehensive neurorehabilitation holistically targets awareness along with cognitive and social skill building versus individual groups that target specific skills as part of an individual's comprehensive, interdisciplinary treatment. Discussion of appropriate candidates for each model, including level of functioning and social support.

Correspondence: *Theodore Tsoulosides, 1 Gustave Levy Place, Box 1240, New York, NY 10029. E-mail: theodore.tsoulosides@mountsinai.com*

J. CANTOR. Comprehensive Neurorehabilitation: Current Clinical Evidence Based Practice.

Top-down, metacognitive interventions have been used effectively in rehabilitation following TBI to improve executive functions, self-monitoring and self-awareness. This presentations will focus on two theory-based and empirically-tested metacognitive interventions: Problem Solving (PS) and Emotional Regulation (ER). PS is a 5-step approach to problem-solving that involves recognition of the existence of a problem, definition of the problem, generation of potential solutions, selection and implementation of solutions, and outcome evaluation. PS is

intended to increase anticipatory awareness, cognitive flexibility, divergent thinking, planning, initiation, self-monitoring, and decision-making. ER is a cognitive-behavioral intervention designed to increase awareness of the nature and impact of emotional reactions on cognition and behavior and to promote skill development to improve emotional control and appropriate behavioral responses. Both will be described in detail and data supporting the effectiveness of these interventions within two RCTs evaluating comprehensive neurorehabilitation program will be presented.

Correspondence: *Joshua Cantor, 1 Gustave Levy Place, Box 1240, New York, NY 10029. E-mail: joshua.cantor@mountsinai.org*

Poster Session 9: Dementia/Epilepsy/TBI

9:00–10:00 a.m.

Dementia (Subcortical, Specific Disorders, MCI, etc.)

P.A. ANDRADE CALDERÓN, J. SALVADOR CRUZ, E. LONGORIA & A.L. SOSA ORTIZ. Positive impact of speech therapy in nonfluent primary progressive aphasia. A single case study.

Objective: Investigate the changes in language processing, neuropsychiatric symptoms (NP), quality of life (QoL) and functionality in a patient with primary progressive aphasia (PPA) after receiving speech therapy. We have hypothesized that cognitive and socioemotional processes would improve.

Participants and Methods: A single-case design was used where JM was on a weekly speech therapy over a 6 month period (stimulating naming, repetition, phonological and syntactic processing); working simultaneously in a daily homework. Assessments (neuropsychological, functionality, NP and QoL; and primary caregiver's emotional state, QoL and burden evaluation scales) were applied before and after therapy.

Results: Comparison pre vs. post evaluation, showed a slight improvement in rhythm and melody of language, fluency and content of spontaneous speech in the performance profile; repetition, reading aloud, nonwords writing and oralphonatory praxias were significantly improved; no phonetic paraphasias were produced. In all modalities, execution speed was reduced. JM's functionality improved and depression changed from moderate to mild. Sustained attention and visuospatial memory improved. Related to primary caregiver, neuropsychiatric symptoms remain absent, good quality of life and decreased burden.

Conclusions: Speech therapy can improve articulation, repetition, fluency and expressive language content; also positively impact other cognitive and socioemotional processes in PPA. This stimulation slows cognitive decline, because after the 6 months of therapy, maintenance and improvements were observed, a success in PPA treatment due to its rapid progression.

Correspondence: *Paola A. Andrade Calderón, Master, Universidad Nacional Autónoma de México, Patricio Sanz 1717 int. 5 Col. Del Valle, Del. Benito Juárez, México 03100, México. E-mail: paolandrade@hotmail.com*

A. ASHIZUKA, H. TAKECHI, K. UEDA, A. KOKURYU, T. MIMA, T. MURAI & H. FUKUYAMA. Semantic memory of environmental sounds in a case with right-dominant semantic dementia.

Objective: Impairments in semantic memory in semantic dementia (SD) are reported to be category-specific: such as living/non-living things. Previous studies on semantic memory have focused mainly on verbal aspects but rarely on its nonverbal aspects. Especially, SD with the atrophy of the right anterior temporal lobe has been characterized by a selective inability to recognize familiar faces, but rarely studied in detail. The purpose of this study is to investigate whether the semantic knowledge of environment sounds is disturbed or not in a patient with right-sided SD.

Participants and Methods: The case is a 76-year-old right-handed man, YK, who was diagnosed as SD at the age of 74. His chief complaints were difficulties in retrieving his familiar person's name. YK's spontaneous oral comprehension was normal, and his speech was fluent and relatively talkative. A structural MRI showed atrophy localized predominantly in the right anterior temporal lobe.

He scored 28/30 in the MMSE with an average full-scale IQ (verbal: 98 / performance: 101). In contrast, he presented difficulties in recognizing faces of famous people in Visual Perception Test for Agnosia.

In addition to the conventional neuropsychological tests, YK was tested for six categories of environmental sounds and corresponding pictures (animals, human-controlled devices, automated machines, musical instruments, nature sounds, situation sounds).

Results: Test scores for environment sounds of YK were significantly disturbed across all categories compared to the age-matched normal volunteers (animals: 54%, human-controlled tools: 45%, automated machines: 46%, musical instruments: 45%, nature sounds: 60%, situation sounds: 67%).

Conclusions: We found that the semantic memory of environment sounds was disturbed in a case of right-dominant SD. Together with the literature of lesion and neuroimaging studies, this case study would suggest the importance of right hemispheric dominance as well as anterior temporal cortices in the processing of environmental sounds.

Correspondence: *Aoi Ashizuka, M.A., Brain Imaging Human Brain Research Center, Kyoto University Graduate School of Medicine, 54 Shogoin Kawahara-cho, Sakyo-ku, Kyoto, Kyoto 606-8507, Japan. E-mail: aoi@kyoto.kuhp.kyoto-u.ac.jp*

J.F. AVILA, I. MEZA-GONZALEZ, J. WONG, M. MURCIA & J. RAZANI. The Utility Of The CVLT-II And A Performance-Based Task In Differentiating MCI Patients From Controls.

Objective: The purpose of this study was to examine how well a verbal learning neuropsychological measure and a performance-based shopping (memory) task differentiate mild cognitively impaired (MCI) patients from healthy adults.

Participants and Methods: Participants were a sample of 25 MCI patients and 67 healthy age- and education- matched controls. MCI patients were recruited from medical centers where diagnoses were made using the modified Petersen criteria (Petersen, 2004). All participants were administered the California Verbal Learning Test (CVLT-II SF) and the shopping task from the Direct Assessment of Functional Status (DAFS). Outcome measures used for the CVLT included: brief delay free recall, long delay free recall, cued delay recall, semantic cluster score, and Discriminability. During this DAFS shopping task, participants are verbally presented a grocery list with six items and asked to remember each item so they can pick it out when they are shopping in ten minutes. After a 10 minute delay, the participants are assessed on: free recall, recognition, and shop with a list.

Results: Discriminant function analyses revealed that all outcome variables, with the exception of semantic clustering, were statistically significant (p values $< .05$) in classifying both groups. The CVLT outcome variables correctly classified 72.2%-76.1% of the MCI patients and control cases. Additionally, the DAFS subscales correctly classified 69.9%-79% of both groups.

Conclusions: These findings suggest that memory impairment in MCI patients can be distinguished from that of healthy adults based on their neuropsychological test performance as well as their functional impairment. Correspondence: *Justina F. Avila, B.A., CSU Northridge, 18111 Nordhoff Street, Northridge, CA 91330. E-mail: justina.avila.48@my.csun.edu*

K.J. BANGEN, A. BEISER, L. DELANO-WOOD, D.A. NATION, M. LAMAR, D.J. LIBON, M.W. BONDI, S. SESHADRI, P.A. WOLF & R. AU. APOE Genotype Modifies the Relationship Between Midlife Vascular Risk Factors and Later Cognitive Decline.

Objective: Vascular risk factors have been associated with cognitive decline, however, it remains unclear whether apolipoprotein E (APOE) genotype modifies this relationship. We aimed to further elucidate these relationships and extend previous findings by examining data from a more comprehensive cognitive assessment than used in prior studies.

Participants and Methods: 1,436 participants from the prospective community-based Framingham Offspring Cohort Study underwent health examination from 1991-1995, followed by a baseline neuropsychological assessment (1999-2003) and a repeat neuropsychological assessment approximately eight years later (2004-2009). Multivariate linear regression analyses were performed to examine the relationship between midlife vascular risk factors and cognitive change. Interaction terms were included to determine whether presence of the APOE e4 allele modified these relationships.

Results: APOE genotype significantly modified the associations between both midlife hypertension and cardiovascular disease and decline in language abilities (i.e., confrontation naming) as well as midlife diabetes and decline in verbal memory, attention, and visuospatial abilities. Associations between increased midlife vascular risk burden and greater cognitive decline were observed among APOE e4 carriers but not non-carriers.

Conclusions: The presence of the APOE e4 allele exacerbated cognitive decline associated with midlife exposure to vascular risk factors. The present findings revealed a subgroup at increased risk for cognitive decline (i.e., APOE e4 carriers with midlife exposure to vascular risk factors) and suggest that treatment of vascular risk factors during midlife may reduce the risk of cognitive impairment later in life, particularly among APOE e4 carriers.

Correspondence: *Katherine J. Bangen, PhD, UCSD, 9500 Gilman Drive, 151B, La Jolla, CA 92093. E-mail: kbangen@ucsd.edu*

S.J. BANKS & G.C. LEGER. Neuropsychiatric symptom profile differs based on pathology in patients with clinically diagnosed frontotemporal dementia.

Objective: There are various pathological changes associated with the clinical diagnosis of frontotemporal dementia (FTD). Neuropsychiatric symptoms are often the most prominent change seen in FTD. Here we assess the relationship between neuropsychiatric symptoms and pathology in patients with a clinical diagnosis of FTD.

Participants and Methods: Data were from a multicenter database - National Alzheimer's Coordinating Center database. Neuropsychiatric symptoms were quantified by caregiver report through the Neuropsychiatric Inventory Questionnaire.

Results: We completed 3 analyses, first comparing patients with clinical diagnosis of FTD (any pathology n=149) with patients with AD (clinically and pathologically n=538). FTD patient had more anxiety, elation, apathy, disinhibition, motor changes, and nighttime behavior compared with those with pathologically-confirmed clinical diagnoses of AD. We then compared those patients with clinically diagnosed FTD whose pathology revealed frontotemporal lobar degeneration (FTLD) with those with pathologically verified AD (about 20%). The patients with AD were more likely to have delusions, hallucinations, and agitation. Finally, we divided FTD patients with FTLD into tauopathies vs. nontauopathies. Patients with tau negative pathology were more likely to show delusions, depression, and changes in appetite and eating.

Conclusions: These results suggest that neuropsychiatric profile during life may be helpful in ascertaining underlying pathology. This will be important as new medications emerge for clinical trial. Prospective studies are required to understand the true predictive value of neuropsychiatric symptoms on pathology.

Correspondence: *Sarah J. Banks, PhD, Cleveland Clinic, 885 W Bonnevill Avenue, Las Vegas, NV 89135. E-mail: bankss2@ccf.org*

K.D. BARRERA, T.G. FOGEL & A.D. SHERZAI. Methodological Issues in Assessing Anosognosia: Are Informants More Accurate?

Objective: Anosognosia is a general term used to describe a lack of awareness of a disability and has been documented in patients with dementia and mild cognitive impairment. A number of different methodologies are used to quantify anosognosia, making comparison across studies difficult. The discrepancy between informant and patient reports is commonly used to measure anosognosia, using informant reports as

the basis of actual patient function, though little research has been done to investigate the accuracy of informant reports. We sought to investigate the accuracy of patient and informant reports as they relate to actual neuropsychological function using a novel approach to assessing anosognosia.

Participants and Methods: A total of 24 MCI and 25 dementia patients underwent neuropsychological evaluation across 6 cognitive domains - global mental status, attention, language, visuospatial skills, memory, and executive function. Predictions and evaluations of performance were obtained from patients before and after administration of each measure. Informants provided parallel prediction ratings for each measure.

Results: MANCOVA results indicated that informant predictions were more accurate than patient predictions with respect to actual neuropsychological performance on only 3 of 20 measures (BNT, $F(2,143)=6.93$, $p=.00$; CVLT IR, $F(2,127)=3.11$, $p<.05$; Trails B, $F(2,127)=9.30$, $p=.00$).

Conclusions: Results reveal that informants are seldom more accurate than patients, and call into question the accuracy of informant predictions of patient ability with respect to neuropsychological function, as well as the commonly used paradigm of comparing patient to informant ratings when assessing anosognosia. In addition, we introduce a readily adoptable method of assessing anosognosia in clinical practice.

Correspondence: *Kyrstle D. Barrera, Loma Linda University, 2441 B Moondust Drive, Chino Hills, CA 91709. E-mail: kbarrera@llu.edu*

C. BOCTI, M. TETREAU, F. PEPIN, H. IMBEAULT, F. LANGLOIS, N. DUVAL, C. BOURGEOIS, G. LACOMBE & T. FULOP. Impact of Orthostatic Hypotension on Cognitive Performance in MCI.

Objective: Orthostatic hypotension (OH) is a frequent but understudied vascular factor that could influence cognitive performance. Our objective was to investigate the relationship between orthostatic hypotension and cognitive functions.

Participants and Methods: One hundred and forty patients referred for cognitive assessment at the Memory Clinic of the University Institute of Geriatrics of Sherbrooke were included in the analysis. Blood pressure of each patient was measured in supine and standing positions, and OH was defined by a fall $\geq 20/10$ mm Hg systolic/diastolic pressure. Participants were classified into one of 3 groups: 1) subjective cognitive impairment (SCI), 2) mild cognitive impairment (MCI), and 3) dementia. Neuropsychological tests that assessed processing speed (Stroop color naming /reading), executive functions (Letter cancellation test, Stroop inhibition and flexibility, Trail Making Test B) and working memory (Digit and Visual Span) were extracted from the database. Differences for patients with or without OH were analysed separately in each group using ANOVAs.

Results: Twenty-one patients (15%) had no objective cognitive deficits, 50 (36%) had mild cognitive impairment (MCI), and 69 (49%) had a diagnosis of dementia. None of the SCI had OH. Among patients with MCI, 22% (n=11) had OH, while among those with dementia, 35% (n=24) had OH. Age, sex, education, and screening cognitive test scores (MMSE and MoCA) were equivalent among patients with and without OH. In the MCI group OH was associated with lower cognitive performances in: Stroop color naming ($p = 0.006$), Trail B ($p = 0.024$), Stroop flexibility ($p = 0.030$), and direct visual span ($p < 0.001$).

Conclusions: This study demonstrates that orthostatic hypotension is associated with lower cognitive performances in processing speed, executive functions, and working memory in patients with MCI, but not in patients with SCI or dementia. OH should be considered in the evaluation of MCI patients. Mechanisms that underly that association warrants further study.

Correspondence: *Christian Bocti, MD, FRCPC, Medicine, Neurology, Université de Sherbrooke, CHUS - Division of Neurology, 3001 12e ave Nord, Sherbrooke, QC J1H 5N4, Canada. E-mail: christian.bocti@usherbrooke.ca*

E. BOLCEKOVA, R. RUSINA, R. MATEJ, K. STOREY, J. KELLER & M. BUNCOVA. FTLD-TDP and Progressive Supranuclear Palsy in Comorbidity: Study of a Rare Case.

Objective: Frontotemporal lobar degenerations (FTLD) encompass several clinically and pathologically heterogeneous disorders. Histopathological analysis of brain tissue recognizes FTLD-tau (with tau-positive inclusions), FTLD-TDP (with protein TDP-43 positive inclusions) and FTLD-UPS (with ubiquitin positive inclusions). Progressive supranuclear palsy (PSP) is a pure tauopathy. We present a case of a 60-year old male with concurrent FTLD-TDP and progressive supranuclear palsy.

Participants and Methods: The patient was referred with a slowly developing cognitive deterioration since two years. He underwent repeated neurological and neuropsychological assessments, MRI and SPECT examinations. He was followed up regularly for three years and a detailed neuropathological investigation was realized on autopsy.

Results: The initial clinical presentation was characterized by marked episodic memory impairment, visuospatial deficits, apraxia and a pronounced dysexecutive syndrome with perseverations. MRI found marked frontal and temporal cortical atrophy, SPECT revealed hypoperfusion in the right occipital-parietal and frontal regions bilaterally. The patient was diagnosed with Alzheimer's disease, and successively treated with rivastigmine, donepezil and memantine. However, the clinical presentation worsened with increasing frontal lobe dementia, development of extrapyramidal features with frequent falls, dysautonomy and oculomotor abnormalities. Neuropathological examination revealed an extremely rare combination of FTLD-TDP and tau pathology fulfilling diagnostic criteria for PSP.

Conclusions: Our presentation of simultaneous affliction with two different neurodegenerations – FTLD-TDP and PSP showed an atypical clinical course from the initial presentation evoking Alzheimer's disease up to a picture compatible with progressive supranuclear palsy. Close clinical and neuropathological correlations are thus very useful in atypical cases of neurodegenerative dementias.

Supported by grant NT13543-4/2012 from the Czech Ministry of Health. Correspondence: *Eva Bolcekova, Mgr., Neurology, Thomayer Hospital, Videnska 800, Prague 14059, Czech Republic. E-mail: eva.bolcekova@gmail.com*

M.M. BURKE, J. FILOTEO, K. OBTERA, D. SCHIEHSER, S. LESSIG & D. SONG. Visual Cognition In Parkinson's Disease Patients With And Without Visual Hallucinations.

Objective: Visual hallucinations (VH) are often observed in patients with Parkinson's disease (PD). Past studies have shown that the presence of VH in PD can be associated with alterations in cognition. The current study examined whether the presence and nature of VH in non-demented patients with PD impacts cognition.

Participants and Methods: Ninety two PD patients were screened for the presence and nature of hallucinations. We identified 22 patients who experienced visual hallucinations, and 70 who did not. Of those patients who had visual hallucinations, 9 experienced simple hallucinations (e.g., seeing unformed patterns) and 13 experienced complex hallucinations (e.g., seeing people who were not there).

Results: The presence of visual hallucinations was associated with lower scores on tests of executive functioning in that patients with hallucinations performed worse on tests of verbal fluency and visual selective attention. In contrast, PD patients with complex visual hallucinations performed worse than patients with simple visual hallucinations on tests of visuospatial cognition.

Conclusions: These results suggest that the presence or absence of visual hallucinations is associated with the integrity of frontostriatal functioning (which mediates executive functions), whereas the nature of visual hallucinations may be more associated with the integrity of posterior visual regions (which mediate visual cognition).

Correspondence: *J. Vincent Filoteo, VA San Diego Healthcare System, 3350 La Jolla Village Dr., San Diego, CA 92161. E-mail: vfiloteo@ucsd.edu*

B.L. CALLAHAN, M. SIMARD, F. ROUSSEAU & C. HUDON. Memory Bias for Emotional Pictures in Amnesic Mild Cognitive Impairment and Late-Life Depression.

Objective: Amnesic mild cognitive impairment (aMCI) and late-life depression (LLD) increase the risk of developing Alzheimer's disease (AD). Yet, little is known about their cognitive similarities and differences or how they relate to aMCI with comorbid subclinical depression (aMCI/D+). This study aimed to differentiate episodic memory performance for emotional images between aMCI, aMCI/D+ and LLD. It was expected that, compared to neutral images, aMCI subjects would recall more positive images, while aMCI/D+ and LLD groups would recall more negative images.

Participants and Methods: Eleven aMCI, 7 aMCI/D+, 13 LLD and 14 controls (CON) were asked to judge the emotional valence of 30 images from the International Affective Picture System (incidental learning). Ten images were positive (e.g., cake), 10 were negative (e.g., cemetery) and 10 were neutral (e.g., truck). Participants then freely recalled the images immediately after stimulus presentation and 20 min later.

Results: Repeated-measures ANOVAs revealed effects of Group, Valence and Group x Valence interactions at both recall phases (all $p < .05$). Effect size analyses showed that aMCI/D+ subjects recalled more positive ($d = .6$) and negative ($d = 1.0$) than neutral items at immediate recall. At 20-min recall, compared to neutral items, aMCI subjects recalled more positive items ($d = .5$), and aMCI/D+ subjects recalled more negative items ($d = .4$). At both recall phases, compared to neutral items, CON subjects recalled more positive ($d = 1.1$; $d = 1.5$) and negative items ($d = 2.3$; $d = 1.8$) and LLD patients recalled more negative items ($d = 0.3$; $d = 0.3$).

Conclusions: These preliminary results indicate an overall emotional memory bias in CON subjects and a negative bias in LLD subjects, consistent with prior work. The positive and negative biases at delayed recall in aMCI and aMCI/D+ groups, respectively, support prior work revealing an interplay between depressive and cognitive symptoms in prodromal AD. Overall, these results contribute to a better nosologic characterization of incipient AD.

Correspondence: *Brandy L. Callahan, B.A., Université Laval, 44 St-Joseph street, #1215, Toronto, ON M4Y 2W4, Canada. E-mail: BRANDY.CALLAHAN.1@ULAVAL.CA*

D. CALVO, J. GUNSTAD, L. MILLER, E. GLICKMAN & M. SPITZNAGEL. Serum IGF-1 is Positively Associated with Cognitive Performance in Mild Cognitive Impairment.

Objective: Serum insulin growth factor-1 (IGF-1) is a mitogenic peptide involved in the regulation of cell proliferation, differentiation, and apoptosis in a wide variety of cells and tissue. Recent research suggests IGF-1 may have a neuroprotective effect. Low levels of serum IGF-1 are associated with the aging process and increased IGF-1 is linked to better cognitive performance in healthy older adults. The relationship between IGF-1 and cognition has not previously been examined in Mild Cognitive Impairment (MCI).

Participants and Methods: Thirty-one participants (83.71 ± 3.59 years; 58% female) with MCI residing in a retirement community completed neuropsychological testing and 12-hour fasting blood draw to assess serum IGF-1.

Results: Partial correlations between serum IGF-1 neuropsychological measures were conducted, adjusting for insulin, body mass index, and age. Significant correlations emerged between IGF-1 and several measures, including global cognition (Modified Mini Mental State Exam; $r = .38$, $p = .04$), verbal list learning (Hopkins Verbal Learning Test [HVLT] Learning = .41, $p = .05$), HVLT free recall ($r = .41$, $p = .03$), and HVLT recognition discriminability ($r = .46$, $p = .01$). In addition, this trend was observed for executive function (Frontal Assessment Battery; $r = .33$, $p = .09$).

Conclusions: Results suggest higher levels of serum IGF-1 are associated with better cognitive performance in persons with MCI, particularly learning and memory. These findings suggest IGF-1 may be neuroprotective not only in healthy older adults, but also in early stages of pathological cognitive aging. Further investigation is needed to clarify the nature of this relationship.

Correspondence: *Dayana Calvo, Kent State University, 9272 89th way N, Seminole, FL 33777. E-mail: dcalvo1@kent.edu*

L.R. CLARK, D.A. NATION, C.E. WIERENGA, S.I. DEV, D.D. SHIN, T.T. LIU & M.W. BONDI. Medial Temporal and Posterior Cingulate Cerebrovascular Resistance Predicts Cognitive Decline and Diagnostic Instability in Non-Demented Older Adults.

Objective: Growing evidence indicates that cerebrovascular factors contribute to cognitive decline in older adults. Our longitudinal analysis examined if cerebrovascular resistance (CVR) at baseline predicts change in neuropsychological diagnosis after one year. We hypothesized that elevated baseline CVR would be associated with deteriorating cognitive status at follow-up.

Participants and Methods: Fifty non-demented older adults (34 NC, 16 MCI) completed an arterial spin labeling MR scan at baseline. Cerebral blood flow (CBF) was extracted from five a priori selected regions of interest. CVR was calculated by dividing CBF in each region by mean arterial pressure. Deterioration in cognitive status was defined as normal to MCI, single-domain to multi-domain MCI, or MCI to dementia, and an ordinal diagnostic progression score quantified each participant's change in diagnosis from baseline to one-year follow-up. Linear regression analyses examined the relationship between diagnostic progression score and baseline CVR while controlling for age, gender, and education.

Results: A significant association between diagnostic progression and baseline CVR was demonstrated in the medial temporal lobe ($\beta = .35$, $t = 2.56$, $p = .01$; $\Delta R^2 = .11$) and the posteromedial region ($\beta = .33$, $t = 2.54$, $p = .02$; $\Delta R^2 = .10$), comprised of the posterior cingulate and precuneus/cuneus. Specifically, elevated CVR was associated with progression to a more severe diagnosis and lower CVR was associated with reversion to less severe diagnostic status at follow-up. By contrast, there were no significant relationships between diagnostic progression and CBF in the regions examined.

Conclusions: Our findings indicate that baseline MTL and posterior-medial CVR is elevated in non-demented older adults who cognitively decline one year later. Conversely, lower CVR is associated with better cognitive performance at follow-up. Our results suggest that CVR is a sensitive cerebrovascular measure associated with cognitive progression as well as diagnostic regression.

Correspondence: *Lindsay R. Clark, Clinical Psychology, San Diego State University/University of California, San Diego, 4573 Florida Street, Apt 3, San Diego, CA 92116. E-mail: ltermini@gmail.com*

R.V. DYE, K.J. MILLER, P. SIDDARTH, J. KIM, J.L. JENNINGS, E. O'TOOLE, J. WONG & G. SMALL. Role of Mood Symptoms in Predicting Cognitive Decline in Aging Adults.

Objective: Mild cognitive impairment (MCI) is likely the earliest identifiable clinical stage of dementia; depressive symptoms may be an early manifestation for both MCI and dementia and may represent a precursor of cognitive decline. The current study examined whether mood symptoms predict lower cognitive functioning and verbal memory performance at a six-month follow-up.

Participants and Methods: A convenience sample of 69 participants (mean age 82, 65% female) was recruited from retirement communities. Individuals participated in a brain fitness program daily and underwent neuropsychological testing at baseline (time 1) and six-months (time 2).

Results: Individuals with MCI (based on a score of 22 or less on the Montreal Cognitive Assessment scale - MoCA) were more depressed and anxious at baseline compared to individuals without MCI. It was notable that the individuals with MCI played fewer sessions on the program ($M=56.79$, $SD=32.21$) than individuals with no MCI ($M=88.74$, $SD=154.69$); however, this was not statistically significant because of the large standard deviation, particularly for individuals with no MCI. Next, mood and cognitive functioning over time was examined. Regression analysis revealed that higher depressive symptoms at time 1

predicted reduced global cognitive functioning at time 2 (as evidenced by lower MoCA scores; $\beta=-.26$, $p < .10$), even when controlling for the number of sessions played. In addition, regression analysis revealed that those who endorsed higher anxiety at baseline performed worse on memory (Hopkins Verbal Learning Test) as measured by time 2 - time 1 for both Total Recall and Delayed Recall (HVLTR Total $\beta=-.38$, $p < .05$, HVLTR Delay $\beta=-.35$, $p < .05$), even when controlling for the number of sessions played.

Conclusions: Those who experience mood symptoms are more likely to have reduced cognitive functioning. They are also more likely to decline within a 6-month period on measures of global cognitive functioning and verbal memory.

Correspondence: *Richelin V. Dye, Ph.D., Longevity Center and Department of Psychiatry and Biobehavioral Sciences, UCLA, 10945 Le Conte Avenue, Peter V. Ueberroth Building, Suite 3119, Los Angeles, CA 90095. E-mail: rdye@mednet.ucla.edu*

L.M. ERCOLI, J. MARTINEZ, N. DONOGHUE, P. SIDDARTH, V. KEPE, S. HUANG, K.J. MILLER, J.R. BARRIO, P. LU, J.M. RINGMAN & G.W. SMALL. Plaque and Tangle Imaging and Cognitive Decline in Non-Amnesic Mild Cognitive Impairment.

Objective: FDDNP-PET imaging identifies senile plaques and neurofibrillary tangles in the brains of people with Alzheimer's disease (AD) and in people with amnesic Mild Cognitive Impairment (MCI-A), who have high AD risk. People with non-amnesic MCI (MCI-N) have non-memory cognitive impairment, but some develop AD, although they may not be identified as at-risk because they do not demonstrate early memory impairment. We used FDDNP-PET imaging to identify MCI-N subjects at high risk for AD.

Participants and Methods: Cognitively normal ($N=30$), MCI-N ($N=26$), MCI-A ($N=23$) and AD ($N=17$) subjects (age range = 44 - 90 years) received FDDNP-PET and neuropsychological testing. Ten MCI-N subjects underwent follow-up neuropsychological testing after 18 months. A disjoint cluster analysis was performed on FDDNP binding levels in frontal, parietal, medial and lateral temporal, and posterior cingulate brain regions of interest. Repeated measures ANOVA was used to determine if higher baseline FDDNP binding predicted cognitive decline.

Results: Three FDDNP binding clusters were identified among all subjects. One cluster had high global FDDNP binding suggestive of an AD-like pattern (HG; $N=34$); another showed low binding in medial temporal and other regions but with elevated binding in the posterior cingulate (Low-MTL; $N=21$); the third demonstrated high binding only in the medial temporal region (Hi-MTL; $N=41$). All AD subjects were in the HG cluster, as were seven MCI-N subjects who also demonstrated significantly worse memory and naming performances compared to other MCI-N subjects without AD-like FDDNP-PET patterns. Higher FDDNP binding in frontal, medial and lateral temporal brain regions predicted declines memory, language and attention (p -value range=0.005 to 0.06).

Conclusions: FDDNP imaging identified MCI-N subjects with AD-like binding patterns and predicted cognitive decline. Early detection of AD is highly important to identify candidates for early intervention.

Correspondence: *Linda M. Ercoli, PhD, Psychiatry, UCLA Semel Institute, 760 Westwood Plaza, 37-440, Los Angeles, CA 90095. E-mail: lercoli@mednet.ucla.edu*

A.T. FLOWERS, S. KERN, I. MEZA-GONZALEZ, P. LU, J. WONG & J. RAZANI. Performance of Patients with Frontotemporal Dementia and Alzheimer's Disease on an Activities of Daily Living Task.

Objective: Objective: Alzheimer's disease (AD) is characterized by degeneration in the parietal and posterior temporal cortices; its clinical applications include profound memory impairment, language disturbance, and visual-spatial dysfunction (Heindel, Samon, and Butters, 1993). Frontal temporal lobe damage (FTD) is characterized primarily by neurodegenerative damage in the frontal and anterior

temporal regions of the brain; its clinical presentation includes significant executive dysfunction, with mild memory problems and relatively intact visual-spatial skills (Brun and Gustafson, 1999). While distinct differences/similarities between these two types of dementia are known, an insignificant amount of information is understood regarding how these separate illnesses vary in the presentation of activities of daily living (ADL). The purpose of the current study was to characterize these differences/similarities by using the Direct Assessment of Functional Status (DAFS), an observation-based test which measures performance in areas such as time orientation, communication, transportation, financial, shopping, grooming, and eating skills.

Participants and Methods: Participants and Methods: A total of 62 patients with AD, 12 patients with FTD, and 65 controls were administered the DAFS as part of a larger test battery.

Results: Results: Overall results revealed a significant difference across groups in terms of total DAFS performance [$F(2, 138)=39.158, p<.05$], where patients with AD and FTD scored significantly worse on the different subscales relative to normal controls but did not differ significantly from one another.

Conclusions: Conclusion: Overall, it appears that while AD and FTD patients may show different patterns of performance on specific cognitive domains, they both have deficits on most ADL domains.

Correspondence: *Amina T. Flowers, Psychology, California State University Northridge, 5454 Brynhurst Avenue, Los Angeles, CA 90043. E-mail: tiannyflowers@hotmail.com*

K. GIFFORD, S. DAMON, R. ROMANO, W. CHAPMAN & A. JEFFERSON. Cognitive Complaints are related to memory performance in older adults with mild cognitive impairment.

Objective: The report of a cognitive complaint is necessary for the diagnosis of mild cognitive impairment (MCI); however the cognitive and neuroanatomical correlates of complaint in MCI are not well understood. We assessed how the presence of a memory complaint is related to different verbal episodic memory indices and regional brain volumes in MCI.

Participants and Methods: MCI participants were drawn from the Alzheimer's Disease Neuroimaging Initiative and included 141 non-complainers (75 ± 7 years, 38% female) and 181 complainers (74 ± 8 years, 39% female). Complaint was defined as endorsement of the question, "Do you feel you have more memory problems than most?" Verbal episodic memory was measured by the Rey Auditory Verbal Learning Test. 1.5T T1 structural MRI was used to quantify intra-cranial volume-corrected hippocampus and entorhinal cortex.

Results: Age, sex, education, race, and Mini-Mental State Examination adjusted ANOVAs revealed lower performances on total learning ($F(1,314)=16.0, p<0.001$), delayed recall ($F(1,314)=11.5, p=0.001$), and delayed recognition ($F(1,314)=4.7, p=0.03$) in complainers compared to non-complainers. A trend for smaller hippocampal ($F(1,314)=2.3, p=0.10$) and entorhinal cortex volumes ($F(1,314)=3.0, p=0.09$) was observed in complainers compared to non-complainers.

Conclusions: Findings suggest MCI individuals with a memory complaint have poorer episodic verbal memory performances that include learning, encoding, and retrieval issues as compared to MCI individuals without a complaint, an observation which may be due to smaller medial temporal lobes. Findings are independent of global cognition and suggest a memory complaint is related to objective memory performances.

Correspondence: *Katherine Gifford, PsyD, Vanderbilt University, 2525 West End Ave, 12th Floor, Suite 1200, Nashville, TN 37203. E-mail: katie.gifford@vanderbilt.edu*

M. KOSMIDIS, G. HADJIGEORGIOU, M. YIANNAKOULIA, T. DARDIOTIS & N. SCARMEAS. Assessing Memory Decline in Illiterate Elderly Adults.

Objective: Neuropsychological assessment based on school-related procedures may confound results, unfairly influencing diagnostic de-

cision making for illiterate individuals. In an epidemiological study of cognitive functioning and factors presumably protective of cognitive decline in the elderly (i.e., diet, social and physical activity), we found a nontrivial proportion of illiterate individuals in our sample and were faced with the question of how to judge potential memory decline.

Participants and Methods: From the total sample (over 900 participants to date), we selected participants aged 70-85 years with 0-6 years of education, who also had a minimum MMSE of 80% correct (illiterates were given 23 of 30 items). This yielded a sample of 411 individuals (56 illiterate). We compared literate and illiterate groups on tests of verbal and visual memory, as well as neurologist ratings on the Clinical Dementia Rating Scale (CDR).

Results: The groups did not differ in mean age and MMSE percentage correct. Mann Whitney U tests revealed poorer performance of the illiterate relative to their literate cohort on verbal learning trials and total words learned, free and cued immediate and delayed recall trials, learning curve, and retention on immediate and delayed visual memory trials. This was in light of no verbal memory differences on 1st learning, interference and recognition trials and on visual memory forgetting rate, as well as on CDR memory and personal care.

Conclusions: Non-demented illiterate individuals have similar initial memory performance, recognition and forgetting rates to literates, but poorer active retrieval and retention strategies. This finding may reflect a lack of adequate learning strategies to aid active retrieval of rote or not personally relevant information — a process trained and practiced in school. Therefore, initial learning, recognition and forgetting rates appear to be more appropriate indices of memory abilities in illiterates than retrieval and rote learning.

Correspondence: *Mary Kosmidis, PhD, School of Psychology, Aristotle University of Thessaloniki, University Campus, Thessaloniki 54124, Greece. E-mail: kosmidis@psy.auth.gr*

S. LIGHT & J. HALSTEN. Diagnosing Mild Cognitive Impairment in the Cognitively Gifted.

Objective: The concept of giftedness is not given much empirical attention in the adult neuropsychological literature, though neuropsychologists are faced with making determinations of the presence of neurodegenerative processes in the context of other areas of cognitive giftedness on a semi-regular basis in the clinical setting.

Participants and Methods: We provide a review of the literature pertaining to the neural basis of giftedness in adulthood and the shared and distinct neural features of mild cognitive impairment and dementia in gifted individuals compared to neurotypically intelligent patients. We provide case examples, including neuropsychological test data and neuroimaging, of two gifted patients who both met criteria for Mild Cognitive Impairment; outlining our method for dealing with these types of cases. We also provide recommendations for efficiently and routinely assessing for giftedness in the adult population, and provide suggestions on how to give feedback to patients who demonstrate giftedness in at least one domain and do (or do not) demonstrate a cognitive deficit consistent with a neurodegenerative process.

Results: Neuropsychological data from two gifted men (a retired aerospace engineer and a psychiatrist) assessed for dementia are presented. Both men demonstrated cognitive giftedness in certain domains, yet deficits in other domains consistent with Mild Cognitive Impairment.

Conclusions: Giftedness and cognitive impairment co-occur. Our results indicate that clinicians should test for giftedness in adults more routinely, and should pay special attention to this variable when making determinations about the presence of neurodegenerative disorder, determining prognosis, and offering recommendations to patients that incorporate the utilization of/or development of cognitive gifts to dampen the effects of deficits and generally promote brain health.

Correspondence: *Sharee Light, Center for Investigating Healthy Minds, University of Wisconsin-Madison, 1500 Highland Avenue, Madison, WI 53704. E-mail: light@wisc.edu*

P. MANGAL, J. JONES, J. LAFO, M. OKUN, R. BAUER, C. PRICE & D. BOWERS. Many Faces of Mild Cognitive Impairment in Parkinson Diseases: Classification Approaches Matter.

Objective: Previous studies of mild cognitive impairment (MCI) in Parkinson disease (PD) report rates ranging from 19% to 79%, reflecting vast variability in specific cognitive measures, classification rules, and impairment criteria. Unfortunately, little empirical data exists regarding optimal criteria for defining MCI in Parkinson disease. This is vital given implications for prognosis and treatment. A previous longitudinal study with elderly (non-PD) adults examined 5 distinct approaches to MCI classification (Jak et al., 2009). In the present study, we adopted this approach and directly compared the clinical characteristic and prevalence of PD-MCI based on commonly used diagnostic strategies.

Participants and Methods: Participants included 362 non-demented idiopathic PD patients who underwent standard neuropsychological evaluation assessing memory, executive function, processing speed, language, and visuospatial skills. Patients were classified into MCI groups according to the 5 approaches of Jak et al. (historical, typical, liberal, conservative, comprehensive), as well as composite domain approaches.

Results: Depending on the criteria, the percent of PD patients classified as MCI ranged from 7.5% (Historical) to 91.2% (Liberal). The Conservative, Comprehensive and Typical classification approaches revealed MCI to occur in 28.2%, 50% or 73.2% of the sample, respectively. Classifications of MCI using composite scores revealed MCI rates to vary based on whether a 1 SD (61.9%), 1.5 SD (34.3%) or 2 SD (18.5%) cut-off value was used.

Conclusions: These results highlight the potential for vastly different outcomes regarding “PD-MCI” depending on what diagnostic strategies are applied. Future longitudinal studies are imperative to determine the stability and utility of these PD-MCI classifications, including the optimal balance of sensitivity and specificity. Findings will be discussed in terms of implications for understanding the concept of MCI in PD.

Correspondence: *Paul Mangal, Clinical Health Psychology, University of Florida, 1149 Newell Drive, L3-135, Gainesville, FL 32611. E-mail: pmangal@phhp.ufl.edu*

S.T. MOELTER, D. WEINTRAUB, M.S. CARY, E.W. SULLO, A.D. SIDEROWF & J.H. KARLAWISH. Neuropsychological Factors Associated with the Decision to Enroll in an Early-Phase Parkinson's Disease Research Study.

Objective: We examined the relationship between neuropsychological variables and the decision to enroll in an early-phase clinical trial in Parkinson's disease (PD). We hypothesized that participants with increased risk taking on the Iowa Gambling Task (IGT) would be more likely to agree to enroll in an early-phase trial.

Participants and Methods: Participants were age-, gender-, and education-matched healthy adults (N=30) and people with PD (N=90). PD participants were classified by the Dementia Rating Scale-2 as cognitively normal (n=30), borderline (n=30), or impaired (n=30). All participants were administered a clinical interview that involved obtaining informed consent for two research scenarios (a drug study and a surgical trial) and a neuropsychological battery that included the IGT and Montreal Cognitive Assessment (MoCA). Capacity to consent was evaluated by the consensus judgment of three experienced clinicians and the MacArthur Competence Assessment Tool—Clinical Research.

Results: In comparison to controls, participants with PD were less likely to enroll in a clinical trial, especially involving surgery. PD participants with cognitive impairment were more likely than other PD participants to select from risky decks on the IGT. Ordinal logistic regressions showed that a risk-oriented IGT profile predicted higher participation in the surgical trial only ($p < .05$). Capacity measures and MoCA performance were not significant predictors of the decision to enroll.

Conclusions: PD patients may adopt a “harm-avoidant” approach to decision-making on the IGT. We demonstrate that PD participants with greater cognitive impairment show a more risk-oriented pattern on the IGT and an increased likelihood of enrolling in an early-phase surgical research trial. These results have implications for the evaluation of the capacity to consent to clinical research in PD.

Correspondence: *Stephen Moelter, University of the Sciences, 600 S. 43rd Street, Philadelphia, PA 19104. E-mail: s.moelte@usciences.edu*

C. ECKERSTRÖM, E. OLSSON, H. MALMGREN, ÅKE. EDMAN, M. BJERKE, A. WALLIN & A. NORDLUND. Neuropsychology Predicts Dementia more Accurately than CSF Biomarkers and MRI Volumetry.

Objective: To study which neuropsychological and biomarker variables strongest predict conversion to dementia in general and Alzheimer's disease (AD) in mild cognitive impairment (MCI).

Participants and Methods: Forty-two MCI subjects and 26 controls were included in the study and followed up after two years. The patients underwent comprehensive examinations at inclusion: a neuropsychological assessment comprising 20 tests covering the domains speed/attention, memory, visuospatial, language and executive functions, MRI and cerebrospinal fluid (CSF) analyses. Twenty-one MCI subjects converted to mild dementia at follow-up (MCI-c), and 21 were stationary MCI (MCI-s).

Results: The neuropsychological tests that most clearly distinguished between MCI-c and MCI-s were memory tests, a visuospatial and a naming test. Also CSF amyloid beta 42 (A β 42) and left hippocampus volume distinguished the groups clearly. On a Partial Least Squares Discriminant Analysis (PLS-DA) the variables that most strongly predicted conversion to dementia were memory tests, a visuospatial, a naming test and A β 42. A second PLS-DA on subjects converting to AD (N=14) was performed. The variables that most strongly predicted conversion to AD were a visuospatial test, CSF total tau, a memory and a naming test. According to a ROC analysis neuropsychological tests had higher sensitivities and specificities than biomarkers and MRI markers for both dementia in general and AD. The best predictive power was obtained by combining neuropsychology, biomarkers and MRI, with an area under the curve of 0.96 for dementia and 0.98 for AD.

Conclusions: Neuropsychological tests outperformed CSF biomarkers and hippocampal volume in identifying dementia. Memory, visuospatial and language tests were the best neuropsychological predictors of both dementia and AD. A combination of neuropsychological, CSF and MRI markers, however, increased the accuracy. Notably the strongest single predictor of AD was not a memory but a visuospatial test.

Correspondence: *Arto Nordlund, PhD, Institute of Neuroscience and Physiology, Sahlgrenska Academy at University of Gothenburg, SU/Molndal, Wallingsgatan 6, Molndal 431 41, Sweden. E-mail: arto.nordlund@neuro.gu.se*

C.M. PARSEY & M. SCHMITTER-EDGECOMBE. Direct Observation of Instrumental Activities of Daily Living in Normal Aging, Mild Cognitive Impairment, and Dementia.

Objective: Formal assessment of instrumental activities of daily living (IADL) is generally limited to self-report and laboratory-based tasks. This study investigated whether performance of IADLs (e.g., cooking, managing medication) in a simulated home environment could distinguish between diagnostic groups.

Participants and Methods: Young adults (YA; n=44), cognitively healthy older adults (OA; n=92), and individuals with mild cognitive impairment (MCI; n=58) and dementia (n=36) completed eight IADLs in a campus apartment under direct observation of researchers. Each IADL was scored for six error types: critical and noncritical omissions and substitutions, inefficient actions, and irrelevant actions. These errors were used to calculate an overall score for each activity, which was summed to create a total score.

Results: Kruskal-Wallis nonparametric tests revealed significant differences between groups for the total score, $\chi^2(3, n=194) = 32.63$, $p < .001$, task completion time, $\chi^2(3, n=214) = 43.72$, $p < .001$, and all error types except irrelevant actions (p 's < .001). Post-hoc analyses suggested significantly poorer total scores for IADL task performance as age and cognitive difficulties increased (i.e., YA to dementia). In comparison to the YA, the older groups completed the tasks significantly

slower and engaged in more inefficient actions (e.g., multiple trips to a cupboard or closet). Both critical and noncritical omission errors (e.g., failure to retrieve or return necessary items, respectively) were significantly more common in the MCI group compared to the healthy OA and YA groups. Critical and noncritical omission errors and inefficient actions, in addition to substitution errors (e.g., using an alternative object or approach), were significantly greater in the dementia group compared to the other three groups.

Conclusions: These findings suggest that with increasing age and levels of cognitive decline, errors in IADLs increase in quantity and severity, with substitution errors being prominent only in the dementia group. Correspondence: *Carolyn M. Parsey, M.S., Washington State University, 1700 NW Lamont St, Pullman, WA 99163. E-mail: carolyn.parsey@email.wsu.edu*

J. PINEAULT, P. JOLICOEUR, S. GRIMAUULT, J. LACOMBE, S. BRAMBATI, S. BELLEVILLE, N. BIER, C. CHAYER & J. SVEN. Neural Substrates Of Residual Semantic Processing In Semantic Dementia: A Case Study in MEG.

Objective: Recent theoretical models of semantic processing suggest the anterior temporal lobes (ATL) as a key anatomical region underlying the processing of semantic information at an abstract and amodal level (Patterson, Nestor & Rogers, 2007). This model is based largely on the observation of predominant atrophy of the ATLs in a semantic dementia (SD), a neurodegenerative condition known to wipe out semantic memory. Despite the relatively well-documented pattern of semantic decline and atrophy in this condition, little is known about the brain regions that are associated with preserved semantic abilities in SD. The aim of this study is to determine to what extent other structures part of the semantic network can compensate the severe atrophy of the ATLs in SD.

Participants and Methods: In the current study, we asked one SD patient and healthy age-matched controls to take part in a magnetoencephalography (MEG) study during which they completed a semantic decision task. Stimuli consisted of 192 objects belonging to four different semantic categories (fruits/vegetables, means of transportation, animals and tools). At the beginning of each block, the written name of a category appeared on the screen and the subject had to determine if each stimulus presented subsequently (e.g., animal – screwdriver) belonged to that category.

Results: In spite of similar performance at the behavioural level between the SD patient and controls, MEG analyses revealed significant differences in cortical activation related to semantic processing in key regions of the semantic network. More specifically, the results demonstrated hypoactivation of the left inferior prefrontal cortex as well as the left temporal pole, while the right ATL and centroparietal regions were hyperactivated in the SD patient during the semantic decision task.

Conclusions: These differences may reflect the fact that other regions part of a semantic network may help compensate ATL atrophy in SD when general semantic processing is still possible.

Correspondence: *Jessica Pineault, Université de Montréal, 90 avenue Vincent d'Indy, Montréal, QC H2V 2S9, Canada. E-mail: jessica.pineault@umontreal.ca*

T.M. SCOTT, J. AVILA, P. LU & J. RAZANI. Performance Differences on a Measure of Information Processing Speed between Alzheimer's, Mild Cognitive Impairment, and Healthy Control Participants.

Objective: Differences in neuropsychological test performance in the area of information processing speed between patients with dementia and healthy controls have been widely documented. The present study examines differences in performance in this domain in patients with mild cognitive impairment (MCI), Alzheimer's disease (AD), and healthy controls. We predict that, healthy controls and MCI patients will outperform AD patients on a neuropsychological measure of information processing, but that healthy controls and MCI patients will perform similarly on this test.

Participants and Methods: Participants were 22 MCI patients (mean age = 75.09), 57 AD patients (mean age = 74.89), and 66 healthy controls (mean age = 70.46). MCI patients were diagnosed using a multi-disciplinary evaluation and the modified Peterson criteria (Peterson, 2004), and AD patients were diagnosed using the NINCDS-ADRDA criteria (McKhann et al., 1984). As part of a larger neuropsychological battery, all participants were administered the color naming and word reading parts of the Stroop Test.

Results: Comparison between the groups revealed that the three groups significantly differed on both the color naming ($p < .01$) and word reading ($p < .05$) parts of the Stroop Test. In particular, post-hoc testing revealed that, on the color naming part, both healthy controls and MCI patients outperformed AD patients (p values $< .01$). Likewise, on the word reading part, healthy controls and MCI patients outperformed AD patients (p values $< .05$). However, healthy controls and MCI patients performed similarly on the color naming and word reading parts of the Stroop (p values $> .05$).

Conclusions: These results support our hypothesis and suggest that, while AD patients display deficits in information processing speed, this area appears to be relatively intact in patients with MCI.

Correspondence: *Travis M. Scott, BA, California State University, Northridge, 8752 Delco Ave, Los Angeles, CA 91306. E-mail: tscott11@ion.lmu.edu*

L. SHAUGHNESSY, M.B. MITCHELL, S.N. GOMPERS & A. ATRI. Diagnostic Accuracy of UDS-Plus Neuropsychological Measures for the Lewy Body Spectrum Disorders.

Objective: To characterize and compare the diagnostic accuracy of measures from the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS) neuropsychological battery and supplementary tests (UDS-PLUS) that included the Free and Cued Selective Reminding Test (FCSRT) (Buschke, 1984) and Letter Fluency, to distinguish between cognitively intact older adults and individuals along the Lewy Body/Idiopathic Parkinson's disease cognitive impairment/dementia spectrum.

Participants and Methods: Two-hundred-and-seventeen participants from the Massachusetts Alzheimer's Disease Research Center (MADRC) were classified, per UDS protocol, as older adults with normal cognition ($n=173$) or with cognitive impairment on the Lewy Body spectrum (Lewy-CI) ($n=44$), which included individuals with Lewy Body Dementia, Parkinson's disease with mild cognitive impairment, or Parkinson's disease dementia. Diagnostic accuracy of single and combined UDS-Plus measures was assessed using receiver operating characteristic (ROC) curve analysis.

Results: The Digit symbol test (Dsym), followed closely by semantic fluency (Sflu), demonstrated the best accuracy for distinguishing between Control and Lewy-CI groups ($AUC=.976$, $AUC=.961$ respectively). Combined performance on Dsym and Sflu increased diagnostic accuracy for Control vs. Lewy-CI ($AUC=.987$). Additional highly accurate measures include Trail Making Test A ($AUC=.943$) and B ($AUC=.957$), and memory measures FC-SRT free recall ($AUC=.932$) and Logical Memory II ($AUC=.912$).

Conclusions: These results suggest excellent accuracy for several NACC-UDS measures in distinguishing subjects with intact cognition from those on the Lewy Body spectrum. While the findings are mostly consistent with the expected neuropsychological profile of Lewy Body Spectrum disorders in that the highest diagnostic accuracies were generally observed for tests of psychomotor speed and executive function, semantic fluency also showed very high accuracy in this cohort.

Correspondence: *Lynn Shaughnessy, Psy.D., Beth Israel Deaconess Medical Center, 1 Longfellow Pl, Apt 2024, Boston, MA 02114. E-mail: Lynn.Shaughnessy@gmail.com*

J. SOUTHWICK, J. BARRASH, R. JONES & D. TRANEL. Personality Change in "Frontotemporal Sagging Brain Syndrome" and Frontotemporal Dementia.

Objective: Spontaneous intracranial hypotension is a rare condition that may show a "sagging brain" on neuroimaging ("frontotemporal sagging brain syndrome" or FSBS), and cognitive and personality changes resembling frontotemporal dementia (FTD; Walker & DeMeulemeester, 2008). We examined personality changes in two patients with FSBS, and compared them with changes in FTD.

Participants and Methods: Patients with FSBS were males, ages 50 and 57. Patients with FTD (n=20; 5f/15m; ages 38-81). Knowledgeable informants completed the Iowa Scales of Personality Change (Barrash et al., 1997; Lezak et al., 2012) in the context of clinical assessment.

Results: Both patients with FSBS were rated as 6 or 7 (indicating moderate or severe disturbance) in several personality characteristics, including Lack of Planning, Lack of Initiative, Insensitivity, Impatience, and Social Inappropriateness. Also, Perseverative Behavior, Lack of Persistence, Poor Judgment, Indecisiveness, and Vulnerability to Pressure were also rated as moderately or severely disturbed for one or the other FSBS patient.

The aforementioned scales were all clinically elevated in our FTD sample, with mean ratings ≥ 5.0 for each, indicating at least mild disturbance. No other mean scale elevations were ≥ 5.0 in the FTD group.

Two ISPC scales did register severe changes in FSBS (both patients ≥ 6) that were atypical of the FTD sample: Lack of Stamina (Mann-Whitney U, $p = .009$) and Depression ($p = .02$).

Both groups had been rated as having unremarkable premorbid personality functioning.

Conclusions: These results support prior reports of similar behavioral disturbances in FSBS and FTD. However, in our two patients, FSBS was distinguished by prominent complaints of poor stamina and depression, which may represent the effects of daytime somnolence (common in FSBS; Wicklund et al., 2011). The strong similarity of acquired disturbances in FSBS and FTD suggest a common neuropathological correlate: prefrontal involvement.

Supported by NINDS P01 NS19632 and the Kiwanis Foundation.

Correspondence: Jason Southwick, PhD, Clinical Psychology, Neurology, University of Iowa Hospitals and Clinics, 1800 Calvin Court #6, Iowa City, IA 52246. E-mail: jssouthwick@yahoo.com

B. SPRINGATE, G. TREMONT & B.R. OTT. Conversion from Mild Cognitive Impairment to Dementia is Associated with Repetitive Behaviors.

Objective: The relationship between repetitiveness and cognition within the mild cognitive impairment (MCI) population is not well established. This study aimed to determine whether the presence of repetitive behaviors or verbalizations is associated with poorer cognition as well as whether repetitiveness is effective in identifying MCI patients who convert to dementia within one year.

Participants and Methods: 46 patients diagnosed with amnesic MCI underwent two neuropsychological evaluations approximately one year apart (M=15.02 months, SD=2.51). Diagnostic status (MCI vs dementia) at each time point was established by consensus conference. A family member rated the severity of repetitive behaviors (RB) and verbalizations (RV).

Results: At baseline, patients with RV performed more poorly on the HVLIT delayed recall task, while patients with RB showed poorer learning on the HVLIT. 9 MCI patients (20%) converted to dementia over one year. Logistic regression with MMSE, RB, and RV as predictors revealed only RB to be a significant predictor of conversion ($\beta = 1.44$, $p < .05$). ROC analysis revealed that RB have a 78% sensitivity and 65% specificity for distinguishing converters from non-converters (AUC = 0.73).

Conclusions: Results suggest that RB, as rated by a family informant, are related to cognitive functioning and may be effective in identifying individuals with MCI who convert to dementia one year later. Questions regarding RB may be useful to include as part of a screening measure. Future research should replicate these findings in a larger sample to provide the most accurate reflection of its predictive utility.

Correspondence: Beth Springate, PhD, Rhode Island Hospital, 593 Eddy St, POB 430, Providence, RI 02903. E-mail: bspringate@lifespans.org

C. SULLIVAN, C. ONYIKE & J. BRANDT. The Clinical Features of Neuropathology-Confirmed Hippocampal Sclerosis Dementia.

Objective: Previous research has attempted to characterize the clinical profile of hippocampal sclerosis dementia (HSD). However, cognitive

and behavioral features that differentiate HSD from other dementias remain unclear. In an effort to improve clinical detection of HSD, we present findings from neuropathology-confirmed patients diagnosed with HSD, Alzheimer's disease (AD), and Frontotemporal lobar degeneration (FTLD).

Participants and Methods: Using data from the National Alzheimer's Coordinating Center (NACC), we compared cognitive and neuropsychiatric data from 20 neuropathology-confirmed HSD patients with cognitively normal patients, as well as those with AD and FTLD. Patients with AD and FTLD pathology were matched to HSD subjects on sex, education, and level of independence, and then randomly selected for inclusion.

Results: Despite indistinguishable performance on memory testing, patients with HSD pathology had significantly higher MMSE scores, better orientation to place, and higher semantic fluency than AD patients. Those with FTLD did not differ significantly from HSD subjects on any cognitive measures, but they were younger and had higher NPI scores. Discriminant analysis yielded two significant functions that differentiated patient groups, $\lambda = 0.27$, $X^2(14) = 64.90$, $p < .0001$; $\lambda = 0.70$, $X^2(6) = 17.67$, $p < .007$. Total score the NPI ($r = 0.91$) and memory ($r = 0.73$) loaded high on the first function, discriminating FTLD from AD and HSD. MMSE ($r = 0.86$) and age ($r = 0.52$) loaded more highly on the second function, discriminating HSD from AD and FTLD. Cross-validation analysis correctly classified 71% of cases.

Conclusions: These results are promising, suggesting that HSD may have a distinct cognitive and behavioral profile that is independent from AD and FTLD.

Correspondence: Campbell Sullivan, Psy.D., Johns Hopkins University, 600 N. Wolfe Street, Meyer 218, Baltimore, MD 21287. E-mail: asulli15@jhmi.edu

J. TAN, J.O. CARVALHO, B.A. SPRINGATE, M. EDWARDS, V.H. BALLDIN, H.J. WESTERVELT & S.E. O'BRYANT. Category Fluency is Superior to Letter Fluency in Identifying Spanish-speakers with MCI/AD.

Objective: Past studies indicate native English and Swiss-German speakers with Alzheimer's disease perform worse on category fluency than letter fluency compared to healthy controls. The utility of these tasks to distinguish between these groups in Spanish-speakers is unknown. We compared the performance of healthy Spanish-speaking individuals and those diagnosed with Mild Cognitive Impairment or Alzheimer's disease (MCI/AD) on these verbal fluency (VF) tasks.

Participants and Methods: 120 participants (99 healthy controls, 21 MCI/AD) from rural western Texas were recruited using a community-based participatory research approach for Project FRONTIER. Analyses were modeled after Monsch et al (1997). Verbal fluency (FAS/Animals) was the dependent variable and cognitive impairment group (MCI/AD or healthy control) was the independent variable in separate ANCOVAs, covarying years of education. Accuracy of VF in differentiating the groups was tested using Receiver Operating Characteristics (ROC) curves.

Results: Performance of the groups differed on both VF tasks: the cognitively impaired group obtained lower scores than healthy controls; however, after controlling for education, only Animals differed between the two groups. Based on the ROC findings, Animals showed better discriminability (maximum cutoff score: 9/10, sensitivity 94.9%, specificity 42.9%, area under the curve [AUC] 0.745) than FAS (maximum cutoff score: 10/11, sensitivity 71.4%, specificity 43.5%, AUC 0.665).

Conclusions: Similar to English and Swiss-German-speaking samples, Spanish-speakers also differed on VF tasks. Category fluency exhibited better accuracy in differentiating between the MCI/AD and healthy control groups than letter fluency. The relative difference between letter and category fluency may be used to identify AD in Spanish-speakers.

Correspondence: Jing Ee Tan, PhD, Brown Medical School, 593 Eddy Street, POB 430, Providence, RI 02903. E-mail: jingee.tan@gmail.com

M.R. TIMPANO SPORTIELLO & D.M. CAMMISULI. Stability/in-stability in Mild Cognitive Impairment progression.

Objective: Mild Cognitive Impairment (MCI) represents the most important nosological entity currently adopted by clinicians to diagnose the preclinical phase of dementia (especially Alzheimer's Disease). Nevertheless, the concept of MCI is still debated. In particular, recent investigations have pointed out that the adoption of the quadripartite model for subtyping MCI (Petersen, 2004) presents some difficulties. The present study aims at clarifying the progression of the major MCI subtypes, longitudinally observed during a 3-year period.

Participants and Methods: 196 patients with MCI (M:F=46:54%, age 74 ± 7 , education 5.7 ± 3) were strictly classified at baseline following Petersen's diagnostic algorithm into Type I (N=49), Type II (N=134), Type III (N=10), and Type IV (N=3). They were assessed by a wide neuropsychological battery, including: Milan Overall Dementia Assessment, ADL and IADL, Digit Span, Corsi Span, Pairs Associates Learning, Story Recall, Corsi Learning Suvra-span, Rivermead Behavioural Memory Test, Visual Search Test, Stroop Test, Boston Naming Test, Category Fluency Test, Street's Completion Test, Constructive Apraxia Test, Frontal Assessment Battery, Tower of London, and Brixton Test. A subset of patients (N=61; Type I: N=16; Type II: N=45) was reassessed after an interval of 36 months.

Results: Among patients who developed dementia, the most common diagnosis at baseline was MCI Type II (59%), as expected. 31% of the patients with MCI Type I progressed to dementia (with an average of 22 months). 50% of the patients with MCI Type I progressed to MCI Type II, of which 12.5% subsequently converted into dementia (with an average of 14 months).

Conclusions: Our research confirms the reduced accuracy of MCI nosographic concept. Probably, for a subset of MCI patients, Type I and Type II should not be considered as discrete sub-categories but as progressive stages prior to the conversion into frank dementia.

Correspondence: *Davide M. Cammisuli, Ph.D., Department of Psychiatry, Pisa University School of Medicine, 6, Via Bonanno Pisano, Pisa 56010, Italy. E-mail: d.cammisuli@med.unipi.it*

A.M. WEAKLEY, M. SCHMITTER-EDGEcombe & J. ANDERSON. Analysis of Verbal Fluency in Mild Cognitive Impairment.

Objective: The purpose of this study was to investigate the pattern of performance on letter (FAS) and category (animal) fluency tests of individuals with varying subtypes of mild cognitive impairment (MCI). Previous research has suggested that components of efficient verbal fluency performance include cognitive organization strategies such as clustering (i.e., groups of related words) and switching (i.e., shift from one cluster to another).

Participants and Methods: Participants were 25 persons with single-domain amnesic MCI, 49 with multi-domain amnesic MCI, 16 with non-amnesic MCI, and 90 cognitively healthy older adults. Letter and category fluency performances were analyzed for total words produced, cluster size and switching using the criteria developed by Troyer et al., 1997.

Results: ANOVA analyses with follow-up tests revealed that the single-domain amnesic MCI group performed comparably to healthy controls on each dependent measure across both fluency tasks. In contrast, the multi-domain amnesic MCI group showed performance decrements in total words and switching production compared to healthy controls on both fluency tasks. Furthermore, compared to healthy controls, the non-amnesic MCI group produced fewer words and switches on letter fluency, but not the category fluency task. There were no clustering differences between groups.

Conclusions: As indicated by the single-domain amnesic MCI group's unimpaired performance, our findings demonstrate that verbal fluency performance decreases as domains beyond memory become impaired in MCI. Switching, which has been linked to prefrontal executive abilities, appears to be the cognitive strategy that contributed most to the poorer performance of individuals with multi-domain MCI and non-amnesic MCI.

Correspondence: *Alyssa M. Weakley, M.S., Psychology, Washington State University, 415 NW Maryland st, Pullman, WA 99163. E-mail: alyweakley@gmail.com*

G. WEISSBERGER, L.R. CLARK, L. DELANO-WOOD, D.J. LIBON & M.W. BONDI. Error Profiles on the California Verbal Learning Test Across Four Empirically Derived MCI Subgroups.

Objective: The conventional method of diagnosing mild cognitive impairment (MCI), in which individuals are classified as either amnesic or non-amnesic, may not capture the heterogeneity that exists within MCI. We examined whether empirically derived MCI subtypes would display divergent error profiles on the California Verbal Learning Test (CVLT) consistent with different dementia prodromes.

Participants and Methods: MCI subtypes were empirically derived from a community-based older adult sample through cluster analytic techniques using test performances across multiple domains. We investigated error profiles on the CVLT across 4 empirically derived MCI groups: Amnesic (N=29), Dysexecutive (N=13), Visuospatial (N=19), and Mixed (N=19), and age- and education-matched normal controls (N=41). One-way ANOVAs and post-hoc comparisons were performed to evaluate pairwise differences between groups.

Results: Patterns of performance were consistent with the empirically derived subtypes. The Mixed MCI group, characterized by deficits in delayed recall, recognition, language, and executive function, demonstrated greater impairment across measures, showing a larger free recall recency effect, more recognition false positives, and greater cued recall intrusions ($p \leq .03$) than the other groups and controls. Furthermore, the Amnesic MCI group, which showed purely memory deficits in delayed recall and recognition, generated fewer recognition false positives relative to the Mixed group, but more false positives than Dysexecutive, Visuospatial, and control groups ($p \leq .01$). The Dysexecutive and Visuospatial groups did not differ from controls on error measures evaluated ($p \geq .2$).

Conclusions: The MCI groups displayed CVLT error profiles consistent with different putative pathologic processes of dementia. Results speak to the utility of empirically defining subtypes to better understand MCI heterogeneity and enhance our ability to predict underlying neuropathologic substrates.

Correspondence: *Gali Weissberger, Clinical Psychology, SDSU/UCSD Joint Doctoral Program, 811 West Nutmeg St., Apt. 401, San Diego, CA 92103. E-mail: gweissbe@gmail.com*

T.C. WU, E.A. WILDE, C. KARMONIK, R. YALLAMPALLI, A.M. STRUTT, J. JANKOVIC & M.K. YORK. Frontostratial Changes Detected by DTI Tractography in Parkinson's Disease Dementia.

Objective: Patients with Parkinson's disease (PD) can demonstrate significant neuropsychological changes, including PD dementia (PDD). To elucidate if PD-related cognitive changes are associated with cerebral microstructural changes, we examined the white matter integrity using diffusion tensor imaging (DTI) in patients with PDD compared to patients with PD who were cognitively intact (PDI).

Participants and Methods: Ten (7 males, 3 females) PDI participants and 18 PDD participants (13 males, 5 females) were examined. Participants who performed 1.5 standard deviations below the mean in two cognitive domains were classified in the PDD group. All participants underwent DTI on a 3-Tesla scanner. Three DTI metrics, fractional anisotropy (FA), apparent diffusion coefficient (ADC), and radial diffusivity (RD), were analyzed with quantitative tractography using Philips PRIDE software.

Results: The PDI and PDD groups did not differ significantly on age, educational level, gender, or race. The PDD group demonstrated significantly lower FA in the anterior limb of the internal capsule (ALIC) bilaterally than the PDI group (right: $p=0.024$, $F=5.728$, left: $p=0.004$, $F=10.202$). Results revealed significantly higher ADC (right: $p=0.047$,

F=4.336, left: $p=0.006$, $P=8.759$) and RD (right: $p=0.030$, $F=5.248$, left: $p=0.004$, $F=9.898$) bilaterally in the ALIC for PDD than PDI. The groups did not differ significantly in other examined regions, including the posterior limb of the internal capsule, corticospinal tracts, and the splenium of the corpus callosum.

Conclusions: DTI is sensitive to changes of the microstructural integrity of the frontostriatal circuitry in PDD.

Correspondence: *Trevor C. Wu, Ph.D., Baylor College of Medicine, One Baylor Plaza, Houston, TX 77030. E-mail: ctwu@bcm.edu*

H. YOSHIKAWA, J.P. VONSATTEL & L.S. HONIG. Neuropsychological Differentiation of Autopsy-confirmed Lewy Body Disease in Early Stage.

Objective: To investigate the cognitive profile in an early stage of dementia with Lewy bodies (DLB), and to determine which neuropsychological test measures at the initial visit will differentiate DLB from Alzheimer Disease (AD).

Participants and Methods: Neuropsychological profiles at the initial visits were compared among autopsy-confirmed patients; 92 definite AD, 20 DLB with AD pathology (DLB+AD), and 12 DLB without AD pathology (pure DLB). Patients with Clinical Dementia Rating (CDR) 0, 0.5, or 1 were included. We investigated the diagnostic utility of neuropsychological test measures in differentiating pure DLB from definite AD, pure DLB from DLB+AD, and DLB+AD from definite AD using separate logistic regression analyses and receiver operating characteristic curve (ROC) analyses.

Results: Pure DLB patients showed more impaired visuo-spatial function than AD ($p = 0.006$) and DLB+AD patients ($p = 0.006$), whereas memory function in AD was more severely impaired than pure DLB ($p = 0.001$). Analysis of memory subscore revealed that retrieval failure mainly contributed to the memory deficit of DLB. Multiple logistic regression analysis showed that visuo-spatial function and delayed memory recognition were independent predictors of pure DLB from AD and from DLB+AD. However, no neuropsychological test measures remained as independent predictors of DLB+AD from AD. ROC analysis of the performance of these two measures in predicting pure DLB from AD, pure DLB from DLB+AD, and DLB + AD from AD showed that the area under the curves (AUC) were 0.909, 0.944, and 0.638, respectively.

Conclusions: Visuo-spatial function was more affected in DLB than AD, while memory retrieval deficit was more affected in AD than DLB, in the early stages of dementia. However, we could not differentiate DLB+AD from AD only by clinical manifestation, since neuropsychological profile of DLB+AD was similar to AD.

Correspondence: *Hiroshi Yoshizawa, MD, Taub Institute for Research on Alzheimer's Disease and the Aging Brain, Columbia University College of Physicians & Surgeons, 630 West 168th St., PH19-121, New York, NY 10032. E-mail: hy2315@columbia.edu*

Epilepsy/Seizures

L.E. BARRETT, L.S. BLACKWELL, V.L. RAMOS & C.F. SALORIO. Patterns of Attention and Hyperactivity in Children with Epilepsy compared to those with ADHD.

Objective: Children with epilepsy are often impacted by attentional difficulties that affect their ability to learn. While approximately 30% of these children are co-diagnosed with Attention Deficit Hyperactivity Disorder (ADHD), it is unclear whether the pattern of deficits are similar to those seen in children with ADHD who do not have epilepsy. The purpose of this study is to identify differences in symptom presentation based on parent rating scales in children with epilepsy compared to ADHD.

Participants and Methods: 52 children ($M=9.9$ years) with a primary diagnosis of epilepsy and 162 children ($M=10.5$ years) with a primary diagnosis of ADHD who presented for neuropsychological evaluation were studied. Parents completed the DuPaul ADHD Rating Scale IV and the Penny Sluggish Cognitive Tempo Scale (SCT).

Results: Overall, children with ADHD scored significantly higher on all scales. While 84% of children with epilepsy and 92% of children with ADHD had elevated scores on the DuPaul Inattention scale, the average score was significantly higher in the ADHD group ($p<0.05$). On the Hyperactivity subscale, children with ADHD also had significantly higher ratings ($p<0.01$); 22% of children with epilepsy and 35% of children with ADHD had scores in the elevated range. Similarly, children with ADHD had higher scores on the Daydreamy and Low Initiation/Speed subscales on the SCT ($p<0.05$). On the Daydreamy subscale, 17% of children with epilepsy had elevated scores vs. 38% of children with ADHD. Elevated scores on the Low Initiation/Speed subscale were found in 37% of the epilepsy group compared to 63% of the ADHD group. Though elevated scores were found in both groups on all scales, the level of endorsement of specific items varied across groups.

Conclusions: Although children with either epilepsy or ADHD may show elevations on rating scales measuring attention difficulties, it is important to understand differences in patterns of symptom presentation in order to provide appropriate treatment recommendations.

Correspondence: *Cynthia Salorio, Ph.D., Kennedy Krieger Institute, 707 North Broadway, Baltimore, MD 21205. E-mail: salorio@kennedykrieger.org*

B. LAURA, L. BARRETT, V. RAMOS & C. SALORIO. Academic Difficulties in Children with Epilepsy.

Objective: Previous literature suggests that children with epilepsy are at risk for developing learning disorders (LD). The prevalence of LD in the general population has been found to be between 2–10%, while rates of LD in children with epilepsy are between 14–50%. Several major factors may contribute to academic concerns, including seizure or medication effects, psychosocial factors, and developmental disorders. The purpose of the current study is to examine the prevalence of LD in a clinical sample of children with epilepsy and identify potential risk factors associated with its occurrence.

Participants and Methods: 52 children with a primary billing diagnosis of epilepsy (55.8% female, $M=9.9$ years) were studied. Parents completed an online screening that included the Colorado Learning Difficulties Questionnaire (CLDQ) prior to their appointment for neuropsychological evaluation.

Results: On the CLDQ, reading difficulties were present in 33%, spatial reasoning difficulties were present in 41% and math difficulties were present in 71%. Overall, 54% of the sample was taking epilepsy medications, 42% were identified as having cryptogenic epilepsy, 42% had reported problems with sleep, and 46% reported symptoms of inattention. The presence of learning difficulties was not associated with any of the identified risk factors; including, inattention problems, hyperactivity, sleep difficulties, medications, or cause of epilepsy (all p -values $> .05$).

Conclusions: The results of the current study support previous literature identifying high incidences of learning difficulties in children with epilepsy. More difficulties with math abilities were identified compared to other academic skills. It remains unclear as to what specific risk factors contribute to these difficulties, as diagnosis, medication, sleep, and inattention all were unrelated to academic concerns. Further research should focus on understanding risk factors and patterns of learning difficulties in this population.

Correspondence: *Cynthia Salorio, Ph.D., Kennedy Krieger Institute, 707 North Broadway, Baltimore, MD 21205. E-mail: salorio@kennedykrieger.org*

L. ZAJAC, J. GIRARD, C. VEGA, S.M. LUNDY-KRIGBAUM, D.P. SARCO, M. TAKEOKA, D.P. WABER & K. BOYER. Predictors of Risk for Behavior and Learning Problems in Children with Benign Rolandic Epilepsy.

Objective: Some patients with Benign Rolandic Epilepsy (BRE) do not have a "benign" course, demonstrating mild to moderate language, attention, learning and visual-motor problems despite preserved intelligence. It is not clear which children with BRE are at greatest risk for these problems.

Executive functioning and psychosocial adjustment of children with BRE was evaluated in relation to 3 potential risk factors: age of seizure onset, antiepileptic drug (AED) treatment and seizure frequency.

Participants and Methods: Thirty-one children, aged 6–12 years, with EEGs and history consistent with BRE were recruited from neurology databases. Parents and teachers completed questionnaires assessing emotion, behavior and executive function within 6 months of the clinical EEG.

Multivariate regression analyses assessed medical variables on neurobehavioral outcomes. One-way ANOVA was carried out for outcomes where AED treatment and/or seizure frequency were significant predictors comparing 3 subgroups: patients with low seizure frequency not taking AEDs (N=12); patients with low seizure frequency taking AEDs (N=10); and patients with higher seizure frequency taking AEDs (N=5).

Results: Group means for the outcomes were within the normal range, but parent report of executive function highlighted 19% of subjects in the clinical range. Children taking AEDs were rated higher on anxiety (Parent, $p < 0.05$), learning problems (Teacher, $p < 0.05$), and school problems (Teacher, $p < 0.10$). Patients with high seizure rate and AED treatment were at heightened risk for each of these problems.

Conclusions: While BRE patients as a group do not exhibit significant behavioral or emotional problems, a subgroup that has higher seizure frequency and requires AED treatment is at increased risk for anxiety, learning and school problems. Thus, behavioral symptoms appear to be associated with severity of BRE. These findings, however, should not be interpreted to imply causation, and potential mechanisms underlying these associations remain to be determined.

Correspondence: *Katrina Boyer, PhD, Neurology, Boston Children's Hospital, 300 Longwood Avenue, Fegan 9, Boston, MA 02115. E-mail: Katrina.boyer@childrens.harvard.edu*

B.E. PRAYSON, R.A. PRAYSON, C.S. KUBU, W. BINGAMAN, I.M. NAJM & R.M. BUSCH. Dual Pathology is Associated with Better Language and Memory Outcome Following Left Anterior Temporal Lobectomy for the Treatment of Epilepsy.

Objective: Pathology [e.g., mesial temporal sclerosis (MTS), focal cortical dysplasia (CD)] is an important factor in cognitive outcome following anterior temporal lobectomy (ATL) in adults with temporal lobe epilepsy. However, little is known about the potential impact of dual pathology on postoperative cognitive outcome. This study sought to examine differences in language and memory outcome between patients with single (MTS) versus dual pathology (MTS + CD) in resected tissue.

Participants and Methods: Sixty-three adults (Mage=36.5 years, 52.4% female) who underwent left ATL for treatment of epilepsy (MTS=28; DUAL=35) completed pre and postoperative neuropsychological evaluations including measures of naming (BNT), fluency (COWAT, Animals), and verbal memory (WMS-III, RAVLT). Mean age at seizure onset was 14.7 years (SD=11.1), and mean duration of epilepsy was 21.6 years (SD=13.4). Groups were well matched demographically prior to surgery. A series of repeated measures ANOVAs were used to examine differences in cognitive outcome between the two pathology groups postoperatively.

Results: Results revealed significant 2-way interactions (group x time) on the following measures: Animals, VPA I, and RAVLT Delayed Free Recall and trends toward significance on COWAT and RAVLT Trials 1–5. Specifically, the MTS group demonstrated declines on these measures after surgery whereas the DUAL pathology group demonstrated unchanged or improved performance. There was a main effect of time on BNT and LMI, with both groups declining following surgery. There was also a trend toward a significant group effect on LM I with the MTS group performing more poorly than the DUAL group.

Conclusions: Unexpectedly, results suggest that dual pathology is associated with better cognitive outcome following epilepsy surgery than MTS alone, possibly reflecting reorganization of function in the context of a developmental lesion. Implications are discussed as well as directions for future research.

Correspondence: *Robyn M. Busch, Ph.D., Epilepsy Center, Cleveland Clinic, 9500 Euclid Avenue, P57, Cleveland, OH 44111. E-mail: buschr@ccf.org*

B.E. PRAYSON, L.L. FERGUSON, D.P. FLODEN & R.M. BUSCH. Differences in Postoperative Mood and Psychological Outcome Between Adults with Frontal and Temporal Lobe Epilepsy.

Objective: To examine differences in mood and psychological outcome after epilepsy surgery as a function of surgical resection site (i.e., temporal versus frontal).

Participants and Methods: Eighty-nine adults with medically intractable epilepsy (FLE=39, TLE=50) completed the Beck Depression Inventory – Second Edition (BDI-II) as a part of routine pre- and post-surgical neuropsychological evaluations. A subset of patients (n=72) also completed the Personality Assessment Inventory (PAI) before and after surgery. Groups were matched on age, education, FSIQ, and age at seizure onset. Repeated measures ANOVAs were used to examine group differences in mood and psychological symptoms over time.

Results: Significant 2-way interactions (group x time) were observed on the Somatization, Anxiety, and Anxiety Related Disorders PAI clinical subscales. There was also a trend toward a significant 2-way interaction on the BDI-II. Overall, the TLE group endorsed more symptoms of anxiety and depression as well as greater somatic complaints prior to surgery as compared to patients with FLE. TLE group responses indicated significant symptom improvement after surgery, whereas subscale scores for the FLE group remained largely unchanged. Main effects of time were observed on the Depression, Paranoia, Borderline, and Anti-social subscales of the PAI with scores improving from before to after surgery. There was also a main effect of group on the Depression and Mania subscales such that the FLE group endorsed fewer symptoms on these scales than the TLE group.

Conclusions: Results suggest differential effects of surgical resection site on mood and personality variables. Patients with TLE report greater psychological distress prior to surgery than those with FLE; however, many of their symptoms significantly improve after surgical resection with postoperative scores similar to those of FLE patients.

Correspondence: *Robyn M. Busch, Ph.D., Epilepsy Center, Cleveland Clinic, 9500 Euclid Avenue, P57, Cleveland, OH 44111. E-mail: buschr@ccf.org*

E. CHIN, J. BUCKWALTER, S.D. MARION, G. MATHERN, S. AMANO, J. LEE, R. WILSON & R. ASARNOW. Lateralization and Plasticity of Communication and Socialization Among Hemispherectomy Patients.

Objective: The surgical removal of one half of the brain, that is hemispherectomy (HE), secondary to treatment refractory epilepsy, provides a unique opportunity to study brain plasticity in action. The literature is mixed with regard to lateralization following HE, though it is known to be complex. In this study, we investigated long-term outcome of HE patients, hypothesizing that a history of left HE would result in worse communication and socialization vs. those with right HE.

Participants and Methods: Participants were 50 individuals recruited from the UCLA Pediatric Neurosurgery Program followed at varying intervals following left (n=32) or right (n=18) hemispherectomy (mean age at surgery = 4.26 years). The Vineland-II, a semi-structured interview served as a proxy of Communication, Daily Living Skills, and Socialization.

Results: No differences were found by side of resection in communication ($r = .13, p = .38$) and socialization ($r = .14, p = .35$) as well as the overall adaptive functioning ($r = .11, p = .44$). Rather, better communication was related to younger age at surgery ($r = -.31, p < .05$) and shorter seizure duration ($r = -.37, p < .01$). Better socialization was related to shorter seizure duration ($r = -.34, p < .01$).

Conclusions: The results of this study stand in contrast to previous, well-established models of language lateralization. The absence of typ-

ical lateralization effects is similar to a growing body of literature indicating a complicated picture of plasticity and functional reorganization following HE. In our sample of which left HE was most prominent, the remaining right hemisphere was likely able to support communication and socialization at least as well as the remaining left hemisphere of the right HE patients. Adding to this complexity, previous studies have shown differential patterns of lateralization across etiology.

Correspondence: *Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 150 N. Oakland Ave., Pasadena, CA 91101. E-mail: sdmarion@fuller.edu*

R.T. WILSON, S.D. MARION, E. CHIN, J. LEE, G. MATHERN, S. YU-DOVIN & R. ASARNOW. Verbal and Nonverbal Memory in Hemispherectomy: Lateralization Effects.

Objective: Given what is known about the left and right hemispheres, it is natural to suppose that hemispherectomy—a radical and often life-saving surgery in which one hemisphere is removed or disconnected—would yield profound respective impairments in verbally- or visually-mediated tasks. However, the literature is mixed, often based on case-studies, and includes few studies of memory. In this study, we examined lateralization of verbal and non-verbal memory following left (LH) and right (RH) hemispherectomy. We hypothesized that verbal memory would be better in individuals with a history of LH and that visual memory would be significantly better with a history of RH.

Participants and Methods: Participants were 25 patients recruited from the UCLA Pediatric Epilepsy Surgery Program (RH = 7; LH = 18) and brought back for a neurocognitive assessment at varying intervals following surgery. At the time of testing, participants ranged in age from 5 to 31 years of age ($M = 15.34$). The CVLT-C was used to measure verbal memory and the Doors Visual Recall test was used to measure nonverbal memory.

Results: Results revealed no effect for hemispherectomy side alone but did show a significant memory by hemispherectomy side interaction, $\eta^2 = .39$, $F(1, 23) = 14.39$, $p = .001$. Verbal memory was significantly better and within the average range in RH patients relative to LH patients, whose verbal memory was impaired ($t[23] = -2.37$, $p < .05$).

Conclusions: While the expected pattern of lateralization of verbal memory was demonstrated, we failed to observe significant differences between non-verbal memory by side of resection. Findings are consistent with and strengthen previous indications that verbal memory is more strongly lateralized than is visual memory, particularly given the fact that the CVLT is well-validated measure of mesial-temporal memory functioning. Findings also indicate that the nature of lateralization of visual memory is more complex.

Correspondence: *Sarah D. Marion, Ph.D., Psychology, Travis Research Institute, 150 N. Oakland Ave., Pasadena, CA 91101. E-mail: sdmarion@fuller.edu*

M. COHN, M. ST-LAURENT & M. MCANDREWS. Sarcasm Comprehension and the Temporal Lobes: Evidence from Temporal Epilepsy and Excision.

Objective: Neuroimaging and neuropsychological studies of theory-of-mind (i.e. ability to attribute the mental state of others) typically demonstrate orbitofrontal and amygdala involvement as well as temporal pole involvement when the tasks used have a narrative component. Our goal was to investigate sarcasm comprehension, a narrative theory-of-mind task, in individuals with unilateral temporal lobe epilepsy and temporal lobe excisions. We hypothesized that deficits would be greater in the excision group given the removal of the temporal pole and amygdala, and that performance in temporal lobe epilepsy may be related to atrophy in these regions.

Participants and Methods: We recruited individuals with temporal lobe epilepsy (17right, 17left), temporal lobe excision (15right, 14 left) and 15 healthy control participants. We used The Awareness of So-

cial Inference Test, which involves inferring the mental state of characters from video clips depicting sincere, deceitful and sarcastic exchanges. Performance on this task was compared across groups and we used voxel-based morphometry analyses of T1-weighted 3T MRI to investigate atrophy-sarcasm score relationship in the epilepsy groups.

Results: Basic theory-of-mind abilities were intact (sincere exchanges) but sarcasm comprehension was impaired in all patients groups and clinically relevant deficits ($>2sd$ relative to norms) were most frequent in the left excision group. In epilepsy, sarcasm comprehension was negatively correlated with left hippocampal and temporal pole grey matter atrophy, but not with amygdala atrophy.

Conclusions: The left temporal pole supports theory-of-mind abilities as it may be important in interpreting contextually-rich scripts by comparing them to stored, social semantic knowledge. Our results also suggest that mesial temporal lobe structures may also be important in integrating contextual information from disparate modalities given the noted deficits in all patient groups.

Correspondence: *Melanie Cohn, PhD, Krembil Neuroscience - Neuropsychology Clinic, UHN - Toronto Western Hospital, 4F-409, 399 bathurst, Toronto, ON M5T2S8, Canada. E-mail: melcohn@hmail.com*

A. DORFMAN, L. FERGUSON, P. KLAAS, J.S. HAUT & R.M. BUSCH. Frontal Lobectomy for Treatment of Intractable Epilepsy in Children: Cognitive Outcome as a Function of Side of Surgery.

Objective: To evaluate cognitive outcome as a function of surgical resection side (left vs. right) in pediatric epilepsy patients following frontal lobe resection (FLR).

Participants and Methods: Thirty-nine children (Mage=10.5 years, SD=2.6) that underwent FLR for refractory epilepsy completed routine pre and postsurgical neuropsychological evaluations that included measures of intelligence and memory. Repeated measures ANOVAs examined postsurgical changes in IQ and memory scores as a function of surgical side (left = 18; right = 21). Due to the relatively small sample sizes, effect sizes ($\eta^2 > 0.05$) were used to evaluate results rather than traditional p values.

Results: There were no significant differences between groups (right vs. left) on relevant demographic and seizure variables or presurgical cognitive performance. Significant two-way interactions (group x time) were observed on the Visual Immediate and Delayed Memory Indices of the Children's Memory Scale (CMS). The right surgical group showed postoperative improvements, while scores for the left surgical group remained largely unchanged. Results also revealed significant two-way interactions on the Verbal Delayed and Verbal Delayed Recognition Indices with postoperative improvements after left FLR compared to unchanged performance following right FLR. There was a significant main effect of time on the Verbal Immediate Memory Index with improved test performance following surgery. In contrast, there was a general decline on the Verbal Comprehension Index of the WISC III/IV following surgery. No significant effects were found on other WISC Indices.

Conclusions: Results suggest favorable memory outcomes following FLR in children with most patients demonstrating unchanged or improved performance. Side of surgery appears to play a role in memory with improved scores on measures associated with ipsilateral temporal lobe functioning. Results are discussed in the context of existing literature.

Correspondence: *Ara Dorfman, Cleveland Clinic, 9500 Euclid Ave., P-57, Cleveland, OH 44195. E-mail: dorfmaa@ccf.org*

M.F. DULAY, W.N. HAVINS, K.A. AGBAYANI, J.T. CRAWLEY, J. WAGUSPACK, S. FUNG, C. KARMONIK, T. TRASK & R.G. GROSSMAN. White and gray matter integrity and cognitive impairments in patients with epilepsy with and without major depression.

Objective: Individuals with depression are at greater risk of cognitive impairment compared to individuals without depression. Previous studies suggested that alterations in white matter tracts and gray matter

structures may contribute to impaired mood regulation and cognitive impairment. Frontal and temporal white matter (WM) tract integrity, gray matter volumes and neuropsychological test performance was compared between patients with temporal lobe epilepsy (TLE) with and without major depression.

Participants and Methods: Thirty-four patients (16 males, mean age of 31.4 years) with TLE (19 with a left-sided focus; disease duration of 18.4 years) received neuroimaging and neuropsychological assessment. The MINI International Neuropsychiatric Inventory and clinical interview were used to diagnose Major Depressive Episode. Gray matter volumes were quantified with voxel-based morphometry. Fractional anisotropy (FA) was computed for white matter tracts using TracVis with manual tracings.

Results: Thirty-nine percent of individuals met DSM-IV criteria for major depression. Based on MANOVA, depressed patients with TLE had reduced superior longitudinal fasciculus ($F[1,31]10.2, p<0.01$), arcuate fasciculus, uncinate fasciculus, cingulum bundle and hippocampal volumes compared to patients without depression. Depressed patients performed poorer on tests of verbal and visual learning ($F[1,30]9.2, p<0.01$), naming to confrontation, cognitive speed and executive functioning (e.g., unstructured problem solving, impulsivity) compared to patients without depression with results varying based on side of seizure foci.

Conclusions: Individuals with temporal lobe epilepsy and a DSM-IV diagnosis of major depression had reduced gray and white matter integrity and greater cognitive impairment compared to individuals without depression. White and gray matter alterations may explain why some individuals with epilepsy are susceptible to depressive disorders and cognitive impairment.

Correspondence: *Mario F. Dulay, Ph.D., Neurosurgery, The Methodist Hospital Neurological Institute, 6560 Fannin, Suite 944, Houston, TX 77030. E-mail: mdulay@tmhs.org*

M. GERSTLE, K.D. EVANKOVICH & M.L. CHAPIESKI. Relative Sensitivity of IQ Scores to Parental Education and Seizure-Related Variables.

Objective: Epilepsy in childhood is a common neurological condition that presents with various etiologies and sequelae. Children with epilepsy have been found to be at increased risk of cognitive difficulties; however, research remains mixed regarding the sensitivity of seizure-related variables to intellectual function. Further, there is continued debate about the validity of IQ scores (particularly verbal-nonverbal discrepancies) as potential signs of lateralized brain dysfunction in children and whether IQ scores should inform surgical intervention. The present study had two main aims: 1) to determine what factors predict IQ performance in children with medically intractable seizures, and 2) whether IQ was useful in establishing seizure focus laterality in these children.

Participants and Methods: Ninety-two right-handed children ($M=13.14$ years, $SD=3.11$) with a Full Scale IQ > 55 were evaluated prior to epilepsy surgery. Sociodemographic variables and medical indicators (e.g., age of seizure onset, seizure frequency, lifetime duration, seizure focus, number of medications) were also obtained.

Results: Results of stepwise regression analyses indicated that parental education and seizure frequency accounted for the most variance in global IQ ($p=.001$), with parental education accounting for the greatest proportion ($p=.001$). For specific IQ composite scores, parental education only accounted for the most variance in the final models, and seizure variables were not generally predictive of IQ subdomains (exception: number of medications was inversely related to the Processing Speed Index). In regards to seizure focus, Verbal-Performance IQ discrepancies were not predictive of laterality.

Conclusions: In sum, IQ scores do not appear particularly sensitive to seizure-related variables, with sociodemographic variables (i.e., parental education) generally better predictors of IQ test performance in children with epilepsy. Additionally, VIQ-PIQ discrepancies were not found to be a useful indication of seizure focus laterality.

Correspondence: *Melissa Gerstle, Ph.D., Department of Pediatrics-Psychology, Baylor College of Medicine/Texas Children's Hospital, 6701 Fannin St., Ste. 1630, Houston, TX 77030. E-mail: mxgerstl@texaschildrens.org*

L. GOTTLIEB, F.A. ZELKO, D. KIM & D.R. NORDLI. Application of a GAI-CPI Analytic Framework to Wechsler Intelligence Scales in Pediatric Epilepsy.

Objective: Cognitive proficiency (CP) is a sensitive gauge of neurologic status but is not typically viewed in relation to focal cerebral function. This study examined CP and its relationship to general intellectual ability, seizure focus, and age of epilepsy onset in pediatric epilepsy patients.

Participants and Methods: WISC/WAIS universal short-forms were developed from the six shared Wechsler subtests. The General Abilities Index (GAI)-Cognitive Proficiency Index (CPI) analytic framework was then applied to a retrospective chart review of 131 patients (M age=11.2, $SD=3.63$) evaluated within a tertiary-care pediatric epilepsy center.

Results: CPI scores ($M=80.8$, $SD=20.1$) were significantly lower than GAI scores [$M=87.0$, $SD=15.5$; $t(130)=4.75$, $p<.001$], with greater discrepancies (i.e., GAI-CPI difference larger) occurring in individuals with lower full scale IQs [$r(129)=-.32$, $p<.001$]. Regarding seizure foci, greater GAI-CPI discrepancies were observed in right-temporal ($M=9.07$, $SD=15.8$) than left-temporal subjects [$M=-2.15$, $SD=12.9$; $t(28)=2.12$, $p=.04$]. Earlier epilepsy onset was associated with more global neurocognitive dysfunction, as reflected by slowing of the electroencephalographic posterior dominant rhythm [$r(104)=.34$, $p<.001$; $r(104)=.18$, $p=.07$ after controlling for participant age] and lower full scale IQs [$r(111)=.19$, $p=.05$].

Conclusions: Deficits of CP are a defining characteristic of pediatric epilepsy and serve as an important marker of neurocognitive status, especially when seizures originate from a primary epileptogenic focus within the right-temporal lobe. Seizures in early childhood must be controlled in order for the brain to develop functional connections and networks, and efforts are needed to identify interventions and accommodations that can effectively remediate CP deficits when they arise.

Correspondence: *Lev Gottlieb, Ann & Robert H. Lurie Children's Hospital of Chicago, Northwestern University, 710 N Lake Shore Dr, Suite 1205, Chicago, IL 60611. E-mail: Lev.Gottlieb@u.northwestern.edu*

E. HEIDEMAN, D. WABER, C. VEGA & K. BOYER. Depressive Symptoms Decrease in Pediatric Epilepsy Patients Post-Surgery.

Objective: Pediatric epilepsy is associated with both internalizing and externalizing symptoms (Spencer & Huh, 2008). Children who undergo epilepsy surgery can exhibit a significant reduction in behavioral problems after surgery, typically associated with seizure freedom (Lendt et al., 2000). Less is known about potential benefits of epilepsy surgery with respect to emotional symptoms. The present study evaluated internalizing and externalizing symptoms pre- and post-surgery, as well as the potential role of seizure outcome in any observed changes. We hypothesized that symptoms would decline post-surgery and that the effect would be most pronounced in those patients with positive seizure outcome.

Participants and Methods: Participants were 42 patients between the ages of 6-20 who underwent a comprehensive epilepsy evaluation and surgery. Parents completed the BASC2 before and after surgery. Seizure outcome was quantified dichotomously (seizure free vs. not seizure free). A repeated measures ANOVA was implemented to assess changes in symptoms and to test for an effect of seizure outcome.

Results: The hypothesized outcomes were documented for depressive symptoms but not for the other scales. The level of depressive symptoms decreased from pre- ($M=56.61$, $SD=13.04$) to post-surgery ($M=53.35$, $SD=11.03$). There was a main effect of change ($F(1, 40) = 7.10$, $p=.01$) as well as a marginally significant change x seizure outcome interaction ($F(1, 40) = 3.22$, $p=.08$), such that the change was greater in those with a positive seizure outcome. Ten participants reported elevated symptoms of depression (in the at-risk or clinical range). All but one had reduced symptoms after surgery, with only 4 in the elevated range.

Conclusions: Depressive symptoms decrease post epilepsy surgery, and this decrease is related to some extent to seizure outcome. Whether this decrease in depressive symptoms is neurologically based or secondary to other psychological or quality of life factors remains to be determined. Correspondence: *Elizabeth Heideman, Boston Children's Hospital, 300 Longwood Ave., Boston, MA 02115. E-mail: elizabeth.heideman@childrens.harvard.edu*

S.W. HILL & S.D. GALE. A Case of Amnesia Following Subtemporal Selective Amygdalohippocampectomy: Implications for Practice.

Objective: Profound memory impairment, or amnesia, following unilateral mesial temporal lobe resection for treatment of temporal lobe seizures is rare; however, such cases can provide important information about neurocognitive functions and inform clinical practice. Through a case example we aim to identify preoperative factors that may have been associated with increased risk for profound post-operative memory impairment and we discuss their implications for clinical practice.

Participants and Methods: We present a case of anterograde amnesia following left sided subtemporal selective amygdalohippocampectomy in a 29 year old right handed female. The patient underwent neurocognitive evaluations pre-operatively and both 19 and 33 months post-operatively. The pre-operative evaluation also included MRI, scalp video-EEG, invasive monitoring, PET, and Wada testing which are reviewed. Results from post-operative evaluations are also discussed including neuropsychological testing, video-EEG, and MRI.

Results: Pre-operative evaluations showed conflicting results with evidence of right hemisphere dysfunction based on neuropsychological testing and Wada, bi-hemispheric structural changes on MRI, and a left mesial temporal seizure focus based on depth-wires. Post-operatively, the patient had profound verbal and visual memory impairment but other cognitive functions were relatively stable.

Conclusions: The current case provides support for the importance of pre-operative neuropsychological evaluation in predicting risk for post-operative cognitive decline. In addition, this case highlights the significance of bilateral cerebral dysfunction to post-operative amnesia. Neurocognitive outcome following unilateral amygdalohippocampectomy is discussed in the context of pre-operative evaluations, prior published cases of amnesia following mesial temporal lobe resection, and neuroimaging findings.

Correspondence: *Stacy W. Hill, Ph.D., Clearwater Neurosciences, 3326 4th Street, Suite 6, Lewiston, ID 83501. E-mail: stwhill0@gmail.com*

L.M. JACOLA, K. WASHINGTON, E. GUSTAFSON, M. KOHRMAN & S.J. HUNTER. Executive Function and Maladaptive Behavior Before and After Surgical Intervention in Children with Epilepsy.

Objective: Children with epilepsy demonstrate higher rates of maladaptive behavior and psychopathology when compared to children with other chronic illnesses. The effect of surgical intervention on the development of behavior in this population remains unclear, and studies have not well elucidated the relationship between neurocognition and behavior post-intervention. Executive functioning (EF) abilities have been shown to be related to maladaptive behavior in many pediatric populations. The present study investigated the pattern of maladaptive behavior and EF in children with epilepsy before and after surgical intervention. We hypothesized that parent-report measures of these constructs prior to intervention would account for unique variance in the presence of internalizing and externalizing behavior after surgery.

Participants and Methods: Twenty-two children with epilepsy completed a neuropsychological evaluation before and after surgical intervention. Participants were between the ages of 2 years, 5 months and 17 years, 6 months at the time of first assessment (M = 15; F = 7). Caregivers completed the Behavior Assessment System for Children, 2nd Edition (BASC-II) as a measure of behavior and the Behavior Rating Inventory of Executive Function (BRIEF) as a proxy measure of EF.

Results: No significant mean differences were found between pre- and post-intervention measures of maladaptive behavior; borderline clinical

elevations were seen on subscales measuring atypical behavior, withdrawal, and inattention. In contrast, borderline clinical elevations were present on all composite measures on the BRIEF and persisted across assessments. Only behavior prior to intervention was an independent predictor of behavior post-intervention; thus, our hypotheses regarding the predictive utility of EF were not supported.

Conclusions: Results contribute additional information regarding the presence and development of maladaptive behavior and EF in children with epilepsy who undergo surgical intervention.

Correspondence: *Lisa M. Jacola, Ph.D., Department of Psychology, St. Jude Children's Research Hospital, 262 Danny Thomas Place, Mail Stop 740, Memphis, TN 38105. E-mail: lisa.jacola@gmail.com*

J. JANECEK, F.S. WINSTANLEY, D. SABSEVITZ, M. RAGHAVAN, W. MUELLER, J. BINDER & S. SWANSON. Naming Outcome after Left or Right Temporal Lobectomy in Patients with Bilateral Language Representation by Wada Testing.

Objective: To examine language outcome after left or right anterior temporal lobectomy (ATL) in epilepsy patients with bilateral language representation on intracarotid sodium amobarbital (Wada) testing.

Participants and Methods: Twenty-two epilepsy patients with bilateral language on Wada testing (laterality index between -50 and 50) underwent right ATL (n = 10) or left ATL (n = 12). All patients were administered the Boston Naming Test pre-operatively and six months post-operatively.

Results: LATL patients showed greater post-operative decline than RATL patients on the Boston Naming Test (LATL M = -1.5; RATL M = 1.8, p = .04). Group differences were also observed in Wada subtest performance. Performance on the Wada naming items was better in the non-surgical hemisphere (M = 2.5) than the surgical hemisphere (M = 1.5) in the RATL group (p = .02), but there was no difference in non-surgical hemisphere (M = 1.8) and surgical hemisphere (M = 1.4) Wada naming performance in the LATL group (p = .17).

Conclusions: LATL patients with bilateral language are at greater risk for naming decline than RATL patients with bilateral language. Based on Wada testing, only the RATL patients with bilateral language demonstrated better naming abilities in the non-surgical hemisphere compared to the surgical hemisphere, which may explain the group differences in language outcome.

Correspondence: *Julie Janecek, PhD, Medical College of Wisconsin, 9200 W. Wisconsin Ave., Milwaukee, WI 53226. E-mail: juliekjanecek@gmail.com*

M.E. LENTZ, L.K. KLOSS, S.D. GALE, S.W. HILL & C.M. PEARSON. Differences in Personality Assessment Inventory (PAI) Profiles For Individuals With Focal Versus Non-Epileptic Seizures.

Objective: Epilepsy research has shown that different areas of focal seizure onset (e.g., temporal lobe onset (TLE) vs. frontal lobe onset (FLE)), may cause different patterns of emotional and/or personality dysfunction. The literature also indicates that individuals with non-epileptic seizures (NES) tend to have more diffuse and severe emotional and personality difficulties. However, few studies have compared Personality Assessment Inventory (PAI) results amongst these groups. The present study aims to determine the relative differences in PAI profiles for people with TLE, FLE, and NES.

Participants and Methods: Subjects were 302 patients admitted to the St. Joseph's Hospital and Medical Center Epilepsy Monitoring Unit (EMU) in Phoenix, AZ (TLE = 120, FLE = 7, NES = 175). The PAI was administered as part of a comprehensive neuropsychological evaluation. MANCOVAs were conducted to determine significant differences between groups on PAI validity, clinical, and supplemental scales. Covariates were years of education and years since seizure onset.

Results: A p value of $\leq .05$ was required for significance. In comparison to the FLE group, TLE patients had significant scale elevations on Schizophrenia, Antisocial features, and Nonsupport. The TLE group scored higher than the NES group on Schizophrenia-psychotic features

and Antisocial features. The NES group scored higher than the TLE group on Somatic complaints, Anxiety, Depression, Schizophrenia-social detachment, Borderline Features, Stress, and Nonsupport. The NES group scored significantly higher on Anxiety-psychological and Nonsupport than the FLE group.

Conclusions: Epileptic foci and NES impact the pattern of relative scale elevations on the PAI. TLE patients report higher degrees of social detachment and emotional dysregulation than FLE patients. NES patients report greater dysfunction than either focal group, primarily in somatic concerns and more severe emotional and personality dysfunction.

Correspondence: *Meagan E. Lentz, Psy.D., Clinical Neuropsychology, Barrow Neurological Institute, 222 W. Thomas Road, Suite 315, Phoenix, AZ 85013. E-mail: maelentz@gmail.com*

M.E. LENTZ, C.L. BRESCASIN, M.D. SHAPIRO, S.V. PACKWOOD & C.M. PEARSON. Gender Differences on the Personality Assessment Inventory (PAI) in Patients with Non-Epileptic Seizures (NES).

Objective: Epilepsy research has shown that individuals with non-epileptic seizures (NES) tend to have more severe dysfunction in personality and emotional functioning than those with EEG-confirmed seizures. Research on NES gender differences suggests males display more severe emotional maladjustment on personality measures. However, no research has examined NES gender differences on the Personality Assessment Inventory (PAI), which the present study aims to do.

Participants and Methods: Subjects were 116 patients (NES=59, Epilepsy (EPI) =57) admitted to the St. Joseph's Hospital and Medical Center Epilepsy Monitoring Unit in Phoenix, AZ. EEG monitoring determined groups. The PAI was administered as part of a comprehensive neuropsychological evaluation. MANCOVAs were conducted to determine significant differences between NES and EPI groups, gender differences within NES subjects, and within-gender differences between NES and EPI subjects on PAI validity, clinical and supplemental scales. Covariates were years of education and years since seizure onset.

Results: A p value of $\leq .05$ was required for significance. In comparison to EPI, the NES group had significantly greater elevations on scales of conversion, somatic concerns, and somatization. Comparison of gender differences within the NES group revealed males to have greater elevations on self harm and antisocial features. Within gender differences between NES and EPI showed that NES subjects of both genders had higher elevations on somatic complaints and/or conversion than EPI counterparts. Males with NES also had higher levels of physical aggression than males with EPI

Conclusions: As measured by the PAI, NES is related to a greater degree of somatic and conversion symptoms for males and females than for those with epilepsy. For males, NES also results in greater physical aggression than EPI. Gender differences within NES subjects suggests males to have greater self-injurious and antisocial behaviors than females.

Correspondence: *Meagan E. Lentz, Psy.D., Clinical Neuropsychology, Barrow Neurological Institute, 222 W. Thomas Road, Suite 315, Phoenix, AZ 85013. E-mail: maelentz@gmail.com*

R.B. MARTIN & J.I. BREIER. Memory and Executive Functions in Children Following Frontal and Temporal Lobotomies.

Objective: Memory declines following temporal lobotomy (TLE) and declines in executive functions (EF) following frontal lobotomy (FLE) for seizure remediation have been consistently found in adults. Findings from studies of pediatric epilepsy surgery are less consistent. This study compares children who have undergone TLE or FLE in either hemisphere for intractable epilepsy.

Participants and Methods: Participants were 36 consecutive (19 female; 31 right handed) children who underwent pre- and post-surgical neuropsychological evaluations from 1990 - 2011. The average age at the first evaluation was 13. The average time between testing was 4.5 years. Verbal memory was assessed with the CVLT or Verbal Se-

lective Reminding and TOMAL or WRAML story memory. Nonverbal memory was assessed with Visual Selective Reminding. EF was assessed with FAS, WCST, and Trails A & B. Difference scores (post - pre) were compared for each variable by lobe and hemisphere controlling for time between assessments, though these were unavailable in some cases.

Results: Results showed that the LTLE group had the greatest decline in FSIQ, VIQ, and PIQ ($SS\Delta = -10.98, -4.31, \& -12.87$, respectively) though not statistically significant ($p = .19, .16, \& .43$). For story memory, there was a significant effect of lobe ($p < .05$); the TLE group declined ($z\Delta = -0.73$) and the FLE group improved ($z\Delta = 2.09$). For the WCST categories achieved there was the opposite effect; the FLE group declined ($z\Delta = -1.07$), while the TLE group improved ($z\Delta = 1.65$; $p < .01$). Effects of lobe by hemisphere were evident for verbal fluency with the LTLE group declining the most ($z\Delta = -2.28$). There was a trend ($p = .06$) for a decline in Trails B for the LTLE group ($z\Delta = -1.47$).

Conclusions: Results are consistent with literature suggesting patients may perform more poorly after LTLE than RTLE. Though our sample was small, there is evidence for expected changes in memory and EF following TLE and FLE. However, aspects of EF also decline in the TLE group suggesting these skills may be affected.

Correspondence: *Rebecca B. Martin, M.A., Neuropsychology, University of Houston, 4505 Cullen, Houston, TX 77030. E-mail: rmartin29@gmail.com*

R.B. MARTIN & M.L. CHAPIESKI. Verbal and Nonverbal Memory Following Surgical Intervention for Intractable Epilepsy in Children.

Objective: Declines in verbal memory following dominant hemisphere temporal lobectomies for intractable seizures have been consistently found in adults. Changes in nonverbal memory are less consistent. The findings from studies of pediatric epilepsy surgery are mixed for verbal and nonverbal memory. Most studies compare left (LTLE) and right temporal (RTLE) resections. This study included two comparison groups: extratemporal resections and intractable seizures without surgery while also considering seizure control and age at surgery as moderating factors.

Participants and Methods: Participants were 46 (23 female) children with a diagnosis of epilepsy who underwent two neuropsychological evaluations. The average age at baseline testing was 12.62 years (range 5 - 17), average age at seizure onset was 6.82 years and mean IQ was 89. Verbal learning (VL), paired associates (PA) and story memory (SM) were used as measures of verbal memory. Visual selective reminding (VSR) and facial memory (FM) were used for nonverbal memory. Repeated measures ANOVAs were used to test the difference between groups pre- and post-surgery on verbal and nonverbal memory.

Results: Repeated measures ANOVA showed no difference between the groups on verbal memory. However, there was a significant decline in VL in LTLE group only. For the non-surgery comparison group, VL improved significantly over time. For FM, there was no difference between groups; however all groups declined. Neither seizure frequency nor age at surgery had a significantly predicted the declines in verbal and nonverbal memory. VSR did not significantly decline.

Conclusions: Our findings for a decline in verbal memory following LTLE in children are consistent with findings in the adult literature. Interestingly, the comparison group without surgery improved in verbal memory. Nonverbal memory in our study did not prove to be hemisphere specific as each group evidenced a decline or stability over time. Correspondence: *Rebecca B. Martin, M.A., Neuropsychology, University of Houston, 4505 Cullen, Houston, TX 77030. E-mail: rmartin29@gmail.com*

A. MAZUR-MOSIEWICZ, H. CARLSON, J. DYKEMAN, T. LENDERS, B.L. BROOKS & S. WIEBE. The Effectiveness of Cognitive Rehabilitation in Epilepsy Surgery Patients: Systematic Review.

Objective: Cognitive rehabilitation (CR) is a well researched and widely accepted therapeutic option for a variety of neurocognitive problems. Recently, CR has been proposed as an option for patients who experi-

ence cognitive difficulties following epilepsy surgery. However, there is some inconsistency in reporting the efficacy of CR in this patient population. As such, a systematic review of the literature was conducted to (1) explore the most commonly used CR approaches in patients undergoing resective epilepsy surgery; and (2) review the effectiveness of specific CR strategies.

Participants and Methods: A comprehensive literature search using MEDLINE, EMBASE, CINAHL, PsycINFO, and EBM Reviews (including the Cochrane database) was used to identify articles published before August 2012 and related to CR in patients who underwent focal resective epilepsy surgery. All articles meeting inclusion and exclusion criteria were reviewed for further selection.

Results: Of 1189 citations identified, 44 investigated the effectiveness of specific CR strategies in patients with either left or right temporal lobe resections. CR strategies that are used with epilepsy surgery patients include: internal compensatory strategies; external memory aids; psychoeducation; verbal and visual memory training; as well as exercises of attention and executive functions.

Conclusions: CR has a significant positive impact on verbal learning and memory performance. However, improvements seem to also be significantly related to the site of the surgery, attention, mood, age, and education. More research is needed to fully elucidate the efficacy of CR in patients undergoing resective epilepsy surgery.

Correspondence: *Anya Mazur-Mosiewicz, Alberta Children's Hospital, 2888 Shaganappi Trail NW, Neurosciences, Calgary, AB T3B 6A5, Canada. E-mail: Anya.Mazur-Mosiewicz@albertahealthservices.ca*

A. MAZUR-MOSIEWICZ, H. CARLSON, J. DYKEMAN, B.L. BROOKS & S. WIEBE. Employment of Symptom Validity Measures in Longitudinal Neuropsychological Evaluation of Epilepsy Surgery Patients: Systematic Review.

Objective: Insufficient patient effort during neuropsychological assessments has the potential to provide non-representative results and suggest a misleading neuropsychological profile. Inclusion of symptom validity measures is often considered a standard element of modern pediatric and adult assessment, particularly if the goal is to obtain a profile of strengths and weaknesses and/or an estimation of changes in performance over time. Symptom validity measures are particularly important in pre- and post-surgical evaluation in epilepsy surgery patients to ensure that the profile of strengths and weaknesses is reflective of true cognitive functioning. As such, a systematic literature review was conducted that focused on change in cognitive status following epilepsy surgery. The goal was to (1) identify the percentage of studies that report formal measures of symptom validity, and (2) explore the most commonly used measures of testing validity, both stand-alone and embedded.

Participants and Methods: A comprehensive search was undertaken using the PubMed, EmBase, and Cochrane databases, and identified articles published between 1991 and 2010 that report neuropsychological data from before and after focal resective epilepsy surgery. All articles meeting the inclusion and exclusion criteria were reviewed for further selection.

Results: The search identified 5254 citations related to epilepsy surgery, 148 of which included longitudinal neuropsychological outcome variables in pediatric and adult patients with left and right temporal lobe surgeries. Analysis suggested that approximately two percent of the studies used symptom validity measures including indices from the Minnesota Multiphasic Personality Inventory, Second Edition, and California Verbal Learning Test, Second Edition.

Conclusions: Symptom validity indices are largely underreported or not utilized in studies that investigate neurocognitive outcomes of epilepsy surgery.

Correspondence: *Anya Mazur-Mosiewicz, Alberta Children's Hospital, 2888 Shaganappi Trail NW, Neurosciences, Calgary, AB T3B 6A5, Canada. E-mail: Anya.Mazur-Mosiewicz@albertahealthservices.ca*

S. PACKWOOD, C.M. PEARSON, L.K. KLOSS & M. LENTZ. Wechsler Adult Intelligence Scale-Fourth Edition Performance in Temporal Lobe Epilepsy.

Objective: The Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) is a relatively new tool in the presurgical workup of temporal lobe epilepsy patients. The present study investigates the factor structure of the WAIS-IV in a temporal lobe epilepsy (TLE) sample.

Participants and Methods: Forty-eight patients with intractable temporal lobe epilepsy completed the core WAIS-IV subtests. Means for age and education were 42.52 years (SD = 13.09) and 13.33 years (SD = 2.23), respectively. The mean age of diagnosis was 22.60 (SD = 15.98). Fifty percent of the sample were diagnosed with left TLE and the other half was diagnosed with right TLE. Ninety percent of participants were right-handed. An exploratory factor analysis of the core subtests from the WAIS-IV was conducted to assess the WAIS-IV factor structure in epilepsy patients. A secondary analysis was also performed wherein the number of factors to be extracted was set to 4 to match the current WAIS-IV structure.

Results: The first analysis produced three factors. The first and second factors contained subtests from the Verbal Comprehension (VCI) and Perceptual Reasoning (PRI) Indices, accounting for 25.61 and 21.21 percent of the total variance, respectively. Subtests from both the Processing Speed (PSI) and Working Memory (WMI) Indices loaded on the third factor, which accounted for 20.40 percent of the total variance. The secondary analysis resulted in the expected factors, with the exception of the Arithmetic subtest, which loaded on the verbal comprehension factor. The verbal comprehension, perceptual reasoning, working memory, and processing speed factors accounted for 24.97%, 19.86%, 11.94%, and 17.88% of the variance, respectively.

Conclusions: Two factors emerged that were consistent with the VCI and PRI from the original WAIS-IV normative studies. A third factor that included subtests from the PSI and WMI was also observed. The overall implications of these findings as they relate to epilepsy were considered.

Correspondence: *Sonia Packwood, Ph.D., Clinical Neuropsychology, Barrow Neurological Institute, 2868 S 27th Ave, Phoenix, AZ 85041. E-mail: Sonia.Packwood@DignityHealth.org*

C.M. PEARSON, S.D. GALE & S.W. HILL. Material Specific Memory Impairment Across Multiple Age Cohorts in a Temporal Lobe Epilepsy Sample.

Objective: Previous research has suggested that material specific memory impairment in epilepsy is most apparent in adolescent and middle-aged adult patients (Helmstaedter & Elger, 2009). Onset of epilepsy prior to complete hemispheric specialization may be a factor. Additionally, older adults with temporal lobe epilepsy (TLE) may display less material specific memory impairment due to a generalized memory decline and a chronic reduction of mental reserve. The present study examined these concepts in the context of right and left TLE with congruent mesial temporal sclerosis (MTS).

Participants and Methods: Seventy-nine individuals with right (n = 38) or left TLE between the ages of 20 and 64 were divided into 6 equal age cohorts to examine the interaction between age and material specific memory deficits. All patients had MRI evidence of MTS. A one-way ANOVA using the age-corrected total learning and delayed recall T-scores from the BVMT-R and RAVLT was conducted.

Results: Between groups analysis revealed only one interaction involving age and RAVLT delayed recall ($p < 0.006$) with the youngest cohort outperforming the second, fifth, and sixth (oldest) cohorts. All other interactions were found to be nonsignificant. No consistent pattern supporting age differences, compared to normative data, in material specific memory deficits in the context of TLE and MRI verified MTS was observed. Similarly, the proportion of TLE patients with material specific memory impairment did not differ between cohorts.

Conclusions: These findings were not consistent with previous work suggesting that older adults with TLE show less material specific memory impairment. Reasons for these discrepancies are discussed.

Correspondence: *Caleb M. Pearson, Psy.D., Neuropsychology, Barrow Neurological Institute, 222 West Thomas Road, Suite 315, Phoenix, AZ 85013. E-mail: caleb.pearson@gmail.com*

S. SCHAFFER, Y. CUKIER & G. CHAYA. Ability of the ACS Faces Subtest to Lateralize Patients with Right Seizure Focus.

Objective: One of the primary goals of pre-surgical neuropsychological evaluations in patients with intractable epilepsy is to assist in lateralizing seizure focus. However, the common belief that verbal vs. visual memory performance can differentiate left vs. right seizure focus, respectively, is somewhat apocryphal. While we have become quite proficient at identifying left-sided seizures, we have been slow to find measures that reliably detect right temporal lobe dysfunction.

Participants and Methods: Twenty patients with intractable epilepsy were given the Faces and Social Perception subtests from the WAIS-IV ACS battery, as part of a pre-surgical neuropsychological evaluation. A recent pilot study demonstrated that neuropsychological data is most concordant with interictal activity. Interictal lateralization was established based on video-EEG recordings (Left =7, Right =7, and Non-lateralizing=9). Group differences were examined using one-way ANOVA, chi square, and linear regression.

Results: The groups did not differ in their performance on the Faces II Content score or on any of the Social Perception subtests; however, the Faces II Spatial score differentiated the groups across all analyses, despite the small sample size. All of the left-lateralized patients exhibited intact performance ($ss \geq 7$), while 71% of the right-hemisphere patients had a scaled score ≤ 6 ($\chi^2=7.78$, $p < .01$). Further, the Faces Spatial score was the only variable to predict a significant amount of the variance in interictal lateralization ($p < .01$), despite inclusion of several verbal tests known to be good predictors of left seizure focus.

Conclusions: Despite the widely held belief that verbal and visual measures lateralize to the left and right hemispheres respectively, such trends have not actually been borne out in the literature. There are currently no measures in widespread use that reliably lateralize to the right hemisphere. These results suggest that the ACS Faces-Spatial task may be a first step in reversing this trend.

Correspondence: *Sarah Schaffer, Ph.D., Hofstra - NSLIJ School of Medicine, 611 Northern Blvd, Suite 150, Great Neck, NY 11021. E-mail: sschaffer1@nshs.edu*

L. SEPETA, M. MEHTA, B. XU, L.A. ZIMMARO, W.H. THEODORE, W.D. GAILLARD & M.M. BERL. Hippocampal Activation during Preoperative Functional MRI Across the Life Span in Epilepsy.

Objective: fMRI activation of the hippocampal formation (HF) may yield information for surgical planning. As memory fMRI is methodologically challenging, other methods to study HF activation are necessary. Thus, we examined lateralization indices (LI) of HF activation during a language task in pediatric and adult epilepsy populations (EPI) compared to controls (CON).

Participants and Methods: Children and adults with left hemisphere focal epilepsy had normal MRI (Pediatric: EPI, $n=16$, mean age=10.1, $SD=2.3$; CON, $n=32$; mean age=9.1, $SD=2.3$; Adult: EPI, $n=38$, mean age=27.3 \pm 9.27; CON, $n=59$, mean age=26.5 \pm 7.74). We used 3T fMRI with age-level adjusted auditory description decision task. Image processing and analyses were conducted in SPM8.

Results: For children, HF LI did not differ between the two groups ($p=0.89$) and was bilateral [EPI Mean LI: -0.01 (7 bilateral (B), 4 left (L), 3 right (R)); CON Mean LI: 0.0 (10 B, 6 L 5 R)]. For adults, HF LI was similar between groups ($p=0.37$) and was left lateralized [EPI Mean LI: 0.36 (4 B, 30 L, 4 R); CON Mean LI: 0.44 (6 B, 46 L, 7 R)]. In adults, the pattern was related to language lateralization; patients and controls with left lateralized language ($n=90$) showed mostly left lateralized HF activation (9 B, 74 L, 7 R), while those with atypical language ($n=7$; bilateral, right, or crossed dominance) showed predominantly right lateralized activation (1 B, 2 L, 4 R). For children, this pattern was not observed (typical language: 16 B, 5 L, 7 R; atypical language: 1 B, 5 L, 2 R).

Conclusions: Irrespective of diagnosis, children demonstrated bilateral HF activation, while adults showed left-lateralized activation. For adults, HF lateralization was related to language lateralization, but not for children. This bilateral HF activation in children may be indicative of less material-specific lateralization of memory function than in adults. This developmental difference may explain why children have better memory performance following surgical resection compared to adults.

Correspondence: *Leigh Sepeta, Children's National Medical Center, 111 Michigan Ave, NW, Washington, DC 20010. E-mail: lsepeta@cnmc.org*

E. STAIKOVA & W.S. MACALLISTER. Selective Mutism Status-Post Left Temporal Resection in Children with Treatment-Resistant Epilepsy: a Report on Two Cases.

Objective: The relation between language problems and anxiety has been well documented in the general population. One of the behavioral manifestations of anxiety is selective mutism. The purpose of this case study was to examine the neuropsychological profiles and clinical sequelae of selective mutism in two children with a history of a left temporal resection surgery for treatment-resistant epilepsy.

Participants and Methods: Both participants underwent a comprehensive outpatient neuropsychological evaluation as part of a post-surgical neurological follow-up that included assessment of language abilities. Social and emotional functioning was assessed via parental report, review of school records, and direct observations of children during the evaluation. A qualitative comparison of the two cases was performed.

Results: Both children demonstrated impairments in language-related academic skills and met criteria for at least one language-based disorder (e.g., reading disorder, expressive language disorder). Both children also demonstrated notable social anxiety manifesting as selective mutism post-surgically. In one case refusal to speak was noted prior to the surgery, while in the other symptoms began following the procedure and were observed three years later.

Conclusions: The relation between language impairment and anxiety has not been examined in epilepsy. We described two cases of selective mutism in children with intractable epilepsy and a left temporal resection. This has important clinical implications for considering potential outcomes of the procedure.

Correspondence: *Ekaterina Staikova, M.A., NYU Langone Medical Center, 550 First Avenue, New York, NY, NY 10016. E-mail: katya.staikova@gmail.com*

A.K. STEFANATOS & N.L. NUSSBAUM. Psychosocial Outcomes of Children With Intractable Epilepsy: A Comparison of Pre- and Post-Surgical Functioning.

Objective: The objective of this study was to examine changes in psychosocial functioning of children with intractable epilepsy following a resective surgical intervention.

Participants and Methods: Archival records of 13 children (ages 6 to 17) diagnosed with intractable epilepsy were reviewed. Patients were initially referred for a comprehensive neuropsychological evaluation by a pediatric epilepsy neurosurgery team in order to characterize pre-operative functioning. During this evaluation, psychosocial and emotional functioning was assessed using a parent-report measure (Achenbach Child Behavior Checklist). Approximately 1 year post-surgery, patients completed a follow-up evaluation.

Results: A series of paired samples t-tests revealed a significant decrease in internalizing and overall psychosocial problems following resective surgery ($p = .013$ & $.008$, respectively). A significant trend towards decreased externalizing behaviors was also observed ($p = .069$). Further analysis revealed that these improvements in post-surgical internalizing difficulties and overall psychosocial functioning were significant even after covarying for IQ ($p = .027$ & $.00$, respectively).

Conclusions: While cognitive outcomes following resective surgery have been well described in the literature, our understanding of behavioral

and emotional outcomes has been much more limited. This area of research has important implications for understanding the impact of epilepsy surgery on psychosocial functioning and quality of life for both the child and family. The strengths and limitations of the current study will be discussed.

Correspondence: *Arianna K. Stefanatos, MA, Psychology, The University of Texas at Austin, Seay Building, 108 East Dean Keeton St., Austin, TX 78712. E-mail: akstefanatos@utexas.edu*

L.G. UMFLEET, J. JANECEK, E. QUASNEY, J.J. RYAN, D. SABSEVITZ & S.J. SWANSON. Sensitivity of Memory and Naming Tests for Identifying Left Temporal Lobe Epilepsy.

Objective: Neuropsychological assessment of epilepsy provides useful information regarding lateralization of temporal lobe seizure onset and the probability of postoperative decline of memory and language functions. Formal testing of these functions often varies across institutions. To help inform clinicians in their test selection, the present investigation compares the sensitivities of verbal memory and confrontation naming tests to lateralized temporal lobe dysfunction.

Participants and Methods: Participants were 177 patients with intractable left (L-TLE; $n = 84$) or right (R-TLE; $n = 93$) temporal lobe epilepsy. Exclusion criteria included FSIQ < 70 and Wada results indicating right or bilateral hemisphere language dominance. Most participants underwent ATL resection at a later date. Group means and standard deviations on demographic variables, age of seizure onset, duration of seizure disorder, and FSIQ are displayed in Table 1. A series of logistic regression analyses were conducted to determine the sensitivities of the Selective Reminding Test (SRT), Logical Memory subtest, and Boston Naming Test (BNT).

Results: Logistic regression results along with sensitivity and specificity data are presented in Tables 2-4. The delayed recall trial raw score of the SRT was the most sensitive test in terms of predicting left seizure focus (sensitivity = 58.8%; specificity = 61.5%). The BNT and Logical Memory tests did not significantly add to the prediction of left seizure focus.

Conclusions: The SRT delayed recall was superior to other SRT trials as well as the Logical Memory subtest. SRT delayed recall was slightly more sensitive and specific than the BNT in predicting side of seizure focus. Limitations will be discussed.

Correspondence: *Laura G. Umfleet, Psy.D., Medical College of Wisconsin, 3162 W American Dr, Greenfield, WI 53221. E-mail: lumfleet@mcw.edu*

N. WISDOM, R.L. COLLINS, N. SESTITO, J. ROBINSON, D. PROTO, R. FRANKS & D.K. CHEN. Use of the Health History Checklist (HHC) to detect patients experiencing psychogenic non-epileptic events (PNEE) on a long-term monitoring unit.

Objective: The Health History Checklist (HHC) is a brief checklist of physical symptoms that mirror the DSM-III diagnostic criteria for somatization disorder. The purpose of this study was to calculate the diagnostic classification statistics for the HHC in patients being evaluated for seizures. It was hypothesized that the HHC would help differentiate between patients with epilepsy and patients experiencing psychogenic non-epileptic events (PNEE).

Participants and Methods: The HHC was administered to 170 inpatients (145 men; 25 women) as part of a larger neuropsychological screening. All of the patients were referred by the neurology department at a large VA hospital and were undergoing week-long observation on an epilepsy monitoring unit. Group membership (epilepsy vs PNEE) was determined by a board-certified neurologist and director of the epilepsy program. Diagnostic classification statistics were calculated for the HHC after dividing the sample into two groups. The first group only included patients diagnosed using "gold standard" video EEG (vEEG) findings following induction ($n=93$). All 170 patients were included in the second group and they were diagnosed using either vEEG, clinical observation, or self-reported semiology.

Results: Using a cut score > 15 , the HHC demonstrated adequate diagnostic classification statistics in patients diagnosed using vEEG ($SE=.33$, $SP=.88$) relative to other screening measures used in this population. Interestingly, the diagnostic accuracy of the HHC improved when applying the same cut score to all of the patients including those with a more ambiguous clinical presentation ($SE=.41$, $SP=.85$).

Conclusions: The HHC is a promising measure of somatization and can be included as a brief screener during neuropsychological evaluations. However, until more research has been conducted, it should only be used in conjunction with other well-validated instruments. Limitations of this study include not all patients being induced and the elimination of 12 patients with mixed PNEE and confirmed epilepsy.

Correspondence: *Nick Wisdom, Ph.D., Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd, Houston, TX 77030. E-mail: nickandjen@gmail.com*

TBI (Adult)

N. ADAMSON, D. PERRY & V. WHEATON. Vocational rehabilitation services related to successful employment outcomes of persons with traumatic brain injury.

Objective: Research has demonstrated the importance of vocational rehabilitation (VR) for individuals with traumatic brain injury (TBI) who seek competitive long-term employment. Unfortunately, there has been minimal research on the provision of services provided by VR as a moderating factor, and almost non-existent research for individuals in rural regions. Research in this area is crucial given that the services are provided as a way to increase the individual's likelihood of overcoming barriers to gaining employment. Therefore, this study focused on individual's diagnosed with TBI who are clients of North Dakota's Division of Vocational Rehabilitation (DVR) and the connection between services provided by DVR and long-term competitive employment.

Participants and Methods: 327 consumers of VR services who had sustained a TBI were tracked between 2007 and 2011 Federal Fiscal Year (FFY).

Results: Cross tabulations revealed significant relationships between obtaining/maintaining long-term employment and consumers who participated in diagnosis and treatment services ($p = .01$), provision of job readiness services ($p = .01$), on-the-job support services ($p = .02$), and job placement services ($p = .001$). Contrary to previous research, no significant differences were found between individuals who received supportive employment and their counterparts.

Conclusions: The results of this research have important implications for practitioners and patients. In general, some services may be more effective for individual's diagnosed with TBI in state VR agency settings than others. Overall, these findings provide evidence to help assist practitioners in treatment planning.

Correspondence: *Natasha Adamson, MS, The University of North Dakota, 4141 woodlaun drive, 72, nashville, TN 37205. E-mail: natasha.adamson@und.edu*

P. ARNETT, L. KESSLER, C. BAILEY, F. BARWICK, A. RABINOWITZ & G. VARGAS. Poor Baseline Neuropsychological Test Performance is Associated with Low Examiner-Rated Motivation in Collegiate Athletes.

Objective: Differential motivation at baseline compared with post-concussion testing can confound test interpretation and interfere with making accurate determinations about brain recovery following sports-related concussion. In the present study, we investigated the validity of the high and low motivation at baseline groupings from Bailey et al. (2006) using a simple examiner-observed rating of participants' test motivation.

Participants and Methods: 270 participants who underwent neuropsychological testing as part of a collegiate sports concussion program were included in the current study. Following Bailey et al. (2006), we divided athletes into High Motivation at Baseline (HMB) and Suspect Motivation at Baseline (SMB) groups based upon their baseline performance on a neuropsychological battery. Athletes scoring one or more SD's above the athlete mean of a test at baseline comprised the HMB group, and those scoring one or more SD's below the mean of a test comprised the SMB group. Neuropsychological tests included the Stroop, Trailmaking Tests A & B, Digit Span, Vigil, SDMT, HVLT-R, BVMT-R, & PSU Cancellation Test. Examiner ratings of participant motivation following testing were completed using a 7-point Likert scale (1 = not trying at all; 7 = trying as hard as possible).

Results: ANCOVAs (using WTAR IQ estimates as the covariate) revealed that the SMB group was rated significantly lower ($p < .001$) in motivation than the HMB group on every task grouping, with large effect sizes across all tasks (Range = 1.31 for PSU Cancellation to 2.41 for Stroop Color-Word Trial).

Conclusions: Future neuropsychological evaluation of athletes who are at risk for concussion should consider the likely possibility that some athletes do not put forth optimal effort at baseline, something that will make the accurate detection of post-injury changes difficult. Measurement of motivation through an examiner rating is a simple method that can help to clarify interpretive issues.

Correspondence: *Peter Arnett, Ph.D., Psychology, Penn State University, 352 Moore Building, University Park, PA 16802. E-mail: paa6@psu.edu*

L. AVERILL, L. WEIS, M. LOPEZ-LARSON, E. MCGLADE & D. YURGELUN-TODD. Sex Differences in Veterans with Mild Traumatic Brain Injuries.

Objective: The rapid growth of the female Veteran population has led to a great interest in identifying and examining sex differences in Veterans with TBI. Therefore, we conducted a study assessing impulsivity in relation to OFC morphology, depression and anxiety in a group of male and female Veterans with mild traumatic brain injuries (TBI).

Participants and Methods: Nineteen male Veterans, aged 41.1 ± 8.9 years and 15 female Veterans, aged 41.7 ± 10.2 years, with TBI received MRI scans using a 3T scanner. Subjects received clinical assessments, including the Barratt Impulsiveness Scale (BIS), Hamilton Anxiety Scale (HAM-A), and Hamilton Depression Rating Scale (HAM-D). Morphometric analysis was performed with the Freesurfer image analysis suite (<http://surfer.nmr.mgh.harvard.edu/>). Group differences in cortical thickness (CT) for right and left OFC was assessed. Correlations were performed between BIS and clinical measures for both sexes. Results are based on $p < 0.05$ (2-tailed).

Results: There were no group differences between male and female participants on BIS, HAM-A, HAM-D or CT for OFC regions. For male participants, positive correlations between HAM-A and BIS Attention and BIS Total scores were found. For HAM-D scores, positive correlations were seen with BIS Motor, BIS Attention, and BIS Total scores. For female participants, there were no significant correlations found between clinical measures. In addition, the right OFC in males was negatively correlated with BIS Planning, Motor, Attention and Total scores and this same region negatively correlated with HAM-D in males. Neither the right or left OFC correlated with any clinical measures in females.

Conclusions: Our results highlight the relationship between impulsivity, clinical measures and OFC morphometry in male but not female Veterans with mild TBI. These findings suggest that psychosocial and neurobiological treatment interventions targeted at male Veterans with TBI may not be optimal in the treatment of a female Veteran population with mild TBI.

Correspondence: *Melissa Lopez-Larson, M.D., The Brain Institute, University of Utah, 353 Colorow Drive, Salt Lake City, UT 84098. E-mail: melissa.lopez-larson@hsc.utah.edu*

J.S. CAMPBELL, T. JACK, J. HARAN, A. CREASON, L. STENTZ, K. GARCIA, S. WING & M. WOLDE. Source of Injury Differentiates Concussed from Non-Concussed Marines Returning from Combat Deployments.

Objective: This study evaluated the prevalence, co-occurrence, and rates of self-reported concussion for five self-reported injuries thought to be common in insurgent warfare and responsible for combat related Traumatic Brain Injury (TBI).

Participants and Methods: Data were analyzed from Marines ($N = 1,435$) who completed a post-deployment health screen upon return from Afghanistan.

Results: The frequency of injury sources, from most to least frequent, were: blasts (41.2%), falls (8.6%), vehicles (6.9%), fragments (4.5%), and bullets (1%). Bivariate correlations between the five injury types indicated fragments were significantly associated with blast ($p < .001$), vehicular ($p < .001$), and bullet injuries ($p < .01$); whereas falls were not associated with any other sources of injury. A multi-dimensional scaling plot of injury types in two dimensions suggested that fragmentation injuries can be further delineated into two patterns: (a) an improvised explosive device (IED) pattern where fragmentation co-occurs with vehicular and blast injury, and (b) fragmentation associated with bullet injury. To investigate potential differences in rates of concussion for unique sources of injury, the sample was divided into three mutually exclusive injury groups: IED pattern (fragmentation and blast or vehicular, $n = 501$); Bullet (bullet or bullet and fragmentation $n = 5$); or fall absent any other injury ($n = 61$). The rates of concussion differed significantly between the three groups ($\chi^2 2, N = 567 = 45.784, p < .001$; with the IED group possessing the highest rate of concussion (50.1%), followed by the fall group (6.6%). The bullet injury group did not report any concussion.

Conclusions: The results from this study indicate that IED related blast injuries encountered during mounted vehicle patrols account for the majority of self-reported injuries sustained during combat deployments, and furthermore, are the most likely source of concussions during a combat deployment.

Correspondence: *Justin S. Campbell, Ph.D., U.S. Navy, 1062 Law St, Unit #1, San Diego, CA 92109. E-mail: justin.s.campbell@navy.mil*

S. CHEEMERLA, E.A. WILDE, K.W. AYOUB, M. TROYANSKAYA, G.S. VOGT, R.S. SCHEIBEL, M.R. NEWSOME, D. CHU, S. MUKHI & H. LEVIN. Examining Changes in Fractional Anisotropy (FA) of White Matter Tracts in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans with Tract-Based Spatial Statistics (TBSS).

Objective: Studies of blast-related TBI have been inconsistent in their report of persistent white matter changes, with some studies reporting significant changes in DTI-derived metrics such as fractional anisotropy (FA), and others reporting no differences. Additionally, few studies have examined the relation between FA and cognitive performance in veteran populations.

Participants and Methods: Nineteen OEF/OIF veterans (19M, 0F) aged 21-42 years with predominantly mild blast-related TBI experienced 2-8 years earlier and no history of substance abuse and thirteen military (OEF/OIF deployed) controls without exposure to blast (9M, 4F) of comparable age and educational background with no history of TBI underwent DTI. Tract-based spatial statistics (TBSS) was used to establish differences in FA on white matter tracts.

Results: In relation to controls, veterans with blast-related TBI showed decreased FA in multiple regions of the brain, but most predominantly in the corpus callosum, cerebellum and cerebral peduncles, right cingulum bundle, right thalamus, superior temporal lobe, orbitofrontal white matter, left dorso-lateral frontal white matter, and superior/medial frontal white matter.

Conclusions: Our results are consistent with recent reports of decreased FA in the orbitofrontal white matter, cingulum bundle and cerebral peduncles in veterans and service members with blast-related TBI. However, whole brain analysis using TBSS reveals the pattern of injury in a sample of veterans with chronic mild TBI with only blast-related injury (without additional mechanism of injury).

Correspondence: *Elisabeth A. Wilde, PhD, Physical Medicine and Rehabilitation, Neurology, and Radiology, Baylor College of Medicine, 1790 Dryden Rd., Ste 1200, Houston, TX 77030. E-mail: ewilde@bcm.edu*

J. FABER, E.A. WILDE, R. YALLAMPALLI, M. TROYANSKAYA, X. LI, M. NEWSOME, R. SCHEIBEL, G. VOGT, D. CHU, S. MUKHI & H. LEVIN. Diffusion Tensor Imaging of the Fornix and Perforant Pathway in Relation to Memory in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans.

Objective: Memory deficits, common following TBI, may result from changes to white matter tracts such as the fornix and perforant pathway. Using diffusion tensor imaging (DTI), we examined these structures known to mediate memory functioning in cohorts of OEF/OIF veterans with and without blast-related TBI. We also examined the relation between DTI-derived metrics and verbal recall performance.

Participants and Methods: Nineteen OEF/OIF veterans (19M, 0F) aged 21-42 years with predominantly mild blast-related TBI experienced 2-8 years earlier and no history of substance abuse and thirteen military (OEF/OIF deployed) controls without exposure to blast (9M, 4F) of comparable age and educational background with no history of TBI underwent DTI (quantitative tractography) and were administered the Verbal Selective Reminder Test (VSRT), a measure of verbal memory.

Results: T-tests revealed a marginally significant difference with large effect size in apparent diffusion coefficient (ADC) of the fornix ($p=0.056$, $d=0.72$). For FA, groups marginally differed with moderate to large effect sizes for the fornix ($p=0.068$; Cohen's $d=0.68$) and the left ($p=0.089$, Cohen's $d=0.63$) and right ($p=0.182$, Cohen's $d=0.49$) perforant pathway white matter. These differences persisted even when veterans ($n=4$) with PTSD were excluded. Although groups did not differ on VSRT performance, VSRT delayed recall correlated with both FA ($r=0.507$, $p=0.032$) and ADC ($r=-0.634$, $p=0.005$) of the fornix in the TBI group, though VSRT continuous long-term retrieval and total measures were not correlated in the TBI group. Poorer performance was associated with lower FA and higher ADC. DTI metrics of the right and left perforant pathways were not related to memory performance.

Conclusions: Few studies have examined chronic cognitive and imaging sequelae of blast-related TBI. These preliminary results indicate an association between changes in the fornix following blast-related TBI and performance on delayed verbal recall.

Correspondence: *Elisabeth A. Wilde, PhD, Physical Medicine and Rehabilitation, Neurology, and Radiology, Baylor College of Medicine, 1790 Dryden Rd., Ste 1200, Houston, TX 77030. E-mail: ewilde@bcm.edu*

J. FABER, E.A. WILDE, R. YALLAMPALLI, M. TROYANSKAYA, X. LI, M. NEWSOME, R. SCHEIBEL, G. VOGT, D. CHU, S. MUKHI & H. LEVIN. Diffusion Tensor Imaging of the Ventral Striatum in Relation to Executive Function in Blast-Related Traumatic Brain Injury (TBI) in OEF/OIF Veterans.

Objective: The ventral striatum has been shown to be vulnerable to traumatic brain injury, and changes to the neural substrate of this area may underlie some of the common cognitive complaints resulting from TBI. Using diffusion tensor imaging (DTI), we examined the ventral striatal (VS) pathway in veterans with and without blast-related TBI in relation to measures of verbal fluency, symptom report, and exposure history.

Participants and Methods: Nineteen Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans (19M, 0F) aged 21-42 years with predominantly mild blast-related TBI experienced 2-8 years earlier and thirteen previously deployed military controls without exposure to blast (9M, 4F) of comparable age and years of education underwent DTI quantitative tractography and were administered the Controlled Oral Word Association (COWA), PTSD Checklist-Civilian version (PCL-C), Neurobehavioral Symptom Inventory (NBSI) and an interview regarding their exposure to blast injury.

Results: T-tests did not reveal group differences in the right or left VS, though the FA of the right VS was lower in the TBI group and

showed a moderate effect size in this small sample ($p=0.165$, $d=0.525$). While there were no relations between the DTI-derived metrics for the VS pathways and cognitive or symptom report measures in the control group, marginally significant correlations were noted in the TBI group between the COWA and right VS ADC ($r=-0.419$, $p=0.0836$) and right VS FA and the COWA ($r=0.440$, $p=0.068$). Right VS FA also correlated with NBSI ($r=-0.497$, $p=0.036$) and number of primary blasts ($r=-0.535$, $p=0.022$). Left VS FA correlated with PCL-C ($r=-0.419$, $p=0.084$). In each case, lower FA or higher ADC was associated with poorer performance or greater symptom report.

Conclusions: While a definitive pattern of blast-related injury has yet to emerge, the coherence of white matter regions such as the VS pathway may relate to cognitive, emotional, and functional sequelae of blast-related TBI.

Correspondence: *Elisabeth A. Wilde, PhD, Physical Medicine and Rehabilitation, Neurology, and Radiology, Baylor College of Medicine, 1790 Dryden Rd., Ste 1200, Houston, TX 77030. E-mail: ewilde@bcm.edu*

R.S. KAMATH, K.W. AYOUB, E.D. BIGLER, Z.D. CHU, J.V. HUNTER, M. MACLEOD & E.A. WILDE. Case Studies in Patients with Severe Traumatic Brain Injury Patients Utilizing Tract-Based Spatial Statistics: Commonalities and Differences in Injury Patterns.

Objective: Despite tremendous heterogeneity in the nature, degree and location of focal injury, the Glasgow Coma Scale (GCS) score is often used to categorize or grade injury severity in both research and clinical practice. While this approach is common and has advantages, sole reliance upon the GCS may inaccurately represent "injury" as observed on imaging.

Participants and Methods: Nine adults aged 20-30 with severe TBI indicated by Glasgow Coma Scale scores of 3 to 8 and 3-4 neurologically-intact adults of comparable age underwent DTI on a 3T Philips scanner. Patients were scanned 3-6 months post-injury. The FMRIB Software Library (FSL) was used to perform tract-based spatial statistical (TBSS) analysis for each patient against a template of the control cases to examine patterns of injury in relation to initial CT and follow-up MR imaging.

Results: Despite the seeming similarity of injury severity as determined by GCS score, this series of cases reveals a wide range and heterogeneous pattern of injury. DTI-related changes appear to be influenced by not only the proximity to areas of injury evident on CT and conventional MR sequences, but also more diffuse changes. While there were regions such as the corpus callosum that were commonly affected across patients, this case series demonstrates the considerable heterogeneity that occurs in "severe" TBI.

Conclusions: Advanced imaging techniques such as DTI may play a useful role in future classification and understanding of TBI severity.

Correspondence: *Elisabeth A. Wilde, PhD, Physical Medicine and Rehabilitation, Neurology, and Radiology, Baylor College of Medicine, 1790 Dryden Rd., Ste 1200, Houston, TX 77030. E-mail: ewilde@bcm.edu*

L. DELANO-WOOD, S.F. SORG, N.K. LUC, D.M. SCHIEHSER, E.B. LANNI, M.W. JACOBSON, D.A. NATION, J.J. AMY, K.L. HANSON, L.R. FRANK, M.J. MELOY, D.C. DELIS, J.B. LOHR & M.W. BONDI. Fornix Integrity is Related to Cognition but not Post-concussive Symptoms in Chronic Military Traumatic Brain Injury: A Quantitative Tractography Study.

Objective: Though histopathologic and imaging studies have shown that the fornix—a limbic white matter (WM) structure connecting the hippocampus and mammillary bodies—is a predilection site for neurotrauma, few if any DTI tractography studies of military mild-to-moderate traumatic brain injury (TBI) exist. Given this structure's potential role in the emergence of cognitive and postconcussive symptomatology (PCS) following TBI, we examined associations between the fornix, cognition, and PCS in veterans with TBI.

Participants and Methods: 68 OEF/OIF veterans (mTBI: $n=48$; NC: $n=20$); mean age=29.2; mean time since injury=2.3 years) were administered 3T DTI scans (61 directions) and comprehensive cognitive and psychiatric assessments. Tractography was employed by seeding ROIs in bilateral contiguous slices on registered T1 images, and mean DTI values were derived from fractional anisotropic (FA) maps.

Results: Compared to NCs, TBI participants showed lower fornix FA ($t=-2.34$; $p=.02$) and increased MD ($t=2.15$; $p=.04$), and changes were observed with respect to axial diffusivity (AD; $t=2.01$; $p=.05$) but not radial diffusivity (RD; $p=.38$). Age at most significant TBI was negatively related to fornix integrity, even after adjusting for current age ($r=-.55$, $p=.02$). Fornix DTI indices were associated with WAIS-III Digit Span (FA: $r=.58$, $p=.01$; MD: $r=-.53$, $p=.04$), and DKEFS Verbal Fluency Switching (FA: $r=.66$, $p=.006$) and Switching Accuracy (FA: $r=.64$, $p=.01$). Fornix DTI indices were not associated with PCS symptomatology (PTSD, depression, anxiety, and quality of life).

Conclusions: Results show that fornix WM integrity is positively associated with performance on tasks of working memory and executive function but not PCS symptoms in veterans with TBI. Findings suggest that mild-to-moderate TBI affects connectivity between temporal and fronto-limbic circuits—particularly in those at more advanced ages at time of injury—and that these neuropathologic changes may lead to chronic working memory deficits and executive dysfunction.

Correspondence: *Lisa Delano-Wood, Ph.D., Psychiatry, University of California, San Diego, 3350 La Jolla Village Dr, Bldg 13 —151B, San Diego, CA 92161. E-mail: ldelano@ucsd.edu*

S.W. LIEBEL, D.K. BJORN, J.E. FAIR & M.J. LARSON. The Roles of Positive and Negative Affect on Cognitive Rehabilitation after Moderate-to-Severe Traumatic Brain Injury.

Objective: Traumatic brain injury (TBI) is a leading cause of disability and survivors are more likely to develop depression and anxiety, which pose barriers to rehabilitation. Few studies to date address the influence of negative affect on learning in TBI. We examined the roles of negative/positive affect (NA/PA) on behavioral indices of learning (reaction time: RT; and error rate: ER) with survivors of moderate-severe (MS) TBI.

Participants and Methods: Individuals with MSTBI and healthy controls completed a word learning task using errorless and errorful learning (EL, EF). EL included giving the target words with minimal intrusions while EF required guessing to acquire words. Neuropsychological and mood data were also collected. Data were analyzed with Group (TBI/Control) \times Condition (EF/EL) \times Accuracy (correct/incorrect) ANOVAS, zero-order correlations, and T-tests.

Results: There was a significant group difference for age, but not sex or education. The EL condition resulted in faster RTs in both groups; the TBI group benefited from EL with RTs (controls did not); additionally there was a main effect of condition on accuracy and RT. There was no significant group difference with regard to HADS Anxiety or PANAS-Positivity scores, and these variables were significant predictors of ACC on EF conditions. NA did not correlate with accuracy or RT, but PA was correlated with RT on EF and EL correct trials.

Conclusions: The benefits of EL on TBI cognitive rehabilitation are replicated in that the TBI group had improved RTs (but still slower than controls), as well as better accuracy in the EL vs EF condition. While poor mood did not appear to play a role in performance, anxiety and PA did correlate with RT, suggesting vigilance and positive mood may assist behavioral indices of cognition in this sample.

Correspondence: *Spencer W. Liebel, Psychology/Neuroscience, Brigham Young University, 5555 West 10080 North, Highland, UT 84003. E-mail: spencerliebel@gmail.com*

L.M. FORD-JOHNSON, J. LENGENFELDER, E. SANTANA & N.D. CHIARAVALLI. The Impact of Cognitive and Emotional Functioning on Medication Adherence in TBI.

Objective: Individuals with TBI experience deficits in memory, executive function, and information processing speed, with depression and

anxiety also prevalent. Such factors have been related to medication non-adherence in other clinical populations, making it reasonable to expect that individuals with TBI might also evidence poor adherence to medications. The study aimed to examine rates of adherence and explore factors affecting adherence among persons with TBI.

Participants and Methods: 26 individuals with moderate-severe TBI participated in the study. The sample was 54% male and 74% Caucasian with a mean age of 42.9 ± 16.79 years and 14.4 ± 2.10 years of education. Participants were recruited through clinics at UMDNJ, Northern New Jersey TBI Model System, and Kessler Institute for Rehabilitation. Participants were free of prior neurological insult other than TBI, significant psychiatric history, and alcohol and drug history. Participants completed a thorough neuropsychological battery, which included a self-report measure of medication adherence.

Results: Findings revealed that 69% of participants self-reported difficulty adhering to prescribed medications. There was a significant negative correlation between medication non-adherence and CLVT-II measures Long Delay Free Recall ($r=-.495$, $p=.01$), Long Delay Cued Recall ($r=-.463$, $p=.01$), and Trials 1-5 ($r=-.437$, $p=.01$), with poorer cognitive performance related to greater non-adherence. The most common reason cited for non-adherence was forgetting to take medications. There was also a significant negative correlation between medication non-adherence and CMDI vegetative scale ($r=-.659$, $p=.01$), with higher levels of depression related to greater non-adherence.

Conclusions: Many individuals with TBI report difficulty adhering to prescribed medications. Further research exploring factors related to poor adherence will help us to design rehabilitation interventions to optimize adherence, and thereby treatment efficacy and overall quality of life.

Correspondence: *Lawanda M. Ford-Johnson, Psy.D., Neuroscience & Neuropsychology Lab, Kessler Foundation Research Center, 300 Executive Drive, Suite 70, West Orange, NJ 07052. E-mail: lfordjohnson@kesslerfoundation.org*

H.A. GREENE, L.J. RAPPORT, R.A. HANKS, S.R. MILLIS & R. WHITMAN. Coping Style and Subjective and Functional Well-Being in Persons with Traumatic Brain Injury.

Objective: Beyond acquired cognitive and physical impairments associated with traumatic brain injury (TBI), patients often show increased distress and diminished life satisfaction. Although research suggests that coping style affects TBI recovery, research on successful and unsuccessful mechanisms of coping with the stress of TBI is sparse. This study examined the relationship between coping style and TBI recovery, including subjective and objective well-being outcomes.

Participants and Methods: Participants were 331 adults with moderate to severe TBI who were 1 to 15 years post injury. Outcomes included the Satisfaction with Life Scale (SWLS) and Disability Rating Scale (DRS). Predictors included demographic (age, education) and injury severity (Glasgow Coma Scale, DRS at discharge) characteristics, Positive (PA) and Negative (NA) Affectivity scales of the Positive Affective and Negative Affect Schedule (PANAS), and the Coping Inventory for Stressful Situations (CISS; Task, Emotion, Distraction, and Social Diversion scales).

Results: Hierarchical multiple regression examined prediction of DRS and SWLS at follow-up. Step 1 included demographic and injury characteristics. Step 2 included PA and NA, and Step 3 included the CISS scales. For DRS, all CISS scales added uniquely to the model, as did age, injury severity, disability at discharge, and negative affectivity, total model $R^2 = .26$, $p < .001$. Task and Distraction coping loaded inversely, whereas Emotion and Social Diversion coping loaded positively in DRS prediction. For SWLS, Emotion and Social Diversion scales added uniquely to the model, as did positive affectivity, total model $R^2 = .16$, $p < .001$. Emotion coping loaded inversely, whereas Social Diversion loaded positively in SWLS prediction.

Conclusions: Coping style uniquely predicts subjective and functional well-being after TBI, even after accounting for injury severity, sociodemographic factors, and global response bias. TBI rehabilitation might benefit from appropriately targeting coping style in treatment.

Correspondence: *Hillary A. Greene, B.S., Psychology; Wayne State University; 120 S. Maple Ave., Royal Oak, MI 48067. E-mail: greeneha@wayne.edu*

K.L. HANSON, D. NATION, H.J. ORFF, S. SORG, L. DELANOWOOD, D. SCHIEHSER, E. TWAMLEY, J. LOHR, A. JAK & D. DELIS. Cognitive Discrepancy-Based Analysis of Traumatic Brain Injury in Veterans Suggests Mild Executive Dysfunction.

Objective: The long-term cognitive sequelae of mild-to-moderate traumatic brain injury (TBI) are unclear. We used traditional single-test analysis and a novel discrepancy-based analysis to detect subtle cognitive deficits among veterans with history of TBI. Baseline components of executive function tasks (thought to be less sensitive to brain injury) were compared to higher-order components (thought to be more sensitive to brain injury).

Participants and Methods: 486 individuals (n=293 veterans with TBI history; n=193 normal controls [NC]) completed the Delis Kaplan Executive Function System Color-Word Interference (CWI), Verbal Fluency, and Trailmaking tests. Veterans were patients who presented for neuropsychological assessment at the VA San Diego Healthcare System. Groups were compared on individual subtest age-scaled scores and discrepancy scores (higher-order executive skill – baseline skill).

Results: After excluding for suboptimal effort (n=66 TBI patients), 420 demographically-matched individuals remained (mean age = 31.78; 8% women). TBI patients scored worse than NCs on CWI Color Naming (p=.02), Inhibition (p=.01), and Inhibition Switching (p=.001), and they had a larger discrepancy between the baseline conditions and Inhibition Switching (Switching < baseline; p=.07). The TBI group scored higher than NCs on Category Fluency (p=.04) but worse on Letter Fluency (p=.09), and they showed a greater discrepancy between these two subtests relative to NCs (Letter < Category; p<.001). Finally, TBI veterans scored worse on the Trailmaking Switching condition (p=.03) and had a greater discrepancy score (Switching < baseline; p<.001).

Conclusions: Findings suggest that a mild-to-moderate TBI history among veterans may be associated with executive function decline. Further, veterans with TBI demonstrate greater decline from basic cognitive skills to the higher-order components of the same tests relative to healthy controls. A discrepancy-based analysis may be a useful approach in detecting mild enduring effects of TBI.

Correspondence: *Karen L. Hanson, Ph.D., Psychiatry, VA San Diego Healthcare System, 3350 La Jolla Village Drive, 116B, San Diego, CA 92161. E-mail: klhanson@ucsd.edu*

A.M. HERGES, W. JOHNSON, R.K. PERUMPARAICHALLAI, K. HUSK & P. KLONOFF. The Relationship Between Neuropsychological Functioning and Productivity Outcomes in Adults with Brain Injury.

Objective: The aim of the present study was to examine the relationship between neuropsychological functioning and productivity outcomes in adults with brain injury who participated in a holistic neurorehabilitation program.

Participants and Methods: Analyses utilized admission and discharge neuropsychological testing including Wisconsin Card Sorting Test, Halstead Category Test, Controlled Oral Word Association Test, California Verbal Learning Test – II, and Rey Complex Figure Test for 142 (male) adults diagnosed with brain injury (traumatic brain injury, cerebrovascular disorders, tumor, anoxic brain injury, and neuroinfection disorders).

Results: A repeated measures ANOVA with productivity status as a between subjects variable demonstrated that the patients who returned to work/school full-time performed significantly better than those who returned to part-time work/school, or volunteering/unemployed on measures of short and delayed verbal memory. Additionally, those who returned to full-time work/school performed significantly better than those who were volunteering/unemployed on a measure of set shifting and mental flexibility. Improvements made on the verbal fluency trended toward significance between those who returned to full-time work/school and those who returned to part-time work/school.

Conclusions: Overall, the study found that regardless of productivity status after discharge from neurorehabilitation, participants improved on all measures from admission to discharge. Moreover, individuals who returned to full-time work/school demonstrated greater gains on measures of rote verbal memory and set shifting than the other productivity groups.

Correspondence: *Amanda M. Herges, Doctorate of Clinical Psychology, Clinical Neuropsychology, Barrow Neurological Institute-St. Joseph's Hospital and Medical Center, 222 W. Thomas Rd., Suite 315, Phoenix, AZ, AZ 85013. E-mail: Amanda.Herges@DignityHealth.org*

S.M. JURICK, C. COLON, H.J. ORFF, C. HAYS, A. GREGORY, E.W. TWAMLEY & A.J. JAK. Cognitive Profiles of Mild to Moderate Traumatic Brain Injury Iraq and Afghanistan Veterans.

Objective: Psychiatric comorbidities following mild to moderate TBI (mTBI) in Iraq/Afghanistan Veterans have been reasonably well-documented but the broad neuropsychological characteristics have not. Previous work suggests only a subgroup referred for cognitive complaints have objective impairments. This study, therefore, sought to better characterize the cognitive profiles of this Veteran group.

Participants and Methods: 356 veterans with mTBI underwent comprehensive clinical neuropsychological testing. A profile analysis was conducted to examine domain specific (attention, memory, processing speed, and executive functioning) profiles of scores between clinical diagnostic groups. The groups were cognitively normal (n=126), Cognitive Disorder, NOS, (n=183) and invalid (n=47). Groups did not differ significantly in demographic or injury variables.

Results: As expected, profiles differed in overall level between groups in all cognitive domains (all p's <.001), with the invalid group scoring significantly more poorly than the cognitive disorder group, which scored significantly more poorly than the cognitively normal group. However, significantly different performance patterns between groups (parallelism) in processing speed (F=3.5, p = .008) and memory (F=3.6, p<.001) also emerged that distinguished the invalid group from either the normal or cognitive disorder groups. These differing patterns were driven by performances on WAIS-IV Symbol Search, WMS Logical Memory and CVLT-II.

Conclusions: Results suggest that overall patterns of performances between those who are cognitively normal and those with objective cognitive deficits following mTBI are similar, and differ in level only, while the invalid group is distinguished by both level and pattern, notably in processing speed and memory. Patterns of deficits within particular cognitive domains can help distinguish suboptimal performance in this population, and holds significance for more effective diagnosis and treatment.

Correspondence: *Sarah M. Jurick, B.A., Psychiatry, University of California San Diego, 9500 Gilman Drive, Mail Code 0603, La Jolla, CA 92037-0603. E-mail: smjurick@gmail.com*

J.E. KENNEDY, D.B. COOPER, R. AMADOR, M. CULLEN, N. CRAIG, A. CHANG, N. ELLIOTTE, D.F. TATE, G. YORK & C.A. HOPEWELL. Psychological Profiles of Active-Duty Military Service Members following mild TBI with and without High Levels of Combat Stress.

Objective: This retrospective analysis examined Personality Assessment Inventory (PAI) scores in consecutive samples of U.S. service members with mild TBI who received neuropsychological evaluations in the TBI Clinics at Darnall Army Medical Center (n=94) and San Antonio Military Medical Center (n=41).

Participants and Methods: The sample was divided into two groups based on PCL-M score. The positive combat stress group (n=56) had PCL-M scores > 60 and the negative group (n= 20) had PCL-M scores < 30. T scores on the PAI were compared across the two groups.

Results: Results showed significant differences (p<.001) between the groups on 2 of 4 validity scales (NIM, PIM), 8 of 11 clinical scales (SOM,

ANX, ARD, DEP, MAN, PAR, SCZ, BOR, ANT), 5 of 5 treatment consideration scales (AGG, SUI, STR, NON, RXR) and 1 of 2 interpersonal scales (WRM). Less significant differences ($p < .05$) were found on the ICN and ANT scales. In summary, compared to the negative combat stress group, those with positive combat stress displayed a greater tendency toward negative response distortion (e.g., symptom exaggeration) and showed elevations on all PAI scales except those tapping alcohol and drug related problems and level of interpersonal dominance. Results indicate that military service members with mild TBI who have high levels of combat stress symptoms at the time of evaluation tend to express global distress across a variety of psychological, emotional, attitudinal and interpersonal domains of function.

Conclusions: In evaluating military members following a TBI, it is important to consider the effects of ongoing symptoms of combat stress on the individual's overall level of distress, as well as on psychological factors that may impede treatment success and adversely affect interpersonal functioning.

Correspondence: *Jan E. Kennedy, PhD, Neurology/DVBIC, Brooke Army Medical Center, MCHE MDU (DVBIC), 3351 Roger Brooke Drive, Ft Sam Houston, TX 78234-6200. E-mail: jan.kennedy@amedd.army.mil*

D. KRCH, N.D. CHIARAVALLI, J. DELUCA & J.F. SUMOWSKI. Cognitive Reserve Protects Against Memory Dysfunction in TBI.

Objective: Cognitive impairment is the leading cause of disability following Traumatic Brain Injury (TBI), with memory and cognitive efficiency impairments quite common. The relationship between neuropsychological outcomes and neuropathology in TBI is variable. Cognitive reserve (CR), which has been shown to provide a protective effective in various neurological conditions (e.g., Alzheimer's disease), may help to explain the neuropsychological expression of neuropathology in TBI. We hypothesized that CR would moderate the relationship between TBI status (TBI vs healthy controls (HC)) and cognitive functioning.

Participants and Methods: Forty-eight persons with TBI and 35 matched HCs performed neuropsychological tasks assessing memory (CVLT-II, SRT) and cognitive efficiency (SDMT, Digit Span, Letter-Number Sequencing). Educational attainment was used to estimate CR. To evaluate the CR hypothesis, we ran two separate hierarchical regressions predicting memory and cognitive efficiency. Group (TBI, HC) and educational attainment were entered into block one, and the interaction between Group and educational attainment was entered into block two.

Results: The outcome of primary interest was the interaction term within step two for each regression analysis. This interaction was significant for the regression predicting memory ($p = .019$), such that higher educational attainment moderated the negative impact of TBI on memory performance. The interaction was not significant for cognitive efficiency ($p = .162$). These results support the CR hypothesis in persons with TBI, as higher educational attainment protected against TBI-related memory problems. These results do not support the CR hypothesis for cognitive efficiency.

Conclusions: The current study identified higher cognitive reserve as a protective factor against TBI-related memory dysfunction. Given the current findings, cognitive reserve should be an important consideration when planning studies and interpreting treatment effectiveness.

Correspondence: *Denise Krch, PhD, Neuropsychology & Neuroscience Laboratory, Kessler Foundation Research Center, 300 Executive Dr., Suite 70, West Orange, NJ 07052. E-mail: dkrc@kesslerfoundation.org*

J. LENGENFELDER, H. GENOVA, G. WYLIE, E. SANTANA & N. CHIARAVALLI. Emotion Perception Deficits and Executive Functions in TBI.

Objective: Neuropsychological impairments are common following TBI, including impaired executive functions. Emotion perception, which includes the ability to recognize facial affect, is necessary for communication and successful social relationships. The purpose of this work is to examine the relationship between emotion perception and executive function in individuals with TBI.

Participants and Methods: Participants consisted of 42 individuals with moderate to severe TBI and 14 age and education matched healthy controls. Individuals received a neuropsychological battery which included measures of executive functions and the Facial Emotion Identification Test (FEIT, Kerr & Neale, 1993) to assess emotion perception.

Results: Individuals with TBI had significantly fewer correct responses than healthy individuals ($p < .003$) on the task of emotion identification, demonstrating impairments in emotion perception. Performance on emotional perception also significantly correlated with various executive measures assessing organizational strategies (CVLT Semantic Clustering $r = -.36$, Rey Complex Figure Copy $r = -.40$), switching (DKEFS Design Fluency $r = -.37$, Verbal Fluency $r = -.37$, Trails $r = -.36$), and abstraction (DKEFS Twenty Questions $r = -.45$).

Conclusions: The ability to identify emotions on a facial affect measure is impaired in individual following TBI. The data show that emotion perception deficits correspond with impaired executive function in these individuals with TBI. Therefore, individuals with TBI with executive impairments may also be at increased risk for having emotion perception deficits as well. These deficits may have meaningful consequences for social functioning for individuals with TBI and impact their social relationships.

Correspondence: *Jeannie Lengenfelder, Kessler Foundation Research Center, 300 Executive Drive, Suite 70, West Orange, NJ 07052. E-mail: jlengenfelder@kesslerfoundation.org*

N.K. LUC, D.A. NATION, S.F. SORG, D.M. SCHIEHSER, K.L. HANSON, E.B. LANNI, A.J. JAK, R.T. KIM, A. MATSEVOYAN, M.W. JACOBSON, M.W. BONDI, J.B. LOHR & L. DELANO-WOOD. Iowa Gambling Task Impairment is Associated with Executive Dysfunction in Veterans with Chronic Mild-to-Moderate Traumatic Brain Injury.

Objective: The Iowa Gambling Task (IGT) has been used to examine reward-related decision-making ability across many clinical populations; however, few studies have investigated IGT performance in the context of traumatic brain injury (TBI). Given that decision-making likely affects long-term functional outcome following neurotrauma, we examined IGT performance in OEF/OIF veterans with a history of chronic mild-to-moderate TBI and normal control (NC) participants. We hypothesized that TBI patients would demonstrate decision-making deficits and that IGT performance would relate to other measures of executive function.

Participants and Methods: Forty-seven demographically-matched participants (TBI: $n = 26$; NC: $n = 21$; mean age = 32.7; mean months since TBI = 80.7) were administered a comprehensive neuropsychological battery, including a computerized version of the IGT. Participants were divided into impaired and unimpaired performance on IGT based on a T-score cutoff of more than one SD below the mean ($T \leq 39$).

Results: TBI participants were more likely to exhibit impairment on the IGT total score relative to the NC group (% Impaired: TBI = 20.7%; NC = 0%; $p = .02$). Mixed model ANOVA indicated a group by block interaction ($p = .04$), whereby the TBI group performed worse than NCs on block 4 ($p = .03$) and were more likely to exhibit impairment on 2 or more blocks (% Impaired: TBI = 19.2%; NC = 0%, $p = .03$). Within the whole sample, IGT performance was correlated with worse performance on executive function measures (DKEFS Trails Switching [$r = -.36$, $p = .02$], WCST Perseverative Responses [$r = -.35$, $p = .02$], and WCST Set Losses [$r = -.30$, $p = .049$]).

Conclusions: Findings demonstrate that mild-to-moderate TBI is associated with subtle reward-related decision-making impairment, and they suggest that the IGT is a sensitive index of this aspect of executive dysfunction in veterans with chronic TBI.

Correspondence: *Norman K. Luc, BA, UCSD - VASDHS, 3350 La Jolla Village Dr., San Diego, CA 92161. E-mail: nluc@vapop.ucsd.edu*

K. MAESTAS, N. PASTOREK, M. TROYANSKAYA, A. SANDER & H. LEVIN. Quantifying Social Participation with the Mayo-Portland Participation Index (M2PI) in Returning Veterans with Mild Traumatic Brain Injury.

Objective: The Department of Veteran Affairs (VA) has called for the implementation of the Mayo-Portland Participation Index (M2PI) into

clinical practice and rehabilitation research to measure social participation outcomes in returning Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans who have sustained mild traumatic brain injuries (mTBI). This study will take a descriptive approach of the M2PI to 1) profile the type and severity of social participation problems in Veterans with histories of blast-related mTBI and 2) to determine the influence of mTBI on level social participation. To our knowledge, this study is the first to describe M2PI performance in OEF/OIF Veterans with mTBI.

Participants and Methods: 105 OEF/OIF Veterans with blast-related mTBI and 57 OEF/OIF Veterans with no history of mTBI (controls) completed the M2PI via self-report. The M2PI contains 9-items that each measure different aspect of social participation.

Results: Compared to controls, Veterans with histories of mTBI reported significantly lower scores on M2PI items measuring Initiation, Social Contact, Leisure Self-care, Residence (homemaking, meal preparation), Non-paid Employment (e.g., childrearing), and Money Management (all p values $<.001$). There were no significant differences between groups on M2PI items measuring Transportation ($p = .06$) and Paid Employment ($p = .18$). Within the mTBI sample, the areas of greatest impairment were demonstrated on items measuring Social Contact and Initiation. Independence in transportation did not appear to be problematic in the mTBI sample.

Conclusions: OEF/OIF Veterans with mTBI report challenges in returning to full participation across multiple home, vocational, and social activities. Interventions targeting increased social participation may go far to improve post-acute rehabilitation outcome among OEF/OIF Veterans with mTBI.

Correspondence: *Kacey Maestas, Ph.D., Baylor College of Medicine, 2323 S. Shepherd, ste. 907, Houston, TX 77019. E-mail: kacey.maestas@memorialhermann.org*

H.J. ORFF, A.J. JAK, A.M. GREGORY, C. COLON, D.M. SCHIEHSER, J. LOHR & E.W. TWAMLEY. Association of Sleep Disturbance With Neuropsychological and Psychiatric Functioning in Veterans with Mild to Moderate Traumatic Brain Injury.

Objective: Sleep disturbances following traumatic brain injury (TBI) are some of the most common and least studied of post-TBI sequelae. Research suggests that sleep problems following TBI may exacerbate cognitive, emotional, and physical symptoms, thereby slowing recovery and decreasing quality of life. This investigation was therefore designed to examine the association between sleep, psychiatric and cognitive factors in a population of Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) Veterans with mild to moderate TBI.

Participants and Methods: Retrospective chart reviews were conducted on 137 OEF/OIF Veterans with a history of mild to moderate TBI referred for neuropsychological assessment. Bivariate correlations were used to assess relationships between the Pittsburgh Sleep Quality Inventory (PSQI) and measures of neuropsychological performance and psychiatric and post-concussive symptoms.

Results: 100% of Veterans in the sample reported clinically significant sleep disturbance (PSQI Global scores >5). Veterans also reported clinically relevant impairments in sleep latency (50 minutes), total sleep time (5.5 hours), and sleep efficiency (77%). Sleep disturbance showed significant associations with neuropsychological measures of attention (Digits Forward: $r = -.237$, $p = .007$), working memory (Digits Backward: $r = -.204$, $p = .020$) and executive functioning (D-KEFS Color-Word Switching: $r = -.251$, $p = .006$). More severe sleep problems were also related to greater endorsement of post-concussive, mood, and PTSD symptomatology.

Conclusions: Veterans with mild to moderate TBI are at high risk of developing sleep problems following brain injury. Sleep disturbance appears to be associated with increased prevalence of psychiatric symptomatology and/or maintenance of post-concussive symptoms and may also impact specific areas of neuropsychological performance. These results have implications for treatment strategies for Veterans with TBI, suggesting that sleep interventions may be warranted in this population.

Correspondence: *Henry Orff, Ph.D., University of California, San Diego, 3350 La Jolla Village Drive, San Diego, CA 92161. E-mail: horff@ucsd.edu*

T.A. REAGAN, J.L. CARSWELL, B.W. ABLITZ & J. BLANCHETTE. Neurorehabilitation: Treatment Gains Beyond Two Years Post Brain Injury?

Objective: The majority of research on neurorehabilitation following traumatic brain injury indicates that the most meaningful treatment gains occur within two years post injury (Levine, 1995). Recently, there has been greater recognition that individuals continue to benefit from rehabilitation efforts even after two years (Ablitz, Naidoo, & Perna, 2006). This study builds upon that previous work to further explore whether individuals show functional improvement in rehabilitation greater than two years post injury.

Participants and Methods: Participants consisted of 191 adults who were previously treated at one of two transdisciplinary neurorehabilitation facilities in Maine. This sample was comprised of 42.4% males and 57.6% females, ages 18 to 79 years. Changes in Full Scale MPAI-4 (Malec and Lezak, 2003) and its three index scores were compared.

Results: Paired sample t -tests indicated positive changes in functional status of the participant sample as measured by the MPAI-4 ($t = 6.075$, $p = .000$) with 84.3 % of individuals showing some improvement in overall functioning. Effect sizes ranged from small to medium with greatest improvement occurring in MPAI-4 Full Scale and Ability Index.

Conclusions: The above findings suggest that individuals greater than two years post acquired brain injury show significant improvement in functioning through participation in a neurorehabilitation program. Improvements were most notable with regard to sensory, motor, and cognitive abilities, with lesser gains observed in terms of their emotional adjustment and social reintegration.

Correspondence: *Tara A. Reagan, Bayside Neurorehabilitation, Goodwill Industries of Northern New England, 26 Portland Street, Portland, ME 04101. E-mail: astaelreagan@gmail.com*

C.N. SOZDA, D.A. KAUFMAN, J.T. GRAVANO, T. HILL-JARRETT & W.M. PERLSTEIN. The effect of traumatic brain injury on attentional networks: An event-related potential investigation.

Objective: The pattern of neurocognitive difficulties following traumatic brain injury (TBI) often varies widely between patients, however, cognitive impairments in attentional processes are commonly observed across injury severity level. How TBI affects interactive component processes of attention (e.g., alerting, orienting, and executive control) is poorly understood.

Participants and Methods: To address this issue, electroencephalogram (EEG) and behavioral data (RT and error rates) were acquired while 12 moderate-to-severe TBI participants and 12 neurologically-healthy controls performed an attention network test.

Results: Significant alerting and executive control RT differences were observed between groups; however, after controlling for generalized slowing, only alerting functioning remained significantly reduced in TBI patients. No group differences were observed in orienting, as both groups showed RT improvement on target conditions preceded by spatially informative cues. Both groups committed significantly more errors on incongruent vs. congruent trials, though this effect was not different between groups. Event-related potential (ERP) data revealed that bilateral posterior-parietal N1 amplitude reflecting alerting was significantly enhanced in controls versus TBI participants; however, both groups demonstrated similar-magnitude enhancement of N1 amplitude to more than less spatially informative cues, reflecting similar orienting functioning. Target-related P3 amplitude was attenuated to incongruent "conflict" conditions at central-posterior scalp sites, an effect that did not significantly differ between groups.

Conclusions: Taken together, TBI participants demonstrated behavioral and neural alterations primarily in the alerting network, which likely reflects difficulty in processing ambiguous stimuli, and may be the result of disruptions in norepinephrine neurotransmitter systems. Difficulties in executive control manifested as cognitive slowing, rather than core impairment in executive functioning.

Correspondence: *Christopher N. Sozda, M.S., University of Florida, PO BOX 100165, Gainesville, FL 32610. E-mail: csozda@ufl.edu*

J. HARAN, J.S. CAMPBELL, A. CREASON, A. ALPHONSO, M. WOLDE & J.W. TSAO. Decrements in Post-Deployment Automated Neurocognitive Testing Performance in Marines.

Objective: Redeployed Marine units with high rates of mild traumatic brain injury (mTBI) and/or blast exposure were administered post-deployment Automated Neuropsychological Assessment Metrics (ANAM) to determine the usefulness of routine post-deployment neurocognitive testing.

Participants and Methods: 705 recently deployed Marines were administered the ANAM pre- and post-deployment. This computerized test measures: Simple Reaction Time, Coded Substitution, Procedural Reaction Time, Mathematical Processing, Matching to Sample, and Coded Substitution Delayed (CDS). The battery also includes a TBI questionnaire from which participants were divided into groups based on their responses. Mild TBI (mTBI) was defined by when individuals reported an injury event accompanied by an alteration of consciousness. This included endorsement of at least one of the following: feeling dazed and confused, experiencing loss of consciousness, or experiencing loss of memory for the injury. Throughput scores, which represent the correct number of responses per minute were analyzed using multiple repeated measures ANOVA.

Results: 168 Marines sustained a mTBI. There were no significant differences between the TBI group and non-mTBI groups pre-deployment scores for all subtests ($p > .05$) except for CDS ($p = 0.042$). The mTBI group had significantly worse post-deployment scores for all subtests ($p < .0001$) than the non-mTBI group. Surprisingly both the mTBI and non-TBI groups had significantly worse post-deployment than pre-deployment scores for all subtests ($p < .0001$).

Conclusions: Some Marines with self-reported history of mTBI demonstrated steeper declines in ANAM performance when compared to Marines without history of mTBI. Surprisingly as both groups had performance decrements indicate that there may be a “deployment effect” on neurocognitive functioning.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Navy or the DoD.

Correspondence: *Jack W. Tsao, MD, DPhil, Neurology, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Room A1036, Bethesda, MD 20814. E-mail: jacksao@earthlink.net*

D. UKUEBERUWA, J.D. MEDAGLIA & F.G. HILLARY. Structural Integrity and Working Memory Performance in TBI.

Objective: Diffusion tensor imaging (DTI) has been developing as an informative tool for relating structural characteristics of the brain, such as anatomical connectivity changes following traumatic brain injury (TBI), with patterns of cognitive functioning. TBI frequently results in diffuse axonal injury to the deep communicating fibers of the forebrain. Working memory is a cognitive process known to be frequently challenged following TBI, and it is possible that reductions in markers of white matter integrity (WMI) after injury could influence network efficiency and affect task learning and performance.

Participants and Methods: Diffusion weighted MRI was acquired for 18 participants. The sample included 9 participants with moderate to severe TBI, mean age 29.7 (SD=10.2) and education 14.9 (3.2), as well as 9 healthy controls, mean age 27.1 (SD=11.2) and education 14.7 (1.9). Participants completed a run of the 1-back working memory task in the scanner, followed by a run of practice outside the scanner, and a third run upon re-entering. WMI, operationalized as whole brain fractional anisotropy (FA), was analyzed with MedINRIA 1.9 tractography. Mean reaction time (RT) for the 1-back before and after practice was determined.

Results: Both groups improved in mean RT after practice ($p < .05$ TBI and controls). Compared to TBI, controls had better mean RT after practice at a trend level ($p = .06$) but not before. In TBI, whole brain FA was significantly correlated ($r = .72, p < .05$) with mean RT before practice but not after. FA values did not correlate with mean RT among controls.

Conclusions: This study showed that in TBI, whole brain white matter integrity was associated with performance during a novel working memory task, but after practice WMI had a weak connection to performance. Results suggest that brain injury may provide an early challenge to working memory but exposure provides opportunity for cognitive mechanisms to assist performance.

Correspondence: *Dede Ukueberuwa, M.S., Penn State University, 115C Moore Building, University Park, PA 16802. E-mail: dedemu@psu.edu*

Imaging (Functional)

D. POTVIN, N. NUSSBAUM, D. LEAKE & C. RICHARDS. Reliability Study: Visual Readings of fMRI of Language Lateralization.

Objective: Although a departure from the lateralization indices used in most research studies (e.g. Fernandes, et al., 2006; Thomsen, et al., 2003), visual inspection as a means of determining lateralization reflects common clinical practice and shows a strong concordance with categories based on lateralization indices (Leach & Holland, 2010). Despite its widespread usage little research exists on the reliability of visual inspection.

Participants and Methods: fMRIs of language were collected from ten pediatric epilepsy patients seen prior to surgery. Cohen's Kappa was used to assess inter-rater reliability. Initial readings involved two neuroradiologists, with each neuroradiologist reading the studies that occurred on his shift. For the reliability study, studies were rated by the other neuroradiologist. Each radiologist was asked to provide ratings of language activation as predominantly left, predominantly right, mixed, or inconclusive for both word generation and verb generation paradigms, as well as an overall rating based on both paradigms.

Results: An analysis of inter-rater agreement across all responses showed moderate agreement (percent agreement = 70%, Cohen's Kappa = .566). A more limited analysis of inter-rater agreement for decisions on overall language lateralization only showed moderate agreement (percent agreement = 80%, Cohen's Kappa = .667). Follow-up analyses with radiologists' readings reduced to typical (left) or non-typical language (right, mixed, or inconclusive) showed similar results across all responses (percent agreement = 80%, Cohen's Kappa = .615) and for overall language only (percent agreement = 80%, Cohen's Kappa = .600).

Conclusions: These results support earlier findings of good agreement between fMRI ratings based on visual inspection and those based on lateralization indices (Leach & Holland, 2010), as well as findings of strong reliability for fMRI ratings (e.g. Rutten, Ramsey, van Rijen, & van Veen, 2002).

Correspondence: *Deborah Potvin, MS Ed, UT Austin, 800 West 38th Street, Apt 13105, Austin, TX 78705. E-mail: deborah.potvin@gmail.com*

Poster Session 10: Drugs/Alcoholism/EEG/Genetics/ HIV/AIDS/Psychopathology

10:15–11:15 a.m.

Drug/Toxin-Related Disorders (Including Alcoholism)

F. ARIAS, J. ARNSTEN, C. CUNNINGHAM, K. COULEHAN, M. BRISBANE, K. SEGAL, A. BATCHELDER & M. RIVERA-MINDT. Neurocognitive Characteristics of Opioid-Dependent Adults Seeking Buprenorphine Treatment.

Objective: Opioid-dependent adults are at increased risk for neurocognitive (NC) impairment, as well as for comorbid substance use & depression. Buprenorphine (BUP), a newer opioid agonist therapy, may

have fewer negative NC effects than methadone, yet little is known about the NC characteristics of opioid-dependent adults seeking BUP treatment. This study sought to describe this group's NC characteristics & explore the impact of comorbid lifetime substance dependence & Major Depressive Disorder (MDD) on NC functioning.

Participants and Methods: Thirty-eight opioid dependent adults seeking BUP treatment completed a baseline NC battery & structured diagnostic interview. NC impairment in Global NC function & across 7 domains (executive functioning (EF), learning, memory, attention/working memory (A/WM), processing speed (PS), verbal, & motor) was calculated using descriptive statistics & defined as average T-score <40 (Heaton et al., 2004).

Results: Participants were 68% male; 55% Hispanic; with a mean age of 46.39 yrs (SD=9.56) & mean education of 11.61 yrs (SD=2.55). Overall, 42% of the sample was Globally NC impaired; >70% scored in the impaired range in learning & memory domains & >33% scored in the impaired range in EF, A/WM, verbal, & motor. Lifetime alcohol comorbidity was associated with greater impairment in Global NC function, EF & PS (all p 's<.05). Lifetime cocaine comorbidity was associated with greater impairment in EF & motor (all p 's<.05). Lifetime MDD comorbidity was not associated with NC impairment (all p 's>.10).

Conclusions: Opioid-dependent adults seeking BUP treatment have high rates of Global NC & domain-specific impairment. Comorbid lifetime alcohol & cocaine dependence are related to greater risk for NC impairment, particularly in executive function, which is critical for abstract reasoning & decision-making. These findings suggest that care providers need to be aware of the potentially high rates of NC impairment in this group & how such impairments may affect clinical care.

Correspondence: *Franchesca Arias, Master of Science, Psychology, Fordham University, 15 Chelsea Square, Binghamton, NY 13905. E-mail: farias2@fordham.edu*

K. COULEHAN, J. ARNSTEN, C. CUNNINGHAM, F. ARIAS, M. BRISBANE, K. SEGAL, A. BATCHELDER & M. RIVERA MINDT. Neurocognitive Effects of Buprenorphine and Methadone: A Systematic Review.

Objective: Relative neurocognitive (NC) effects of the 2 most common opioid agonist therapies (OATs; buprenorphine [BUP] & methadone [MMT]) remain poorly understood & the evidence has not been systematically reviewed. This study aimed to systematically review the literature on the relative NC effects of BUP & MMT.

Participants and Methods: We queried databases (PubMed, PsycINFO & Cochrane Reviews; bet. Jan 1980–July 2012) for original research articles with terms related to NC testing in adults on OAT. Two independent raters read all abstracts & eligible studies. NC data were extracted from eligible studies & grouped by domain (executive functioning (EF), attention/working memory (A/WM), learning, memory, visuospatial abilities (VS), processing speed (PS) & motor). Study quality ratings were based on study design & control for bias.

Results: The search retrieved 1794 abstracts, of which 107 manuscripts were reviewed & 28 fit eligibility criteria. All 28 studies were observational, and sample characteristics & methods varied widely. Of the 7 studies comparing BUP to MMT, BUP performed better than MMT overall, with medium to large effect sizes in EF, A/WM, Learning & Memory (d 's=.30-1.69). In longitudinal studies, BUP performed better than MMT in A/WM (d 's=.68-.82) and memory (d 's=.37-.42). When compared to former opiate users (FOU), BUP performed better than FOU in A/WM (d =1.10) & equivalent in all other NC domains; whereas MMT's performance compared to FOU was variable, with worse performance in EF & A/WM (d 's=.34-.68). Both BUP & MMT performed worse than healthy controls. All studies were rated 'Poor' in quality.

Conclusions: BUP may be a better treatment option than MMT, particularly for those vulnerable to NC sequelae. Due to wide variability in studies & poor study quality, findings are difficult to generalize. The state of the literature in this area is weak given uniformly poor study quality. Future studies should focus on more rigorous comparisons of BUP to MMT (e.g., RCTs) to better inform treatment recommendations.

Correspondence: *Kelly Coulehan, Psychology, Fordham University, 441 East Fordham Road, Bronx, NY, NY 10458. E-mail: kcoulehan@fordham.edu*

N.A. CRANE, R.M. SCHUSTER & R. GONZALEZ. Sex Differences in Associations between Amount of Cannabis Use and Neuropsychological Performance.

Objective: Cannabis is associated with deficits in decision-making & memory. Evidence suggests sex-specific subjective & psychoactive effects of cannabis. This study examined sex moderated associations between amount of cannabis use (across several time-frames) & performance on a measure of decision-making (Iowa Gambling Task; IGT) & episodic memory (Hopkins Verbal Learning Test; HVLTR).

Participants and Methods: Participants were 44 male & 25 female cannabis users aged 18-24 years who reported no developmental, psychiatric, or neurological problems, & had minimal history of other drug use. We conducted moderated hierarchical multiple regression analyses with 1) lifetime, past year, or past month cannabis use entered as separate independent variables, 2) sex, & 3) their interaction. IGT net score, HVLTR total immediate, or HVLTR total delayed recall scores served as the dependent variables.

Results: Across all cannabis use time frames, more cannabis use was significantly associated with poorer performance on the IGT for males (p 's <.01, β =-.38 to -.39), but not for females (p 's >.30). Similarly, lifetime estimates of cannabis use predicted poorer delayed & immediate recall for both males & females (p 's <.05, β =-.23 & -.28). In contrast, past year & past month cannabis use tended to predict worse delayed recall for females (p 's <.02, β =-.32 & -.30), but not males (p 's >.08).

Conclusions: We found partial evidence to support a double dissociation between amount of cannabis use & neuropsychological performance in males & females. Males appeared more vulnerable than females to the adverse effects of cannabis use on decision-making. In contrast, females appeared more vulnerable to memory problems. Neurodevelopmental, metabolic, & behavioral factors may all contribute to the observed sex differences and will be explored in future studies.

Correspondence: *Natania A. Crane, University of Illinois at Chicago, 1007 W Harrison Street (M/C 285), Chicago, IL 60607. E-mail: ncrane3@uic.edu*

C. ELLIS, S. JAEHNERT, J. PLAGGE, J. LOFTIS, D. SCHWARTZ, W. HOFFMAN & M. HUCKANS. Everyday problems related to executive dysfunction and impulsivity in adults recovering from methamphetamine addiction.

Objective: Our group and others have previously shown that, compared with non-addicted controls (CTLs), adults in early remission from methamphetamine addiction (MA-REM) evidence greater impairment on neuropsychological tests measuring executive functions, as well as an increased tendency to discount delayed rewards on the delay discounting task (DDT), a behavioral test of impulsivity. The purpose of this study, therefore, was to evaluate whether adults in MA-REM self-report problems in their daily life related to executive dysfunction and impulsivity.

Participants and Methods: Demographically (age, gender, ethnicity, estimated baseline intellectual function) matched groups (MA-REM, n =30; CTLs, n =24) completed the DDT, a self-report measure of executive function [Behavior Rating Inventory of Executive Function, Adult Version (BRIEF-A)], and a self-report measure of impulsivity [Barratt Impulsiveness Scale (BIS)].

Results: Consistent with previous studies, the MA-REM group evidenced significantly ($p < 0.050$) greater impulsivity on the DDT. A MANOVA, with the nine BRIEF-A clinical scales and the six BIS factor scales entered as the dependent variables and group entered as the independent variable, revealed that the MA-REM group reported significantly more everyday problems related to executive dysfunction and impulsivity. Follow up ANOVAs indicated that, compared with CTLs, the MA-REM

group reported significantly increased dysfunction on most BRIEF-A clinical scales including inhibition, shift, emotional control, self-monitor, initiate, working memory, plan/organize, and task monitor, and most BIS factors including attention, cognitive instability, motor impulsiveness, self control and cognitive complexity.

Conclusions: Adults in MA-REM report a range of everyday problems related to executive dysfunction and impulsivity which corresponds with objective test results and suggests that they have insight into these deficits and that these deficits cause them distress.

Correspondence: *Carilyn Ellis, Graduate Department of Clinical Psychology, George Fox University, 12445 NW Barnes Rd Apt 142, Portland, OR 97229. E-mail: cellis09@georgefox.edu*

R.L. SHIBANO & G. FEIN. Comorbid Internalizing Disorders in Abstinent Alcoholics.

Objective: Alcoholics commonly have a comorbid psychiatric disorder diagnosis. This study examined the lifetime and current prevalence of mood and anxiety disorders in short-term (6-15 week, n=101) and long-term (> 18 months, n=110) abstinent alcoholics and in non-substance abusing controls (NSAC, n=82) to determine whether such comorbidity affects one's ability to achieve and maintain abstinence.

Participants and Methods: 293 subjects were interviewed using the Diagnostic Interview Schedule – Computerized version, which yielded lifetime and current (prior 12 months) diagnoses.

Results: More than half of both short-term abstinent alcoholics (STAA) and long-term abstinent alcoholics (LTAA) had a lifetime internalizing diagnosis, compared to only a quarter of controls, with no difference between STAA and LTAA. When internalizing diagnoses were separated into their mood and anxiety domains, and into specific disorder diagnoses, the results were highly similar to those for internalizing diagnoses in general, except that Major Depressive Disorder (MDD) showed a difference between STAA and LTAA groups, with a current diagnosis more likely in STAA than LTAA.

Conclusions: These results suggest that the presence of a lifetime internalizing diagnosis does not militate against initiating and maintaining abstinence in alcoholics. The results for MDD are consistent with either current MDD in STAA remitting or with MDD in STAA being associated with a greater probability of relapse such that individuals are less represented in the LTAA population.

Correspondence: *George Fein, Ph. D., Neurobehavioral Research Inc., 1585 Kapiolani Blvd. Ste 1030, Honolulu, HI 96814. E-mail: george@nbresearch.com*

R. HOFFMAN & M. AL'ABSI. Verbal Learning Deficits With Daily Use of Khat.

Objective: The purpose of this study is to assess whether regular, daily users of khat (a psychostimulant) would demonstrate similar impairments in verbal learning as the impairments seen in samples of chronic amphetamine users.

Participants and Methods: Ss were 175 Yemeni college students (90 M, 85 F) ranging in age from 18 to 38; 75 Ss were chronic, daily khat users (50 M, 25 F). 48 Ss were episodic, occasional khat users (15 M, 33 F) and 52 Ss (25 M, 27 F) had no history of khat use. Verbal learning was assessed by performance on the Arabic version of the RAVLT.

Results: Analyses were conducted using MANOVA, with gender and age as covariates. There were significant differences observed in RAVLT Trials 2-5 between daily khat users compared to both the occasional khat user group and the control group of nonusers of khat. On each of these trials, daily users recalled fewer words, demonstrating a slowed rate of verbal learning. The results were as follows: Trial 2 ($F[2,174] = 3.886, p=.01$); Trial 3 ($F[2,174] = 3.176, p=.02$); Trial 4 ($F[2,174] = 2.752, p=.03$); Trial 5 or Best Learning - BL ($F[2,174] = 2.336, p=.05$). The maximum level of free recall performance was significantly lower in the regular khat user group compared to the occasional khat user group and the control group ($F[2,174] = 2.34, p=.05$). The Retroactive Interference effect was more pronounced in the regular khat user group ($F[2,174] = 3.02, p=.05$) and total learning across all trials was markedly lower in the regular khat user group ($F[2,174] = 4.78, p=.01$).

Conclusions: The daily use of khat is very common in many countries and the observed poorer performance on RAVLT measures of verbal learning and recall in the present study is cause for significant public health concern.

Correspondence: *Richard Hoffman, Ph.D., Dept. of Biobehavioral Health and Population Sciences, University of Minnesota Medical School, 1035 University Avenue, Duluth, MN 55812. E-mail: rhoffman@d.umn.edu*

T. MARCOTTE, R. MEYER, T. HENDRIX, T. ROSENTHAL, G. KAY, R. HEATON, S.P. WOODS, R. ELLIS & I. GRANT. Methamphetamine dependence and risky driving behaviors.

Objective: Methamphetamine (METH) use is associated with poor decision-making and risky behaviors, which may reflect frontal systems dysfunction. There is limited data regarding driving performance among METH users. The goal of this study was to examine self-reported and performance-based driving behaviors among individuals with a history of METH dependence.

Participants and Methods: 24 current drivers with a history of METH dependence, and 30 controls (CONT) were assessed using a PG-based driving simulation and measures of risky decision-making (Iowa Gambling Task [IGT]) and frontal systems dysfunction (Frontal Systems Behavior Scale [FrSBe]). The simulation required participants to drive to a location as quickly as possible. They received additional compensation for reaching the location on time; payment was reduced based upon crashes, tickets, and late arrival to the destination.

Results: METH and CONT groups had similar recent driving mileage. The METH group self-reported more real-world risky driving (racing, passing in no-passing lanes) and had more lifetime crashes/tickets. On the simulation, the METH group had more speeding tickets (2.3 vs. 1.3, $p = .008$) and unsafe closing speeds on lead cars ($p = .006$). The METH group had a higher ratio of risk/time penalties than the CONT group ($p = .02$). IGT ($\beta = .25; p = .049$) and FrSBe scores ($\beta = -.35; p = .007$) independently predicted dangerous closing speeds ($R^2 = .17, p = .003$), while the FrSBe alone predicted the ratio of risk/time penalties ($r = .33, p = .015$) and speeding tickets ($r = .33; p = .014$).

Conclusions: METH dependence is associated with increased risky driving, based upon both real world driving and performance-based measures. Risk taking was predicted by different aspects of frontal systems behaviors, possibly related to the decision-making time frame (milliseconds [closing speed] vs. seconds [risk vs. arrival time prioritization]). It remains to be determined whether such propensities precede METH use, or are exacerbated by METH-related brain changes.

Correspondence: *Thomas Marcotte, PhD, University of California, San Diego, 220 Dickinson St., Suite B, San Diego, CA 92103. E-mail: tmarcotte@ucsd.edu*

R.C. RASALAN, R.M. BOWLER, F.G. DU, V.V. GOICHEVA, R. PARK, H.A. ROELS, A. BOOTY & J. WILKINSON. Association Between Increasing Length of Exposure to Manganese in Welding Fumes and Motor Function in Welders.

Objective: Length of time of exposure to manganese (Mn) welding fumes has been associated with adverse changes in neurological and neuropsychological functions similar to parkinsonism, especially in work environments without adequate ventilation and personal protective equipment. Decline in motor speed, grip strength, and visual motor coordination are reported in many studies of exposure to Mn in welding fumes.

Participants and Methods: Forty-three welders working in confined spaces on the San Francisco-Oakland Bay Bridge (Group I) for 16 years (range: 1-40; M age = 44) and 59 welders working on joining pipes on barges in the Gulf of Mexico near Houma, LA (Group II) for an average of 26 years (range: 5-53; M age = 60) were assessed in 2005 and 2004, respectively. Finger Tapping, Dynamometer, Grooved Pegboard and the motor scale of the Unified Parkinson's Disease Rating Scale (UPDRS) were administered. Finger Tapping, Dynamometer, and Grooved Pegboard scores were adjusted for age, education, sex, and race using the revised norms for the expanded Halstead-Reitan Comprehensive Battery (Heaton et al., 2005).

Results: Group II had significantly lower mean T scores bilaterally on the Finger Tapping, Dynamometer, and Grooved Pegboard than Group I. Group II also showed worse motor and movement function on the UPDRS (Group I M = 0.25, Group II M = 0.40). When combining the two groups in regression analyses, welding duration and having tremors or shakiness were inversely associated with both Finger Tapping and Grooved Pegboard T scores; welding duration and being disabled were associated with lower T scores on the Dynamometer, and being disabled was associated with higher scores on the UPDRS total motor scale.

Conclusions: As is shown, greater length of time of welding is associated with increased impairment in motor function and the development of early parkinsonian signs and symptoms, including tremors. This suggests using welding duration as a proxy for Mn exposure is efficacious when more specific exposure data is not available.

Correspondence: *Ralph C. Rasalan, BA - Psychology, Psychology, San Francisco State University, 3465 25th St., Apt. 8, San Francisco, CA 94110. E-mail: rrasalan@mail.sfsu.edu*

K.S. SAWYER, R. LUHAR, M. OSCAR-BERMAN, J.E. JENSEN & M.M. SILVERI. Associations of Anterior Cingulate Metabolite Levels with Neuropsychological Measures in Alcoholism.

Objective: Alterations in brain metabolites, as measured by magnetic resonance spectroscopy (MRS), have been reported in current alcohol drinkers as well as in recently detoxified alcoholics. While short-term abstinence has been associated with the recovery of metabolite levels and some cognitive functions, little is known regarding these associations in abstinent alcoholics. Given that executive functions and memory are highly vulnerable to alcoholism, the objective of the present study was to explore associations between metabolite levels, alcoholism severity, and neuropsychological performance, and to assess whether gender differences exist among abstinent alcoholics (ALC).

Participants and Methods: The participants were 30 ALC (15 men) and 29 non-alcoholic (NC) age-matched comparison subjects (15 men). Proton MRS was employed at 3T (TE=30 ms) to acquire metabolite data from a single voxel placed in the anterior cingulate region. Proton metabolites were quantified using LCModel and normalized to creatine levels. Neuropsychological performance on the domains of executive functioning, memory, processing speed, and affect were examined.

Results: In the NC group, but not in the ALC group, metabolite levels were positively related to age. The groups also differed on metabolite levels in relation to several neuropsychological measures. Within the ALC group, higher levels of glutamate were associated with lower scores on executive functioning (especially working memory) and processing speed tasks. Within the NC group, higher levels of glutamate were associated with lower scores on some tasks examined. Furthermore, higher glutamate and choline levels were associated with negative affect within the ALC group.

Conclusions: These data provide preliminary evidence of a relationship between measures of alcoholism severity, neuropsychological performance, negative affect, and brain metabolite levels in the anterior cingulate region.

Correspondence: *Kayle S. Sawyer, BA, Behavioral Neuroscience, Boston University School of Medicine, 72 E. Concord St L-815, Boston University Laboratory of Neuropsychology, Boston, MA 02118. E-mail: kslays@bu.edu*

D.J. SCHRETLEN, C. SULLIVAN, S. BARR, L. EMERY, T.D. VAN-NORS DALL & C.A. MUNRO. Does Childhood Lead Ingestion Predict Self-reported Depression and Antisocial Behavior in Adults?

Objective: Many studies of childhood lead poisoning have focused on potential declines in intelligence (IQ). Interest in the development of depression, antisocial behavior, and other psychiatric disorders following early lead ingestion has increased in recent years, but little is known

about these potential consequences. In this study we correlated blood lead levels (BLLs) obtained during childhood with the severity of self-reported depression and antisocial behavior among adult plaintiffs referred for neuropsychological examinations by defense counsel in the context of litigation.

Participants and Methods: The sample included all plaintiffs (47 men, 47 women) who were referred to the Johns Hopkins Medical Psychology Clinic for assessment between 2005 and 2012 and who completed the Personality Assessment Inventory (PAI). The sample consisted exclusively of African Americans with a mean age of 20.2 (SD=1.8) years and a mean education of 10.6 (SD=2.0) years. We recorded each person's lowest (M=7.4; SD=4.3 µg/dL), highest (M=13.4; SD=6.8 µg/dL), and mean (M=12.8; SD=4.7 µg/dL) BLLs for correlation with PAI T-scores for the Depression and Antisocial Features scales.

Results: Mean (SD) T-scores for the PAI Depression and Antisocial Features scales were 64.3 (14.0) and 62.5 (13.9), respectively. PAI scores did not correlate with any of the three BLL measures (all ps > .25). However, PAI Depression scores correlated with maternal education ($\rho = -.379$; $p < .001$) and maternal psychiatric history ($\rho = .236$; $p < .05$), as did scores on the Antisocial Features scale ($\rho = -.27$; $p < .02$ and $\rho = .323$; $p < .005$, respectively). Linear multiple regression models explained substantial variance in both PAI scale scores, but none of the BLL beta weights was statistically significant.

Conclusions: Childhood blood lead levels did not show any dose relationship with self-reported depression or antisocial behavior among young adults referred for assessment in the context of litigation.

Correspondence: *David J. Schretlen, Ph.D., Department of Psychiatry, Johns Hopkins University School of Medicine, 600 N. Wolfe Street, Meyer 218, Baltimore, MD 21287-7218. E-mail: dschret@jhmi.edu*

R.M. SCHUSTER, R. MERMELSTEIN & R. GONZALEZ. Interactions between Cannabis and Tobacco on Episodic Memory among Young Adult Cannabis Users.

Objective: Cannabis and tobacco use co-occur at exceptionally high rates among young adults, which may be due to the reinforcing effects of conjoint use on memory. Although this phenomenon has not been extensively investigated, it is suspected that cannabis disrupts memory functioning and these deficits may be attenuated in the context of co-occurring tobacco use.

Participants and Methods: We examined interactions between cannabis and tobacco use on several indices of episodic memory among young adults who identified cannabis as their current drug of choice (N=52). They completed the Hopkins Verbal Learning Test—Revised (HVLT-R) as part of a larger study assessing cannabis use and inhibitory control.

Results: Moderated regression analyses indicated that after controlling for alcohol use, more cannabis use was associated with poorer Total Immediate Recall, Delayed Recall, and Recognition Discriminability on the HVLT-R. On the contrary, tobacco use was only associated with better Recognition Discriminability. Significant interactions also emerged. Specifically, more cannabis use was associated with poorer Total Immediate Recall, poorer Total Learning and poorer Delayed Recall only among those with lower levels of past year tobacco exposure. There was no relationship between amount of cannabis consumed and episodic memory among those who were heavier tobacco users.

Conclusions: The present study shows that more cannabis use is associated with poorer performance in episodic memory, but only among individuals with lesser tobacco exposure. One potential mechanism for these effects may be the action of nicotine on nicotinic acetylcholine receptors, which may counteract some of the detrimental effects of cannabis on episodic memory. This possibility may have significant clinical ramifications, as an attenuation of cannabis-associated episodic memory decrements among tobacco users may further reinforce use of both substances and hamper cessation attempts.

Correspondence: *Randi M. Schuster, M.A., Psychology, University of Illinois at Chicago, 1747 West Roosevelt, Chicago, IL 60608. E-mail: Rschuste@gmail.com*

K. SULLIVAN, M. KRENGEL, P. JANULEWICZ-LLOYD, M. YEE & A. FINEMAN. Qualitative Neuropsychological Errors and MRI Correlates in Military Pesticide Applicators from Gulf War I.

Objective: Qualitative errors are often used to document specific patterns of neuropsychological deficit in clinical test batteries. Tests including the Controlled Oral Word Associations Test (COWAT), Recurrent Series Writing and Multiple Loops, California Verbal Learning Test (CVLT), Hooper Visual Organization Test, Rey-Osterrieth Complex Figure Test (ROCFT) and Trail Making Test provide optimal errors to evaluate executive system and memory functioning through perseveration, confabulation, set-loss, pull to stimulus, and fragmentation errors. These deficits are also encountered in individuals with white matter pathway damage to the frontal and limbic systems.

Participants and Methods: This study examined qualitative errors in a group of Gulf War I veterans (GWV) with known pesticide exposure from their military occupational specialty as pesticide applicators during the war. It was hypothesized that GWV with higher levels and more exposures to acetylcholinesterase-inhibiting pesticides would show lower brain white matter volumes (WMV) and hippocampal volumes (HV) on MRI and would commit more qualitative errors on cognitive testing than less exposed veterans. Twenty-four GW veterans were separated into high and low pesticide exposed groups and total number of qualitative errors and errors on each test were compared between groups. Errors were also correlated with WMV and HV.

Results: Correlation analyses indicated that WMV and high pesticide exposures were significantly associated with total qualitative errors. Regression analyses showed that HV were significantly inversely associated with ROCFT fragmentation ($p=.03$) and expansion errors ($p=.05$) and COWAT loss of set was inversely associated with WMV ($p=.03$).

Conclusions: This study documents the utility of qualitative error analysis in neurotoxicant-exposed groups that correlates with brain imaging measures. These results also suggest that pesticide exposed GW veterans appear to be showing deficits in WM pathways related to executive system and visual memory functioning.

Correspondence: *Kimberly Sullivan, PhD, Environmental Health, Boston University School of Public Health, 715 Albany Street, Talbot 4West, Boston, MA 02118. E-mail: ty@bu.edu*

M.M. VALMAS, D.A. GANSLER & M. OSCAR-BERMAN. Construct and Criterion Validity of Social Cognition Measures in Alcoholism.

Objective: Social cognition is an established element of intelligence and memory. Recently developed measures of social cognition, validated on healthy control and clinical populations, include social perception and face processing subtests of the Advanced Clinical Solutions (ACS) module for the Wechsler Adult Intelligence Scale-IV and Wechsler Memory Scale-IV. Alcoholism has been associated with diminished social cognitive functioning, as well as neuropathology of brain areas presumed to underlie social processing abilities. The current study assessed the construct and criterion validity of the social cognition subtests within the context of a neuropsychological test battery that included other recognized measures of social cognition.

Participants and Methods: We examined the validity of ACS social cognition measures using a multitrait-multimethod approach as well as exploratory factor analysis to evaluate construct and criterion validity in 69 abstinent alcoholic individuals (36 men) and 50 demographically equivalent nonalcoholic control participants (23 men). Relationships of drinking variables to performance on the social cognition subtests also were assessed.

Results: Exploratory factor analysis indicated convergent and divergent validity for the social cognition measures: A three-factor solution emerged that was comprised of general intelligence, social perception, and visual processing. The alcoholic group performed significantly worse than the nonalcoholic group on the Affect Naming subtest, supporting criterion validity of the social perception subtests. For the alcoholics, duration of heavy drinking was associated with poor performance on an omnibus measure of social perception and on a measure of delayed memory for processing facial identity.

Conclusions: These findings, in conjunction with results of further investigation of the construct of social cognition, have potential utility for neuropsychological assessment, evaluation, and treatment planning in individuals with a history of alcohol abuse or dependence.

Correspondence: *Mary M. Valmas, MA, Behavioral Neuroscience, Boston University School of Medicine, 10 Dickson Street, Somerville, MA 02144. E-mail: mvalmas@bu.edu*

Electrophysiology/EEG/ERP

G. CRUZ, K. KILBORN & J. EVANS. Neural correlate of prospective memory: Is preparatory attention required for successful identification of Prospective Memory cues?

Objective: Prospective memory (PM), the ability to execute delayed intentions, is more effective when it relies on external cues to prompt the action. However, it is still being debated whether attentional processes are required for detecting PM cues or if this is more an automatic process. We examined the neural substrate of monitoring and cue detection in a computerized prospective memory task. Modulations of the cognitive demand for cue detection were done through manipulation of the properties of the PM cues.

Participants and Methods: Twenty-six students undertook a task that prevented the continuous rehearsal of the intended intention. The task consisted on an n-back memory task which involved categorization of words presented one at a time. For the PM task, participants had to indicate each time they saw either an animal word (conceptual cue) or a word presented with the first letter in upper case (perceptual cue). The intended action associated to the cue was to press a different key from the one used in the ongoing task. High-density EEG activity was recorded.

Results: Behavioral results show that perceptual distinctiveness was more likely to promote the retrieval of delayed intentions. No behavioural evidence was provided to infer that preparatory attentional processes were involved. However, Event Related Potentials (ERP) revealed visual attentional modulations at 180ms, where ongoing task components were enhanced compared to Base Line and PM conditions were enhanced compared to ongoing task. No difference was found between early ERPs of PM conditions, despite the behavioural differences observed.

Conclusions: The results suggest that preparatory attention is involved in selectively modulating the processing of features related to PM cues. However, early processing of different types of PM cues appear to be similar. Later ERPs components still need to be explored. Identification of cognitive demands required for PM performance is particularly relevant for optimizing strategies used in cognitive rehabilitation.

Correspondence: *Gabriela Cruz, Master in Neuroscience, University of Glasgow, 2/2 70 Hotspur street, Glasgow G20 5LP, United Kingdom. E-mail: g.cruz@psy.gla.ac.uk*

K. SELZLER, N. D'ALBERTO, R. BENDER, M. BURACK, A. WENSEL, J. MINK & M. MAPSTONE. Subthalamic Nucleus Deep Brain Stimulation Reduces Cortical Oscillatory Power.

Objective: Parkinson's Disease (PD) is a movement disorder characterized by tremor, rigidity, and bradykinesia. These motor symptoms are related to disruption of fronto-striatal circuits that support motor control. Pathological beta oscillatory activity (12-32 Hz) has been identified in several basal ganglia structures and may represent the underlying mechanism for these motor symptoms. Deep brain stimulation (DBS) of the subthalamic nucleus (STN) may improve motor disability in PD by disrupting pathological beta synchrony. In this study, we sought to determine if PD participants show abnormal beta synchrony at the cortex and if STN DBS reduces this in association with improved motor function.

Participants and Methods: We studied nine PD DBS subjects who were on overnight medication withdrawal, 10 age-matched elderly control subjects (ECS), and 10 younger control subjects (YCS). We obtained

32-channel cortical EEG from each subject while they relaxed in a quiet, darkened room for two minutes. We completed the Unified Parkinson's Disease Rating Scale (UPDRS) and obtained EEG from the PD subjects with DBS stimulation ON and OFF. EEG power from eight frontal channels was discretized into theta, alpha, beta, and gamma frequency bands. **Results:** Relative to the control groups, PD subjects with DBS OFF had significantly higher levels of power in the theta ($\chi^2=8.33$, $p<.05$) and alpha bands ($\chi^2=7.24$, $p<.05$), but not the beta band. DBS significantly reduced PD motor disability ($Z=-2.67$, $p<.01$) and significantly reduced total overall power as well as power in each frequency band (Z 's = -2.49 to -2.67, all p values $<.01$). With DBS ON, the PD group no longer differed from the control groups in theta and alpha power ($p>.05$).

Conclusions: Here, we find that untreated PD subjects show increased cortical oscillatory activity in lower frequency (theta and alpha), but not the beta range relative to controls. STN DBS appears to improve motor disability and normalize cortical oscillatory activity across all frequency ranges.

Correspondence: *Mark Mapstone, PhD, Neurology, University of Rochester, Box 673, 601 Elmwood Avenue, Rochester, NY 14642. E-mail: mark_mapstone@urmc.rochester.edu*

B. FAUSTO, E.M. BENAÛ, M. FONTANA & S. MOELTER. Aerobic Capacity and Attention Network Efficiency in Young Adulthood.

Objective: We examined associations between aerobic capacity (AC), attention, and brain electrophysiology, particularly the N1 and P3b event-related potentials. Although links between AC and cognition are well studied in older adults, less is known about these factors in young adults. We hypothesized that higher AC is associated with more efficient executive control.

Participants and Methods: Twenty-seven college students completed the Attention Network Test (ANT) while 32-channel EEG was recorded. The Harvard Step Test (HST), a measure of maximal aerobic capacity (AC), related to VO₂ max, was also administered to a subsample of these participants ($n=21$). The ANT uses 4 cue (no, center, double, spatial) and 3 flanker conditions (neutral, congruent, incongruent) to assess 3 attention-related constructs: alerting, orienting, and executive. Alerting and orienting efficiency are measured by the gain in performance associated with the presence and spatial information of a cue, respectively. Executive efficiency is associated with the ability to respond rapidly to a target that is incongruent with flanking stimuli.

Results: As expected, N1 amplitude, an index of visual selective attention, was greatest following a double cue while P3b amplitude, an index of stimulus evaluation and decision-making, was significantly greater in incongruent than congruent conditions at posterior electrodes. A significant negative correlation between AC and alerting efficiency ($p=.03$) suggests higher AC was associated with rapid RT in both both cued and non-cued conditions. Increased AC trended toward correlating to executive efficiency ($p=.10$, two-tailed). Our study did not reveal associations between N1 and P3b amplitude and AC.

Conclusions: The present study supports the association between AC and more efficient alerting and executive control networks and, therefore, suggests that fitness may enhance visual attention in young adults. Further research is needed to identify neural correlates of the interaction of AC and executive function.

Correspondence: *Stephen Moelter, University of the Sciences, 600 S. 43rd Street, Philadelphia, PA 19104. E-mail: s.moelte@uscience.edu*

C. BRYDGES, M. ANDERSON, C. REID & A. FOX. Different Developmental Trajectories of Response Inhibition and Interference Suppression: An Electrophysiological Perspective.

Objective: Cognitive control refers to a group of inhibitory processes associated with the ability to attend to a relevant task whilst suppressing distracting information or prepotent responses. The current study examined the electrophysiological development of these two subprocesses, response inhibition and interference suppression, by examining N2 ERP amplitude, latency, and topography.

Participants and Methods: Thirty participants grouped into young children ($n=9$; mean age = 7.56 years), older children ($n=8$; mean age = 10.75 years), and young adults ($n=13$; mean age = 18.00 years) completed a hybrid Go/Nogo flanker task while continuous EEG data were recorded.

Results: The N2 ERP indices for both response inhibition and interference suppression displayed changes in topography between age groups in terms of N2 amplitude. The topography of neural activation associated with response inhibition becomes increasingly frontal with age, possibly due to frontal regions of the brain developing later than other regions. The topography of neural activation associated with interference suppression was found to become increasingly focalized with age, perhaps as a result of a strengthening of synaptic connections that occurs during childhood and adolescence. Additionally, N2 latency decreased with age during successful response inhibition, possibly to be due to myelination occurring during this developmental period.

Conclusions: Overall, these results provide evidence of differential developmental trajectories of response inhibition and interference suppression. These results highlight that combining neuroscience techniques with traditional behavioural measures is useful for improving theories of childhood development.

Correspondence: *Allison Fox, PhD/MClinNeuro, UWA, Mailbag M304, 35 Stirling Hwy Crawley, Perth, WA 6009, Australia. E-mail: allison.fox@uwa.edu.au*

C.S. GILMORE & G. FEIN. Event-Related Theta Synchronization as a Biomarker for Alcoholism's Morbid Effect on Brain Function in Treatment-Naïve Actively Drinking Alcoholics.

Objective: The objective of this study was to investigate the hypothesis that increased induced (non-stimulus-phase-locked) theta event-related synchronization (ERS) is a biomarker for the morbid effects of alcohol abuse on brain function by investigating theta ERS in a group of treatment naïve actively drinking alcoholics (TNA). We have shown previously that induced theta ERS was increased in long-term (>18 months; LTAA) and short-term (6-15 weeks; STAA) abstinent alcoholics when compared to non-alcoholic controls, with greater enhancement in STAA than LTAA. These effects were independent of, and opposite in direction to, results in evoked (stimulus-phase-locked) theta activity which has been shown to be genetically influenced.

Participants and Methods: EEG was recorded from 37 TNA, 33 STAA, 41 LTAA, and 74 non-alcoholic controls in response to targets in a 3-condition visual oddball task. Time-frequency analysis was applied to the EEG data to extract evoked and induced theta activity. Evoked and induced theta were then compared between groups.

Results: One-way ANOVAs were conducted, separately for the dependent variables evoked theta and induced theta, with the independent variable Group (TNA, STAA, LTAA, and non-alcoholic controls). The main results were 1) that induced theta ERS was significantly greater in each of the three alcoholic groups (TNA, STAA, and LTAA) when compared to non-alcoholic controls, and 2) that the theta ERS enhancement in the TNA and STAA groups, compared to controls, was significantly greater than that in the LTAA group.

Conclusions: Results are consistent with the proposition that increased theta band ERS is likely a biomarker for the morbid effects of alcohol use/abuse on the brain that may partially resolve with extended abstinence. However, it will be important and necessary in future studies to demonstrate a relationship between increased induced theta ERS and cognitive deficits in these alcoholic groups.

Correspondence: *Casey S. Gilmore, Neurobehavioral Research, Inc., 1585 Kapiolani Blvd., Suite 1030, Honolulu, HI 96814. E-mail: cgilmore@nbresearch.com*

L. GRAVES, M. CERVANTEZ, A.J. GREEN, C.D. MORGAN & C. MURPHY. The effects of age and the Apolipoprotein E $\epsilon 4$ allele on OERP scalp topography in odor recognition memory.

Objective: Alzheimer's is a neurodegenerative disease that affects 5.4 million Americans. Two major risk factors for AD are age and the $\epsilon 4$

variant of the Apolipoprotein E gene. The earliest stages of AD affect brain areas involved in olfaction and memory. Olfactory event-related potentials, due to their excellent temporal resolution, are a valuable method for investigating olfactory function. Studies show that individuals at risk for AD display increased OERP latency and decreased amplitude in cross-modal tasks of odor recognition memory. These differences are evident before onset of dementia, signifying the potential contribution of OERPs in AD diagnosis. Dual-process models suggest that recognition memory consists of two distinct processes: familiarity and recollection. ERP studies of visual recognition memory have reported distinct neural correlates for these processes, with notable activity at scalp electrode sites over frontal, medial temporal, and parietal areas. Whereas recollection is compromised in aging, familiarity remains fairly intact. This study investigated the effects of age and $\epsilon 4$ status on OERP scalp topography in odor recognition memory.

Participants and Methods: Sixty adults were equally divided into three age groups (young, middle, old) matched on $\epsilon 4$ status. OERPs were recorded while participants completed an odor recognition memory task. Odors were presented with a computer-controlled olfactometer.

Results: In addition to univariate analyses of the effects of age, $\epsilon 4$ status, and response type on OERP latency and amplitude, statistical analyses of topographical differences were performed using Cartool. Results indicated differences in scalp topography as a function of age, $\epsilon 4$ status, and response type during retrieval of odors.

Conclusions: These findings reveal the effects of age and the $\epsilon 4$ allele on the neural correlates of odor recognition memory and improve our understanding of olfaction and its relation to neurodegenerative disease. This study is supported by NIH grant DC002064-15 to Claire Murphy. Correspondence: *Lisa Graves, SDSU, 4760 Kansas St., Unit F, San Diego, CA 92116. E-mail: lvgraves@gmail.com*

D.J. HARDY, J.T. HARTLEY & A.A. HARTLEY. Older Adults Maintain Visual-Spatial Filtering Ability: RT and Event-Related Brain Potential Evidence.

Objective: Successful navigation of everyday life requires selective attention to sensory information as well as to responses. Older adults have been shown to have declines in a variety of attention-related processes. In the present study, we examined visual-spatial filtering ability and response selection in younger and older adults. Visual-spatial filtering requires the selection of relevant information and the ignoring or blocking of irrelevant information. One situation where irrelevant information can be ignored (versus being processed and then rejected) is when such information is in a fixed location.

Participants and Methods: Participants completed a simple task in which they had to identify a centrally-located target letter (L or R) that was flanked by non-target letters. Response selection was manipulated via a cue indicating whether a compatible response (e.g., “press the right button when you see the target R”) or incompatible response (e.g., “press the left button when you see the target R”) must be made. Reaction time and event-related potentials (P300 latency) were recorded on each trial.

Results: Both measures indicated that the older group, while generally slower, did not show greater interference from non-target letters or from response incompatibility relative to the younger group. In addition, using an additive factors approach, visual-spatial filtering and response selection appear to be independent non-interacting processes.

Conclusions: Our conclusions are that visual filtering ability and response selection are maintained in older adults, and that those previous studies finding age-related deficits in filtering ability involved tasks that did not in fact permit the blocking of irrelevant information. Finally, we argue that it is important to identify not only impaired cognitive functions in older adults but also those processes that are spared. In this way, a balanced model of cognitive and brain health through the lifespan can be developed.

Correspondence: *David J. Hardy, Ph.D., Loyola Marymount University, 1 LMU Drive, University Hall, Suite 4700, Los Angeles, CA 90045. E-mail: dhardy@lmu.edu*

D.M. LOGAN, D. RACKHAM & M.J. LARSON. Cognitive Control and Performance Monitoring in Pregnant/Post-Partum Women.

Objective: Research on cognitive changes during pregnancy is mixed. Recent studies suggest improved cognitive control abilities related to performance monitoring in women postpartum relative to during pregnancy. The objective of the current study was to longitudinally examine cognitive control and performance monitoring in pregnant/post-partum women and never-pregnant controls. Electroencephalogram (EEG) was used to gather data on the error-related negativity (ERN) and the post-error positivity (Pe) event-related potentials (ERPs) and response times (RT) and error rates.

Participants and Methods: A computerized color-word Stroop test was administered while EEG was collected to a group of 18 pregnant women in their third trimester and repeated approximately three months following childbirth. Results were compared to 20 healthy, never pregnant female controls retested at the same interval. Separate 2-Group (pregnant, control) x 2-Time x 2-Congruency repeated measures ANOVAs were used to examine behavioral data (RT and accuracy) with separate 2-Group x 2-Time x 2-Accuracy repeated measures ANOVAs for ERP analysis.

Results: There was a significant Group x Time x Accuracy interaction for RTs and error rates with the control group showing faster RTs with less accuracy than was seen in the pregnant group. A main effect of accuracy was seen with both the ERN and the Pe, but no main effects or interactions with group were significant.

Conclusions: Findings suggest that the pregnant/postpartum women may have been more vigilant to task requirements during the second session, but do not support an increase in electrophysiological reflections of performance monitoring following childbirth seen through the ERN or Pe.

Correspondence: *Dustin M. Logan, MS, Brigham Young University, 1955 N. 1400 E., Provo, UT 84604. E-mail: logan.dustin@gmail.com*

P. MOES & B. CAVANAUGH. “Happy Together:” Interhemispheric ERP Synchrony for Happy and Angry Emotion Perception.

Objective: A number of neuroimaging studies have shown hemisphere differences in emotion perception (see Wager et al., 2003). However, no studies have examined how emotion perception influences synchronization of left-right hemisphere processing modules. We examined differences in interhemispheric synchrony scores (IHSS) in relation to emotion perception (angry vs. happy), 3 cortical areas (frontal, anterior temporal, posterior temporal), and gender. We predicted that happy expressions would create greater left-right synchrony, females would show greater synchrony, and angry expressions would be associated with greater anterior temporal synchrony, while happy expressions would produce greater synchrony in the other areas.

Participants and Methods: 20 (10 male; 10 female) participants compared bilaterally presented face-emotion pairs. We used a cross-correlation analysis (Jerger, et al., 2004) or “interhemispheric synchrony score” of the P300 wave (i.e., 300-800 msec) to determine the synchrony of left-right lead pairs.

Results: Females had significantly greater IHSS values for all conditions, but the predicted main effect of emotion did not reach significance ($p=.054$). Surprisingly, anterior temporal areas produced significantly lower IHSS than frontal or posterior temporal areas, and these differences did not interact with emotion. There was a significant 3-way interaction, with females showing significantly greater angry IHSS for anterior temporal areas, but males showing greater happy IHSS for posterior temporal areas.

Conclusions: The results suggest that gender differences exist in the extent that left and right modules synchronize in response to emotion perception and this difference interacts with the type of emotion and the specific modules involved. The present study also serves as a baseline-performance study for individuals with autism and agenesis of the corpus callosum; the conclusions are related to predicted outcomes for these clinical populations.

Correspondence: *Paul Moes, Ph.D., Psychology, Calvin College, 3201 Burton St. SE, Grand Rapids, MI 49546. E-mail: pmoes@calvin.edu*

W.R. MOORE, M.A. GARCIA-BARRERA, J.H. DAVIDOW, T.E. BAKER, C.B. HOLROYD & J.E. KARR. Electrophysiological and Behavioral Investigation of Dopamine-Related Error Processing in Individuals Who Stutter: A Foundation for Future Treatments.

Objective: Recent models of stuttering suggest that dysfluencies (tagged as 'errors') are exacerbated by either an early detection and attempt to covertly repair them or by a hyperactive monitoring system, possibly involving a dysfunctional basal ganglia and anterior cingulate cortex (ACC). Both stuttering and monitoring systems are thought to involve dopaminergic circuits; thus, the hyper-engagement of dopamine-related monitoring systems could be empirically tested using a neurophysiological response associated with reward prediction error signals; specifically, the feedback error-related negativity (fERN; Holroyd & Coles, 2002). For this study, we predicted larger fERN amplitudes in individuals who stutter (IWS) as a result of the underlying increased engagement of error processing networks.

Participants and Methods: High-density ERPs were collected from 12 IWS and 13 fluent controls who participated in a virtual T-maze task where they could earn monetary rewards (5 cents) or no rewards (0 cents) on each of 160 trials. A difference wave (i.e., fERN) was created at a frontal-central channel where the fERN was maximal by subtracting no reward from reward ERPs and the peak amplitude was compared between groups.

Results: Inconsistent with our predictions of hyperactivity, the fERN amplitude was not significantly larger in IWS; however, results did approach significance, $t(23) = -1.05$, $p = 0.151$. Other serendipitous behavioral findings, such as a significant increase in eye blinks following stimulus presentation in IWS, $t(23) = 2.82$, $p < 0.0001$, suggest other avenues for hyperactive dopamine activity in this group.

Conclusions: Although hyperactivity was not found in this generic marker of error processing, our findings suggest that the possibility of a dysregulated dopamine system still exists in IWS. Treatments that target the error processing and dopamine networks (i.e., basal ganglia and ACC), such as mediation, may provide fruitful benefits for IWS; implications for future research avenues are discussed.

Correspondence: *William R. Moore, University of Victoria, 301-1233 Fairfield Rd, Victoria, BC V8V 3B4, Canada. E-mail: wrmoore@uvic.ca*

C. SIMON, J. YANG, A. SCHNEIDER, L. HAMILTON, P. HAGERMAN, R. HAGERMAN & J. OLICHNEY. Abnormal Semantic Processing and Episodic Memory in Females with Fragile X-associated Tremor/Ataxia Syndrome (FXTAS).

Objective: FXTAS, a recently discovered neurodegenerative disorder, affects Fragile X (FMR1) gene premutation carriers in late-life. Studies have shown cognitive impairments in FXTAS including executive dysfunction, working memory and visual-spatial deficits. However, less is known about cognition in FXTAS females, in whom different pathogenic mechanisms from males have been suggested (RJ Hagerman et al 2009 Am J Hum Genet). Thus, we examined semantic and episodic memory in FXTAS females with event-related potentials (ERPs) and neuropsychological testing.

Participants and Methods: 37 females (20 FXTAS $M_{age}=62.7$, 17 controls $M_{age}=60.5$) were studied with 32-channel ERPs during a category judgment/word repetition paradigm in which semantically congruous (50%) and incongruous target words are repeated ~10-140 s later. N400 and P600 amplitude data were submitted to ANOVA.

Results: Neuropsychological testing revealed slightly reduced verbal learning in FXTAS females. ERP analyses showed larger N400 amplitudes to target words ($F = 9.9$, $p = 0.003$), with a smaller N400 congruity effect (Incongruous - Congruous) in FXTAS ($F = 14.6$, $p = 0.001$). The P600 repetition effect (New - Old) was significantly reduced in FXTAS females ($F = 17.8$, $p < .001$). Significant correlations were present between P600 repetition effect amplitude and episodic memory, both on the CVLT (e.g. $r = .70$, $p = .0004$ with learning across trials 1-5; $r = .41$, $p = .035$ with long delayed cued recall), and subsequent memory for the experimental stimuli (e.g. $r = .38$, $p = 0.02$ with cued recall).

Conclusions: The N400 abnormalities found in FXTAS females provide electrophysiological evidence for abnormal semantic processing.

The increased N400 amplitude may reflect increased semantic processing load and/or a failure to inhibit semantically irrelevant information. Their smaller N400 congruity effect suggests abnormal semantic memory organization. Reduced P600 repetition effect amplitudes appear sensitive to subtle decline in episodic verbal memory.

Correspondence: *Christa Simon, B.S, Neurology; UC Davis, 202 Cousteau Place, Center for Mind and Brain, Davis, CA 95618. E-mail: christasimon@gmail.com*

T. SPOKES, T. CUTMORE & D. SHUM. Age-Related Changes to Neural Processing of an Automatic and Controlled Task of Cognitive Inhibition.

Objective: The ability to suppress unwanted processes and distracting stimuli, or cognitive inhibition, has been identified as a possible contributor to general age-related cognitive decline. In theory, cognitive inhibition has been divided into two streams; automatic and controlled. Automatic inhibition is efficient and occurs without awareness, while controlled inhibition is effortful and requires more cognitive resources. Behavioural findings often suggest that automatic tasks are preserved in older adults, while controlled tasks are impaired to varying degrees. Contrary to this, a growing body of evidence suggests that although older adults maintain performance on automatic tasks, neural processing of these tasks is impaired.

Participants and Methods: The current study used EEG to compare neural processing associated with a controlled and an automatic cognitive inhibition task across three age groups: 18-35, 55-70 and 70+ years ($n=20$ /group. Total $N=60$).

Results: Despite no behavioural differences between the groups on either task, neural processing of the automatic task was significantly different between the young adults and the two older age groups (all p 's $< .014$), while the two older groups did not differ. The controlled task was significantly different between the young adults and the oldest age group ($p < .004$), while the middle aged adults did not differ from either group. Processing differences on both tasks show that older adults have greater activity over the frontal sites (~250-450ms) with an associated reduced activity in the parietal sites compared to the younger adults.

Conclusions: These results suggest that young adults are distinct from the two older age groups when processing an automatic task, possibly reflecting some efficient processing advantage. However, a more gradual age-related change occurs to the processing of a controlled task. Clarifying age-related changes in neural processing of automatic and controlled tasks provides insight into a potential core component of general cognitive decline.

Correspondence: *Tara Spokes, Applied Psychology; Griffith University, 10 Benson St, Ormeau, QLD 4208, Australia. E-mail: t.spokes@griffith.edu.au*

G.A. STEFANATOS, H. ZOBEL, H. MEHRER, A.T. TESLA & T.P. COSTANZO. Attentional Effects on Steady State Auditory Evoked Responses to FM.

Objective: Attention is known to exert significant effects on the amplitude of late cognitive event related potentials. Several studies suggested that attention can also modulate the magnitude of steady state auditory evoked responses (SSAEPs) to amplitude modulation in sound. Whether attention also influences SSAEPs' to frequency modulations (FM) is uncertain. We therefore examined the influence of attention on SSAEPs to rapid FM in sound.

Participants and Methods: SSAEPs were recorded from 16 normally hearing adults with 21 electrodes in 10-20-array. Averages were computed off-line following movement artifact removal. Participants listened to FM tones comprised of continuous repetitive runs of upward or downward going pulsed modulations presented four times a second. In the auditory attend condition, participants listened for and counted rare "oddball" events where the direction of modulation briefly changed (from up going to down going or vice versa). In the distract-condition, the same FM tones were presented while participants performed a visual oddball task by counting pseudo-randomly occurring letters on a screen.

Results: In auditory attend-condition a transient response was observed to the onset of the oddball stimuli (auditory evoked stimulus onset potential (AESOP)). This was composed of a negative peak at about 170 milliseconds followed by a positive peak at 270 milliseconds. In the distract-condition this response was greatly diminished or lacking. FFT-analysis of the interleaved SSAEPs reflected no significant difference in amplitude or phase between conditions.

Conclusions: This paradigm demonstrates the influence of attention, which clearly modulated the magnitude of the AESOP responses. By contrast, attention appeared to have no effect on the amplitude or phase of SSAEPs. This suggests that these are obligatory responses that are pre-attentive in nature. These results have important implications for interpreting anomalies of SSAEPs that have been described in various clinical populations. Correspondence: *Gerry A. Stefanatos, D.Phil., Communication Sciences and Disorders, Temple University, 1701 N. 13th St., Philadelphia, PA 19122. E-mail: stefang@temple.edu*

Genetics/Genetic Disorders

B. BARBER & S. MARCY. Neuropsychological Profile of 7q11.23 Duplication: A Family Case Study.

Objective: The phenotype of reciprocal Williams-Beuren Syndrome duplications (7q11.23 Duplication Syndrome) has only recently emerged, as the first case was not identified until 2005. Thus far, less than 100 cases have been identified in the scientific literature, with MRI's revealing a lack of consistent brain abnormalities (Berg et al., 2007; Osborne & Mervis, 2007; Somerville et al., Van der Aa et al., 2009; Velleman, 2011). We hypothesize that our results will build upon initial studies that revealed higher incidences of autism, varying intellectual functioning, speech and language delay, developmental delay, social anxiety, with intact visual-spatial skills (Van der Aa et al., 2009, Velleman, 2011).

Participants and Methods: This case study evaluates the neuropsychological functioning of five family members ranging in age from 3 months to 34 years old ($M=9.65$, $SD=13.8$), all with confirmed 7q11.23 Duplication Syndrome.

Results: Results reveal generally Low Average intellectual functioning ($M=83.2$, $SD=6.9$). Receptive language ($M=97$, $SD=9.2$) was consistently stronger than expressive language ($M=85$, $SD=6.4$). A deficit was found in visual-spatial skills ($M=70$, $SD=18.9$) as compared to motor coordination ($M=79$, $SD=10.1$) and visual motor abilities ($M=87$, $SD=10.9$). Reading is a relative academic strength ($M=83.7$, $SD=5.5$) with a weakness in mathematics ($M=67.7$, $SD=11.7$). The three school-aged girls demonstrated elevated internalizing and externalizing behaviors. Four of the five subjects presented with symptoms on the autism spectrum. Overall, adaptive functioning was significantly higher for the children's father with the strongest general cognitive performance in the Average range by the infant.

Conclusions: This case study suggests a distinct neuropsychological profile of 7q11.23 Duplication Syndrome, specifically highlighting relative strengths and deficits and potential emerging differences across age spans. The results may serve as an aide in increasing the accuracy of early identification, diagnosis, and intervention.

Correspondence: *Beth Barber, Psy.D., Children's Hospital Los Angeles, 4650 Sunset Blvd., MS#53, Los Angeles, CA 90037. E-mail: bbarber@chla.usc.edu*

H.A. BENDER, A.M. ÅKERSTEDT-MILEY, J. SPAT, J.S. STROBEL, S. TOWNS, J. WEINFELD, N. HOCHSZTEIN, W.S. MACALLISTER, C.E. CARLSON, J. WEISFELD-ADAMS & G.A. DIAZ. The neuropsychological and adaptive functioning of children with Cobalamin C (cblC) disease.

Objective: Cobalamin C (cblC) is a rare genetic disorder affecting vitamin B12 metabolism, resulting in widespread neurometabolic, neurochemical and neuroanatomical abnormalities. To date, no known study has comprehensively examined the intellectual, neuropsychological, behavioral and adaptive functioning of this population along the developmental line.

Participants and Methods: Nine children, aged 18 – 77 months ($X=46.55$, $SD=17.61$), were evaluated. Neurocognition was assessed by

either the Bayley Scales of Infant and Toddler Development-III (BSITD-III) or Wechsler Preschool and Primary Scale of Intelligence-III (WPPSI-III). Adaptive behavior was measured via the Vineland Adaptive Behavior Scale-II (VABS-II) Expanded Interview edition conducted with the child's parent(s). Medical records and blood serum levels of homocysteine and methylmalonic acid were also reviewed.

Results: Overall, children with cblC demonstrate widespread neurocognitive dysfunction, falling in the Impaired range on all tasks administered (Full Scale composites, language-, non-verbal-, and motor functioning), with relative strengths observed on performance-based tasks. Adaptive functioning was also pervasively delayed (all domains falling in the Impaired range), with most notable deficits occurring in the areas of communication abilities, socialization and motor functioning. The relationship between cognition/adaptive functioning, cblC genetic variant, age at diagnosis, and current homocysteine and methylmalonic acid levels were also evaluated. The severity of the aforementioned deficits varies significantly based on disease subtype and ongoing hyperhomocystinaemia.

Conclusions: Comprehensive assessment of populations with cblC is crucial given the high risk for pervasive intellectual, motor, social and functional delays. Serial neuropsychological evaluations should begin in early childhood in order to maximize future functioning in these areas. Correspondence: *Heidi A. Bender, Ph.D., Neurology, Mt. Sinai School of Medicine, 5 East 98th Street, 7th Floor, New York, NY 10029. E-mail: HeidiBender@aol.com*

M. BLACKWELL & E. KERR. Psychosocial Protective Factors Within Families of Children With Shwachman Diamond Syndrome.

Objective: Shwachman Diamond Syndrome (SDS) is a rare, recessive and life-threatening disease impacting multiple organs. It is associated with cognitive and functional difficulties in children. Previous studies have highlighted parent reports of behavioral and social issues, but have conceptualized these difficulties as a direct consequence of gene dysfunction. To date, there is inadequate information regarding psychosocial adjustment in SDS. We examined multiple family and self-esteem factors related to psychosocial adjustment of children with SDS.

Participants and Methods: Responses to measures of psychosocial adjustment (FES and CFSEI-2) of 32 children (6 through 16 years) with SDS were compared to norms, healthy siblings, and age- and sex-matched children with Cystic Fibrosis (CF), a similar recessive disease. Ratings were compared to overall intellectual functioning (WISC-IV FSIQ) and parent ratings of attention, social (CBCL), and adaptive functioning (SIB-R).

Results: Mean T-scores from FES and CFSEI-2 scales were compared to norms and CF controls using t-tests. Paired t-tests compared SDS to sibling controls. Pearson Product Moment correlations were conducted between the FES and CFSEI-2 and age, gender, FSIQ, CBCL and SIB-R scales. The family environment of children with SDS was reported to emphasize organization and rules while being committed and supportive, compared to CF controls and norms. Parents also reported stronger intellectual, cultural, ethical and religious values than expected. Sizeable proportions of children with SDS reported low social and academic self-esteem, which is in keeping with parent-identified (CBCL) issues, and had significantly lower perceptions of self-esteem than children with CF. However, as a group, they reported average self-esteem.

Conclusions: Despite having multiple disease-related stressors, risk factors and functional impairments, there appear to be psychosocial protective and compensatory factors within families of children with SDS. Correspondence: *Melissa Blackwell, Psy.D., Psychology, The Hospital for Sick Children, 77 Elm St., Apt. 102, Toronto, ON M5G 1H4, Canada. E-mail: melissacarrie@gmail.com*

A.L. BROWN, L.M. CROWE, A. BONEH & V. ANDERSON. Neuropsychological profile of children with glutaric aciduria type 1 detected by newborn screening – 5 year follow up.

Objective: Glutaric Acidemia Type 1 (GA1) is a metabolic disorder that occurs in approximately 1 in 100, 000 newborns. Affecting the metabolism of lysine and tryptophan, it causes an accumulation of glutaric

acid and 3-hydroxyglutaric (3OHGA) acid. These can be neurotoxic to the brain, and typically affect the basal ganglia, resulting in movement disorders. Though newborn screening has improved clinical and motor outcomes, it is still unclear how this may have affected neurodevelopmental outcomes. Whilst problems with speech and language have been acknowledged in the literature, more recently fine motor deficits have been proposed to occur. Currently there is limited reports on the neurodevelopment of children with GA1, and even less on the developmental trajectory. The aim of the study was to follow up on previously assessed participants, and provide further long term information on the neuropsychological profile of GA1.

Participants and Methods: Four participants were assessed using a comprehensive, standardised neuropsychological assessment battery focusing on IQ, memory, executive functioning, attention, motor skills, language, behaviour, social skills, and adaptive behaviour. Results were compared to previous assessments.

Results: Standard scores on all tests will be reported and compared to the standardised, age based test norms. Individual case reports will be presented over two time points, with a focus on the language and fine motor weaknesses that may be central to the profile of children with GA1.

Conclusions: Although early treatment may improve motor outcomes, children may still present with deficits in particular neurocognitive areas. The case studies presented highlight the importance of a comprehensive neuropsychological assessment, in order to identify specific strengths and weaknesses. Follow up assessments are essential to monitor neurodevelopment and provide appropriate interventions to improve outcomes.

Correspondence: *Amy L. Brown, Postgraduate Diploma of Psychology, Child Neuropsychology, Murdoch Childrens Research Institute, Level 4 West Royal Childrens Hospital, Flemington Rd, Parkville, Melbourne, VIC 3052, Australia. E-mail: amy.brown@mcri.edu.au*

R.M. BUSCH, J.S. CHAPIN, J.S. HAUT, J.L. MESTER, L.L. FERGUSON & C. ENG. Cognitive Characteristics Associated with Cowden Syndrome (CS), Bannayan-Riley-Ruvalcaba Syndrome (BRRS), and Other Syndromes Involving PTEN Mutations.

Objective: Germline mutations of PTEN, a tumor suppressor gene, occur in several clinical syndromes, including Cowden Syndrome and Bannayan-Riley-Ruvalcaba Syndrome. Macrocephaly, developmental delay, and mental retardation have been associated with PTEN mutations and these clinical syndromes. However, no studies have systematically investigated the cognitive characteristics of these patients. This case series characterizes cognition in 20 individuals with known PTEN mutations as well as 3 individuals with classic CS (n=1) or BRRS (n=2) without PTEN mutations.

Participants and Methods: All participants (20 adults, 3 children) voluntarily completed a neuropsychological assessment as part of their participation in this research study. Adults ranged in age 23-60 (M=43.95, SD=12.19) and had a mean of 16.25 years of education (SD=2.36). Children were 14-17 years old. Test performance was examined across a wide range of cognitive abilities.

Results: Three participants (12.5%) showed rather global cognitive impairments, including borderline to extremely low range FSIQ scores. FSIQ for the remaining participants (n=20) ranged 85-137 (M=108.84, SD=12.79). The most commonly observed findings were borderline to extremely low dominant hand dexterity (n=8, 40%) and reduced performance on executive functioning (EF) measures (n=11, 55%). Most patients demonstrated reduced performance on one (n=8) or two (n=2) EF measures. Only one participant demonstrated low performance on all measures of EF, and nine patients did not have difficulty on any EF measure. Most patients with low average or above IQ scores demonstrated intact performance on measures of academic ability, memory, naming, semantic fluency, visuospatial skills, and motor speed.

Conclusions: Global cognitive impairment is relatively rare in patients with PTEN mutations or associated clinical syndromes and certainly less prevalent than the current literature would suggest. However, mild to moderate frontal lobe dysfunction appears to be relatively common in such patients.

Correspondence: *Robyn M. Busch, Ph.D., Epilepsy Center, Cleveland Clinic, 9500 Euclid Avenue, P57, Cleveland, OH 44111. E-mail: buschr@ccf.org*

J.S. CHANG. Elevated Plasma Lactate/Pyruvate Ratio as a Marker for Deficits in Adaptive and Neurocognitive Abilities in Children with Mitochondrial Disease.

Objective: Mitochondrial Diseases (MD) are disorders of function in cellular oxidative phosphorylation caused by diverse genetic mutations and seen in 1/5,000 births. A critical problem in understanding MD is quantifying all their clinical manifestations due to the large spectrum of symptoms presented. The purpose of this study was to examine relationships among biochemical measures and neuropsychological functioning of children with MD. Special attention was given to blood levels of lactate and pyruvate, which are often elevated in patients with mitochondrial dysfunction.

Participants and Methods: 25 children (ages 5-12) were recruited from Medical Neurogenetics, LLC, a research clinic focused on neurogenetic disorders. Participants were administered subtests from the DAS-II, NEPSY-II, and WIAT-II. The BASC-II Parent Rating Form and Vineland-II Survey Interview were also completed. The mean plasma lactate/pyruvate (L:P) ratios were obtained from the participants' medical records up to a year before and after neuropsychological testing was completed.

Results: The relationships between the mean L:P ratio and neurocognitive measures were investigated using Pearson product-moment correlation coefficient. Strong negative correlations were found between L:P ratios and measures of adaptive skills (e.g. Vineland Adaptive Behavior Composite $r=-.40$), language (e.g. DAS Verbal Cluster $r=-.61$), processing speed (e.g. DAS PS Cluster $r=-.58$), working memory (e.g. DAS-II WM Cluster $r=-.60$), fine motor abilities (e.g. NEPSY FTT Repetition $r=-.52$), and attention and executive functioning (e.g. NEPSY Inhibition-Switching $r=-.50$).

Conclusions: The results of this study suggest that increased levels of L:P ratio may be a marker for deficits in adaptive skills and a wide-range of neurocognitive abilities in children with mitochondrial dysfunction. Lactic acidemia is characterized by an accumulation of lactate in blood and tissues. In MD, lactate accumulates without significant acidosis in most patients.

Correspondence: *Jihye S. Chang, Psychology, Georgia State University, 195 Arizona Avenue #128, 8229 164th street, Atlanta, GA 30307. E-mail: jchang15@student.gsu.edu*

S.B. CLARKE & E. SHAPIRO. Psychosocial Functioning in Mucopolysaccharidosis I: Disease Severity, Treatment Type, and Age.

Objective: Accumulating evidence supports a behavioral phenotype in mucopolysaccharidosis I (MPS I; Pitt, Lavery, & Wager, 2009; Pitt, Lavery, & Wager, 2006; Bax & Colville, 1995), which includes increased levels of withdrawal and less well developed adaptive and social skills. Further, targeted assessment by age group revealed that these findings were significant in the preschool years and in adolescence; however, they were not significant in middle childhood. The current study examines these associations, and includes associations with disease severity (Hurler, Hurler-Scheie) and treatment type (enzyme replacement therapy, hematopoietic cell transplantation, or both).

Participants and Methods: Participants included 47 children diagnosed with Hurler or Hurler-Scheie Syndrome who had undergone ERT, HCT, or both. Parents completed the Behavior Assessment System for Children, 2nd Edition.

Results: Findings support previous evidence for increased withdrawal in individuals with MPS I.

Conclusions: Determination of behavioral phenotypes for neurogenetic disorders with known biological underpinnings provides unique opportunities for examining the relationship between nature and nurture in the psychosocial development of individuals with such conditions as well as their typically-developing counterparts. Further, increased understanding of the natural course of psychosocial development of these disorders may serve to discern efficacy of treatments in the future.

Correspondence: *Stephanie B. Clarke, B.A., Institute of Child Development, University of Minnesota, 51 East River Road, Minneapolis, MN 55455. E-mail: clar0491@umn.edu*

S.W. DUVALL, K.E. KING, K. RUDSER, K. DELANEY & E. SHAPIRO. Executive Function in Individuals with Mucopolysaccharidosis, Type I (MPSI).

Objective: Mucopolysaccharidosis, type I (MPSI) is a rare neurodegenerative genetic disorder with severe and attenuated forms. Individuals with the severe type, Hurler Syndrome (MPSIH) have earlier onset and more CNS involvement than those with attenuated MPSI (MPSIA) and are treated with hematopoietic cell transplant (HCT), halting cognitive decline. However, HCT adversely affects white matter and its functions and has been associated with executive functioning (EF) difficulties. The goal of this study was to examine the EF of individuals with MPSIH and MPSIA in comparison to each other and the normative population. **Participants and Methods:** Seventeen individuals with MPSIH (all treated with HCT) and 13 individuals with MPSIA (all treated with enzyme replacement therapy) completed tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB®).

Results: Compared to the normative sample, individuals with MPSIH showed deficits (z-scores greater than 1.5 standard deviations from the mean) on measures of spatial recognition memory and spatial working memory. Individuals with MPSIA showed large deficits in spatial working memory compared to the normative sample. Compared to the MPSIA group, MPSIH individuals showed greater executive dysfunction on a task of spatial recognition memory. On a task of planning and sequencing, the MPSIH group started the task slower on average than the MPSIA group possibly suggesting more careful planning. However, after adjusting for IQ, the MPSIA group was found to have greater difficulty on a task of spatial working memory than did the MPSIH group.

Conclusions: The current study suggests that the EF domain of spatial working memory was most affected in our sample. While both groups performed below expectation based on normative data, despite their history of HCT, the MPSIH group performed significantly better than the MPSIA group when adjusted for IQ. This may suggest that the benefits of HCT may outweigh the possible neurotoxic consequences with regards to spatial working memory.

Correspondence: *Susanne W. Duvall, Ph.D., University of Minnesota, Univ New Mexico, 420 Delaware Street SE, MMC 486, Minneapolis, MN 55455. E-mail: swduvall@umn.edu*

G. GERNER, S. MURPHY-BOWMAN, T.E. HO, T.D. VANNORS-DALL, J.C. HARRIS, H. JINNAH & D.J. SCHRETLEN. Episodic Memory in Autism and Lesch-Nyhan Disease.

Objective: Persons with autism can show impairments of episodic memory, but the specificity of these is unclear. Here we compared performance on a test of episodic memory by adults with autism or autism spectrum disorder, Lesch-Nyhan disease and no developmental disorder.

Participants and Methods: Using multiple one-way ANOVAs and Bonferroni-corrected post hoc comparisons, we examined group differences in learning, delayed recall, retention, and delayed recognition memory on the revised Hopkins Verbal Learning Test (HVLT-R) in 11 adults with classic Lesch-Nyhan disease (LND), 7 with a less severe variant of it (LNV), 9 with classic autism (CA), 8 with autism spectrum disorder (ASD), and 18 healthy adults (HC). Diagnoses of LND/LNV were based on fibroblast assays of residual hypoxanthine phosphoribosyltransferase enzyme activity and clinical features. Diagnoses of CA/ASD were based on self-report and caregiver ratings on the Childhood Autism Rating Scale (CARS). Participants with autism were classified as having CA if their CARS total score exceeded 37 (and ASD if their CARS total was less than 38).

Results: Significant ($p < 0.05$) group differences were observed on every HVLT-R measure. All four patient groups performed more poorly than healthy adults. However, those with CA showed worse retention than the other clinical groups. Adults with LND and LNV showed worse de-

layed recognition than HCs, while the delayed recognition performances of adults with CA/ASD were intermediate between those of the HC and LND/LNV groups. Finally, adults with CA made more semantically-unrelated false positive errors on recognition testing than the other patient groups.

Conclusions: Adults with CA/ASD and LND/LNV showed impairments of word list learning and memory that vary by disease type and severity. Patients with CA showed worse retention and made disproportionate number of semantically-unrelated false positive errors that could result from dysfunction of their semantic systems.

Correspondence: *Guendolyn Gerner, Psy.D., Neurology & Developmental Medicine, Kennedy Krieger Institute, 716 N. Broadway, Baltimore, MD 21205. E-mail: gerner@gkennedykrieger.org*

G. GERNER, Y. TAKAYANAGI, T.E. HO, A.S. BUCCHHOLZ, M. VARVARIS, T.D. VANNORS-DALL, J.C. HARRIS, H. JINNAH & D.J. SCHRETLEN. Cortical Thickness Abnormalities in Lesch-Nyhan Disease.

Objective: Lesch-Nyhan disease (LND) is an X-linked recessive disorder caused by deficiency of hypoxanthine phosphoribosyltransferase (HPRT). Phenotypic characterization includes over-production of uric acid, severe dystonia, intellectual disability, and self-injury. Other features include mood disturbance, aggressive, inattentive, stereotyped, hyperactive, and disturbing interpersonal behavior. Imaging and autopsy findings in LND highlight reduced striatal volume and prominent horns of the lateral ventricles. No studies have examined cortical thickness in patients with LND.

Participants and Methods: Magnetic resonance imaging (MRI) was obtained for 8 males with LND and 16 age- and sex-matched healthy controls (HC). We used FreeSurfer v5.1.0 to measure cortical and sub-cortical volume, as well as cortical thickness. A MANCOVA with a Monte-Carlo simulation correction ($p < .01$), controlling for age, sex, and intracranial volume compared brain volumes/thickness between groups.

Results: Compared to NCs, the LND group had significantly reduced cortical gray (16%) and white (27%) matter. Subcortical gray matter was also reduced (13%) particularly in the striatum, ventral diencephalon, amygdala, and accumbens. Increased cortical thickness was observed in the bilateral anterior cingulate (15%), medial orbitofrontal (12%), superior frontal (4%), and superior parietal (5%) cortices. Cortical thinning was observed only in the left precentral gyrus (7%).

Conclusions: We found reduced brain volumes consistent with the microcephalic presentation of LND patients and previous imaging and autopsy findings. Significant cortical thickening and thinning may suggest abnormal neuronal migration and/or pruning within the context of LND. Similar imaging findings in other conditions have been found to correlate with hyperactivity, impulsivity, mood disturbance, aggression, lying, and socially inappropriate behaviors, many of which are seen in persons with LND.

Correspondence: *Guendolyn Gerner, Psy.D., Neurology & Developmental Medicine, Kennedy Krieger Institute, 716 N. Broadway, Baltimore, MD 21205. E-mail: gerner@gkennedykrieger.org*

A.B. GOLD, T.E. LOTZE, H. YOSHIDA & K.D. EVANKOVICH. Duchenne Muscular Dystrophy: Academic Achievement and Cognitive Correlates.

Objective: To further explore the cognitive profile of children with Duchenne muscular dystrophy (DMD), and the relationship between this cognitive profile and academic achievement. Cognitive skills examined include immediate recall of verbal information (verbal span), verbal working memory, language skills, and behavioral and cognitive attention.

Participants and Methods: Children with DMD between the ages of 6 and 16 years ($n = 17$) and a sibling comparison group ($n = 8$) were administered measures of math and reading achievement, as well as cognitive measures having established correlations with read-

ing and math disabilities. Given the small sample size, comparisons were made between the entire group with DMD and a smaller sibling comparison group using descriptive statistics and effect sizes. Because of the dependence that may occur when using siblings as a comparison group, DMD-sibling pairs were also analyzed. The contribution of verbal span, verbal working memory, attention, and language skills to academic achievement was also examined in children with DMD.

Results: Children with DMD were found to have difficulties across academic measures, with specific difficulties in math. Although children with DMD displayed lower performance on all but one cognitive measure, the DMD group performed significantly worse than the sibling comparison group on a measure of verbal working memory. Pearson correlations between academic achievement and cognitive measures in children with DMD revealed that phonological awareness, a skill which requires verbal working memory, contributed the most to both reading and math skills.

Conclusions: Findings suggest that children with DMD display poor academic achievement due to poorly developed verbal working memory skills. A lower distribution of dystrophin in cerebral areas may lead to limited verbal working memory, which in turn contributes to poor phonological awareness and deficits in reading and math.

Correspondence: *Alanna B. Gold, Ph.D., Clinical Neuropsychology, University of Houston, 241 Perkins St, Unit JS01, Jamaica Plain, MA 02130. E-mail: alanna.gold@gmail.com*

M. NEUGNOT CERIOLI, F. HAMDAN, J. MICHAUD & M. BEAUCHAMP. Cognitive profiles of children affected by a de novo truncating SYNGAP1 Mutation.

Objective: Intellectual Deficiency (ID) is mainly attributed to autosomal genetic diseases. However, few of the genes responsible for ID have been identified. Previous studies indicate that a de novo truncating mutation on the SYNGAP1 gene could be responsible for some cases of ID. This gene codes for the protein SYNGAP1, which is known to be involved in synapse functioning and cognition. The aim of this case series study was to determine the neuropsychological profiles of patients affected by de novo SYNGAP1 mutations.

Participants and Methods: Three patients aged 3-8, 4-1, and 16-0 years were assessed with neuropsychological measures. The youngest completed the third edition of the Bayley Scales of Infant and Toddler Development and the Vineland Adaptive Behaviour Scale while the older patient was assessed with the Wechsler Intelligence Scale for Children (WISC-III).

Results: All patients present moderate intellectual deficiency. Two of them have epilepsy with several absence seizures a day and respond little to medication. All presented an important delay for both receptive and expressive language acquisition, and one can still not produce language at 3 years, 8 months. Global motor skills appear to be better preserved for all patients, while fine motor skills are poor. Finally, one of the children was diagnosed with autism.

Conclusions: De novo truncating mutation on the SYNGAP1 gene caused moderate intellectual deficiency with an important delay for expressive and receptive language, while global motor skills were better developed. SYNGAP1 mutation causes ID and might cause epilepsy and autism, but not systemically.

Correspondence: *Mathilde Neugnot Cerioli, Université de Montréal, 90 avenue Vincent d'Indy, Outremont, QC H2V 2S9, Canada. E-mail: mathilde.neugnot@gmail.com*

L. SALMINEN, P. SCHOFIELD, T. CONTURO, D. LAIDLAW, R. CABEEN, D. TATE, E. LANE, J. HEAPS & R. PAUL. Impact of the Serotonin Receptor Transporter Polymorphism on Cognitive Aging.

Objective: The serotonin receptor transporter polymorphism (5HTTLPR) is a common genetic variant that has been associated with increased risk of psychiatric and neurological conditions including early symptoms of Alzheimer's disease (AD). Previous studies have revealed

specific associations between the polymorphism and performance on tests of frontal lobe function in both animals and in humans, but it remains unclear to what extent the polymorphism is associated with age-related cognitive change among healthy older adults. Since previous studies suggest that cognitive flexibility is dependent on genetic variations of 5HTTLPR, we anticipated smaller volumes in frontal-subcortical gray matter and lower scores on neuropsychological measures among short allele carriers compared to individuals with two long alleles.

Participants and Methods: In the present study, 98 older adults were gene sequenced for allele variants of 5HTTLPR and completed neuropsychological testing. Of the 98 participants, 63 underwent brain imaging. MRI was utilized to examine brain volumes between individuals with at least one short allele of the 5HTTLPR variant (N = 42) compared to individuals with two long alleles of the gene (N = 21). We examined neuropsychological performance on measures of executive function and global cognition.

Results: Results revealed lower gray matter volume in the frontal lobe (Left F = 4.313, p = .042, Right F = 4.455, p = .039) among participants with at least one short allele. Additionally, short allele carriers exhibited lower measures of executive function compared to individuals with two long alleles. Measures of global cognition did not vary between groups.

Conclusions: These results suggest that the frontal lobe is sensitive to reduced transcriptional activity associated with the 5HTTLPR polymorphism, and provides additional evidence of genotypic influences on brain integrity among healthy individuals.

Correspondence: *Lauren Salminen, B.A., Psychology, University of Missouri Saint Louis, 8001 Natural Bridge Road, St. Louis, MO 63121. E-mail: lespr4@umsl.edu*

H. VAN DER VLUGT, S. VERSTRAETEN & M. VAN DER WEES. Neuropsychological profiles of Marinesco-Sjögren syndrome: A unique sibling study.

Objective: Marinesco-Sjögren syndrome is a rare autosomal recessive disorder characterized by cerebellar ataxia, congenital cataracts, psychomotor retardation, myopathy and skeletal abnormalities. Mutations in the SIL1 gene on chromosome 5q31 were demonstrated to cause Marinesco-Sjögren syndrome. The phenotypical characteristics of this disorder have been well documented, however little is known about the neuropsychological representation.

Participants and Methods: In this sibling study two brothers, 10-years and 7-years old, diagnosed with Marinesco-Sjögren syndrome are described. Previous neurological assessment revealed developmental delays in fine and gross motor functions, dysmorphic features, cerebellar hypoplasia and ataxia, cataracts and learning difficulties. They underwent a comprehensive neuropsychological assessment to determine their current level of functioning and to better understand the underlying aspects of this disorder.

Results: The neuropsychological profiles of the siblings revealed similarities and differences. Intellectual functioning was extremely low on the level of mild mental retardation. The 10-years old presented significant better verbal skills than non-verbal skills. Neuropsychological tests revealed in both boys severe impairments on tasks of response inhibition, visual constructive skills, executive functioning and social cognition. Profound impairments were noted in mental en motor pace. Visual perception was intact. Memory functions were intact when information was repeatedly offered. The 7-years old presented severe attention impairments.

Conclusions: The neuropsychological profiles presented suggest a gross impairment across various domains. At first sight they have many characteristics in common, however closer inspection revealed significant differences between the neuropsychological profiles. Therefore, future research is needed to identify neuropsychological patterns that are specific to this disorder.

Correspondence: *Marleen van der Wees, Blixembosch, Rehabilitation Centre Libra Zorggroep, Toledolaan 2, Postbus 1355, Eindhoven 5602 BJ, Netherlands. E-mail: m.vanderwees@librazorggroep.nl*

L.M. WONG, F. TASSONE & T.J. SIMON. Oculomotor Performance Indicates Adult Male Fragile X Premutation Carriers Asymptomatic for FXTAS Exhibit Impaired Cognitive Control.

Objective: Fragile X premutation carriers (FXPCs) have an expansion of 55–200 CGG repeats in the FMR1 gene. Male FXPCs are at risk for developing a neurodegenerative motor disorder (FXTAS) often accompanied by cognitive control impairments. We tested whether cognitive control impairments are observable in adult FXPCs without FXTAS by assessing oculomotor performance.

Participants and Methods: Participants were males aged 18–45 years asymptomatic for FXTAS. FXPCs ($n = 18$) and healthy age-matched controls ($n = 17$) performed four oculomotor tasks. In the Fixation task, participants fixated on a central cross and maintained gaze position when a peripheral stimulus appeared. Dependent measures were magnitude of gaze deviation from center. In the Prosaccade task, participants fixated on a central cross, then looked at a peripheral stimulus. The Antisaccade task was identical to the Prosaccade task, except participants looked in the direction opposite the stimulus. For both saccade tasks, dependent measures were latency and speed of the initial saccade. In the Pursuit task, participants maintained gaze on a square moving at constant velocity. Dependent measures were closed loop pursuit gain (CLPG; ratio of eye and target velocity) and root mean square error (RMSE; position error of gaze relative to target).

Results: FXPCs deviated more from center in the Fixation task, and had slower latency in the Antisaccade task, than did controls. Increased CGG was associated with increased motion tracking error (RMSE). No group differences or associations were observed in other tasks.

Conclusions: The Fixation and Antisaccade tasks both require cognitive control to inhibit reflexive eye movements. We found that adult male FXPCs asymptomatic for FXTAS demonstrate specific impairments in tasks requiring control, consistent with previously reported executive function impairments in FXPCs. Increased CGG repeat length negatively affects motion tracking, possibly via disruption of timing perception and/or error-correction mechanisms.

Correspondence: *Ling M. Wong, M.S., UC Davis MIND Institute, 1621 Pacific Dr, Davis, CA 95616. E-mail: lmeuwong@ucdavis.edu*

B.D. YUND, K. RUDSER, K. DELANEY, V. KOVAC, M. NGUYEN-DRIVER, R. STEINER & E. SHAPIRO. Brain Abnormalities and Neuropsychological Function in Children with Attenuated Mucopolysaccharidosis type II.

Objective: Mucopolysaccharidosis type II (MPS II) is an X-linked genetic disorder with a spectrum of severity depending on involvement of the central nervous system. As part of a longitudinal study of MPS II, we explored both brain and cognitive abnormalities in the attenuated form of this rarely studied group known to have structural abnormalities of brain.

Participants and Methods: Thirteen children (ages 6–15 years) were administered the Wechsler Abbreviated Scale of Intelligence (WASI). The Test of Variables of Attention (TOVA) was used to measure attention, and The Cambridge Neuropsychological Test Automated Battery (CANTAB) subtest Stockings of Cambridge (SOC) was administered to measure executive function. Grey and white matter, frontal lobe, and corpus callosum volumes were generated from an automated segmentation analysis.

Results: All had significant MRI abnormalities with normal cognition but relatively poor attention span/reaction time. Brain abnormalities consisted of increased volume of cerebrospinal fluid, many perivascular spaces, and ventriculomegaly. Usual correction of values using the ICV (intracranial volume) produced spurious results. Using absolute values we found that total volume of gray matter was associated with IQ, that frontal lobe volumes were associated with response inhibition on the TOVA (controlling for IQ) and SOC on the CANTAB, and corpus callosum volumes were associated with reaction time on the TOVA.

Conclusions: MPS II patients demonstrated executive function abnormalities, while IQ remained in the average to above-average range. Analysis required the unconventional method of use of absolute values of frontal volumes, which were significantly related to response inhibition as measured on the TOVA and planning ability as measured by SOC.

Correspondence: *Brianna D. Yund, B.A., Pediatrics, University of Minnesota, 516 Delaware St SE, 12-170 PWB, Minneapolis, MN 55455. E-mail: bdy@umn.edu*

T. ZINK, T. VASILOPOULOS, C.S. MOORE, M.D. GRANT, M.S. PANIZZON, W.S. KREMEN, C.E. FRANZ & M.J. LYONS. Trauma Exposure Decreases the Heritability of Verbal Learning.

Objective: While cognitive deficits associated with posttraumatic stress disorder are well-characterized, there is less evidence regarding whether trauma exposure also affects cognition. Furthermore, the mechanisms by which trauma exposure influences cognition are unclear. The present study examined whether trauma exposure significantly moderated the genetic and environmental influences underlying verbal learning.

Participants and Methods: This study included 688 monozygotic and 539 dizygotic male twins (mean age=55; range=51–60) from the Vietnam Era Twin Study of Aging who completed the California Verbal Learning Test-2nd Ed. Trauma exposure was determined using the Diagnostic Interview Schedule-Version III-Revised. Twin analyses were used to estimate the proportion of variance in verbal learning that was explained by additive genetic (heritability, h^2), common environmental, and unique environmental influences, and how these influences differed based on trauma exposure status.

Results: No significant mean group differences in verbal learning based on trauma exposure status were found. However, twin analyses demonstrated that the variance in verbal learning that could be explained by unique environmental factors was significantly ($p=0.042$) greater among those who experienced trauma compared to those who did not. Because heritability is the proportion of variance in a trait explained by genes, these greater environmental influences resulted in overall decreased heritability of verbal learning among those who experienced trauma ($h^2=0.36$) as compared to those who did not ($h^2=0.55$).

Conclusions: These results demonstrate that, although trauma exposure does not directly affect verbal learning performance, it does affect how sensitive verbal learning is to environmental factors. This finding can inform the recommendations neuropsychologists make for those who have experienced trauma. For example, trauma survivors might be advised to avoid additional environmental factors that can negatively affect cognition, such as substance use.

Correspondence: *Tyler Zink, M.A., Tyler Zink, Boston Univ, 77 Pond Ave., Apt. 1212, Brookline, MA 02445-7115. E-mail: tzink@bu.edu*

HIV/AIDS/Infectious Disease

N. ARBID, T.J. ARENTSEN, A.D. THAMES, S.E. PANOS, J.M. FOLEY, R.Z. BALLARD, S.A. CASTELLON & C.H. HINKIN. Implicit Learning Among Patients With HIV/AIDS: The Role of Cognitive Reserve.

Objective: Implicit learning uses non-declarative memory to learn information based on its association. While this skill is thought to rely heavily on intact frontal-striatal circuitry - which is often impaired in HIV - the literature has been mixed about the impact of HIV on implicit learning (e.g., Gonzalez et al., 2008; Martin et al., 2011). It is possible that factors such as cognitive reserve and HIV disease severity may explain inter-individual differences, therefore the current study sought to determine how these two variables affect implicit learning.

Participants and Methods: Ninety-one, older (> 50 years), HIV+ adults with no history of medical comorbidities completed a computerized probabilistic learning task (Weather Prediction Task, WPT; Knowlton et al., 1994). For analyses, the overall rate of “optimal responses” was calculated using the number of responses associated with the highest probability (despite feedback) divided by the total number of responses. A cognitive reserve composite score was created, which combined the number years of formal education and word reading ability into a standardized score (see Foley et al., 2012).

Results: There was a significant relationship between WPT and HIV disease severity, $F(1,87)=4.71$, $p=.03$, $\eta^2=.05$ when cognitive reserve was included as a statistical covariate. We also observed a significant relationship between global cognitive functioning and WPT performance, $r(91)=.33$, $p=.001$.

Conclusions: Results from the current study suggests that HIV-associated cognitive dysfunction and cognitive reserve play important roles in implicit learning. Specifically, cognitive reserve masks the deleterious effects of HIV disease severity on implicit learning and memory. Our results are consistent with other studies that have demonstrated implicit learning and memory impairments among populations with predominant frontal-striatal dysfunction.

Correspondence: *Natalie Arbid, B.A., West Los Angeles VA, 1574 S. Hayworth Ave., Los Angeles, CA 90035. E-mail: nataliearbid@gmail.com*

M. ARCE RENTERIA, D. BYRD, C. MIRANDA, A. FUENTES, A.K. ROSARIO, K. COULEHAN, J. SHEYNIN, S. MORCELLO & M. RIVERA MINDT. The Role of Neurocognitive Dispersion in HIV+ Adults with a History of Substance Use Disorders.

Objective: Both HIV & substance use disorders (SUD) are linked to neurocognitive (NC) & functional deficits (FD), yet findings on comorbid effects are mixed. Intra-individual variability in performance is linked with NC & FD in HIV, indicating worse cognitive control. NC dispersion (NCD; intra-individual variability across tests) predicts worse activities of daily living (ADL) & medication adherence among NC normal people living with HIV (PLWH). However, NCD has not been examined in PLWH with comorbid SUD, an at-risk group for worse health outcomes. It was hypothesized that PLWH with past SUDs (SUD+) would have more NCD than those without SUD (SUD-) comorbidity.

Participants and Methods: In this cross-sectional study, 95 NC normal PLWH (72% male; 69% Hispanic & 31% non-Hispanic White; mean age=48 yrs [SD=8.8]; mean education=13 yrs [SD=2.9]; 74 SUD+) completed a comprehensive NC battery; structured diagnostic interview; the Iowa Gambling Task (IGT; a cognitive control proxy); urine toxicology (UTOX) & functional scales (ADLs & self-reported medication adherence). SUDs were based on DSM-IV diagnosis of past (>30 days ago) dependence or abuse. Over half of the SUD+ group (72%) had ≥ 2 SUDs. NCD was computed using demographically-corrected NC T-scores.

Results: Although there was no difference in NCD between the SUD+ & SUD- groups ($p>.10$), a trend showed more NCD in the UTOX+ group than the UTOX- group ($p=.06$). However, NCD was not related with the IGT or functional scales (all $p's>.10$). A follow-up analysis showed that NCD was positively related with worse overall NC function (based on Global Deficit Score) in the SUD+ group ($\rho=.25$, $p<.05$).

Conclusions: In this sample of NC normal PLWH, recent illicit substance use may impact risk for NCD. It is unclear if this implies cognitive recovery with substance use cessation. Also unknown is if greater NCD promotes NC & functional decline. Longitudinal research may answer if NC or FD are more likely to develop over time & clarify the role of cognitive control in this at-risk group.

Correspondence: *Miguel Arce Renteria, B.A., Fordham University, 685 Academy St, Apt 27, New York, NY 10034. E-mail: marce3@fordham.edu*

A. ARENTOFT, A.D. THAMES, J. FOLEY, T. ARENTSEN, N. ARBID, S. PANOS, S. PATEL, R. BALLARD, S.A. CASTELLON & C.H. HINKIN. Decision Making among HIV+ adults: The influence of neurocognition, sensation seeking, and personality.

Objective: The Iowa Gambling Task (IGT) is thought to predict complex, real-world decision-making, including risk-taking behavior. IGT outcome measures typically dichotomize disadvantageous/risky and advantageous deck selection. We hypothesized that finer grained analysis would reveal distinct groups based on whether a systematic strategy (i.e., preference for either advantageous or risky decks) or a random approach was used.

Participants and Methods: 175 HIV+ adults completed a comprehensive NP battery and several self-report measures, including the Personality Assessment Screener (PAS) and the Sensation Seeking Scale-V (SSS-V). Current and past risk-taking behaviors were also assessed.

Results: Cluster analysis revealed: 1) a consistent, advantageous strategy (AS) group, 2) a "no strategy" (NS) group, and 3) a group that ultimately adopted a disadvantageous, high-risk strategy after initially employing an advantageous approach (i.e., risky strategy or RS group). A series of one-way ANOVAS showed that groups significantly differed in the hypothesized direction on Global NP (AS>RS>NS, $p=.03$), Executive (AS>RS>NS, $p<.01$) and Processing Speed T-scores (AS>RS>NS, $p=.03$). Groups also significantly differed on personality variables, most notably the SSS-V Experiencing Seeking subscale (RS>AS>NS, $p=.04$) and the PAS Acting Out subscale (RS>AS>NS, $p=.02$), as well as recent IV drug use (RS=17%, AS=3%, NS=2%, $p=.02$).

Conclusions: Three groups emerged. The AS group performed best on cognitive measures and the RS group scored highest on experience seeking and acting out scales. The RS group reported more recent IV drug use, but groups did not significantly differ on other risk-taking behaviors (i.e., unprotected sex, needle sharing). These results suggest that a more nuanced interpretation of IGT performance may be warranted. Future research should examine whether similar IGT performance patterns emerge in other clinical groups.

Correspondence: *Alyssa Arentoft, PhD, Semel Institute for Neuroscience & Human Behavior, UCLA, 760 Westwood Plaza CS-746, Los Angeles, CA 90095. E-mail: alyssa.arentoft@gmail.com*

T.J. ARENTSEN, A.D. THAMES, J.M. FOLEY, J. ARBID, S.E. PANOS, S. PATEL, R. BALLARD, S.A. CASTELLON & C.H. HINKIN. Probabilistic learning and basal ganglia integrity among HIV+, older adults: A diffusion tensor imaging study.

Objective: Probabilistic learning (PL) relies heavily upon intact frontal-striatal circuitry, particularly the basal ganglia (BG). It is well-known that HIV-infection targets BG structures, which may place HIV+ individuals at risk for PL impairments. While some studies have noted HIV-associated deficits in PL, others have not. Further, it remains unclear whether PL is selective to BG damage or whether other structures related to learning and memory (e.g., hippocampus) influence performance. The current study used Diffusion Tensor Imaging to examine the relationship between HIV-associated basal ganglia dysfunction and PL.

Participants and Methods: Twenty older (age > 50), HIV+ adults underwent MRI. All were clear of medical histories that may confound neuropsychological performance (e.g., seizures, stroke, prolonged loss of consciousness). The BG (putamen and caudate) and hippocampus were selected as regions of interest. Participants also completed the Weather Prediction Task (WPT), a computerized measure of PL (Knowlton et al., 1994). For analyses, the overall rate of "optimal responses" was calculated using the number of responses associated with the highest probability (despite feedback) divided by the total number of responses.

Results: Overall WPT performance correlated significantly with BG diffusivity (MD), $r(19)=-0.51$, $p=.03$, but not fractional anisotropy, $r(20)=.05$, $p=.83$, or volume, $r(19)=-0.09$, $p=.73$. Correlations between WPT and hippocampus diffusivity, $r(20)=-0.23$, $p=.33$, fractional anisotropy, $r(20)=.15$, $p=.52$, and volume, $r(19)=-0.37$, $p=.12$, were nonsignificant.

Conclusions: Results of the current study suggest that integrity of the BG is related to performance on the WPT among HIV+ adults. We did not find a similar relationship between hippocampus and WPT, suggesting that the PL is selective to functions of the BG. This study extends previous findings about the role of the basal ganglia in PL by using a population with known BG dysfunction (i.e., HIV+ adults).

Correspondence: *Timothy J. Arentsen, MA, Fuller Graduate School of Psychology, 285 N Oakland Ave, Pasadena, CA 91101. E-mail: timjarentsen@hotmail.com*

I. BABAKHANYAN, C.C. VELAZQUEZ, C. LONGA, A. CUADRA & E.J. WILLEN. Long Term Cognitive Impact of Perinatally Infected HIV Positive Youth.

Objective: With medical advances, many children with HIV will survive into adulthood. Some children experience HIV-related CNS diseases, such as encephalopathy, which is associated with impaired cognitive functioning. Little is known about the neurocognitive effects of these long-term survivors. This study compared executive functioning and memory among adolescents/young adults with and without early histories of HIV-encephalopathy, and evaluated HIV-biomarkers as predictors of executive functioning and memory.

Participants and Methods: Perinatally-infected HIV-positive encephalopathic adolescents/young adults (N=33) were age-matched to non-encephalopathic (N=33) HIV-positive patients (ages 15-22). HIV-biomarkers included CD4 count, Nadir CD4, and Log10 Viral Load. Participants completed measures of cognitive functioning (Wechsler scale; N=66), executive functioning (D-KEFS, N=40), and memory (WMS-III, N=26).

Results: No significant differences in executive functioning or memory were found between the two groups. Groups were collapsed in the overall hierarchical multiple regression analyses to assess if HIV-biomarkers predicted executive functioning and memory. Results revealed Nadir CD4 was a significant predictor of cognitive switching ($\beta=.29, p<.05$) and auditory memory ($\beta=.52, p<.05$), while viral load was a significant predictor of verbal fluency ($\beta=.03, p<.05$), after adjusting for the variance accounted for by IQ.

Conclusions: Findings indicate that executive function and memory are at risk of impairment in adolescent/young adult HIV patients with early histories of encephalopathy. Independent of IQ, HIV-biomarkers were significant predictors of executive functioning and verbal fluency, suggesting the impact of the virus on cognitive functioning. These findings have important implications for assessment and treatment needs for individuals with HIV. As these skills are important for daily functioning, including adherence to medical regimens, regular assessment, treatment, and additional support are essential.

Correspondence: *Ida Babakhanyan, M.A., Pediatrics, University of Miami, 1601 NW 12th Avenue, Miami, FL 33136. E-mail: ibabakhanyan@med.miami.edu*

L.M. BAKER, J.M. HEAPS, R.H. PAUL, B. ANCES, E. WESTERHAUS & J. BOLZENUIS. Impact of age on cognitive changes following the initiation of combined antiretroviral therapy (cART) in HIV+ patients.

Objective: Advances in the treatment of the human immunodeficiency virus (HIV) have dramatically improved survival rates over the past 10 years, but HIV-associated neurocognitive disorders (HAND) remain highly prevalent. As a result, there are an increasing number of older adults diagnosed with HAND. Currently, few studies have examined changes in cognitive function after initiation of cART among older individuals (> 50). The present study evaluated cognitive changes in a sample of HIV+ individuals immediately before and approximately three to six months after receiving cART.

Participants and Methods: All participants completed a battery of neuropsychological tests to assess memory, language, psychomotor speed, and executive functioning. These tests included Trail-Making A and B, the Hopkins Verbal Learning Test Revised (HVLT-R), Category Fluency Test and the Digit-Symbol Modalities Test (WAIS-III). Alternate forms of the HVLT-R were administered to ensure that subjects were not influenced by previous exposure.

Results: Performances on Category Fluency ($p=.02$) and Digit Symbol ($p=.03$) improved significantly following treatment. No differences were observed in Trail-Making A and B or HVLT-R. Further analysis revealed a significant increase in Category Fluency ($p < .01$) scores after initiation of cART in older, but not younger individuals.

Conclusions: Findings support prior data that cART may be effective in improving specific aspects of cognitive function among HIV+ individuals. Additionally, cART is useful in improving psychomotor speed,

language, and executive functioning in all HIV+ individuals, yet follow up analysis is needed to determine its effect on memory. Interestingly, relative comparisons between age groups suggest that brain function may be more responsive to treatment in advanced age. Overall, cART may have a more profound effect on cognitive function in older, rather than younger individuals.

Correspondence: *Laurie M. Baker, University of Missouri- St. Louis, 1705 Marshall Ct., Florissant, MO 63031. E-mail: lmbtyd@mail.umsl.edu*

R. BICKHAM, K. KRUSE, P. BANGIRANA, R.O. OPOKA, E.E. SCHUT, B. GIORDANI, J.K. BASS & M.J. BOIVIN. HAART Treatment Status AND Neurocognitive Development in Pre-school Aged HIV Positive Ugandan Children.

Objective: With increasing availability of effective anti-retroviral therapies in sub-Saharan Africa, HIV has begun to shift toward a manageable chronic condition. Children who are infected with HIV in infancy and survive to school age, however, have significant neurodevelopmental deficits. We tested whether HAART treatment affected school-age children's scores on assessments of neurocognitive development.

Participants and Methods: The HAART treatment status of 81 HIV positive Ugandan children (age range= 2 to 5 years) was determined (HAART treated=46 children) and blood work used for CD4 and CD8 counts and viral load. Children were tested using the Mullen Scales of Early Learning (subtests: Gross Motor, Fine Motor, Visual Reception, Receptive Language and Expressive Language) and the Color Object Association Test (COAT subtests: Immediate Memory and Total Recall).

Results: Children not on HAART had significantly higher scores than children on HAART for the Total Recall COAT subtest and on the Mullen scales of cognitive development ($p = 0.006$ to 0.024), with the exception of no difference found on the Mullen Gross Motor subtest ($p = 0.177$). No difference was found between the two groups on the Immediate Memory COAT subtest ($p = 0.421$).

Conclusions: Use of HAART was associated with significantly lower scores on measures of cognition, but not gross motor ability. Because WHO guidelines for anti-retroviral therapy require that children reach a specific CD4 count before HAART is initiated, treated children have experienced more severe disease progression, which may underlie the lower cognitive performance seen in children undergoing HAART treatment. It does not appear that HAART treatment is associated with a reversal of HIV-associated neurodevelopmental deficits. It is possible, however, that earlier implementation of HAART could lead to a reduction in the extent and severity of cognitive impairment evident as children progress in their illness.

Correspondence: *Bruno Giordani, PhD, Neuropsychology Section, Department of Psychiatry, University of Michigan, Neuropsychology Section, Suite C, 2101 Commonwealth Blvd., Ann Arbor, MI 48105. E-mail: giordani@umich.edu*

A. GARDNER, M. ARABKHAZAEI, P. BANGIRANA, R.O. OPOKA, N. NAKASUJJA, B. GIORDANI & M.J. BOIVIN. HAART Treatment Status and Neurocognitive Outcomes Among HIV Positive Ugandan Children.

Objective: Over 90% of pediatric HIV infections and AIDS deaths occur in Africa, making the African context clearly paramount. As a whole, children with HIV display greater difficulties in cognitive functioning, but the relationship to HAART treatment and cognition is not well understood. We investigated differences in neurocognitive function in HIV positive Ugandan children based on whether they are receiving HAART.

Participants and Methods: Children aged 6-12 years were recruited from the Kayunga district in Uganda (N=92 with 47 on HAART). Blood draws and basic clinical evaluations were performed on the children to determine CD4, CD8, and absolute viral load, as well as height, weight, and HIV treatment status. Neuropsychological evaluations included the Kaufman Assessment Battery for Children (KABC) and the Test of Variables of Attention (TOVA).

Results: Children on HAART performed significantly lower on the KABC subtests of Sequential Processing ($p=0.02$) and Simultaneous Processing ($p=0.02$) than children not on HAART. Additionally, children on HAART performed significantly lower on TOVA omission errors ($p=0.03$) commission errors ($p=0.03$), variability of reaction time ($p=0.003$), and D prime score ($p=0.006$). There were no significant differences shown in the KABC evaluation for Learning, Pattern Reasoning, Global Index, and Global Index without verbal components. TOVA reaction time also did not differ between the two groups.

Conclusions: HIV positive children on HAART performed worse than non-HAART treated children on specific areas of neuropsychological functioning related to short-term memory, visual processing, and sustained attention. Measures of long term memory and reasoning did not differ between the two groups. Although HAART use is expected in children with more severe illness, taking these medications did not appear to be neuroprotective for ongoing neurodevelopmental decline. It is possible that beginning HAART treatment earlier may lead to a less-severe neurocognitive outcome.

Correspondence: *Bruno Giordani, PhD, Neuropsychology Section, Department of Psychiatry, University of Michigan, Neuropsychology Section, Suite C, 2101 Commonwealth Blvd., Ann Arbor, MI 48105. E-mail: giordani@umich.edu*

K.A. BOLDEN, G.C. BROWN, S.P. WOODS, I. GRANT & T. T-MARC GROUP. Assessing Callosal Fiber Tracts in Methamphetamine Dependence and HIV Infection.

Objective: There is a higher prevalence of METH dependence (METH+) in individuals diagnosed with HIV (HIV+). Both disorders have degenerative effects on overlapping brain systems, but the synergetic effects of comorbid diagnosis are not well understood. Investigations of neurological integrity in both HIV+ & METH+ have shown white matter injury in the corpus callosum (CC) for both disorders.

Participants and Methods: 20 HIV+, 19 METH+, 10 HIV+/METH+ comorbid, & 20 HIV-/METH- participants underwent MRI scanning (including diffusion tensor imaging, DTI). We used a tractography method to generate the fibers going through the 3 sections of the CC (splenium, genu, & body). We analyzed Fractional Anisotropy (FA) for all 4 groups in the aforementioned regions.

Results: We performed a 2X2 repeated measures ANOVA examining the effects of group & region on FA. We did not find an interaction of diagnosis & the 3 regions of the CC. We did find a statistically significant effect of HIV on FA with a medium to large effect size ($p<.05$, $\eta^2=.122$) across subregions of the CC, though there was a numerically larger effect in the body of the CC. We did not find a main effect of METH on FA, nor did we see a significant interaction between HIV & METH ($p>.05$, $\eta^2<.001$). However, a post-hoc range test revealed the FA of the HIV+/METH+ group fell in between the HIV+ & METH+ groups, with METH+ having slightly higher FA than HIV-/METH- & HIV+ having significantly lower FA than HIV-/METH- & METH+.

Conclusions: We found significantly lower FA in the HIV+ group compared to HIV-/METH-, whereas METH+ had slightly higher FA than HIV-/METH-. Moreover, we did not find an interaction between HIV & METH dependence, which may indicate opposing, but nevertheless additive & detrimental effects of comorbid diagnosis on FA in the CC. These findings may suggest differences in the types white matter injury associated with HIV infection & METH dependence & further research on the neural mechanisms of the possible opposing effects of HIV & METH should be undertaken.

Correspondence: *Khalima A. Bolden, M.A., SDSU/UCSD Joint Doctoral Program in Clinical Psychology, 3543 Miramar St., Apt. D, La Jolla, CA 92037. E-mail: khalima.bolden@gmail.com*

D. BRAGA. Driving Performance Among Individuals With "Asymptomatic" HIV-Associated Neurocognitive Disorders.

Objective: A large proportion of individuals with HIV-associated neurocognitive disorders have Asymptomatic Neurocognitive Impairment

(ANI), wherein there is evidence of neuropsychological (NP) impairment, but no self-reported reduction in everyday functioning (EDF). Despite limited self-reported problems, we hypothesized that, compared to an HIV+ NP normal group, individuals with ANI would demonstrate worse performance on a driving simulation.

Participants and Methods: 110 current HIV+ drivers completed an NP evaluation and questionnaires addressing cognitive complaints and declines in activities of daily living. ANI was diagnosed using the Frascati criteria. Participants also completed 2 driving simulations. One required them to drive through city and country environs, pass cars, and obey traffic laws. The outcome was a composite weighted score comprised of crashes and tickets. On the second simulation, participants were to maintain lane position while responding to divided attention tasks; the outcome was standard deviation of lateral position (SDLP), or "swerving." Variables were transformed using the Box Cox method. Effect sizes (d) are reported, with p values being single-sided.

Results: 35 individuals were diagnosed with ANI; 75 were NP normal. The groups were similar with respect to age, education, gender, ethnicity and recent driving mileage, as well as AIDS diagnosis, although the ANI group had a lower CD4 cell count (250 vs. 307; $p = .05$). The ANI group had a higher weighted error score than the NP normal group on simulation 1 ($d = .40$; $p = .03$), and evidenced a small-to-medium effect size for SDLP on simulation 2 ($d = .31$; $p = .06$).

Conclusions: Individuals with ANI may demonstrate declines in driving performance, despite a lack of self-reported problems with everyday functioning. An ANI diagnosis may thus portend possible difficulties with EDF, although the real-world driving implications are not clear at this time, and may warrant additional monitoring for possible future difficulties.

Correspondence: *Daniela Braga, UCSD, 220 Dickinson Street, Suite B, MCS231, San Diego, CA 92103-5231. E-mail: dbraga@ucsd.edu*

K.N. DEVLIN, A. GONGVATANA, U. CLARK, J. CHASMAN, K. TASHIMA, B. NAVIA & R. COHEN. The Relation of Cardiovascular Risk Factors and HIV to Neuropsychological Functioning.

Objective: With the successes of combination antiretroviral therapy (cART), cardiovascular disease (CVD) has become an increasingly important cause of morbidity and mortality in HIV+ persons. CVD and its risk factors, as well as HIV, have been linked with neuropsychological dysfunction, but their relative contributions remain unclear. The present study examines the relation of CVD risk factors and HIV to neuropsychological performance.

Participants and Methods: 115 HIV+ and 72 HIV- participants were administered a comprehensive neuropsychological battery. Rates of hypertension, hypercholesterolemia, diabetes, and obesity were 29%, 22%, 11%, and 23%, respectively. Most HIV+ participants (83%) were cART-treated, and 71% had virologic suppression. Mean current and nadir CD4 were 461 and 181 cells/ μ L.

Results: Hypertension, hypercholesterolemia, diabetes, obesity, and HIV status were entered as predictors of neuropsychological performance in multiple regression analyses in the whole group. In the HIV+ group, CVD risk factors and HIV clinical variables (cART, current/nadir CD4, HIV RNA, HIV duration) were entered as predictors. In the whole group, HIV ($\beta=-.18$, $p=.01$) and obesity ($\beta=-.25$, $p<.001$) significantly predicted overall performance. HIV and obesity were associated with poorer processing speed, learning, and memory. Diabetes was related to poorer processing speed. In the HIV+ group, detectable HIV RNA was significantly associated with poorer verbal fluency ($p<.05$) and verbal memory ($p=.03$), obesity was associated poorer processing speed ($p=.02$) and visual learning ($p=.03$) and memory ($p=.04$), and diabetes was associated with poorer verbal learning ($p<.01$) and memory ($p=.02$).

Conclusions: Both HIV and CVD risk factors (notably, obesity and diabetes) contribute significantly to neuropsychological dysfunction in HIV+ persons, particularly in the domains of processing speed, learning, and memory. The contribution of CVD to neuropsychological dysfunction will be increasingly relevant as the HIV population ages.

Correspondence: *Kathryn N. Devlin, Sc.B., Department of Psychology, Temple University, Weiss Hall 1701 North 13th Street, Philadelphia, PA 19122. E-mail: kathryn.devlin@temple.edu*

C.A. DUFOUR, M.J. MARQUINE, A. ROONEY, J. BADIEE, R.J. ELLIS, I. GRANT & D.J. MOORE. Strenuous Exercise is Associated with Less Neurocognitive Impairment In HIV-Infected Adults.

Objective: Little is known about how modifiable lifestyle factors might help ameliorate neurocognitive impairment (NCI) among HIV-infected (HIV+) persons. Several randomized trials have shown that exercise improves NCI in HIV-uninfected adults (Heyn et al., 2004). The objective of the current study was to assess whether engaging in strenuous exercise was associated with less NCI in HIV+ adults.

Participants and Methods: Participants were 335 community-dwelling HIV+ adults. On average, participants were 47.8 (10.3) years old and 75% of them were male. The average CD4 count was 570 (304), 26.3% of participants had a detectable viral load, and 86.5% were on anti-retroviral therapy. NCI was assessed using a comprehensive standardized neurocognitive battery. A Global Deficit Score was calculated and used to define NCI. Exercise was quantified by time spent engaging in strenuous exercise, described as anything that causes one's heart to beat rapidly (e.g., running, jogging, lifting heavy weights, etc) in the last 72 hours (hrs). Participants were considered strenuous exercisers if they reported any time engaging in strenuous exercise in the last 72 hrs ($n = 83$), and they were considered non-strenuous exercisers if they reported no time spent in strenuous exercise in the last 72 hrs ($n = 252$).

Results: Lower rates of NCI were observed in HIV+ participants who engaged in strenuous exercise (15.7%) as compared to those who did not (40.0%; $p < .01$). More complex models examining those factors associated with NCI in univariate analyses ($p < .05$) showed that strenuous exercise remained a significant predictor of NCI even when controlling for demographic factors, HIV disease characteristics, physical functioning, and health status.

Conclusions: Engaging in strenuous exercise is associated with lower rates of NCI among HIV-infected adults. Further study is needed to assess if exercise as a prescription may prevent or ameliorate HIV-associated NCI.

Correspondence: *Catherine A. Dufour, B.S., UCSD, One Miramar st #929037, La Jolla, CA 92092. E-mail: Cadufour@ucsd.edu*

R. EIKELAND & G.C. LØHAUGEN. Neuropsychological Profile In Persons Who Did Not Recover From Lyme Neuroborreliosis 30 Months After Treatment.

Objective: It is previously shown that treated Lyme neuroborreliosis (LNB) might cause cognitive deficits. We wanted to see if there was a specific neuropsychological test-profile characterizing persons who did not recover after treatment of LNB.

Participants and Methods: Fifty persons were treated for LNB with ceftriaxone or doxycycline. Thirty months later the following neuropsychological tests were performed: Trail Making test (TMT), Stroop, California verbal learning test (CVLT) and digit symbol. Clinical non-recovery was defined as a score of > 1 on a clinical composite score combining subjective complaints and neurological deficits (range 0-52, 0 worse), recovery a score of 0 or 1 on the scale. The neuropsychological test results of the non-recovery group ($n=31$) were compared to the test results in the recovery group ($n=19$). Differences in demographic data between the non-recovery and the recovery group were examined.

Results: Patients who did not recover after treated NB scored significantly lower on TMT2 ($p=0.024$), TMT5 ($p=0.003$), Stroop1 ($p=0.001$), Stroop2 ($p=0.032$), Stroop3 ($p=0.012$), Stroop 4 ($p=0.011$), and digit symbol raw score ($p=0.012$) than the recovery group. CVLT revealed no differences between the two groups. The persons in the non recovery group were elder, ($p=0.001$), had more somatic comorbidity ($p=0.09$) and a lower educational level ($p=0.003$).

Conclusions: Persons who do not recover after treatment for LNB score worse on several neuropsychological tests (TMT 2., 5, Stroop 1-4 and digit symbol raw score) but not on CVLT, indicating primary deficits related to attention/executive functions/processing speed and a relative sparing of verbal learning and memory.

Correspondence: *Randi Eikeland, PhD, Neurology, Sorlandet sykehus, Lovjomås, Froald 4820, Norway. E-mail: randi.eikeland@sshf.no*

B. ERICH, K. SMITH, J. ACOSTA, Y. MUNOZ & E. LOPEZ. The effectiveness of the Color Figure Mazes Test in the detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish speaking individuals infected with HIV.

Objective: Despite an abundance of literature regarding neuropsychological tests assessing cognitive abilities in frontal and executive domains, culturally sensitive tests to assess those domains in monolingual Spanish speakers are limited. HIV Associated Neurocognitive Disorder (HAND) remain difficult to diagnose in this population and presents a strong need for effective neuropsychological assessment measures given the HIV epidemic's impact on culturally diverse populations. The present study analyzed data to determine if a cross-culturally validated instrument of attention, concentration, psychomotor speed, and executive functioning called the Color Figure Mazes (CFM) was sensitive to the neurocognitive deficits associated with HAND.

Participants and Methods: In a sample of HIV seropositive participants with and without existing diagnoses of HAND (HAND DX $n=16$, no HAND DX $n=30$). The instrument was originally developed by the World Health Organization (WHO) and University of California, Los Angeles (UCLA) as a cross-culturally valid test to supplement current measures of HIV-related neuropsychological disorders currently used in the United States. Forty-six, Spanish-speaking participants between the ages of 27 and 65-years of age, completed the CFM in addition to well established measures of frontal/executive functioning, such as the Stroop (Golden, C) and Color Trails 1 and 2.

Results: Preliminary analysis shows these tests were highly correlated (CFM2 & Stroop C, Pearson $r=-.451$, $n=46$, $p<.001$; CFM2 & CT-2, Pearson $r=.551$, $n=46$, $p<.001$). CFM was found to be sensitive to HAND on the final trial (ANOVA, $F(1,44)=6.202$, $p<.05$) which involves categorical switching between both colors and figures.

Conclusions: Non-significant findings on earlier trials may represent the ease of the test or be an effect of the small sample size. A unique aspect of this instrument is that knowledge of the English alphabet and number system is not required, potentially making it a more culturally equitable test.

Correspondence: *Bryce Erich, Masters, Department of Psychiatry and Behavioral Neurosciences, Cedars-Sinai Medical Center, 8730 Alden Drive, Thalians Mental Health Center, W-111, Los Angeles, CA 90048. E-mail: Bryce.Erich@cshs.org*

R. FAMA, M. ROSENBLOOM, S. SASSOON, A. PFEFFERBAUM & E.V. SULLIVAN. Verbal and Nonverbal Fluency in HIV Infection and Alcoholism Comorbidity: Contribution of Motor and Memory Processes.

Objective: HIV infection (HIV) and chronic alcoholism (ALC) commonly co-occur (H+A). Each condition is associated with executive dysfunction, potentially involving fluency. Because executive functions comprise multiple components, deficits may arise from compromise in selective processes needed for good performance and related to neuroanatomical systems affected—frontostriatal in HIV and frontocerebellar in ALC.

Participants and Methods: We tested 15 HIV, 45 ALC, 16 H+A, and 34 normal controls (NC) on verbal (phonological: FAS; semantic: animals, inanimate objects, birds/colors) and nonverbal (figural) fluency and ancillary tests of attention, working memory, episodic memory, and motor abilities to identify which processes contribute to fluency.

Results: Based on education-corrected Z-scores, HIV and H+A were impaired on verbal and nonverbal fluency relative to ALC and NC; dif-

ferences were not present between HIV and H+A or between ALC and NC. Phonological and figural fluency deficits were most severe in H+A, indicative of a compounded disease effect. Simple correlations using ancillary test scores as predictors of fluency measures identified that episodic memory was related to verbal fluency in all 4 groups, whereas motor dexterity was related to verbal fluency in the 2 HIV groups. Multiple regression revealed that motor dexterity was a unique predictor, over memory, of bird/color fluency in H+A, whereas episodic memory was a unique predictor of bird/color fluency in ALC and HIV. Figural fluency was related to psychomotor scores in ALC and H+A and memory scores in ALC. Memory, particularly visual memory, but not psychomotor speed, uniquely predicted figural fluency in ALC.

Conclusions: Thus, component functions contribute differentially to verbal and figural production in HIV, ALC, and H+A, and fluency deficits are not necessarily related to motor slowing. We speculate that the compounded disease effect on fluency is linked to a co-occurrence of frontostriatal and frontocerebellar dysfunction. Support: AA017347, AA017168.

Correspondence: *Rosemary Fama, Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 1901 Emory Street, San Jose, CA 95126. E-mail: rfama@stanford.edu*

P.L. FAZELI, K. BLACKSTONE, A. ROONEY & D.J. MOORE. Factors Related to Medication Management Abilities in Older Adults with HIV: A Pilot Study.

Objective: Although HIV-associated dementia has decreased since the advent of combination antiretroviral therapy, the prevalence of subtle cognitive dysfunction has remained. Studies have suggested that such cognitive dysfunction is related to poorer everyday functioning abilities (e.g., medication nonadherence). The purpose of this of this preliminary study was to examine possible correlates, including neurocognitive abilities, of medication management in an older HIV sample.

Participants and Methods: Twenty-six older (mean age = 60.5) HIV-infected participants completed a comprehensive neuropsychological battery summarized using a Global Deficit Score approach as well as a performance-based task of pill-dispensing abilities (Cognitive Screening for Medication Self-Management, Spiers, 1994). Data were also gathered for demographic and HIV disease characteristics. Due to the preliminary nature of these data, strength of association data are primarily reported (i.e., Spearman's correlations and Hedge's *g*).

Results: Results revealed that the strongest correlates of poorer pill-dispensing abilities were having an AIDS diagnosis ($g = -0.85$) and lower education level ($\rho = 0.30$), which trended towards significance (p -values < 0.15). Worse global neurocognitive performance ($\rho = -0.22$) and lower current CD4 count ($\rho = 0.21$) were moderately related to poorer pill-dispensing abilities, but were not significant.

Conclusions: These preliminary findings suggest that older adults with more advanced HIV disease may have particular difficulties in managing HIV medications, which may in turn further progress disease. Additionally, higher education may serve as a protective factor to poor pill-dispensing abilities. Although neurocognitive functioning was not among the strongest predictors in this pilot study, further research is needed to understand the cognitive mechanisms underlying optimal medication management abilities in older individuals living with HIV.

Correspondence: *Pariya L. Fazeli, PhD, Psychiatry, University of California San Diego & HIV Neurobehavioral Research Center, 3720 Sth Avenue, San Diego, CA 92103. E-mail: plfazeli@uab.edu*

A. FUENTES, C. MIRANDA, K. COULEHAN, M. ARCE RENTERIA, A. ROSARIO, A. ARENTOFT, J. MONZONES, J. SHEYNIN, D. BYRD, S. MORCELLO & M. RIVERA MINDT. Neurocognition Influences Health Locus of Control in a Sample of HIV-Seropositive Adults.

Objective: Medication adherence is vital to optimal health outcomes & longevity for people living with HIV (PLWH). Various factors influence adherence, including a sense of control over one's health management. However, HIV-related neurocognitive (NC) impairment may interfere

with patients' ability to independently manage their own care & self-perceived health locus of control (HLoC). This study examined the relationship between NC function & HLoC in PLWH. We hypothesized that worse NC function would be related to greater externalized HLoC (i.e., endorsing that one's health is controlled by others or by chance).

Participants and Methods: 131 PLWH (71% male; 71% Latina/o & 29% non-Latina/o White (Mean Age=47.2 yrs [SD=8.3] & Education=12.8 yrs [SD=2.8]) completed the Multidimensional Health Locus of Control scale (i.e., Internalized [endorsing that one's health is controlled by one's self], Externalized-Others [EO], & Externalized-Chance [EC] subscales) and a comprehensive NC battery. Analyses used average T-scores for Global NC function & 7 domains (attention/working memory [A/W/M], processing speed, learning, memory, verbal, executive & motor function).

Results: The average Global NC T-score negatively correlated with the EO & EC subscales (all p 's $< .05$). The A/W/M, Learning, Memory & Verbal domains negatively correlated with the EO subscale, and the Learning, Memory & Verbal domains negatively correlated with the EC subscale (p 's $< .05$). NC function was not correlated with the Internalized subscale (p 's $> .10$).

Conclusions: Worse global & domain specific NC function appear significantly related to greater reporting of externalized HLoC. Care providers working with medication-taking, NC compromised patients should consider strategies to increase patient self-reliance in order to enhance health management. In contrast, internal HLoC is unrelated to cognition, and may be explained by other factors known to impact self-efficacy and self-reliance. Future studies should examine the combined roles of NC function & HLoC in adherence.

Correspondence: *Armando Fuentes, MA, Psychology, Fordham University, 441 East Fordham Road, Dealy 226, Bronx, NY 10458. E-mail: afuentes5@fordham.edu*

C.J. GIESBRECHT, K.M. GICAS, H.A. BAITZ, F. VILA-RODRIGUEZ, W.J. PANENKA, G.W. MACEWAN, A.M. BARR, D.J. LANG, W.G. HONER & A.E. THORNTON. Sub-Domains of Executive Dysfunction in Poly-Substance Users: Associations with Viral Exposure.

Objective: Viral infections are associated with cognitive impairments, with greater deficits seen in co-infected individuals. In poly-substance users, this study evaluates whether total lifetime viral exposures predicts executive functioning (EF).

Participants and Methods: Participants were recruited from single-room occupancy hotels ($n=278$; age: 23-68; 214 M, 64 F). Assessments involved self-reported substance use via timeline follow-back methods, viral serology (HIV, HBV, HCV, HSV, CMV), and a neurocognitive battery, including paper and pencil, and computerized tests (e.g. CANTAB). Dependent variables (DV) represented various aspects of EF, including response inhibition (STROOP color-word interference), decision making (Iowa Gambling Task total net score), sustained attention/working memory (RVIP A'), attentional set-shifting (IDED extra-dimensional (EDS) shift errors) and utilization of feedback (pre-EDS errors). Linear regressions were run separately for each DV, entering predictors in 4 blocks: 1) age and education, 2) substance use (marijuana, cocaine, methamphetamine, heroin, alcohol), 3) liver function assay and 4) total viral exposures. Follow-up analyses examined individual viruses as a block of predictors.

Results: Average total viral exposure was 2.9 (SD = 1.2) and 94% of participants were substance dependent. Total viral exposures was associated with RVIP A' ($\beta = 0.24$, $p < .001$) and pre-EDS errors ($\beta = 0.16$, $p = .027$) respectively explaining 4.9% and 2.1% of the variance following inclusion of other predictor variables. At follow-up HCV exposure was the only virus that predicted cognition, namely Pre-EDS errors ($\beta = 0.17$, $p = .044$). Liver function did not predict EF.

Conclusions: Total viral exposures predicted select aspects of EF suggesting that specific executive circuitry may be uniquely vulnerable to viruses and/or the associated manifestations of exposure (e.g., immune response). Future work is needed to address how executive processes may be dysregulated by differential impacts of viral poly-infections.

Correspondence: *Chantelle Giesbrecht, MSc, Simon Fraser University, RCB 5246 SSSS University Drive, Department of Psychology, Burnaby, BC V5A1S6, Canada. E-mail: cjgiesbr@sfu.ca*

E. GRULLON, M. GHATE, R. MEYER, T. HENDRIX, R.K. HEATON, S. LETENDRE, I. GRANT, S. MEHENDALE & T.D. MARCOTTE. The relationship between neurocognitive functioning and employment in HIV seropositive women in India.

Objective: HIV often results in neurocognitive impairments, which have previously been shown to impact employment status and vocational functioning. Most of these studies, however, have been conducted in Western societies and with primarily male cohorts. The goal of the present study was to examine the impact of HIV-associated neurocognitive impairments on employment status in women in India.

Participants and Methods: Forty HIV-seropositive (HIV+) and 40 HIV-seronegative (HIV-) females with histories of prior employment were identified from a larger study of individuals with HIV in Pune, India. None of the HIV+ individuals were receiving anti-retroviral treatment. Participants completed a comprehensive neuropsychological test battery, assessing 7 cognitive domains, translated into Marathi. Cognitive functioning at both the global (GDS) and domain-level was established using a deficit score (DS) approach, which emphasizes the level of impairment based upon a large HIV seronegative normative group (adjusting for age, education, and gender). Participants currently engaged in full- or part-time work were considered employed.

Results: A significantly greater percentage of the HIV+ group was unemployed (41.9% vs. 12.8%, $p = .006$). Within the HIV+ group, the employed group had a higher educational level (9.6 vs. 8.1 years, $p = .04$), with a trend for lower CD4 levels (114 vs. 148, $p = .07$). After adjusting for education and CD4 levels, the GDS entered ($p = .04$) a model predicting employment status ($R^2 = .30$; $p < .001$). Learning and Attention/Working Memory DS entered the model predicting 35% of the variance in employment outcome ($p < .001$).

Conclusions: These results suggest that HIV-associated impairment, particularly in the domains of Learning and Attention/Working Memory, are associated with reduced employment status in HIV-infected women in India. Future studies should address whether treatments, including initiation of anti-retroviral medication, might improve cognitive status and result in improved employment status.

Correspondence: *Emily Grullon, MS, HNRC, 327 I Avenue, Coronado, CA 92118. E-mail: emilygrullon@gmail.com*

J.L. HOLT, L. CHANG, C.S. JIANG, X. ZHANG & T. ERNST. Altered Age-Dependent Brain Activation During Working Memory in HIV-Infected Individuals.

Objective: HIV infection may impair the frontostriatal circuit which may affect working memory (WM). Aging is also associated with declined WM function. However, little is known about how aging may affect the HIV-infected brain. With highly active antiretroviral therapy (HAART), HIV patients are living longer and more than half of HIV-infected patients will be over 50 years old by 2015. Therefore, research to evaluate how aging might impact HIV is needed. We hypothesize that, with increasing age, HIV-infected individuals will require greater usage of cognitive reserve (brain activation) to compensate and maintain performance than seronegative controls (SN).

Participants and Methods: 67 healthy SN (ages 47.4 ± 1.4 , 90% men), and 46 HIV+ subjects with normal cognition (HIV+NC, ages 47.8 ± 1.6 , 93% men) completed fMRI scans while performing the n-back task with increasing levels of difficulty. Only scans with performance > 70% correct and less than 1 mm and 1 degree motion are accepted. Images were analyzed with SPM8 (including motion correction, normalization to MNI-152 template, smoothing with an 8mm isotropic kernel) using ANCOVAs (age as a covariate).

Results: Both subject groups had similar performance (%accuracy and reaction times) during fMRI. However, on the 2-back task, HIV subjects showed greater age-dependent increases in BOLD response than SN in the bilateral frontal regions (BA44, BA9, BA6; cluster corrected- $p = 0.01-0.002$) and the temporoparietal regions (BA 40 and BA 22, corrected- $p = 0.006$).

Conclusions: Across this middle age span, both subject groups showed no obvious age-dependent decline in WM performance. However, only HIV subjects required greater brain activation as they age, probably to maintain their performance during the WM task. These findings indicate increased requirement for the usage of the brain reserve in the older HIV subjects.

Grant Support: 1MH61427; 2K24-DA016170; U54-NS56883; P20-RR011091

Correspondence: *John L. Holt, PhD, Medicine, JABSOM, University of Hawaii, 1356 Lusitana Street, 7th Floor, Honolulu, HI 96813. E-mail: johnholt@hawaii.edu*

A. LE BERRE, R. FAMA, M.J. ROSENBLOOM, A. PFEFFERBAUM & E.V. SULLIVAN. Decision Making in Alcoholism, HIV Infection, and Their Comorbidity: Differential Contributions of Cognitive Functions.

Objective: Alcoholism (ALC) and human immunodeficiency virus infection (HIV) comorbidity (A+H) are highly prevalent. Each disease is associated with poor decision making, which can be modeled with the Iowa Gambling Task (IGT), a complex task dependent on multiple component processes of cognition. This study tested whether disease-specific deficits in component processes of cognition contribute differentially to IGT performance in ALC, HIV, and A+H.

Participants and Methods: Participants were 23 ALC, 28 HIV, 37 A+H, and 22 controls matched in age and education. The task involved choosing between advantageous and disadvantageous decks of cards by weighing short-term vs. long-term monetary wins under initially ambiguous conditions. A decision-making score was based on the number of cards from advantageous decks minus the number of cards from disadvantageous decks. Participants also underwent a neuropsychological test battery of global cognitive functioning (Dementia Rating Scale, DRS), memory (Wechsler Memory Scale, Rey-Osterrieth Figure), and executive functions (semantic fluency, Trail Making), targeting processes commonly affected in ALC or HIV.

Results: Patient groups showed similar levels of deficit on the IGT. Other tests indicated global cognitive dysfunction in A+H groups and impairment on memory but not executive functions in ALC and A+H groups. Stepwise regression analyses showed that visual memory scores were predictors of IGT scores in A+H, whereas perseveration scores from the fluency and DRS Initiation/Perseveration score were predictors of IGT scores in HIV.

Conclusions: Despite similar levels of IGT deficit in the 3 patient groups, correlational analysis suggests that different sources of deficit underlie their decision making compromise: visual memory impairment is a unique contributor in Alcoholism+HIV comorbidity, whereas executive dysfunction is a unique contributor in HIV only. Support: AA017347, AA017168, AA017923.

Correspondence: *Anne Pascale Le Berre, PhD, Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 401 Quarry Road, Stanford, CA 94305. E-mail: aleberre@stanford.edu*

A. LEVINE, C. ACHIM, E. SINGER, E. MASLIAH, J. SINSHEIMER, V. SOONTORNIYOMKIJ & D. MOORE. Establishing a Link Between Host Genotype and HIV-Related Neuropathology – A Novel Approach to Understanding Neuropathogenesis.

Objective: The prevalence of HIV-associated neurocognitive disorders (HAND) is near 50% despite the widespread use of combined antiretroviral therapy. HAND is a clinical diagnosis based on neurocognitive impairments. While the exact etiology is unclear, HAND is believed to be the end result of a sequence of physiological events that commences with HIV-induced cellular changes that are modified by genetic factors. We deem quantifiable neuropathological changes that occur proximal to the beginning of this causal chain of HAND pathogenesis as neuropathological intermediate phenotypes (NIPs). Identifying the relevant neuropathological changes will help illuminate the neuropathogenesis of HAND. Here, we leverage known genetic risk factors for the clinical HAND to validate a candidate NIP.

Participants and Methods: Seven HIV-infected brains were neuropathologically characterized and genotyped. We examined synaptodendritic neurodegeneration as measured via quantitative imaging of both synaptophysin (SYN) and microtubule-associated protein-2 (MAP2) in the midfrontal cortex. All cases were genotyped for TNF- α , MIP-1 α , MCP-1, and BDNF.

Results: A significant difference in SYN levels was detected for the MCP-1 polymorphism ($p = .04$), indicating that those with the 'G' allele at the MCP-1 promoter position -2578 site had greater synaptodendritic neurodegeneration.

Conclusions: This is the first study to establish a link between host genotype and a candidate neuropathological phenotype for HAND. Through further examination of the relationship between genetic susceptibility loci and NIPs in brain tissue derived from a clinically well-characterized cohort, it will be possible to determine 1) which genetic variants are biologically relevant to HAND, 2) the pathophysiological mechanisms through which they exert their effect on the neurobehavioral phenotypes, and 3) the relative importance of NIPs as underlying causative factors of HAND.

Correspondence: *Andrew Levine, Ph.D., Neurology, University of California, Los Angeles, 11645 Wilshire Blvd., Ste 770, Los Angeles, CA 90024. E-mail: ajlevine@mednet.ucla.edu*

E. LOPEZ, C. YAMAKAWA, R. KARAMIANS, K. SMITH & H.J. DAVID. The Effectiveness of the Computerized Picture Memory Interference Test in the Detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish Speaking Individuals Infected with HIV.

Objective: Despite an abundance of available neuropsychological tests, culturally sensitive tests to assess memory in monolingual Spanish speakers are limited. For instance, HIV Associated Neurocognitive Disorder (HAND) remains difficult to diagnose in this population and presents a strong need for effective neuropsychological assessment measures given the disproportionate impact of the HIV epidemic on this disenfranchised population. In the present study we analyzed data to determine if a computerized version of the Picture Memory Interference Test (PMIT) was sensitive to the neurocognitive deficits associated with HAND in a sample of Spanish speaking HIV seropositive adults.

Participants and Methods: The PMIT was originally developed by the World Health Organization (WHO) and University of California, Los Angeles (UCLA) in order to assess cross-culturally for HAND. Fifty-two Spanish-speaking participants (HAND DX $n = 19$, No HAND DX $n = 33$) between the ages of 27 and 65-years of age completed the PMIT.

Results: The PMIT was found to be sensitive to HAND (ANCOVA, $F(1,51)=13.358, p<0.01$), with worse performance in the HAND DX group when controlling for education. A unique aspect of this updated instrument is that it measures reaction time for memorizing pictures. The total time to respond to Trials 1, 2 and 3 on the computerized PMIT was found to be sensitive to HAND as well (ANCOVA, $F(1,51)=6.468, p<0.01$).

Conclusions: Assessing for psychomotor speed for memorizing images may be an important tool to assess for HAND among this disenfranchised population. Therefore, preliminary results suggest that this updated computerized test may be a promising measure to assess for memory and psychomotor speed cross-culturally.

Correspondence: *Enrique Lopez, PsyD, Cedars Sinai Medical Center, 8730 Alden dr. W111, West Hollywood, CA 90069. E-mail: lopeze@cshs.org*

R.C. MCINTOSH, J. SEAY, M. ANTONI, R. DURAN & N. SCHNEIDERMAN. A Moderated Mediation Model of Cognitive Depression in HIV.

Objective: Biased inhibitory processes, positive and negative automatic thoughts (AT), and the inability to use positive schemas to regulate negative mood are cited as potential links to emotion dys-

regulation in depression; however, the relationship amongst these mechanisms in cognitively vulnerable HIV+ persons is unclear. We propose a moderated mediation model in which ATs mediate the effect of cognitive coping on depression. Both direct and indirect paths expect to be moderated by a common screening measure for cognitive state in HIV.

Participants and Methods: A total of 333 early and late stage HIV+ adults recruited for a CBT intervention were included (P01MH4954H Schneiderman, N., PI.) The model consisted of cognitive coping (C-COPE) as a predictor; cognitive depression (BDI) as an outcome, automatic thoughts (AT) as mediators; and cognitive state (HDS) as a moderator.

Results: Moderated mediation was confirmed: $R^2 = .40, F(7, 325) = 31.39, p < .0001$. Cognitive coping predicted greater PAT ($\beta = 0.25, p < 0.001$) and lower NAT ($\beta = -0.68, p < 0.001$). Lower levels of depression were predicted by greater PAT ($\beta = -0.26, p < 0.001$) and NAT predicted greater depression ($\beta = 0.15, p < 0.001$). Cognitive state moderated the indirect effect of C-COPE on PAT ($t = 2.55, p < 0.01$); PAT on depression ($t = 3.43, p < 0.001$); and C-COPE on depression ($t = 2.50, p < 0.05$). The indirect paths for NAT were not moderated by cognitive state.

Conclusions: Our findings suggest that automatic thoughts mediate the effect of cognitive coping on depressive symptoms. Our decomposed moderation suggests that HIV+ persons with lower cognitive state experience higher levels of cognitive depression due to their inability to use positive reinterpretation to increase PAT and subsequently implement these PATs towards the reduction of depressive symptoms. It is likely that HIV-related cognitive deficits hinder ability to disengage attention from irrelevant thoughts or deploy adaptive emotion-regulation strategies thereby increasing depression.

Correspondence: *Roger C. McIntosh, Ph.D., Health Psychology, University of Miami, P.O. Box 248185, Coral Gables, FL 33124. E-mail: rmcintosh@psy.miami.edu*

C. MIRANDA, M. ARCE RENTERIA, A. ROSARIO, J. SHEYNIN, A. FUENTES, A. ARENTOFT, J. MONZONES, D. BYRD, S. MORCELLO & M. RIVERA MINDT. Relative Utility of Three English Language Dominance Measures in Predicting the Neuropsychological Test Performance of HIV+ Bilingual Latino Adults.

Objective: Given the disproportionate impact of neurologic disorders such as HIV on ethnic minorities, neuropsychologists are increasingly evaluating individuals of diverse linguistic backgrounds. Accurately assessing language dominance (LD) is critical for ensuring that diagnoses reflect impairment & not linguistic artifacts. However, there is a paucity of research on how to best operationalize LD. It was hypothesized that LD difference scores (LDDS) from the Woodcock Munoz Language Survey-Revised (WMLS-R) would significantly predict neuropsychological (NP) performance after accounting for other LD measures in Latino adults.

Participants and Methods: 64 HIV+ English/Spanish bilingual Latino adults (68% Male; M Age=46.7(2.4) yrs; M Education=11.9(2.4) yrs) completed 3 language proficiency measures: Self-Reported English & Spanish Ability; Verbal Fluency [PMR & FAS]; & WMLS-R English & Spanish tests; as well as an English language NP battery. Mean T-scores for Global NP & domains (Executive Function, Processing Speed, Attention/Working Memory, Learning, Memory) were used. LDDS were computed using English/Spanish difference scores for each LD measure (lower values = >English-dominance).

Results: All 3 LDDS measures were significantly negatively correlated with Global & all NP domains except Learning & Memory (all p 's < .05). A combined model of all 3 LDDS accounted for 21% of the Global NP T-score ($F(3,58)=5.21, p < .05$), but the WMLS-R LDDS did not contribute to the model ($R^2\Delta = .028, p > .05$). Verbal Fluency & Self-Report LDDS were significant predictors of Global NP ($b = -.19, b = -1.42, p < .05$). The WMLS-R did not contribute to the prediction of any domain (all p 's > .05).

Conclusions: LD is an important predictor of NP performance across domains. Although the LDDS of all 3 language measures showed similar bivariate relationships with NP performance, the easily administered Verbal Fluency and Self-Report measures better captured the effects of LD on NP performance, suggesting the more comprehensive WMLS-R does not improve prediction.

Correspondence: *Caitlin Miranda, Fordham University, 23-25 30th Drive, Apt. 4b, Astoria, NY 11102. E-mail: Caitlin.seifert@gmail.com*

D.J. MOORE, A.J. POQUETTE, B. GOUAUX, J. BADIEE, I. GRANT & S.P. WOODS. Time-based Prospective Memory Deficits are Associated with Psychotropic and ART Medication Non-Adherence among HIV+ Individuals with Bipolar Disorder.

Objective: Prospective memory (PM), or remembering to perform a future prescribed intention, is an emerging predictor of medication non-adherence (Woods et al., 2009), and time-based (TB) PM is particularly sensitive to these deficits (Poquette et al., in press). The current study investigated PM as a predictor of psychotropic (PSY) and antiretroviral (ART) medication adherence in a population of HIV+ persons with bipolar disorder (HIV+/BD+).

Participants and Methods: Forty-four HIV+/BD+ individuals were enrolled in a text message intervention study aimed to increase medication adherence, and time- and event- based PM performance were assessed with the Memory for Intentions Screening Test. PSY and ART adherence was tracked using an electronic monitoring system and calculated as number of openings/number of prescribed doses.

Results: TB PM was associated with PSY (Spearman's $\rho=0.34$, $p=0.03$) and ART adherence (Spearman's $\rho=0.46$, $p=0.002$). Manic symptoms were also associated with PSY adherence, whereas ART adherence was associated with manic and depressive symptoms, age, and ethnicity ($ps<0.10$). Neither ART nor PSY adherence was associated with PM recognition, ongoing task scores, HIV disease factors, or global cognitive functioning ($ps>0.10$). TB PM emerged as the only significant predictor of PSY adherence ($p<0.05$) in a multivariable model including TB PM, intervention group, and mania scores; TB PM was a significant predictor ($p=0.002$) of ART adherence in a multivariable model including TB PM, intervention group, mania and depressive scores, age, and ethnicity.

Conclusions: TB PM deficits are related to worse PSY and ART adherence among HIV+/BD+ persons enrolled in an intervention study to improve adherence. Future interventions may need to specifically target TB PM deficits as these appear to be strongly tied to non-adherence even in the context of an intervention targeted at supporting PM difficulties.

Correspondence: *David J. Moore, Ph.D., Psychiatry, University of California, San Diego, 220 Dickinson St., Suite B, Mail Code S231, San Diego, CA 92103. E-mail: djmoore@ucsd.edu*

T. SCHULTE, A. PFEFFERBAUM, Y. JUNG, E.V. SULLIVAN, N.C. HUANG, W. HAWKES & E.M. MÜLLER-OEHRING. Striatal Intrinsic Functional Connectivity in HIV and Parkinson Disease.

Objective: With the widespread use of antiretroviral therapy, patients with human immunodeficiency virus (HIV) infection live longer and are more prone to show age-related decline with clinical symptoms similar to those of Parkinson's disease (PD). Both diseases affect striatal structures (caudate nucleus, putamen), which may disrupt functional networks between subcortical nuclei and cortical regions.

Participants and Methods: We examined striatal intrinsic connectivity in 11 PD, 9 HIV, and 23 controls with resting state functional MRI. During the scan, subjects were instructed to lie relaxed with eyes open. Functional connectivity analysis comprised time series over 135 brain volumes. Caudate and putamen were seed regions for whole brain connectivity maps.

Results: All groups showed synchronized caudate-prefrontal cortex activity and putamen-premotor cortex activity. Age significantly affected these striatal-cortical connectivity maps. To control for differences be-

tween groups in the association between connectivity and age, we used an ANCOVA connectivity model with age as covariate. Compared with controls, PD showed a significantly greater extent of synchronized putamen-premotor cortex activity, whereas HIV showed greater caudate-occipitoparietal and caudate-dorsolateral prefrontal cortex synchronous activity.

Conclusions: The PD-related intrinsic connectivity difference may reflect an expansion of the motor network to compensate for potential impairment in the motor loop passing through the putamen. Conversely, HIV-related greater intrinsic connectivity between the caudate nucleus and frontoparietal regions may support compensatory cognitive network recruitment to counteract neurocognitive impairment in HIV. We propose that these different patterns of extended striatal connectivity in HIV and PD may be a marker for a vulnerability factor for clinical motor or cognitive symptoms. Support: AA018022, AA017347, AA017168, AA017923.

Correspondence: *Eva M. Müller-Oehring, Ph.D., Psychiatry & Beh Sci, Stanford University School of Medicine, 401 Quarry Rd, Stanford, CA 94305. E-mail: evamoe@stanford.edu*

S.M. PATEL, S. PANOS, A.D. THAMES, T. ARENTSEN, N. ARBID, S. CASTELLON & C.H. HINKIN. HIV-associated neurocognitive decline predicts declines in instrumental activities of daily living: A longitudinal study.

Objective: Among HIV+ individuals, neuropsychological (NP) impairment has been shown to interfere with the ability to carry out instrumental activities of daily living (IADL). Furthermore, there is evidence to suggest that other factors (e.g. depression) may influence the accuracy of self-reported functional abilities. What has yet to be explored is whether NP changes over time are associated with changes in self-reported IADL functioning among HIV+ individuals, and whether cognitive reserve influences that relationship.

Participants and Methods: 89 HIV+ adults were administered a battery of NP measures and a self-report measure assessing IADLs (e.g., management of finances, driving, and medications) at baseline and at 12 months. NP performance and self-reported IADLs were categorized as "no decline" or "decline". Logistic regression was utilized to predict self-reported IADL changes based on NP changes.

Results: Results indicated that changes in IADLs was significantly (or near significance) predicted by changes in motor ($p=.03$), language ($p=.03$), and processing speed ($p=.04$). That is, individuals with NP declines were more likely to report IADL declines. Interestingly, when the sample was stratified by cognitive reserve (based on years of education and a premorbid intelligence measure), the above pattern only held true (and in fact, the relationship was stronger) for those with high cognitive reserve. Among individuals with low cognitive reserve, changes in cognition were not predictive of changes in self-reported IADLs.

Conclusions: As hypothesized, HIV infected adults experiencing cognitive declines are also at risk for declines in IADL functioning. Moreover, cognitive reserve appears to moderate the relationship between cognition and IADLs.

Correspondence: *Sapna M. Patel, Ph.D., University of California Los Angeles, 760 Westwood Plaza, CS-746, Los Angeles, CA 90095. E-mail: smpatel@mednet.ucla.edu*

C. POSADA. Emotional Attention Processing among HIV-infected Persons with Bipolar Disorder.

Objective: Studies of emotional attention have shown that persons with bipolar disorder (BD) have an attentional bias toward processing of mood-congruent information (Murphy et al, 1999) and HIV+ individuals have demonstrated attentional bias towards negatively-laden information (Novara, et al., 2000). This study examined the emotional attention abilities of participants with all possible combinations of HIV and BD with the hypothesis that the dually-affected group would demonstrate greater attentional bias than the other groups.

Participants and Methods: HIV+/BD+ (n=37), HIV+/BD- (n=16), HIV-/BD+ (n=21) and HIV-/BD- (n=15) were administered the Affec-

tive Go/No-go task (AGNT). The AGNT is a computerized task where participants press a key to respond to a target word (“Go”) and withhold a response to non-target words (“No-go”). There were three emotional conditions in this task: positive (happy), negative (sad), or neutral (neutral), and all possible combinations of the three emotional conditions were presented (e.g., Go happy, No-go sad). There was also a control condition where individuals responded to neutral words presented uppercase and lowercase font (e.g., Go UPPERCASE, No-go lowercase). Reaction Time (RT) in ms and accuracy were measured.

Results: No interactions effects were found. A main effect of HIV infection was found for RT on both conditions requiring a Go response to sad stimuli (i.e., Go sad, No-go happy; Go sad, No-go neutral) and on the Go happy, No-go sad condition (all p s < 0.05). In terms of accuracy, a main effect of HIV was found for the Go happy, No-go neutral condition only ($p=0.04$). For the control condition, a main effect of HIV was found for both accuracy ($p=0.03$) and RT ($p=0.04$).

Conclusions: HIV-infection seems to have a strong impact on emotional attention regardless of BD status. These results are consistent with previous findings showing that HIV-infected individuals demonstrate attentional bias toward negatively-laden information.

Correspondence: *Carolina Posada, UCSD, 9130-C Regents Rd, La Jolla, CA 92037. E-mail: cposada@ucsd.edu*

R.A. ROMERO, B. YUND, N. ERICKSON, K. WOODWORTH, P. BANGIRANA, M. BOIVIN, J. WONG & E. SHAPIRO. Neurocognitive Effects of HIV on Preschool-aged Children in Uganda.

Objective: Previous research investigating the impact of pediatric HIV on cognitive development has indicated that HIV-positive children show deficits in cognitive ability compared to HIV-negative children. However, relatively little research has looked more specifically at different neurocognitive domains among preschool-aged children. The current study therefore seeks to add to the existing literature by examining attention, memory, and cognition.

Participants and Methods: The participants were originally from different HIV studies conducted in three districts of Uganda: Kampala, Kayunga, and Tororo. Participants included 103 HIV-positive and 147 HIV-negative preschool-aged children. Only baseline scores from the Early Childhood Vigilance Task (ECVT) for attention, Color Object Association Test (COAT) for memory, and the Mullen Scales of Early Learning (Mullen) for cognitive development were included in the analysis. Those who received treatment at baseline were excluded.

Results: A general linear model (ANCOVA Model) was conducted, using age as a covariate, to examine the relationships of the different groups in each of the neurocognitive domains. Significant differences were found between HIV-positive and HIV-negative groups on: attention, measures of memory (immediate and learning ability), and cognitive abilities (expressive and receptive language, visual reception, gross and fine motor).

Conclusions: Consistent with the literature, HIV affects the neurodevelopment of children. These neurocognitive deficits are observed as early as in the preschool age. Even basic attention and learning/memory are affected even at a very young age.

Correspondence: *Regilda Anne A. Romero, Ph.D., University of Minnesota, 360 Spring St. #424, Saint Paul, MN 55102. E-mail: romer061@umn.edu*

M. SAKAMOTO, M. GHATE, R. DEUTSCH, S. LETENDRE, R. MEYER, R.K. HEATON, I. GRANT, S. MEHENDALE & T.D. MARCOTTE. Neuropsychological Test Combinations As a Screening Measure for Detection of HIV-associated Neurocognitive Impairment in India.

Objective: Existing screening measures, such as the International HIV Dementia Scale, lack good classification accuracy for detection of HIV-associated neuropsychological (NP) impairment. This study aimed to identify and validate a screening battery, by pairing up 2 NP tests, for HIV clinicians in settings where time and resources may limit the availability of full NP assessments.

Participants and Methods: 206 HIV-infected participants from Pune, India completed a comprehensive NP battery measuring 7 cognitive domains, translated into Marathi. 53% had an AIDS diagnosis, with the median CD4 cell count being 240 cells/mm³. 33% of the sample was classified as NP impaired based upon a large normative group from Pune. All 22 NP tests were compared using a Superiority Index (Deutsch et al., 2009), which quantifies and ranks relative performance of each diagnostic test based on sensitivity and specificity in comparison to the NP status. Cross-validated recursive partitioning was then executed on 2-test combinations of the highest ranking tests to identify which combinations demonstrated the best prediction of NP impairment.

Results: A test of visual (non-verbal) learning met the criteria for inclusion in each of the top-performing combinations. The best 2-test combinations were the Brief Visuospatial Memory Test – Revised (BVM-T-R) learning and Color Trails 1 (sensitivity = 75%/specificity = 84%), the BVM-T-R learning and Grooved Pegboard (71%/84%), and the BVM-T-R learning and Digit Symbol (72%/83%).

Conclusions: The combination of 2 NP tests, primarily assessing non-verbal learning and processing speed, yielded very good sensitivity and specificity for the detection of NP impairment in this Indian cohort. Given that these NP test pairs have minimal language and literacy requirements, and take only 5 to 10 minutes to administer, HIV clinicians in India and other international settings may benefit from using the screening measures described here.

Correspondence: *Maiko Sakamoto, Ph.D., Psychiatry, UCSD, 220 Dickinson Street, Suite B, San Diego, CA 92103. E-mail: masakamoto@ucsd.edu*

M.E. SHAPIRO, D. PEYSER, J.R. MAHONEY & J. VERGHESE. Apathy Correlates with Cognitive Performance, Functional Disability, and RNA Plasma Levels in HIV Positive Individuals.

Objective: Apathy is a well-known neuropsychiatric sequelae of HIV. Although recent research has associated apathy with neurocognitive impairment and functional disability in HIV patients, findings linking apathy with disease markers have been equivocal. Here, we sought to further investigate the relationship between apathy, neurocognitive performance, and HIV disease characteristics. Additionally, we explored the impact of age on this relationship, which has not been previously studied but is of paramount importance given the aging HIV population.

Participants and Methods: A comprehensive battery of neuropsychological tests, as well as measures of functional disability, apathy, and mood were administered to 120 patients with HIV at an urban AIDS center. Disease characteristics, including: CD4 count, disease duration, AIDS diagnosis, and plasma HIV RNA levels were obtained from medical records. An age-by-apaty product term was computed to assess a potential interaction.

Results: Apathy was significantly associated with plasma RNA levels, functional disability, and performance on tests of processing speed, executive functioning, attention, and visuospatial abilities. These associations remained significant when controlling for age, education, depression, and disease characteristics. Hierarchical regression revealed a significant age-by-apaty interaction, with a stronger association between age and processing speed performance in participants with higher levels of apathy.

Conclusions: Apathy is related to poor neuropsychological functioning and increased functional disability in individuals with HIV. The association between apathy and plasma RNA levels, and not CD4 count or disease duration, suggests that it may co-vary with specific disease markers. Furthermore, to our knowledge, this is the first study to demonstrate an interactive effect of age and apathy on neuropsychological performance in HIV, as apathy appears to magnify the negative effect of age on processing speed.

Correspondence: *Miriam E. Shapiro, BA, School of Psychology, Fairleigh Dickinson University, 1000 River Road T-WH1-01, Teaneck, NJ 07666. E-mail: miriamshap@gmail.com*

M.E. SHAPIRO, D. PEYSER, J.R. MAHONEY & J. VERGHESE. Cognitive Reserve Protects Against Apathy in HIV Positive Patients.

Objective: Apathy is a common symptom in patients with HIV and is associated with impaired neuropsychological functioning. Although recent literature has indicated cognitive reserve (CR) to be a protective factor against cognitive decline in patients with HIV, CR's relationship with apathy has never been studied. We examined the impact of CR on apathy in patients with HIV, and assessed whether this relationship is moderated by disease severity.

Participants and Methods: One hundred and twenty patients from a large urban AIDS center completed the Wechsler Test of Adult Reading, Beck Depression Index, and Apathy Evaluation Scale. Disease and demographic data was obtained from medical records. A CR-composite was created, combining years of education and word-reading ability. Product terms between CR and disease markers (nadir CD4 count, highest plasma RNA level, and disease duration) were computed to assess for possible interactions.

Results: Multiple regression analysis revealed a significant association ($B = -.18, p < .01$) between CR and apathy, controlling for age, gender, depression, and disease severity. Hierarchical regression analysis revealed significant interactions between CR and disease markers in predicting apathy; participants with lower nadir CD4 counts and higher plasma RNA levels demonstrated weaker associations between CR and apathy.

Conclusions: CR is protective against apathy in addition to neuropsychological decline in individuals with HIV. Moreover, the relationship between CR and apathy was weaker in those with more severe disease markers, suggesting the protective quality of CR wanes with HIV progression, consistent with other neurodegenerative diseases. Together, these findings indirectly support the theory that 1) apathy and neurocognitive impairment result from viral damage to shared subcortical systems, and 2) individuals with higher CR can withstand more damage to those systems before exhibiting neurobehavioral symptoms.

Correspondence: *Miriam E. Shapiro, BA, School of Psychology, Fairleigh Dickinson University, 1000 River Road T-WH1-01, Teaneck, NJ 07666. E-mail: miriamshap@gmail.com*

M.E. SHAPIRO, D. PEYSER, J.R. MAHONEY & J. VERGHESE. Disease Severity Moderates the Effect of Age on Neuropsychological Performance in HIV-Positive Patients.

Objective: Aging and HIV are both known to independently compromise neuropsychological functioning. However, research on the intersection between HIV disease and age is limited. We sought to determine the relationship between age, HIV severity, and cognitive performance in an aging population.

Participants and Methods: One hundred and twenty five patients from a large urban AIDS center completed a comprehensive neuropsychological battery sensitive to domains impacted by HIV. Disease characteristics, including: CD4 count, disease duration, and plasma HIV RNA levels were obtained from medical records. Regression analysis with age- by- disease marker product terms was used to assess for possible interactions.

Results: Age, CD4 nadir, and plasma RNA levels were significantly associated with processing speed performance. Age was also related to performance on executive functioning tests. Disease duration exhibited no associations. Hierarchical regression analysis revealed a significant age- by- disease interaction when controlling for disease duration, with CD4 count and plasma RNA levels moderating the effect of age on neuropsychological performance. That is, participants with more severe disease characteristics demonstrated a stronger association between age and performance on processing speed and executive functioning tests.

Conclusions: Our findings demonstrate a synergistic effect of HIV severity and aging on neuropsychological performance. Notably, lower nadir CD4 count and higher plasma RNA levels magnified the neurocognitive effects of age, suggesting that the combined effects of these risk factors amplify their independent adverse consequences. Interestingly, disease

duration did not have an effect on cognitive performance, indicating that HIV acuity is more closely linked with neuropsychological functioning. As HIV becomes a chronic disease, the degree of disease control is critical in attenuating neuropsychological decline, which is especially relevant given the increased life-expectancy of patients with HIV. Correspondence: *Miriam E. Shapiro, BA, School of Psychology, Fairleigh Dickinson University, 1000 River Road T-WH1-01, Teaneck, NJ 07666. E-mail: miriamshap@gmail.com*

R. KARAMIANS, C. YAMAKAWA, E. LOPEZ & C. SAUCEDO. The Effectiveness of the HIV Dementia Scale (HDS) in the Detection of HIV Associated Neurocognitive Disorder (HAND) among Spanish Speaking Individuals Infected with HIV.

Objective: The identification of HIV-Associated Neurocognitive Disorder (HAND) among monolingual Spanish speakers is of vital importance given the impact of HIV on this disenfranchised population. In the present study we analyzed data to determine if the HIV Dementia Scale (HDS) was sensitive to the neurocognitive deficits associated with HAND in Spanish speaking HIV seropositive adults. The HIV Dementia Scale (HDS) consists of subtests that evaluate (1) executive functions (antisaccadic eye movement), (2) psychomotor speed (timed written alphabet), (3) memory (recall of four words) and (4) construction (cube copy time).

Participants and Methods: Fifty-three, Spanish speaking, HIV seropositive adults with and without HAND (HAND DX n=19, no HAND DX n=34) were administered the HDS. An ANCOVA was used to analyze the HDS scores of individuals with and without HAND while controlling for level of education.

Results: Preliminary analyses showed the executive function task (ANCOVA $F(1, 49) = 5.257, p < .05$), psychomotor speed task (ANCOVA $F(1, 51) = 14.169, p < .01$), construction task (ANCOVA $F(1, 49) = 4.183, p < .05$) and total HDS score (ANCOVA $F(1, 46) = 14.568, p < .01$) were sensitive in detecting the presence of a HAND diagnosis when controlling for education. The memory task (ANCOVA $F(1, 51) = .187, p = .67$) was not sensitive to HAND.

Conclusions: The overall sensitivity of the HDS in detecting hand was likely due to the executive function, psychomotor and construction tasks. However, because participants were recalling different amounts of letters of the alphabet (range 11 to 29) their total time was likely not representative of their true abilities. Additionally, the construction task should also be interpreted with caution due to the difficulty it may present for individuals with a non-Western educational background. Overall, the use of the HDS in the detection of HAND should be undertaken with caution and further development of this scale and/or new screening instruments for this disenfranchised group are critically needed. Correspondence: *Cristina Yamakawa, Psy.D., Neurology, Cedars-Sinai, 8730 Alden Drive E-139, Los Angeles, CA 90048. E-mail: cristina.yamakawa@cshs.org*

M.D. BARBOSA, A. ZANINOTTO, D.F. MAZO, C.N. FARIAS, S.A. HAJJ, A. DIAS, F.J. CARRILHO, M.C. DE LÚCIA & A.Q. FARIAS. Cognitive function, depression symptoms and health-related quality of life before and during interferon therapy of chronic hepatitis C.

Objective: There is growing evidence that hepatitis C virus infection is associated with cognitive, mood and health-related quality of life (HrQOL) impairment long before the development of end-stage liver disease and those changes may worsen during treatment. Our aim was to assess these features before and during antiviral therapy.

Participants and Methods: seventeen consecutive patients with chronic hepatitis C with detectable HCV-RNA were enrolled in this prospective study. Genotype 1 was found in 14 and genotype 3 in the remaining 3 patients. 16 patients had biopsy proven chronic hepatitis and 1 had cirrhosis. Minimal hepatic encephalopathy was excluded by the Inhibitory Control Test. Alcohol use was assessed by the AUDIT. All patients received pegylated interferon and ribavirin therapy for at least 24 weeks.

A stringent work-up was performed for assessing cognitive function (stroop color, trail making, Hopkins verbal learning, grooved pegboard, digit span, verbal fluency, clock drawing tests), depression symptoms (Beck depression inventory, BDI) and HrQOL (SF-36 instrument) at the inclusion and 24 weeks after the beginning of therapy.

Results: As compared with baseline, selective attention and verbal fluency were significantly decreased at 24 weeks of therapy ($p=0.02$). We could not demonstrate significant changes in memory (episodic and working), fine motor skill and visual spatial organization. BDI scoring before therapy was 6.3 ± 3.8 and increased to 11.8 ± 6.5 and this difference was statistically significant ($p=0.0003$). The scores of vitality, physical functioning, role physical, role-emotional, social functioning and mental health domains worsened during therapy. Furthermore, a negative correlation was found between BDI scoring and the all SF-36 domains, except pain ($p<0.05$).

Conclusions: Interferon-based therapy of hepatitis C infection is associated with significant impairment of the executive function, depression symptoms and health-related quality of life.

Correspondence: Ana Luiza C. Zaninotto, master, Divisão de Psicologia, Universidade de São Paulo - FMUSP, Rua Dr. Eneas de Carvalho Aguir 155, terreo., São Paulo 05403-000, Brazil. E-mail: ana.zaninotto@yahoo.com.br

Psychopathology/Neuropsychiatry (Schizophrenia)

N. OJEDA, J. PEÑA, A. GARCÍA, C. SCHRETLEN & M. GUTIERREZ. Cognitive impairment in first-episode bipolar I disorder: the processing speed hypothesis.

Objective: Cognitive impairment in bipolar disorder has been well documented. Specifically, processing speed has been recognized as a core cognitive impairment in several disorders, including bipolar disorder. The aim of this study was to determine whether processing speed underlies cognitive impairment on verbal memory, visual memory, verbal fluency, working memory, motor speed and executive functioning in first-episode bipolar disorder. We also tested if controlling for the rest of cognitive domains independently would show similar results to those found after controlling for processing speed.

Participants and Methods: Thirty patients with first-episode bipolar I disorder and 56 healthy controls were assessed in terms of sociodemographic, clinical and cognitive variables. Cognitive domains included processing speed, verbal memory, visual memory, verbal fluency, working memory, executive functioning and motor speed.

Results: Patients showed significant impairment on all cognitive domains. Most impaired domains were processing speed (effect size; $\eta^2 = 0.45$) and visual memory ($\eta^2 = 0.42$). However, after controlling for the effect of processing speed, significant differences in verbal fluency, executive functioning, motor speed and working memory disappeared. Differences in verbal and visual memory remained significant although effect size considerably diminished. In contrast, when other cognitive domains were entered as covariates, differences remained significant for all domains, except for executive functioning.

Conclusions: Processing speed may be considered a core deficit in bipolar disorder that underlies other higher cognitive functions. Future treatment guidelines should target this underlying feature of the illness to improve quality of life of patients with bipolar disorder.

Correspondence: Javier Peña, University of Deusto, Av Universidades 24, Bilbao 48007, Spain. E-mail: javier.pena@deusto.es

R. DEL PINO, C. SCHRETLEN, J. PEÑA, E. ARETOULLI, N. OJEDA, A. DE LA CRUZ & M. ASPIUNZA. Clinical Symptoms Moderate the Association Between Nicotine Dependence and Cognition.

Objective: The self-medication hypothesis suggests that increased nicotine consumption improves cognitive performance in the domains of attention, working memory, and executive function and diminishes clinical symptoms in patients with schizophrenia. However, it is unclear whether clinical symptoms affect the association between nicotine dependence (ND) and cognition

Participants and Methods: We investigated the potential interaction effect of clinical symptoms and ND on cognitive performance in 30 patients with schizophrenia who reported smoking habitually. Level of ND, clinical symptoms, and cognitive performance (attention, memory, working memory, executive functions, and processing speed) were evaluated. We used hierarchical regression to analyze the potential moderator effect of clinical symptoms on the relationship between ND and cognitive performance

Results: Severity of total positive symptoms moderated the relationships between ND and both attention ($p=.046$) and executive function ($p=.043$). Severity of total negative symptoms moderated the relationships between ND and both attention ($p=.007$) and processing speed ($p=.008$). Among negative symptoms, poor social contact influenced the relationships between ND and attention ($p=.005$), processing speed ($p=.007$), and executive function ($p=.013$). Social isolation influenced the relationships between ND and memory ($p=.001$), processing speed ($p=.003$), and executive function ($p=.000$)

Conclusions: Both positive and negative clinical symptoms moderated the relationship between ND and cognitive performance in patients with schizophrenia. Interestingly, in patients with fewer clinical symptoms, high levels of ND contributed to higher cognitive performance. However, in patients with more severe clinical symptoms, high levels of ND were associated with worse performance. Our results suggest a significant interplay between the severity of clinical symptoms and ND in the determination of cognitive function in patients with schizophrenia.

Funding sources: Gobierno Vasco. 2011111102

Correspondence: Javier Peña, University of Deusto, Av Universidades 24, Bilbao 48007, Spain. E-mail: javier.pena@deusto.es

J. POMMY, R. YEO, S. GANGESTAD & V. CALHOUN. The Relationship of General Cognitive Ability and Gray Matter Volumes Mediated by Total Number of Rare Deletions in Individuals with Schizophrenia.

Objective: Schizophrenia is a complex phenotype associated with widespread deficits in cognitive skills. Genetic Copy Number Variations (CNVs) have been observed at higher rates in variety of complex neurological conditions, including autism, ADHD, and schizophrenia. One type of CNV, the total number of uncommon deletions, was predicted to inform the relationship of general intellectual ability on GM volumes in a sample of individuals diagnosed with schizophrenia and healthy controls.

Participants and Methods: 111 normal healthy controls (HC) and 83 individuals diagnosed with schizophrenia (SCZ) were recruited as part of a larger investigation of schizophrenia. General cognitive ability (GCA) was calculated using the first principle component from the neuropsychological battery. Voxel-based morphometry, an unbiased structural neuroimaging analysis technique, was used to assess associations between GCA with gray matter (GM) volume with and without the covariate of rare deletions. Analyses were conducted in the SCZ and HC groups separately. All p-values were uncorrected at less than .001.

Results: In the HC group, GCA was positively correlated with GM in regions of the left: subgyral frontal and postcentral gyrus, middle and superior temporal gyri, and cerebellar tonsil, bilateral precentral gyri, and right middle frontal gyrus. The results of the analysis did not change significantly after controlling for rare deletions. In contrast, in the SCZ group GCA was negatively correlated with GM in left: superior, middle, and medial frontal gyri, and caudate, and right cingulate gyrus. When the impact of rare deletions was included as a covariate only 2 small clusters remained statistically significant: the left superior and inferior frontal gyri.

Conclusions: A greater volume of dysfunctional left frontal regions may lead to lower GCA in the SCZ group. This relationship may be mediated by the impact of rare deletions in the SCZ group. In the HC group rare deletions did not impact the relationship between GCA and brain volume.

Correspondence: Jessica Pommy, University of New Mexico, 5800 Eubank Blvd NE, Apt 3004, Albuquerque, NM 87111. E-mail: jpommy@unm.edu

J.J. SIMON, S.A. CORDEIRO, H. FRIEDERICH, R. WOLF, M. WEBER, M. WEISBROD & S. KAISER. Assessing the relation between symptoms and neural reward processing in healthy subjects and patients with schizophrenia – an fMRI study.

Objective: Previous research has suggested dysfunctional activity in neural reward networks as core elements in the pathophysiology of schizophrenia. However, reduced reward system activation has not been observed in all studies. A dimensional approach to psychopathology might provide an explanation. We examined the hypothesis that different levels of symptom expression are associated with reward system dysfunctions.

Participants and Methods: We recruited healthy subjects using a questionnaire assessing subclinical experiences of positive, negative and depressive symptom dimensions. Out of the 400 subjects who filled out the questionnaire, 11 subjects with a low -, 15 subjects with a medium- and 11 subjects with a high expression level participated in an fMRI study, as well as 24 medicated patients with schizophrenia. Hence we had 4 groups with different level of symptom expression. We used a modified monetary incentive delay task, which allows measurement of the neural processing of rewards.

Results: We did not observe a significant difference in reward processing between patients and healthy participants, but observed a significant interaction between symptom load and neural activity during the expectation and receipt of a reward: higher symptom expression was associated with lower neural activity. A correlational analysis revealed in both patients and healthy controls a negative association between apathy and activation in the ventral striatum during the expectation of possible rewards, and between anhedonia and activity in the medial orbitofrontal cortex during the receipt of a reward.

Conclusions: These results provide evidence that missing group differences could arise due to undocumented symptom expression in healthy subjects. Higher levels of schizophrenia-like symptoms lead to more dysfunctional activity in reward regions. A dimensional approach allows controlling for interindividual differences; future research should include a detailed psychometric assessment in both patients and healthy subjects.

Correspondence: *Joe J. Simon, Dipl. Psych., University of Heidelberg, Voßstrasse 4, Heidelberg 69115, Germany. E-mail: joesimon11@gmail.com*

A. MONDRAGON-MAYA, R. SOLIS-VIVANCO, P. LEON-ORTIZ, Y. RODRIGUEZ-AGUDELO, G. YAÑEZ-TELLEZ, J. BERNAL-HERNANDEZ, K. CADENHEAD & D. CAMILO. Reduced P3a amplitudes in antipsychotic naïve first-episode psychosis patients and individuals at clinical high-risk for psychosis.

Objective: To analyze and compare the MMN-P3a complex in antipsychotic naïve first-episode psychosis patients (FEP), antipsychotic naïve individuals at clinical high-risk for psychosis (CHR) and healthy controls.

Participants and Methods: Twenty antipsychotic naïve first-episode psychosis patients (FEP), 23 antipsychotic naïve individuals at clinical high-risk for psychosis (CHR) and 24 healthy controls were included in the study. The MMN-P3a amplitudes and latencies were obtained during a passive auditory mismatch frequency deviant ERP paradigm and analyzed in frontal and central scalp regions.

Results: There were no significant differences in MMN amplitude between groups. There was a significant group difference in P3a due to reduced amplitude ($F[2,64]=3.7, p=0.03$) in both CHR and FEP groups (Mean difference (MD)=0.39, $p=0.04$ and MD=0.49, $p=0.02$, respectively) compared to the control group and this effect was most prominent on the right side (Group x laterality effect: MD=0.57, $p<0.01$ and MD=0.58, $p<0.01$, respectively). No significant differences were observed for MMN or P3a latencies between groups.

Conclusions: Although a P3a decrement in chronic schizophrenia and FEP has been previously reported, our results suggest that this novelty detection impairment is present even in pre-psychosis stages in antipsychotic naïve subjects. This study supports the evidence that P3a could represent a neurophysiological vulnerability marker for the development of psychosis.

Correspondence: *Rodolfo Solis-Vivanco, PhD, Departamento de Neuropsicología, Instituto Nacional de Neurología y Neurocirugía Manuel Velasco Suárez, Insurgentes Sur 3877, Col. La Fama, Tlalpan, Mexico City 14269, Mexico. E-mail: rodolfofo@hotmail.com*

K. SUNG, T.D. VANNORSALL, K. LEDOUX, B. GORDON & D.J. SCHRETLEN. Persons with Schizophrenia Show Aberrant Clustering on Category Word Fluency Compared to Healthy Adults with Equivalent Productivity.

Objective: Persons with schizophrenia (SZ) report fewer exemplars on category word fluency than healthy adults (NC). One explanation is that semantic information is degraded in SZ. Another is that their word retrieval/access is compromised. The first explanation would directly lead to reduced productivity. The second explanation would not necessarily lead to reduced productivity, but would predict altered word clustering. To test that reduced productivity is not a necessary condition of semantic impairment, we compared the clustering of category exemplars named by SZ and NC groups after matching the groups for overall productivity.

Participants and Methods: Eighty-three adults with SZ completed two category word fluency tasks (supermarket item and animal naming). The patients were compared to 85 NCs (drawn from a larger database) whose average animal naming output ($M=15.9$ words) matched the SZ group ($M=15.7$). Another 88 NCs were selected because their supermarket item naming ($M=21.2$) matched that of the same SZ patients ($M=20.1$). The SZ and NC groups did not differ in age or estimated premorbid IQ. The verbal outputs were analyzed via a clustering procedure called singular value decomposition.

Results: Patients with SZ showed clear clustering of four top-ranked animals (cat and dog as domestic animals; lion and tiger as wild/African animals) whereas NCs did not. We interpreted this pattern as reflecting stronger automatic activations of these concepts by NCs than by persons with SZ in a previous study (Sung et al., 2012). Patients also showed disturbed clusters of other low rank animals and most of supermarket items, markedly different from those of healthy adults.

Conclusions: Differences in clustering of category exemplars between productivity-matched NC and SZ adults support the retrieval/access deficit explanation of semantic system dysfunction in SZ. Reduced productivity clearly is not required to find abnormal patterns of word retrieval in persons with SZ.

Correspondence: *Kyongje Sung, Ph.D, Neurology, Johns Hopkins University School of Medicine, 1629 Thames St., Suite 350, Baltimore, MD 21231. E-mail: ksung3@jhmi.edu*

R.A. YEO, D. MARTINEZ, J. POMMY, S. EHRlich, S. SCHULZ, B. HO, J. BUSTILLO, T. WASSINK & V. CALHOUN. The Impact of Parent Socioeconomic Status on Executive Functioning and Cortical Morphology in Individuals with Schizophrenia and Healthy Controls.

Objective: Relatively lower executive functioning is characteristic of individuals with schizophrenia and it is widely considered a promising endophenotype. As low socioeconomic status (SES) early in life, i.e. parent SES, has been linked with lower executive skills in healthy children, we hypothesized that parent SES would be more strongly related to executive functioning in individuals with schizophrenia than in controls and have a greater impact on prefrontal cortical morphology.

Participants and Methods: Healthy controls ($N = 125$) and individuals with schizophrenia ($N = 102$) were recruited as part of a multi-center study. Participants completed tests assessing executive functioning (three fluency tests, Trails B, Tower of London, Serial Pattern Matching/CPT), and intelligence (four WAIS 3 subtests). The groups were matched on parent SES, which was evaluated with the Hollingshead-Redlich scale. A principal component analysis was conducted on 10 variables from the 6 executive tests yielding three specific components (fluency, planning, and response inhibition). Voxel-based morphometry (VBM) was used to evaluate effects of parent SES on gray matter concentration.

Results: Lower parent SES was associated with lower scores across the three executive functioning components, and a significant group by parent SES interaction was observed, such that low parent SES especially affected individuals with schizophrenia. These effects remained significant for planning and response inhibition when intellectual ability and self SES were added as covariates. VBM revealed that lower parent SES was associated with reduced gray matter volume in several anterior brain regions, especially the superior frontal gyrus, in patients, but not in controls.

Conclusions: These findings suggest that individuals with schizophrenia may be especially vulnerable to the adverse impact of low SES early in life, in terms of both lower executive skills and reduced anterior gray matter volumes.

Correspondence: *Ronald A. Yeo, Ph.D., Psychology, University of New Mexico, Logan Hall, Albuquerque, NM 87131. E-mail: ryeo@unm.edu*

A. ZANJANI, E. JEFFAY, P. KLAS, S. HANNA, M. VANDERMEER & K.K. ZAKZANIS. Component Analysis of Memory Function in Schizophrenia: A Quantitative Review.

Objective: Evidence from cumulative studies on the neuropsychology of Schizophrenia (SCZ) demonstrate that patients are most likely to exhibit impairment in terms of memory disorder. In view of the accumulation of empirical evidence, we undertook a quantitative review of the literature to further elucidate what specific components of memory functioning are compromised in the illness.

Participants and Methods: A meta-analysis of 42 published studies incorporating 3156 patients with SCZ and 2694 healthy controls was undertaken. Measures of memory function were selected and parceled into two categories: verbal and nonverbal memory tests. Verbal memory measures included the (i) Rey Auditory Verbal Learning Test; (ii) California Verbal Learning Test; And (iii) Hopkins Verbal Learning Test. Visual memory measures included the (i) Wechsler Memory Scale- Visual Reproduction I & II; (ii) Rey Osterrieth Complex Figure Test; and (iii) Benton Visual Retention Test.

Results: Medium to large effect sizes were found demonstrating that patients with the illness present with significant memory impairment in both visual and verbal domains. Specifically, we found the largest effect sizes to correspond to the learning trials for both CVLT and RAVLT measures which suggests that deficient encoding may be most compromised in the illness in terms of component memory functioning. Also, patients with SCZ demonstrated better memory performance when retrieval cues were provided in both long and short term recall conditions. Recognition memory was less impaired when effect sizes were compared to recall performance in the verbal memory domain. For the visual memory domain patients with SCZ demonstrate better memory performance in immediate recall than delayed recall.

Conclusions: Overall, we found memory impairment to be a reliable finding in SCZ. Our quantitative synthesis confirms that this patient population is differentially impaired across component memory processes against a background of general memory dysfunction.

Correspondence: *Eliyas Jeffay, M.A., University Of Toronto, 1265 Military Trail, Scarborough, ON M3A1A5, Canada. E-mail: eliyas.jeffay@utoronto.ca*

Aging

B.J. MAINLAND, S. AMODEO & K.I. SHULMAN. Multiple Clock Drawing Scoring Systems: Do They Matter?

Objective: The Clock Drawing Test (CDT) is a cognitive screening tool that has been well accepted among clinicians and patients for its ease of use and short administration time. Recent international surveys indicate that the CDT is an increasingly popular instrument among practitioners from a variety of clinical settings. While there is ample interest in the CDT as a cognitive screening tool, there remains a range of

CDT administration and scoring systems with no international consensus on which system produces the most valid results while remaining user friendly. The aim of this study is to synthesize the available evidence on CDT scoring systems' effectiveness and to recommend which system is best suited for clinical use.

Participants and Methods: A Medline and PsycINFO literature search was done from 1983 to 2012 including manual cross-referencing of bibliographies. A brief summary of all original scoring systems is provided, as well as a review of comparative studies. Psychometric properties, including correlations with other cognitive tests are included.

Results: Among published studies, the mean sensitivity and specificity of the various CDT scoring systems are impressive and correlations with the Mini-Mental State Examination and other cognitive tests was high, generally greater than $r = 0.5$. Psychometric properties of each scoring system are presented.

Conclusions: In comparing scoring systems, no system emerged as consistently superior in terms of predictive validity. Furthermore, there did not appear to be a significant advantage in employing more complex scoring systems when using the CDT as a screening tool. Interestingly, multiple longitudinal studies suggest the CDT's real value appears to be in measuring change over time. The authors conclude that when scoring the CDT as a screener, simpler is better, and perhaps qualitative assessment of "normal" versus "abnormal" is sufficient.

Correspondence: *Brian J. Mainland, MA, Psychology, Ryerson University, 350 Victoria Street, Department of Psychology, Toronto, ON M5B 2K3, Canada. E-mail: bmainland@arts.ryerson.ca*

Symposium 12: Rehabilitation of Mild to Moderate TBI Symptoms in Service Members and Veterans

Chair: Elizabeth Twamley

Discussant: Keith Cicerone

10:30 a.m.–12:00 p.m.

E.W. TWAMLEY, H. BELANGER, D. COOPER, Y. BOGDANOVA, E. TWAMLEY & K. CICERONE. Rehabilitation of Mild to Moderate TBI Symptoms in Service Members and Veterans.

Symposium Description: Traumatic brain injury (TBI) is the signature wound of the wars in Iraq and Afghanistan, occurring in approximately 20% of service members and veterans. About 7% of Iraq and Afghanistan veterans who use VA healthcare have persistent post-concussive symptoms and/or cognitive impairment, which can limit functional recovery. Four investigators will present data on interventions to assist service members or veterans who have sustained mild to moderate TBIs. Dr. Heather Belanger will discuss results from a psychoeducational approach to reducing postconcussive symptoms in active duty, veteran, and civilian populations. Dr. Belanger's data regarding computer and web-based intervention delivery will add to knowledge regarding dissemination of this well-validated psychoeducational approach. Dr. Douglas Cooper will discuss his ongoing trial of four different approaches to cognitive rehabilitation for mild TBI (SCORE trial) among active duty service members. One of the primary aims of the SCORE trial is to examine the role of integrated behavioral health interventions for symptom management. Dr. Yelena Bogdanova will discuss a multimodal approach to cognitive rehabilitation, and her ongoing clinical trials using cognitive training and neuromodulation to target cognitive and stress-related symptoms among veterans with blast-induced TBI. Dr. Elizabeth Twamley will present data on Cognitive Symptom Management and Rehabilitation Therapy (CogSMART), a 12-session compensatory cognitive training intervention that targets post-con-

cussive symptoms and prospective memory, attention, learning/memory, and executive functioning. CogSMART was tested in a veteran population receiving supported employment to assist in return to competitive work. Dr. Keith Cicerone will serve as a discussant, and will summarize what we know about cognitive rehabilitation interventions for mild TBI, as well as new directions that may be applicable to active duty and veteran populations who have sustained TBIs.

Correspondence: *Elizabeth W. Twamley, PhD, Psychiatry, UCSD, 140 Arbor Drive (0851), San Diego, CA 92103. E-mail: etwamley@ucsd.edu*

H. BELANGER, F. BARWICK, E. KING, T. KRETZMER & R. VANDERPLOEG. Psychoeducational Interventions for Postconcussive Symptoms – Computer and Web-based Administration.

Background: Psychoeducational interventions are arguably the most well validated intervention for postconcussion symptoms. The authors will briefly review this literature, present data from two studies of novel delivery methods (desktop and web-based) for postconcussive symptom reduction in active duty, veteran, and civilian patients with acute and chronic complaints.

Design: Twenty-five active duty, veteran, and civilian participants took part in the pilot study of desktop delivery of educational content. At baseline, each participant completed a self-run psychoeducational computer-based treatment. Participants were reassessed one-month post-intervention via phone to evaluate postconcussive symptom severity. **Results:** Participants reported significantly fewer postconcussive symptoms at follow-up than baseline, ($d = .99$). Intervention satisfaction was reported, with feedback related to ease of use and quality.

Conclusions: Extending previous studies, current findings demonstrated that psychoeducational intervention following MTBI was associated with postconcussive symptom complaint reduction in both acute and chronic patients. These data also confirm the feasibility of using computerized psychoeducation and speak to the importance of providing education to both acute and chronic patients across settings. Further investigation with a control group is currently underway using an internet paradigm; initial data from this trial will be summarized.

Correspondence: *Heather Belanger, 13000 Bruce B Downs Blvd - 116B, Tampa, FL 33612. E-mail: Heather.Belanger@va.gov*

D.B. COOPER, A.O. BOWLES, J. PRIMUS, J.E. KENNEDY & R. VANDERPLOEG. A Randomized Controlled Trial of Cognitive Rehabilitation for Service Members with mild Traumatic Brain Injury (mTBI): Insights from the SCORE Trial.

Objective: Although cognitive rehabilitation (CR) is commonly prescribed for service members (SM) in post-deployment settings, there is little empirical basis for its use in mTBI, and little is known about the potential impact of co-occurring psychological conditions on the efficacy of CR. **Method:** Participants included 83 SMs with a history of mTBI incurred during combat deployment. Subjects were recruited from consecutive referrals to a TBI Clinic at a military medical center. All subjects were between 3 and 24 months post-injury and had self-reported cognitive difficulties based on the Neurobehavioral Symptom Inventory (NSI). Consented subjects were randomly assigned to one of four, 6-week treatment arms of the study: 1. Psychoeducational control; 2. Non-therapist directed (self-administered) computerized cognitive rehabilitation; 3. Therapist-directed individualized cognitive rehabilitation; and 4. Integrated interdisciplinary cognitive rehabilitation combined with cognitive behavioral psychotherapy). Treatment dosage was kept constant (10 hrs/wk) for the three intervention arms. **Results:** Examining the baseline characteristics of the sample, subjects were largely male (93%), and their average age was 31.3 (SD=8.9). Using the Posttraumatic Checklist – Military (PCL-M), participants were split into high combat stress ($n=50$; PCL-M > 44) and low combat stress ($n=33$; PCL-M < 44) groups. ANOVA revealed significantly elevated cognitive complaints ($F=30.81$, $p<.001$), as measured by the NSI, in individuals with mTBI and high combat stress symptoms. **Conclusion:** Cognitive rehabilitation

may be beneficial in reducing cognitive symptom complaints in post-deployment SMs. However, it is important to recognize the impact of co-occurring behavioral health conditions on self-reported cognitive symptoms. Integrated behavioral health interventions may be a necessary, not adjunctive component of CR in SMs with chronic cognitive complaints. Correspondence: *Douglas B. Cooper, Brooke Army Medical Center, 3851 Roger Brooke Drive, Ft. Sam Houston, TX 78234. E-mail: douglas.b.cooper@us.army.mil*

Y. BOGDANOVA. Multimodal Approach to Cognitive Rehabilitation of Blast-Induced TBI.

Blast-related traumatic brain injury (bTBI) presents a significant concern for Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) military personnel and returning veterans. Rehabilitation of cognitive difficulties associated with bTBI is guided largely by treatment programs that have proven efficacious in other patient populations, with the overarching goal of improving problem-solving and adaptive abilities by training new adaptive skills, which can carry over into everyday life and lead to improved functional capacity. However, cognitive rehabilitation of OEF/OIF veterans poses unique challenges, since the presence of neuropsychiatric comorbidities, such as posttraumatic stress disorder and sleep problems, can complicate treatment implementation and outcome. In this session we discuss a multimodal rehabilitation approach for addressing mild impairments in executive function and memory in veterans with bTBI and co-occurring neuropsychiatric conditions. The ongoing controlled randomized clinical trials evaluating the efficacy of cognitive rehabilitation in OEF/OIF veterans with bTBI will be presented. Cognitive training, psychoeducational intervention, and a non-invasive neuromodulation technique, transcranial magnetic stimulation (TMS), are utilized in these trials to optimize rehabilitation outcome and promote recovery in veterans with bTBI and associated neuropsychiatric comorbidities.

Correspondence: *Yelena Bogdanova, Psychology Research (151-A), 150 South Huntington Avenue, Boston, MA 02130. E-mail: bogdanov@bu.edu*

E.W. TWAMLEY, R.E. WILLIAMS, A.J. JAK, D.C. DELIS & J.B. LOHR. Compensatory Cognitive Training for Veterans with Mild to Moderate TBI.

Objective: Mild to moderate traumatic brain injury (TBI), the signature wound of the Iraq and Afghanistan wars, is associated with cognitive impairment and functional disability (e.g., unemployment). CogSMART (Cognitive Symptom Management and Rehabilitation Therapy) is a 12-week, compensatory cognitive training intervention emphasizing management of post-concussive symptoms (e.g., sleep disturbance, fatigue, headaches, and tension) and strategies for prospective memory, attention, learning/memory, and executive functioning. We tested CogSMART in the context of supported employment.

Method: 50 unemployed, work-seeking veterans with mild-to-moderate TBI and a diagnosis of Cognitive Disorder, NOS were randomized to receive supported employment plus CogSMART or enhanced supported employment. Assessments of post-concussive symptoms and neuropsychological performance were administered at baseline and post-treatment; work outcomes were measured for one year following study entry, as veterans continued to receive supported employment. The participants' average age was 32, average years of education was 13, 96% were men, and 76% were members of a racial or ethnic minority group. **Results:** ANCOVAs controlling for baseline performance demonstrated significant CogSMART-associated reductions in postconcussive symptoms as measured by the Neurobehavioral Symptom Inventory ($p=.016$), as well as improvements in processing speed as measured by D-KEFS Trails 1 and 3 ($p<.05$). Nonsignificant small to medium effects were found for tests of attention, prospective memory, executive functioning, and functional capacity. Veterans who received CogSMART were also more likely to obtain competitive employment in the course of supported employment (60% vs. 48%).

Conclusion: CogSMART has the potential to improve post-concussive symptoms and cognitive performance following mild-to-moderate TBI and may result in better employment outcomes.

Correspondence: *Elizabeth W. Twamley, UCSD, 140 Arbor Drive, San Diego, CA 92103. E-mail: etwamley@ucsd.edu*

**Symposium 13:
Cognitive Intervention in Aging Populations with
Mild to Severe Memory Disorders: How Basic
Science Influences Practical Application.**

Chair: Kelly Murphy

10:30 a.m.–12:00 p.m.

K. MURPHY, N. ANDERSON, A. TROYER, K. MURPHY & R. GILLIAN. Cognitive Intervention in Aging Populations with Mild to Severe Memory Disorders: How Basic Science Influences Practical Application.

Symposium Description: There are a number of evidence-based memory training techniques including spaced retrieval, vanishing cues, errorless learning, and semantic association. The effective application of these techniques to optimize memory functioning in those aging normally and in those with memory disorders, however, demands intimate understanding of exactly how memory is affected in these populations. In this symposium experts in cognitive aging and memory intervention will illustrate how the knowledge gained from basic science investigating memory systems in healthy aging, mild cognitive impairment, and amnesia informs effective approaches to cognitive intervention. Lifestyle choices affecting brain health and associated impact on memory functioning will also be addressed from the standpoint of crafting effective intervention. Rounding out this symposium will be a brief discussion of successes and challenges to applying effective memory intervention for older adults with significant cognitive deficits extending beyond memory.

Correspondence: *Kelly Murphy, Ph.D., Psychology, Baycrest & University of Toronto, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: kmurphy@baycrest.org*

N.D. ANDERSON. Episodic Memory Processes in Healthy Older Adults and Older Adults with Amnesic Mild Cognitive Impairment. Memory changes of any magnitude from mild to severe can have significant real-life bearing on those older adults who experience them. These effects can range from embarrassment and inconvenience to safety concerns and the ability to live independently, as well as increased stress among family members and caregivers. Minimizing these effects requires improving memory functioning, and developing effective memory interventions relies on having a comprehensive understanding of how memory is affected in these populations. In this talk, I will review both existing and new evidence that three processes supporting episodic memory show age-related decrements in healthy older adults and are even more significantly impaired among people with amnesic mild cognitive impairment (aMCI). These include (avoidance of) proactive interference (Young $M = .86$, Old $M = .67$, aMCI $M = .52$, $p = .003$), recollection (Young $M = .67$, Old $M = .41$, aMCI $M = .21$, $p < .001$), and working memory (n-back: Young $M = .78$, Old $M = .72$, aMCI $M = .61$, $p < .001$). These findings identify important foci for the implementation of effective episodic memory strategies for older adults with age-normal and mildly impaired memory functioning. I will discuss one intervention strategy, errorless learning, and will show some new data demonstrating that errors committed during trial-and-error learning can either hinder or boost later memory for correct (target) information, at least in healthy older adults, and will argue that an important next step for future research will be to explore if errors can similarly help individuals with aMCI and possibly even those with amnesia.

Correspondence: *Nicole D. Anderson, Rotman Research Institute, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: nanderson@rotman-baycrest.on.ca*

A.K. TROYER. Evidence Supporting Memory Intervention for Healthy Older Adults.

With the aging of the population, there is growing interest in understanding and effectively dealing with age-related memory changes. In this talk, I will review research by ourselves and others addressing age-related subjective and objective memory changes and evidence that these changes can be addressed in memory interventions aimed at healthy older adults with age-normal memory decline. The most common memory complaints among healthy older adults include remembering names of acquaintances, locations of objects, and intentions. These subjectively reported changes reflect associative and prospective memory function, and are consistent with objective findings of age-related change. There is accumulating evidence that older adults can learn and benefit from specific memory strategies such as spaced retrieval and semantic associations, as well as maintain optimal memory function over the lifespan by maximizing brain health through lifestyle factors such as physical exercise, cognitive and social engagement, and stress management. These bodies of evidence provide the rationale for interventions targeting healthy older adults and focusing on the provision of education, strategy training, and lifestyle change. We have obtained evidence that a program with these foci results in gains in knowledge transfer, repertoire of memory strategies, behavioural change, and potentially reduced burden on the health care system. Furthermore, our preliminary findings indicate that the large majority of participants attain the goals they individually identify for their participation in the program, underscoring the potential of memory interventions for impacting the cognitive health of older adults.

Correspondence: *Angela K. Troyer, Baycrest, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: atroyer@baycrest.org*

K.J. MURPHY. Approaches to Cognitive Intervention for Mild Cognitive Impairment.

Mild cognitive impairment (MCI) involving primarily memory deficits represents a high risk of dementia, with 80% of individuals converting to dementia within 7 years of classification (Petersen, et al., *Arch Neurol* 2001; 58). A wealth of research demonstrates that individuals with MCI can acquire new information and apply that learning to improve their performance on cognitive tasks (Cotelli et al., *Front Hum Neurosci* 2012; 6). This is powerful evidence of the potential of cognitive interventions to delay or potentially prevent the onset of clinical dementia in this population. In this talk I will present research from our group and from others demonstrating how memory processes are affected by MCI, specifically single and multiple domain amnesic MCI, and how this knowledge is applied to delivering effective memory intervention for this group. I will also argue that a cognitive training approach alone is not sufficient to address the needs of people with MCI. For example, our recent investigations into how the cognitive decline impacts the lives of affected individuals have revealed important impacts on lifestyle, specifically withdrawal from leisure activities; an unfortunate outcome given research demonstrating greater engagement in leisure activities associates with reduced risk of dementia. Importantly, close family members are also impacted by MCI. Research shows evidence of mild declines in their mental and physical health putting them at risk of developing the more serious health outcomes associated with caregiver burden given the likelihood they will become future caregivers of a relative with dementia. In summary, the impact of MCI on cognition, behavior, and close family, argues for a multicomponent holistic approach to cognitive intervention for MCI. I will conclude the talk with some of our recent research evaluating the success of such a holistic intervention approach in addressing the needs of both people with MCI and their close family member.

Correspondence: *Kelly J. Murphy, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: kmurphy@baycrest.org*

G. ROWE & E. SVOBODA. Memory Intervention Techniques for Individuals with Moderate to Severe Amnesia.

Amnesia (marked memory impairment) can accompany many major health disorders affecting older adults, including stroke, aneurysm ruptures, myocardial infarction, and cerebral tumours, negatively impacting an individual's ability to function independently. However, not all types of memory are affected equally in amnesia; there is a cluster of preserved memory systems that help retain existing habits and skills, and enable an individual with amnesia to learn new information and increase their level of independence and overall quality of life. One such area is procedural memory, which is known to be resistant to changes due to aging, neurodegenerative disease, and acquired brain injury. I will discuss our approach in utilizing this knowledge to drive effective interventions for older adults experiencing moderate to severe amnesia. By tapping into their procedural memory systems, we employ techniques such as errorless learning and vanishing cues, to teach patients to effectively use external memory aids, most recently, electronic devices such as smartphones. I will present recent evidence from our group showing the different methods by which people with amnesia can be trained to learn and use information. For example, in a recent study, all amnesic patients learned to use an electronic device to support their prospective memory (memory for future intentions). Following intervention, all patients showed reduced memory errors and increased independence and confidence in their memory functioning. Further benefits from the intervention included regaining social roles and responsibilities. I will conclude the talk by presenting some new and exciting findings to show that tapping into preserved memory systems, even without conscious awareness, benefits people with amnesia even more than those experiencing memory changes characteristic of normal aging and mild cognitive impairment.

Correspondence: *Gillian Rowe, 3560 Bathurst Street, Toronto, ON M6A 2E1, Canada. E-mail: grove@baycrest.org*

Symposium 14: Impaired Socio-emotional Functioning Following Severe TBI: An examination of behavioural, cognitive and neural mechanisms.

Chair: Skye McDonald

10:30 a.m.–12:00 p.m.

S. MCDONALD, J. PONSFORD, J. RUSHBY, C. HONAN & J. COOPER. Impaired socio-emotional functioning following severe TBI: An examination of behavioural, cognitive and neural mechanisms.

Symposium Description: Severe traumatic brain injury is associated with poor interpersonal and emotional behaviour that leads to deterioration of relationships and poor social functioning. Socio-emotional functioning is complex. Impairments may be evident at the level of behaviour, emotional processes, social cognition, or mood and self-esteem. Consequently, a diversity of research approaches are required to characterise deficits and identify routes to remediation. We have formed a Centre of Research Excellence in brain recovery "Moving Ahead" to harness a systematic approach to these issues in children and adults.

In this symposium we present several approaches to characterising socio-emotional problems. We also consider possible causes in terms of cognitive and emotional impairments and their neural correlates. Firstly we present research that attests to impaired self-reported sexual function in adults with TBI and some of the psychological mechanisms that appear to underpin it. Secondly we consider deficits in self-reported empathy following TBI. We examine whether people with TBI are impaired in their capacity to "read" emotion signals in their own body and whether low empathy is related to low basic levels of arousal. We also examine the extent to which damage to amygdala and thalamus are related to

changes in both arousal and empathy. Thirdly we examine two important facets of social cognition – theory of mind judgements (in adults) and social moral reasoning (in adolescents). In doing so we consider the extent to which such problems are uniquely dependent upon social and emotional processes and also, functional neural networks that may be involved.

Correspondence: *Skye McDonald, PhD, School of Psychology, University of NSW, UNSW, Sydney, NSW 2052, Australia. E-mail: s.mcdonald@unsw.edu.au*

J. PONSFORD, R. STOLWYK & M. DOWNING. Sexual changes following traumatic brain injury.

Objective: There have been few studies of sexuality following Traumatic Brain Injury (TBI). Most studies to date have suggested there is a decline in sexuality following TBI. Factors associated with this decline have not been investigated. The aim of this study was to examine changes in sexuality following TBI and factors associated with these changes. **Method:** Participants included 865 people with TBI (PTA days $M=27.6$, $SD=30.6$) and 142 age and gender-matched controls. Measures included the Brain Injury Questionnaire of Sexuality (BIQS), Hospital and Anxiety and Depression Scale and Rosenberg Self Esteem Scale. **Results:** TBI participants reported significantly lower scores than controls on all BIQS subscales, namely Sexual Function, Relationships and Self-Esteem and Mood, and the Total Score, with up to 54% reporting a decline in these aspects of sexuality post-injury. Participants with TBI attributed sexual changes to various causes, most commonly fatigue, low confidence, pain, decreased mobility and feeling unattractive. Significant predictors of lower Total Sexuality scores and Sexual Function scores were older age, higher levels of depression and less independence in activities of daily living (ADL). Being on medication, particularly antidepressants, was also associated with poorer Sexual Function. Poorer Relationship Quality and Self Esteem scores on the BIQS were predicted by higher depression, older age and lower self esteem. Lower Mood was associated with shorter PTA duration, higher depression, lower self esteem and younger age at injury. Neither gender nor time post-injury, nor presence of frontal or temporal lobe lesions on CT scan were associated with sexuality scores. **Discussion:** Therapeutic interventions for sexuality need to focus on depression and self-esteem, whilst avoiding medication, and address barriers to social participation and opportunities for sexual contact in individuals who are less independent.

Correspondence: *Jennie Ponsford, School of Psychology and Psychiatry, Monash University, Clayton, VIC 3800, Australia. E-mail: jennie.ponsford@monash.edu*

M. DETHIER, S. MCDONALD, S. BLAIRY & H. ROSENBERG. Emotional empathy: sensitivity to body and facial feedback following severe traumatic brain injury.

Self-reported empathy is often impaired as a result of severe traumatic brain injury. Empirical evidence as to the mechanisms underpinning this is yet to be established. One possible cause is that there is a lack of sensitivity or awareness of emotional changes that occur in one-self, which might otherwise facilitate an empathic understanding. In this study we evaluated whether adults with severe TBI were sensitive to cues from body and facial gestures associated with particular emotional states. Twenty four adults (18 male: age $M=46.5$, $SD=13$) with severe TBI (PTA: $M=84.1$, $SD=56.6$ days) and 28 demographically matched control participants (16 male: age $M=41.5$, $SD=14.3$) were given specific, neutral (i.e. no mention of emotion) instructions to adopt facial expressions and body postures that were consistent with either a neutral (baseline) or emotional state (anger, sadness, happiness). They were required to maintain these positions for 10 seconds. After each expression/posture manipulation, they rated their subjective emotional state, i.e. how cheerful, sad or irritated they felt. The TBI participants were globally less responsive to the effects of body and facial feedback than control participants. They also showed differential impairment in their

responsiveness to negative expressions relative to happy. In contrast, control participants were responsive to all (happy, angry, and sad) expression/posture manipulations. In conclusion, TBI appears to impair the ability to recognise both the physical configuration of a negative emotion and its associated subjective feeling.

Correspondence: *Skye McDonald, School of Psychology, University of New South Wales, Sydney, NSW 2052, Australia. E-mail: s.mcdonald@unsw.edu.au*

J. RUSHBY, S. MCDONALD, N. PARKS, J. IREDALE, R. RANDALL & O. PIGUET. Neurophysiological Correlates of Empathy after Severe Traumatic Brain Injury.

Loss of emotional responsiveness, i.e., reduced facial mimicry and autonomic arousal to facial expressions have been reported to be associated with low self-reported emotional empathy following TBI (de Sousa, McDonald, Rushby et al., 2011). To date, however no comparisons have been made between changes in brain morphology and loss of emotional responsiveness.

The current study aimed to determine whether a relationship is evident between brain regions implicated in emotion processing and changes to arousal regulation and empathic ability. Using an optimized voxel-based morphometry protocol (FreeSurfer (5.1.0) software package; <http://surfer.nmr.mgh.harvard.edu>) we compared grey matter volume in whole brain, bilateral amygdala and thalamus, with resting arousal (measured by mean skin conductance level (SCL) over 2 minutes with eyes-closed) and self-reported cognitive and emotional empathy scores derived from the Interpersonal Reactivity Index (IRI; Davis, 1980, 1983). Thirteen adults (6 males; M age = 38 years) with severe TBI (Mean PTA = 81 days; ≥ 5 years post injury) and 13 matched controls (6 males; mean age 46 years) participated.

Reduced grey matter volume was found in each structure examined in TBI compared with controls, with the largest reductions found in the left and right amygdala ($p < 0.01$). Compared to controls, TBI participants had lower resting arousal-SCL ($p < 0.01$) and cognitive empathy ($p < 0.01$), but higher emotional empathy levels ($p < 0.001$). Reduced amygdala volume was correlated with lower SCL (left, $p < 0.01$; right, $p < 0.001$) and lower cognitive empathy. It was also associated with greater self-reported emotional empathy (left, ns; right, $p < 0.01$). Correlations were also found between thalamus volume and cognitive empathy (left, $p < 0.05$; right, $p < 0.01$). Overall, the present study shows that amygdala reduction after TBI leads to deficits in the regulation of physiological arousal and empathy.

Correspondence: *Jacqueline Rushby, PO Box 6355, UNSW, Sydney, NSW 1466, Australia. E-mail: j.rushby@unsw.edu.au*

C.A. HONAN, S. MCDONALD, A. GOWLAND, A.C. FISHER & R.K. RANDALL. Deficits in comprehension of speech acts after TBI: The role of Theory of Mind and Executive Function.

Background: An important facet of social cognition that is often impaired in people with traumatic brain injury (TBI) is theory of mind (TOM) - the ability to make inferences about another person's beliefs or intentions. Critical to effective communication, TOM is mediated by frontal brain structures that overlap with those that mediate executive function. While some studies have found relationships between ToM and executive function, others have found no such relationship. Many TOM tasks also use complex stories that require significant capacity to understand. Consequently, the issue of whether TOM uniquely contributes to pragmatic understanding or whether it is mediated by reduced cognitive capacity and executive skills remains unclear. This study aimed to disentangle this issue.

Method: Participants included 24 individuals with severe TBI (18 males; age: $M = 47.5 \pm 12.3$ years) recruited from brain injury units in metropolitan Sydney and 24 age, gender and education-matched Controls. Participants completed comprehension tasks consisting of videotaped vignettes with low TOM (answering questions about causal or logical inferences) and high TOM requirements. These were performed across four conditions with varying executive function demands, including: (1) low cognitive load; (2) high flexibility; (3) high working memory; and (4) high inhibition.

Results: Individuals with TBI were more impaired than controls in high TOM tasks in the working memory and inhibition conditions. When controlling for executive function demands, significant group differences remained in the working memory task, but not the inhibition task. This indicates that TOM is dependent on inhibition demands but not working memory. No group differences were found for the flexibility tasks.

Conclusions: Although TOM is an important facet of social cognition the present results suggest that it does not uniquely contribute to communication comprehension ability in individuals with TBI.

Correspondence: *Cynthia A. Honan, School of Psychology, University of New South Wales, NSW 2052, Australia. E-mail: c.honan@unsw.edu.au*

M.H. BEAUCHAMP, J.M. COOPER, J. DOOLEY, S. ROSEMA & V.A. ANDERSON. Neural Substrates of Moral Reasoning after Traumatic Brain Injury.

Aim: Many of the brain regions associated with sociomoral reasoning involve neural circuits of the frontal lobe, which are particularly vulnerable to the effects of traumatic brain injury (TBI). Despite the potential for disruption of these circuits following TBI, little attention has focused on the presence of moral reasoning deficits in this population. In patients with such lesions, moral decision making has been described as 'concrete, erratically rule-based and formulated primarily around their own needs', reflecting a developmentally immature level of functioning. The overall objective of this project was to identify and quantify the behavioural indices of moral reasoning functions post-TBI and to investigate the neural correlates of such behaviour in adolescents.

Method: Adolescents who sustained moderate-to-severe paediatric TBI and were between 1 and 4 years post-injury were asked to make social decisions with and without moral content during functional magnetic resonance (fMRI) imaging. The novel event related fMRI paradigm is a modification of the Socio-Moral Reasoning Aptitude Level (So-Moral) behavioural task and consists of visual social scenes in the first person perspective. The participant responses, reaction times and functional imaging data was compared to a group of typically developing age matched controls.

Results: Patients with TBI have significantly less mature moral reasoning compared to controls ($p < 0.05$). Imaging analyses using SPM8 revealed a network of brain areas of activation when making moral decisions that included a large prominent cluster in the superior medial prefrontal region extending just to the anterior cingulate, and significant clusters in the left orbitofrontal, the left temporoparietal junction, and left amygdala.

Conclusions: There is a network of brain regions involved in moral reasoning in adolescents and damage to the prefrontal cortex appears to influence socio-moral decision making and maturity.

Correspondence: *Janine M. Cooper, Flemington Road, Parkville, Melbourne, VIC 3070, Australia. E-mail: janine.cooper@mcri.edu.au*