
Final Program Addendum

2020 Virtual Event

International Neuropsychological Society

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The following abstracts were not presented at the 2020 Virtual Event. Due to the COVID-19 pandemic they are included below in their entirety.

Withdrawn Abstracts

M. N. AGHVINIAN, A. F. SANTORO, H. M. GOUSE, J. A. JOSKA, C. ROBERTSON, T. LINDA, R. N. ROBBINS. Taking the Test: Experiences of first-time neuropsychological test-takers in South Africa.

Objective: Demand for neuropsychological (NP) testing with culturally/linguistically diverse individuals, including those with limited or no standardized NP testing experience and living in low- and middle-income countries (LMICs), is increasing. Because no research has examined the experience of undergoing NP testing in any population and how it could affect NP test performance, this qualitative study interviewed Xhosa-speaking South Africans about their first experience taking NP tests.

Participants and Methods: A guided, semi-structured interview covering the causes of cognitive problems and five domains of the NP testing experience (patterns of abilities, cultural values, familiarity, language, and education) was used. Twenty-two (15 HIV+, 7 HIV-) South Africans (Age *M (SD)* – 33.50 (5.88); % Male-32%) were interviewed. Interviews underwent text review and thematic analysis.

Results: Eleven interviewees (50%) thought NP testing was to “check” or “look into” the brain; six (27%) thought it was to assess specific abilities (e.g. memory). Ten (45%) reported feeling nervous due to uncertainty about testing or appearing “dumb”. Eleven (50%) and fifteen (68%) described being unbothered by stopping mid-task and not receiving feedback on performance, respectively. Seven (32%) reported performing tasks quickly and accurately to be contradictory. Among causes of cognitive problems, stress (*n*=5, 23%), excessive worry (*n*=4, 18%), old age (*n*=2, 9%), depression (*n*=1, 5%), and witchcraft (*n*=1, 5%) were the most commonly reported.

Conclusions: There may be limited understanding of the purpose of NP testing, as well as anxiety provoking situations during testing in this sample. Furthermore, there may be limited knowledge of what causes cognitive problems. In LMICs, such as South Africa, neuropsychologists should evaluate an examinee’s understanding of NP testing to help foster optimal testing conditions, and may need to provide education on the causes of cognitive problems.

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Keywords: cross-cultural issues, HIV/AIDS, Assessment

E. A. ALSINA, M. K. EVANS, A. B. ZONDERMAN, S. R. WALDSTEIN. Interactive Relations of Left Ventricular Ejection Fraction and Sociodemographic Factors on Cognitive Function in Urban Dwelling African American and White Adults.

Objective: Examine the interactive relations of left ventricular ejection fraction (LVEF), race, and poverty status to cognitive function and whether these associations are influenced by adjustments for cardiovascular disease risk factors.

Participants and Methods: Participants were 1,107 African American (AA) and White, urban dwelling adults from the Healthy Aging in Neighborhoods of Diversity across the Life Span study. Cognitive performance was assessed by: Digits Forward and Backward, Trail Making Test (TMT) A, and TMT-B, Brief Test of Attention (BTA), Benton Visual Retention Test (BVRT), the California Verbal Learning Test, and semantic fluency (animals). Multivariable linear regression examined the interactive relations of LVEF, race, and poverty status to each outcome. Covariates were added hierarchically in three steps: 1) age, sex, and education (base model), 2) body mass index, smoking status, diabetes, and hypertension 3) left ventricular mass.

Results: There was a significant three-way interaction of LVEF, race, and poverty status for three cognitive outcomes at the base model: TMT-A ($\beta = 1.06, p = .009$), BTA ($\beta = -0.17, p = .019$), and BVRT ($\beta = 0.36, p = .014$). In the second model, TMT-A ($\beta = 0.99, p = .021$), BTA ($\beta = -0.15, p = .045$), and BVRT ($\beta = 0.35, p = .025$) three-way interactions remained significant. For the third model only TMT-A ($\beta = 0.97, p = .025$) and BVRT ($\beta = 0.31, p = .042$) three-way interactions were significant. Lower LVEF was associated with poorer performance across all significant measures, but only for low-SES Whites.

Conclusions: This study suggests that low-SES Whites with lower LVEF may be vulnerable to poorer performance on cognitive measures assessing complex and basic attention, visual memory, and processing speed. Future studies should identify relevant mechanistic pathways unique to this subgroup, as well as interventions to preserve or enhance LVEF in those that are most susceptible to associated cognitive decrements.

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Keywords: Neurocognition/Neuropsychological Assessment, Left Ventricular Hypertrophy, Health Disparities

I. BENITO-SÁNCHEZ, A. RODRÍGUEZ-LORENZANA, L. A. ADANA DÍAZ, C. P. PAZ, T. YACELGA PONCE, D. RIVERA, J. C. ARANGO LASPRILLA. Normative data for test of verbal fluency and naming on healthy Ecuadorian adult population.

Objective: To generate normative data for verbal fluency and naming test in an Ecuadorian adult population.

Participant and methods: The sample consisted of 322 healthy adults (18 to 84 years old) recruited from Quito, Ecuador. The verbal fluency and Boston naming test were administered as part of a larger comprehensive neuropsychological battery. Multiple linear regression analyses were used to generate the normative data taking into account age, education, and sex.

Results: For phonological verbal fluency, results indicated that only education was significantly related to the performance of the letters “A”, “S”, and “M”. However, the performance on the letter “F” was significantly associated with age and education. For semantic fluency the performance on “animals” was significantly influenced by age, quadratic age, and education, while for “fruits” were explained by quadratic age, education, and sex. The performance on the BNT was significantly influenced by age and education. A Microsoft Excel-based calculator was created to help clinicians to obtain the normative data on this test.

Conclusion: This normative data will help neuropsychologist in Ecuador to use these tests both in research and in their clinical practice to improve the diagnosis of cognitive deficits in the population.

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Keywords: normative data, assessment, language

I. BENITO-SÁNCHEZ, D. RIVERA, R. ACOSTA, J. C. RESTREPO, A. CALDERON, C. CAMILO TRUJILLO, S. LEONOR OLIVERA, J. FOLLECO, M. C. QUIJANO, C. BELTRAN, J. C. ARANGO LASPRILLA. Is the intellectual ability related to the prevalence of low scores in neuropsychological test? results from a Colombian sample.

Objective: To determine the prevalence of low scores in measures of language, learning and memory and executive functioning by a level of intellectual ability in a group of children from Colombia.

Participant and methods: The sample consisted in 450 children, 54.7% were male, and the average age was 10.79 ± 2.86 (range 6-17) years. Children were classified by the IQ in very superior (IQ>130), superior (IQ=121-130), above average (IQ=111-120), average (IQ=90-110), below average (IQ=80-89), poor (IQ=70-79) and very poor (IQ<70). Z scores were calculated for Rey-Osterrieth Complex Figure Test (ROCF), Learning & Verbal Memory Test (TAMVI-I), Symbol Digit Modalities Test (SDMT), Trail Making Test (TMT), Modified-Wisconsin Card Sorting Test (M-WCST), Peabody Picture Vocabulary Test (PPVT-III), Token Test and Verbal Fluency Test adjusting for age, age², gender, mean level of parental education (MLPE), and all interaction variables if significant. Each z score was converted to a percentile for each of the 20 sub-test scores. Participants were categorized based on his/her number of low scoring tests in specific percentile cutoff groups: 25th, 16th, 10th, 5th, 2nd.

Results: On the 2nd percentile the percent of children that had one or more low scores in learning and memory test, according to IQ classification was: 9% (IQ>130), 11.5% (IQ=121-130), 6.8% (IQ=111-120), 13.3% (IQ=90-110), 19.6% (IQ=80-89), 52.4% (IQ=70-79) and 78.5% of children with IQ<70. A similar tendency was also observed on percentiles 25th, 16th, 10th, 5th and 2nd in language and executive functions.

Conclusions: There was a relationship between prevalence of low scores and intellectual ability such that children with poor or very poor intellectual functioning tend to have more cumulative percent of low scores than children with average, superior and very superior intellectual functioning in all of three cognitive domains.

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Keywords: Intellectual disability, Cognitive functioning

P.-A. BOURGOUIN, S. RAHAYEL, M. GAUBERT, R. B. POSTUMA, J. MONTPLAISIR, J. CARRIER, O. MONCHI, A. PELLETIER, J.-F. GAGNON. Surface contraction of the thalamus and putamen is related to daytime sleepiness in isolated REM sleep behavior disorder.

Objective: Isolated rapid eye movement sleep behavior disorder (iRBD) is recognized as a prodromal stage of Parkinson's disease (PD) and dementia with Lewy bodies (DLB). Twenty percent of iRBD patients report excessive daytime sleepiness (EDS). However, the anatomical substrates of daytime sleepiness in iRBD have been poorly studied. We aimed to investigate the subcortical substrates of daytime sleepiness in iRBD patients.

Participants and Methods: Forty-nine polysomnography-confirmed iRBD patients and 19 healthy controls were recruited. All participants underwent 3-Tesla magnetic resonance imaging, polysomnography recording, cognitive testing, neurological exam, and completed the Epworth Sleepiness Scale (ESS). Vertex-based shape analysis was performed to investigate the local changes in subcortical structures. Between-group analysis and regression analyses between local surface and ESS total scores were performed. Clusters of surface changes were considered significant at $p < 0.05$ with age, sex, education, and MCI status as covariates.

Results: In patients, higher ESS total score was associated with extensive surface contraction of both thalami (right 79% contraction and left 29%) and the left putamen (30%). iRBD patients with EDS (ESS total score > 10) showed surface contraction of the left putamen (1.6%) compared to iRBD patients without EDS. Moreover, iRBD patients with EDS showed an extensive surface contraction compared to controls (right 56.6% and left 4.2% thalamus, right 48.3% and left 2.4% putamen, right hippocampus 5.3%). Furthermore,

compared to controls, iRBD patients without EDS showed surface contraction limited to the pallidum (59.1%).

Conclusions: Daytime sleepiness in iRBD patients is related to morphological differences in both thalami and putamina, regions known to be related to sleep-wake functions and to neurodegeneration in iRBD. The morphological differences found in our study might reflect neurodegeneration in regions that sustain vigilance.

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Keywords: sleep disorders, neuroimaging: structural, movement disorders

F. BURGIO, S. BENAVIDES-VARELA, L. WEIS, M. MITOLO, K. PALMER, R. TOFFANO, G. ARCARA, A. VALLESI, D. MANTINI, F. MENEGHELLO, C. SEMENZA. The role of limbic structures in financial abilities of Mild Cognitive Impairment Patients.

Objective: Mild Cognitive Impairment (MCI) patients experience impairments in financial abilities that affect everyday functioning. Previous studies exploring the neural correlates of decline in financial capacity indicated that areas traditionally associated with executive functions, i.e. the angular gyrus, precuneus, medial and dorsolateral frontal cortex, can predict financial capacity scores in MCI. Critically, these studies analyzed only a few brain regions, which may be restrictive considering the multidimensional nature of financial abilities that presumably draw upon numerous brain networks, cortical hubs, and associated cognitive and emotional processes. This study aims to examine the correlation between cortical and sub-cortical brain volume alterations and reduced performance in the NADL-F battery in MCI patients.

Participants and Methods: Eighty older adults were included in this study, of which 43 patients had MCI and 37 were healthy controls. All participants completed a full neuropsychological evaluation including Numerical Activities of Daily Living – Financial (NADL-F) battery and underwent volumetric MRI.

Results: As compared to healthy controls, MCI patients showed impaired performance in three out of the seven domains assessed by NADL-F: Item purchase, percentage, and financial concepts. The patients' performance in the NADL-F correlates with memory, language, visuo-spatial, and abstract reasoning composite scores. The analysis also revealed that volumetric differences in the limbic structures significantly correlated with financial abilities in MCI. Specifically, the patients' performance in the NADL-F was correlated with atrophy in the left medial and lateral amygdala and the right anterior thalamic radiation.

Conclusions: In conclusion, we present findings suggesting that completing daily financial tasks involves sub-cortical regions in MCI and presumably also the motivational and emotional processes associated to them.

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Keywords: Pathological aging, Financial decisions, VBM

C. CELLARD, M. DEKERLE, L. BON, J. PLASSE, J. DUBREUCQ, C. QUILÈS, C. MASSOUBRE, I. CHEREAU-BOUDET, N. GUILLARD-BOUHET, G. COUHET, S. CERVELLO, R. POMMIER, E. LEGROS-LAFARGE, N. JAAFARI, N. FRANCK. Clinical determinants of well-being in patients with schizophrenia: the role of insight.

Objective: Clinical determinants of subjective well-being in patients with schizophrenia are still unclear. Clinical characteristics such as positive symptoms predict lower well-being, however, few studies have investigated the role of cognition and insight as potential predictors of well-being. The aim of this study was to identify key clinical factors that may predict subjective well-being in patients with schizophrenia.

Participants: Participants were selected from the REHABase project database – a French observational, prospective, and multicenter cohort study of serious mental illness and autism spectrum disorders. The

inclusion criteria were: 1) a diagnosis of a schizophrenia spectrum disorder; 2) aged between 16 and 60; 3) French as first language. The sample included 190 patients.

Methods: Working memory (digit span backward), insight (Birchwood Insight Scale), symptoms severity (Clinical Global Impression Scale) and well-being (Warwick-Edinburgh Mental Well-being Scale) were measured.

Results: The clinical variables were included as predictors to explain well-being in a linear regression model using backward selection method. The results showed that insight was a significant predictor of well-being ($p < .001$), but working memory was not. Lack of insight is predictive of better well-being in patients with schizophrenia.

Conclusions: Insight is a promising clinical factor to consider in the recovery of those with schizophrenia. Future studies should investigate subjective cognitive complaints to better capture the subjective aspects of well-being.

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Keywords: schizophrenia, cognition

M. CHOIŃSKI, E. SZELAĞ, A. BOMBIŃSKA, T. WOLAK, A. SZYMASZEK. Relationship between working memory and temporal information processing in aphasic individuals.

Objective: Aphasia is defined as an acquired impairment of language functions resulting from a brain lesion in language-dominant hemisphere. It was evidenced that aphasia is usually accompanied by deficits of non-linguistic cognitive functions, i.e., executive functions, working memory or attention, as well as temporal information processing (TIP) in millisecond time range.

The aim of the present study was to investigate efficiency of verbal and spatial working memory (WM) in aphasic subjects in the relation to the efficiency TIP and the severity of language impairment.

Participants: Thirty three right-handed subjects (22 male) suffering from post-stroke aphasia after haemorrhage or infarction (lesion age: $M = 50.26$ weeks; $\pm SD = \pm 52.97$ weeks) participated in the study. They aged from 27 to 82 years ($M = 59.58$ years; $\pm SD = \pm 13.68$ years).

Methods: Two tests for assessing verbal and spatial WM were administered: (1) authored receptive verbal test and, (2) the Corsi block tapping task. Both these tests applied forward (addressing maintenance processes, i.e., storing, monitoring, and matching information) and backward (addressing manipulation processes, i.e., reordering and updating information) versions. Index of aphasia severity was calculated based on applied receptive language tests. Moreover, TIP efficiency was measured using the ability of temporal ordering in millisecond range for auditory stimuli.

Results: For verbal WM both versions of the task correlated with aphasia severity and efficiency of TIP. In contrast, for spatial WM task such correlations were significant only for the backward version.

Conclusions: The results indicated that the efficacy of WM in aphasic subjects depends not only on verbal competency which is crucial for aphasia but also for more advanced processes engaged in the memory task (manipulation).

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Keywords: aphasia, working memory, auditory processing

E. DANIS, J. DEGRÉ-PELLETIER, É. B. BARBEAU, F. SAMSON, I. SOULIÈRES. Similarities and differences in cerebral activity during fluid reasoning in autistic versus typical children.

Objective: Differences in brain activity in autistic (AUT) vs. typical (TYP) individuals have been reported to vary with age. Frontal hypoactivity and occipital hyperactivity underly fluid reasoning in AUT vs. TYP adults (Soulières et al., 2009), but whether a similar pattern is observed in children is unknown.

Methods: 24 TYP and 25 AUT children matched on age (6-14), handedness and Raven's Progressive Matrices (RPM) ($M=60.7$, $SD=29.6$), completed 168 pictorial matrix reasoning problems presented in an event-related fMRI design (3T MRI scanner). Problems varied in complexity (0, 1 or 2 relations to consider in each problem) and content (semantic or visuospatial).

Results: Accuracy ($p=.19$) and response times ($p=.26$) did not differ between groups and varied according to complexity and content, with 2 relations visuospatial problems being the hardest ($p<.01$). Whole-brain analyses ($k=20$ voxels) revealed that AUT and TYP children recruited the same temporo-occipito-frontal network during the task (FWE $p=.05$). However, in complex vs. simple problems, right superior frontal gyrus and precuneus were more strongly activated in the AUT than in the TYP group ($p_{unc}=.001$). Activity in the right precuneus was positively correlated with AUT children's RPM scores ($r=.404$, $p<.05$), a more complex fluid reasoning task. No regions showed stronger activations in the TYP vs. the AUT group. No between-group differences were found according to problem content.

Conclusion: A similarly extended brain network underlies AUT and TYP children's reasoning skills, with increased activity in some frontal regions and in the precuneus in AUT children. The increased activity in the precuneus (involved in visuospatial manipulation) in AUT children is related to individual differences in reasoning abilities in that group. Since an opposite pattern of reduced activity in these areas during reasoning was reported in AUT adults, the reasoning network could specialize differently with development in autism.

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Keywords: autism, reasoning, neuroimaging

C. EAST-RICHARD, C. ST-PIERRE, G. DEMERS, M. TURCOTTE, D. NADEAU, C. CELLARD. Broad neuropsychological impairments in adolescents with a history of maltreatment: a cross-sectional study.

Objective: Maltreatment is associated with neuropsychological impairments. However, recent meta-analyses have highlighted a lack of studies in the adolescent population. Moreover, few studies have investigated broad neuropsychological and clinical profiles. This study aimed to determine the neuropsychological profile of adolescents with a history of maltreatment, as well as other clinical variables.

Participants: Forty adolescents with a history of maltreatment were recruited from two child welfare service centers. Inclusion criteria for this group were the following: 1) aged between 12 and 17, 2) have been exposed to maltreatment. These adolescents were compared to 40 healthy adolescents from the general community without a history of maltreatment.

Methods: Psychological and neuropsychological assessments were carried out over three sessions. For the group with a history of maltreatment, data on maltreatment were collected from their records at the welfare service centers.

Results: Differences were found between groups on cognitive outcomes ($p < .001$). The group with a history of maltreatment showed significant impairments on measures of processing speed, verbal and visuospatial working memory, verbal and visual episodic memory, visuospatial abilities and executive functioning (inhibition, cognitive flexibility, planning, verbal fluency). They also showed more internalized ($p = .003$) and externalized symptoms ($p < .001$) and lower self-esteem ($p < .001$) in comparison to the control group.

Conclusions: Adolescents with a history of maltreatment showed several neuropsychological impairments and clinical symptoms. Such impairments may have negative impacts on many areas of their lives and deserve clinical attention. Personalized cognitive remediation therapy may be relevant for these adolescents to enhance their functioning before their transition to adulthood.

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Keywords: maltreatment, neuropsychological profile, cognitive remediation

M. GIL PAGÉS, A. GARCÍA ROSAS, A. ENSEÑAT CANTALLOPS, A. GARCÍA MOLINA.
Cognitive recovery after stroke: Gender matters.

Objective: To establish any potential relationships between demographic factors and the rate of cognitive recovery among a cohort of stroke patients. We aimed to explore how age, gender, education and type of stroke influence cognitive performance throughout two different stages of stroke recovery: post-acute stage (< 6 months after stroke) and chronic stage.

Participants & Methods: This is a retrospective observational study. Medical records of former stroke patients from Neurorehabilitation Hospital Institut Guttmann with a mean time of evolution of 24 months were studied. Patients with aphasia were excluded. Thirty-four adult patients (women= 15) diagnosed with moderate to severe stroke (hemorrhagic=17; ischemic=17) were recruited. All patients underwent neuropsychological assessment at 2 months (admission), 6 months (discharge) and 24 months (recruitment) after stroke. Battery tests included 3 cognitive factors identified by confirmatory factorial analysis: Attention, Memory and Executive Functions. Change in cognitive domains was obtained calculating the difference of grades in cognitive factors between admission and discharge and between discharge and recruitment.

Results: We found significant differences between men and women when comparing their Attention factor ($p=0.03$, $d=0.8$) between admission and discharge. In contrast, this difference was not found between the time points of discharge and recruitment ($p>0.05$). We did not find any other significant differences based on demographics neither in Memory nor in Executive Functions factors.

Conclusions: Our results suggest that gender influences cognitive recovery after stroke. In this cohort, women showed less improvement in attention than men during post-acute stage of evolution. These results should be considered when planning post-acute rehabilitations programs.

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Keywords: stroke recovery, cognitive rehabilitation, treatment outcome

C. HOGAN, P. CORNWELL, J. FLEMING, D. SHUM. Prospective Memory Impairment After Stroke – What Predicts PM Performance?

Objective: Prospective Memory (PM) is the ability to remember to complete intended actions in the future. Little research has been conducted examining PM after stroke. This study aimed to compare the PM performance of individuals with stroke to neurologically healthy controls, to determine if PM is impaired after stroke. Additionally, it aimed to clarify the nature of PM impairment after stroke. This was done by examining whether demographic, cognitive, and metacognitive factors predict PM performance post-stroke.

Participants and Methods: Twenty-eight individuals with stroke and 27 healthy controls completed the Cambridge Prospective Memory Test (CAMPRMPT), Brief Assessment of Prospective Memory (BAPM), Prospective and Retrospective Memory Questionnaire (PRMQ), Trail Making Task (TMT), Hopkins Verbal Learning Test – Revised (HVLTR), and the Montreal Cognitive Assessment Scale (MoCA).

Results: Individuals with stroke performed significantly poorer than controls on both event- and time-based PM on the CAMPRMPT, indicating PM impairment. Two multiple regression analyses were conducted to examine possible predictors of PM after stroke. Event-based PM was significantly predicted by the age, retrospective memory (RM), and global cognitive function, whereas time-based PM was only predicted by note-taking. Self-reported PM (BAPM total and PRMQ PM) did not predict either time- or event-based PM performance.

Conclusions: Findings of the study clarify that PM is impaired after stroke. Possible reasons for impairments include the demographic factor of age, cognitive factors of RM and global cognitive function, and the metacognitive skill of note-taking. It is therefore recommended that clinicians test for possible PM impairments after stroke and educate individuals with stroke on how PM impairment can impact their daily life.

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Keywords: Prospective memory, Stroke

A. JIMENEZ-MARIN, I. BENITO-SÁNCHEZ, D. RIVERA, V. BOADO, I. DIEZ, F. LABAYEN, D. RAMOS-USUGA, J. RASERO, A. CABRERA-ZUBIZARRETA, I. GABILONDO, S. STRAMAGLIA, J. M. CORTES, J. C. ARANGO-LASPRILLA. The association between neuropsychological functioning, brain connectivity and Quality of life 12 months after Multiorgan Failure (MOF).

Objective: To determine the association between brain connectivity, cognitive functioning and Quality of Life (QoL) in a group of Multiorgan Failure (MOF) patients twelve months after Intensive Care Unit (ICU) discharge.

Participant and Methods: 16 MOF patients with an average age of 53.8 years (range 40-64) and 13.9 years of education (range 5-23). Participants underwent to a functional magnetic resonance imaging (rs-fMRI), a comprehensive neuropsychological and quality of life (QoL) evaluation. A standard preprocessing pipeline for the rs-fMRI data was performed, then, the connectivity pattern at voxel level of the default mode network (DMN) was obtained. A general linear model (GLM) was used to determine the association between brain connectivity, cognitive function and QoL.

Results: It was found that the Stroop Color score was the only neuropsychological test that correlated with the connectivity pattern of the DMN ($r = -0.65$; $p = .007$). The association was majorly between the connectivity of DMN and visual networks (fusiform, calcarine, lingual and inferior occipital gyrus) and cerebellar network. Patients with a lower score, present a highest degree of connectivity between DMN and these networks. In QoL, the General Health score of the SF36 test was correlated with the connectivity pattern of the DMN ($r = -0.82$; $p < .001$). The association was majorly between the connectivity of DMN and three different networks: auditory (insula), cerebellum and frontoparietal (inferior frontal gyrus, triangular part). Patients with a lower score, present a highest degree of connectivity between DMN and these networks.

Conclusions: DMN connectivity in MOF patients 12 months after ICU discharge was associated with worse QoL and lower scores on Stroop Color test. Future studies should determine the trajectories of these outcomes over one year.

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Keywords: Multiorgan failure, Neuroimage, Cognitive functioning

L. KAUFMANN, K. MOELLER, S. HUBER, J. MARKSTEINER. Predictors of pain in patients with Alzheimer's disease: Results from the Prospective Dementia Registry (PRODEM) of the Austrian Alzheimer Society.

Objective: There is a lack of studies investigating pain in dementia. The present longitudinal study aims at identifying potential influencing factors of pain experiences in a large cohort of patients diagnosed with Alzheimer's disease (AD).

Participants and Methods: Participants were 579 non-institutionalized patients with possible (n=390, mean age 75.7 years) and probable AD (n=189, mean age 77.5 years). Follow-up examinations were scheduled every six months over a period of 18 months, resulting in four data points (including baseline assessment). We used cumulative link mixed models for analyses. Patients were diagnosed according to NINCDS-ADRDA criteria. Neuropsychological testing included the MMSE (as part of the CERAD), Clinical Dementia Rating (CDR), Neuropsychiatric Inventory (NPI), Activities of Daily Living (ADL) and Geriatric Depression Scale (GDS). Moreover, patients completed a questionnaire tapping pain duration and intensity. Finally, caregivers of patients completed a questionnaire tapping subjective burden (CBS).

Results: Pain intensity was predicted by NPI and CBS. Higher NPI scores (i.e., more neuropsychiatric symptoms) were associated with lower pain intensity, while higher caregiver burden (i.e., higher CBS scores) was associated with higher pain intensity. Pain duration of more than 18 months was associated with higher NPI scores.

Conclusions: Increasing pain intensity (but not duration) was associated with augmented caregivers' burden. However, increasing NPI scores go along with decreasing pain intensity (but increasing pain duration). Possibly, accumulating neuropsychiatric symptoms may mask perceived pain intensity. Overall, pain experiences in patients with AD may be detected already in early disease stages and get stronger with disease progression. Importantly, patients' increasing pain experiences contribute to augmented caregiver burden.

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Keywords: Alzheimer's disease, pain, neuropsychiatric symptoms

J. KRAMER, R. ROELOFS, E. WINGBERMÜHLE, S. PIETERS, J. EGGER. Executive Function Training Braingame Brian in Children with Noonan Syndrome: A pilot study.

Objective: Noonan syndrome (NS) is a genetic disorder, associated with several cognitive difficulties in childhood, e.g. problems in executive function (EF) and social cognition (SC). These have often been related to negative health outcomes and EF training programs have proven to be effective in other neurodevelopmental disorders. Therefore, the aim of this study was to evaluate the feasibility and effectiveness of the computerised EF training Braingame Brian (BGB) on EF and SC in children with NS.

Participants and Methods: Nine children with NS (age 7-17 years) were randomly allocated to the treatment group (TG, n=5) or the control group (CG, n=4). The TG completed BGB, aimed to improve working memory, response inhibition and cognitive flexibility. In both groups, neuropsychological tests and questionnaires regarding EF and SC were administered at baseline and posttreatment. Differences between the TG and CG were investigated using Mann-Whitney U-tests on the difference scores between the pre- and post-measurements.

Results: All children in the TG completed BGB over a period of six to eight weeks. No drop-outs were reported. A significant difference was found between the difference scores of the TG and the CG on cognitive flexibility, indicating greater improvement in the TG compared to the CG. On other outcome measurements, no significant differences were found, while medium to large effect sizes were found on response inhibition and parent-rated EF, indicating a greater improvement on response inhibition in the CG and a greater improvement on parent-rated EF in the TG.

Conclusions: This first pilot study provides support for the feasibility of the EF training BGB in children with NS. Although the effectiveness of the training has yet to be evaluated in a larger sample, the training showed promising preliminary results, especially regarding cognitive flexibility and parent-rated EF.

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Keywords: Noonan syndrome, Executive function, Braingame Brian

M. LAMAR, S. LEURGANS, A. KILPASI, L. L. BARNES, D. A. BENNETT, K. ARFANAKIS, J. A. SCHNEIDER. Combinations of vessel disease and tissue injury in the brain that drive cognitive phenotypes of older persons.

Objective: While cerebrovascular disease (CVD) in aging is a complex mix of vessel diseases including atherosclerosis, arteriolosclerosis, cerebral amyloid angioplasty (CAA) and tissue injuries including macro- and micro-infarcts, little is known about the most common combinations of CVD and whether these combinations differentially associate with cognition.

Participants & Methods: We investigated 32 possible CVD-related combinations involving 3 types of vessel disease and 2-types of tissue injury using autopsy-confirmed data from 1,528 decedents of Rush Alzheimer's Disease Center cohort studies. We determined the relationships between the most common CVD-related neuropathological combinations and global cognition, and cognitive domains associated with CVD including working memory, (visuo-)perceptual organization, and perceptual speed.

Results: 1,153 decedents (~88yrs at death; 65% female) had available data on all CVD-related neuropathology. Eight CVD-related combinations were found in 50 or more decedents (range 52-148), an additional seven in at least 30 decedents (30-46). When the eight most common phenotypes were entered into a single mixed effects regression model adjusting for demographics, time before death, AD-related and all other neuropathologies of non-interest, and interactions of these variables with time, three mixed CVD-related phenotypes, atherosclerosis and arteriolosclerosis with and without macroinfarcts, and arteriolosclerosis and CAA contributed to global cognitive decline, and level and change in perceptual speed; these same CVD-related phenotypes differentially contributed to working memory and (visuo-)perceptual organization. The remaining mixed CVD-related phenotypes had variable associations with cognition.

Conclusions: The most common mixed CVD-related phenotypes related to decline in cognition and specifically perceptual speed; but, there is significant heterogeneity in pathologic and related clinical phenotypes.

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Keywords: aging, cerebrovascular disease, cognitive functioning

L. LIU, D. ROQUET, M. WIENER, A. BULLEY, O. PIGUET, M. IRISH. Prospective and retrospective time perception in frontotemporal dementia.

Objective: Distortions in prospective and retrospective time perception are well-established in Alzheimer's disease, however, relatively little is known regarding these processes in behavioural-variant frontotemporal dementia (bvFTD). This study aimed to compare and contrast prospective and retrospective time perception profiles between bvFTD and healthy controls.

Participants and Methods: Twenty patients with clinically probable bvFTD, 10 age-matched healthy controls and 30 young healthy controls underwent four experimental tasks to assess prospective time perception in terms of time estimation, time production, time reproduction, and duration discrimination. Supra-second stimuli (2-12 seconds) were used across time estimation, production and reproduction tasks, while both sub- and supra-second stimuli (0.3, 0.6, 2, 8 seconds) were implemented in the duration discrimination task. Retrospective time perception was assessed at the end of the test session by asking participants to estimate how long the session had lasted.

Results: Relative to younger and older controls, bvFTD patients demonstrated comparable prospective time perception performance (mean estimated time) for time estimation, production and reproduction, yet made significantly more errors and displayed more variable performance in time estimation and production. Duration discrimination was also significantly impaired in bvFTD relative to controls. For retrospective time estimation, bvFTD patients underestimated the duration of the test session and made more errors than younger controls only.

Conclusions: This study provides a comprehensive investigation of profiles of prospective and retrospective time perception in bvFTD. We suggest that these pervasive impairments reflect degeneration of key regions implicated in time perception, including the prefrontal cortex, anterior cingulate cortex, and subcortical regions including the basal ganglia.

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E. ŁOJEK, J. STAŃCZAK. Improving detection of depression symptoms in brain damaged patients.

Depression is a complex disorder in terms of mechanisms and symptoms. Screening methods may not be sensitive enough to detect specific symptoms of depression in various clinical populations, including brain damaged patients (BDs). The aim of the study was to investigate how well a multidimensional method can detect low mood symptoms in BDs compared to a screening tool.

Data from 356 healthy subjects (Hs), 86 major depression patients (MDs) and 40 BDs were analyzed. The BDI-II and the KPD – a Polish 75-item multidimensional Questionnaire to Measure Depression (Łojek et al. 2015) were applied. KPD estimates the overall level of mood disorder and describes mental functions that are key to the diagnosis of depression on four depression symptom scales. It also assesses self-regulation (SR) resources protecting against depression. Discriminant analysis was used to classify the individuals.

The comparison of Hs and MDs showed high BDI-II sensitivity (86%). Adding the KPD results did not significantly improve classification (88%). The comparison of Hs and BDs showed that BDI-II contributes to the correct classification only in 58%. The step-by-step analysis including BDI-II and KPD scales increased sensitivity to 75%. The KPD scales measuring cognitive deficits, loss of energy, sense of guilt, anxiety, tension, psychosomatic complaints, and low interests were the best discriminators across the groups ($\lambda=.631$ $F [3,121]=23.6$ $p<.001$). Inclusion of KPD scales to the BDI-II results also improved classifications when MDs and BDs were compared. The scales that most effectively explained the differences between these groups ($\lambda=.548$ $F [4,121]=24.9$ $p<.001$) were: BDI-II and KPD scales measuring sense of guilt and anxiety tension, cognitive deficits and energy loss. BDs showed markedly higher level of SR resources than MDs.

Both measures accurately differentiated Hs from MDs. However, for BDs the detection significantly improves when a multidimensional depression measure is included.

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Keywords: Depression, Brain damage, test validity

Y. MEGURO, H. KIKUCHI, J. FUJIMORI, M. MATSUDA. A case of semantic dementia due to the right dominant temporal lobe atrophy.

Objective: Semantic dementia (SD) is more likely to exhibit atrophy of the left hemisphere, it shows while fluent speech, transcortical sensory aphasia with marked impairment in word recall and comprehension of the word meaning. We present a case of SD with the right dominant atrophy.

Participant and Methods: The case was a 66-year-old right-handed male who graduated from high school and a retiree. About few years ago, he was aware of the difficulty in expressing and understanding, especially proper name. He admitted to our hospital for scrutiny. His spontaneous speech was fluent, his grammar was maintained, and his repetition was good. He did not show the behavior of asking “what is?” which is characteristic of Gogi aphasia. T1 Weighted MR Images showed the right dominant bilateral temporal pole atrophy. IMP-SPECT showed a marked decrease in the right dominance in the bilateral temporal lobes, and moderately reduced in the bilateral prefrontal lobes. WAIS-III VIQ 85, PIQ 80, FIQ 81, WM 117, PS 102. As he was SD, we examined 1) comprehension and naming of 200 line-drawings about 10 semantic categories by Test of Lexical Processing in Aphasia (TLPA), 2) naming and recognition about Japanese

famous peoples by famous faces test (VPTA-FFT), and 3) complementary abilities; Proverb Completion task (verbal task), Completion of goods handle and tip by photos (visual task).

Results : 1) In TLPA he showed comprehension 129/200, naming 74/200, impaired in all categories except body parts and color. In naming task, for him, not only was the propositional hints almost invalid. 2) About VPTA-FFT, he showed little knowingness in names, faces, and meanings. 3) Corrections of complementary tasks: verbal task is 8/20, and visual task is 18/40.

Conclusions: He exhibited Gogi aphasia. He had impaired semantic memory that depended not only on language but also on visual information. These results suggest that due to the right dominance, especially of the anterior temporal lobe atrophy.

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Keywords: semantic dementia, the right dominant atrophy, Gogi aphasia

M. PARKKILA, E. NAAMANKA, E. POUTIAINEN, S. HIEKKALA. Neuropsychological telerehabilitation of patients with severe traumatic brain injury – implementation and experiences.

Objective: Over the last few decades there has been a growing interest in telerehabilitation (TR) and the use of communication technology in neuropsychological rehabilitation. TR can provide advantages like reduced burden of travel and better accessibility to rehabilitation services. The aim of the study was to evaluate implementation of a neuropsychological TR for rehabilitees with severe traumatic brain injury (TBI) and to get experiences of neuropsychological rehabilitation without any face-to-face encounter.

Participants: The participants (n=11) were adults between the age of 35 – 56 with severe TBI. All the participants had significant difficulties in daily activities, participation, and a valid decision and plan for neuropsychological rehabilitation. Two rehabilitators executed the TR interventions.

Methods: The intervention included 15 video-based sessions of neuropsychological TR, and furthermore, assigned asynchronous cognitive training using a mobile application. The rehabilitator reported the use of time and the content of a session after each meeting. All the results were summed together to analyze the total mean of time spent in different activities in TR. The experiences from the TR were gathered by using open-ended electronic questionnaire (rehabilitators) and phone interviewing (rehabilitees). A content analysis was used for classification.

Results: Rehabilitators used most of their time in TR to execute the neuropsychological rehabilitation (74%) which included supportive guidance (44%), psychoeducation (32%), tasks (19%) and cognitive training (6%). In this study, 9 % of time in TR was used in solving technical problems. The experiences of the rehabilitators and rehabilitees were mainly positive. Most negative experiences concerned technical problems.

Conclusions: TR can offer an alternative method to deliver neuropsychological rehabilitation for patients with severe TBI. Yet, the patients' personal suitability for TR must always be evaluated.

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Keywords: telerehabilitation, neuropsychological rehabilitation, traumatic brain injury

J. L. PONSFORD, A. HICKS, S. CARRIER, A. MCKAY. Assessment and Management of Patients in Post-Traumatic Amnesia – A World-wide Survey.

Objective: Most individuals who sustain a traumatic brain injury (TBI) experience a period of post-traumatic amnesia (PTA), characterised by disorientation, amnesia, generalised cognitive disturbance, agitation, hallucinations and sleep disturbance. Recent guidelines suggest the importance of assessment and

consistent management during PTA, but current practice worldwide remains unknown. This survey aimed to elucidate current international practice in assessment and management of patients in PTA after TBI.

Participants and Methods: The web-based survey was sent to hospitals and clinicians working with acute TBI patients. There were 400 participants (69% females), from 41 countries, of many disciplines, mostly neuropsychologists, rehabilitation physicians and occupational therapists (OTs), with M age 43, and M 12.8 years' experience with TBI, 94% working with adults.

Results: Of those working with adults (n=376), most described this acute recovery period as post-traumatic amnesia (78%) and used its duration to indicate injury severity (86%). 86% used a tool to assess patients in this phase, mostly the Glasgow Coma Scale (GCS) (46%), Westmead PTA Scale (WPTAS) (37%), Galveston Orientation and Amnesia Test (29%), Rancho Los Amigos Scale (26%) and O-Log (21%). The GCS and WPTAS were mostly administered daily, but other measures less often. Meeting criteria on the assessment tool (53%) or clinical judgement (28%) determined emergence from this phase, indicated by recovery of orientation (83%), day to day memories (56%), ability to follow commands (55%) or to participate in rehabilitation (59%). Most patients had physiotherapy (86%), OT (82%), speech therapy (69%), and environmental changes (79%), with 35% indicating sedating medication was prescribed during this phase.

Conclusions: Findings suggest that, consistent with guidelines, post-traumatic amnesia is a widely recognised and measured TBI recovery phase, used to determine injury severity and readiness for therapy.

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Keywords: traumatic brain injury, post traumatic amnesia, acute recovery

D. RAMOS-USUGA. Normative data of neuropsychological test of attention and executive functions in Ecuadorian adult population.

Objective: To generate normative data for five tests of attention and executive functions (M-WCST, Stroop test, TMT, BTA, and SDMT).

Participants and Method: The study included 322 Ecuadorian adults between the ages of 18 and 84 (M=41.3; SD=18.2), who had educational backgrounds ranging from 2-25 years (M=13.2; SD=4.6). Multiple linear regression analyses taking into account age, education, and gender were used to generate the norms.

Results: M-WCST Categories score was negatively influenced by age and increased linearly as a function of education. M-WCST Perseverative errors score was positively and negatively influenced by quadratic age and education, respectively, and by the interaction of these 2 variables. M-WCST Total errors score was positively influenced by quadratic age and decreased linearly as a function of education. The interaction between age and education also affected the score. Stroop Word, Color, and Word-color scores were negatively influenced by age and increased linearly as a function of education, while Stroop Interference score was negatively influenced by age. TMT-A score was positively influenced by age and decreased linearly as a function of education, and TMT-B score was positively influenced by quadratic age and decreased linearly as a function of education. The SDMT score was negatively influenced by age and increased linearly as a function of education. Finally, BTA score was affected by a quadratic age effect and increased linearly as a function of education. The amount of variance explained by these predictors range from 27% to 37% for M-WCST, 7% to 38% for Stroop test, 28% to 43% for TMT, 57% for SDMT, and 19% for BTA.

Conclusions: This is the first study that presents sociodemographic-adjusted normative data for test of executive functions and attention in Ecuadorian adult population. This data will improve the clinical practice of neuropsychology and help to develop the field in the country.

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Keywords: Attention, Executive functions, Normative data

D. RIVERA, L. OLABARRIETA-LANDA, W. RODRIGUEZ-IRIZARRY, Y. RODRIGUEZ-AGUDELO, M. LONGONI, A. AGUAYO, J. C. ARANGO-LASPRILLA. Delayed and Recognition Recall Indexes of the Hopkins Verbal Learning test: Normative data from a healthy adult population from 11 Latin-American.

Objective: To develop sociodemographic-adjusted norms for Delayed and Recognition Recall Indexes of the Hopkins Verbal Learning Test (HVLTR) in 11 Latin-America countries.

Participants and Methods: The sample consisted of 2862 healthy adults from 11 Latin-American countries. Inclusion criteria were to have a MMSE score of ≥ 23 , have a Patient Health Questionnaire (PHQ-9) score of ≤ 4 , and have a Barthel Index of ≥ 90 . 63% of participants were women, the average age was 51.95 ± 19.70 , and the average years of education were 10.77 ± 5.15 . Participants completed the HVLTR and three scores were calculated: Retention, Recognition, and Recognition Discrimination Index (RDI). Polynomial regression models were run including age, age², education, education², sex, and all two-way interactions between these variables as predictor variables, and each score as single dependent variable in each model.

Results: The final regression models of HVLTR Retention score showed significant effects for age in all countries. Age and age² showed a significant effect on Puerto Rico, and education on Argentina, Honduras, and Paraguay. The final regression models of HVLTR Recognition score showed significant effects for age in all countries, except El Salvador, and Guatemala. Education showed a significant effect on Argentina, El Salvador, Mexico, and Paraguay, and Sex on Guatemala and Puerto Rico, such as women achieved higher scores on Recognition. The final regression models of HVLTR RDI showed significant effects of age in all countries except for Guatemala. Age and Age² showed a significant effect on Chile and Paraguay, and education on Argentina, El Salvador, Honduras, and Peru. Guatemala showed a significant effect of education and education². Sex showed an effect on Chile, such as men obtained higher RDI.

Conclusions: This study complement HVLTR normative data for 11 Latin American countries published in 2015 by including the information of the Retention, Recognition, and RDI indexes.

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Keywords: Normative data, Verbal memory, Latin-America

D. RIVERA, D. MACHANDO, S. NÚÑEZ-FERNÁNDEZ, K. NYAKUSENDWA, P. NJOMBORO, V. DZORO, L. OLABARRIETA-LANDA, J. C. ARANGO-LASPRILLA. Hopkins Verbal Learning Test-Revised, and Rey–Osterrieth Complex Figure Test: Normative Data for an Adult Population from Zimbabwe.

Objective: To develop sociodemographic-adjusted norms for Hopkins Verbal Learning Test-Revised (HVLTR), and Rey–Osterrieth Complex Figure Test (ROCFT) in a group of adults from Zimbabwe.

Participants and Methods: The sample consisted of 358 healthy adults from Zimbabwe. Inclusion criteria were a Mini-Mental State Examination (MMSE) score of ≥ 23 , a Patient Health Questionnaire (PHQ-9) score of ≤ 9 , and a Barthel Index of ≥ 90 . 60% of participants were women, the average age was 36.9 ± 12.1 (18-72), and the average years of education were 12.5 ± 3.0 . Participants completed the HVLTR and ROCFT as part of a comprehensive neuropsychological evaluation. Polynomial up to fifth-order regression models were tested for age and education effects for each test-score. Then, seven regression models were run using the best polynomial order: thus, age, age², age³, education, education², sex, and all two-way interactions between these variables were included as predictor variables, and each score as single dependent variable in each model.

Results: The final regression models of HVLTR showed significant effects for education in all scores except on percentage of retention, and significant effects for age was also found for all scores except on learning index and recognition. Age and age² showed a significant effect on delayed recall (p 's < .005). The final

regression models of ROCFT showed significant effects interaction between age² and education, and age² and sex in copy score. Sex and education showed a significant effect on copy and memory scores (p 's<.005), and age also showed a significant effect on memory scores (p <.001).

Conclusions: This study presents normative data for the HVLTR, and ROCFT in a group of healthy adult's population from Zimbabwe. These tests provide local reference norms for clinicians and researchers to interpret their results when evaluating learning and memory in healthy individuals and clinical populations.

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Keywords: memory: normal, normative data, Zimbabwe

M. STUDER, K. ALLENSPACH-SCHLISSBACH, D. HEINEMANN, K. GUTBROD. Memory performance after one week in healthy adults using a newly developed verbal memory test.

Objective: Patients with accelerated long-term forgetting (ALF) show a normal learning and episodic memory performance after 30-min, but an increased loss of information over time. Although recent studies indicate that neurological patients may have an ALF, neuropsychologists often do not test memory performance after the standardized delay of 30-min, probably due to a lack of appropriate standardized test material. Thus, our aim was to develop a verbal memory test to get retention rates for 30-min as well as 1-week after learning in healthy participants.

Participants: We have included 30 healthy adults (14 male) in the age of 24 to 65 years ($M=36.8$, $SD=10.2$).

Methods: We created a verbal memory test using two separate semantic wordlists "groceries" and "objects" to have different stimuli for free recall after 30-min and 1-week. The word lists were comparable regarding important linguistic parameters, so that the order of the list regarding learning and recall was counterbalanced. Each wordlist contains 12 words and was learned over 5 trials. We collected mean values of verbal learning capacity (recall after learning trial 5), verbal recall after 30-min as well as 1-week. Furthermore, we computed retention rates after 30-min and 1-week (compared to learning capacity) and performed a standardized memory test (HVLTR) to test ecological validity of the created memory test.

Results: Retention rate after 30-min was 89.8% ($SD=10.8$) and after 1-week 54.1% ($SD=18.5$). Recall after 30-min correlated with the delayed recall of the HVLTR ($r=.47$, $p<.01$), however, recall after 1-week did not correlate significantly with the delayed recall of the HVLTR ($r=.27$, $p=.15$).

Conclusions: Results show that recall after 30-min correlated with long-term recall of the HVLTR, however, there was only a small correlation between 1-week recall and long-term recall of the HVLTR, indicating that 1-week recall might be influenced by other memory functions than the standard recall after 30-min.

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Keywords: memory performance

G. M. TALLARITA, A. PARENTE, A. R. GIOVAGNOLI. The theory of mind and sense of reality in adults with frontal lobe epilepsy.

Objective: The frontal lobe is highly important to theory of mind (ToM) and behaviour control. We evaluated ToM, sense of reality and executive functions in adult patients with frontal lobe epilepsy (FLE). The main objective was to clarify the salience of ToM impairment relative to other cognitive deficits.

Participants and Methods: Eighty-four adult patients with FLE were compared with matched healthy controls. The Faux Pas Task (FPT) and other neuropsychological tests assessed ToM, sense of reality, and executive functions.

Results: The patients showed significant impairments in recognizing and understanding existent beliefs, intentions, and affective mental states, while their sense of reality, as expressed by the discrimination of inexistent mental states, was well-retained. Schooling was the major predictor of the FPT scores, whereas the clinical variables or other neuropsychological test scores had no relevant effects. Conversely, the capacity to exclude inexistent mental states related to age at the seizure onset and epilepsy duration.

Conclusions: Impaired ToM, as expressed by the processing of existent mental states, is a main issue of FLE. On the contrary, FLE does not affect the regulatory elements of ToM, such as sense of reality. These results suggest that such a pattern may be a neurobehavioral marker of FLE

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Keywords: frontal lobes, theory of mind, social cognition

S. G. VICENTE, I. BENITO-SÁNCHEZ, F. BARBOSA, N. GASPAR, A. R. DORES, D. RIVERA, J. C. ARANGO LASPRILLA. Normative data for verbal fluency and object naming tests in a sample of European Portuguese adult population.

Objective: The main goal of this study was to produce normative data for adult European Portuguese population on two neuropsychological tests widely used to assess two subdomains of language: verbal fluency and object naming.

Participant and methods: The study included 300 individuals aged between 18 and 92 years ($M = 50.4$, $SD = 21.2$), who had educational backgrounds ranging from 3 to 25 years ($M = 10.4$, $SD = 5.2$) from the north region of Portugal. The Verbal Fluency Test (semantic and phonemic) and the Boston Naming Test (BNT) were administered as part of a larger comprehensive neuropsychological battery. Multiple linear regression analyses were used to generate the normative data taking into account age, education, and sex.

Results: For phonological verbal fluency, results indicated that quadratic age and education was significantly related to the performance of the letters “F”, “A”, “S”. However, the performance on the letter “M” was only associated with education. For semantic fluency the performance on “animals”, “fruits”, and “professions” were explained by quadratic age and education. The performance on the BNT both short and standard were significantly influenced by quadratic age and quadratic education. A Microsoft Excel-based calculator was created to help clinicians to obtain the normative data on this test.

Conclusions: The normative data are presented as regression-based algorithms to adjust direct and derived test scores for age, education, and sex. This study provides a calculator of normative data, derived from the results of the regression models.

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Keywords: assessment, normative data, language

S. G. VICENTE, D. RIVERA, F. BARBOSA, N. GASPAR, A. R. DORES, G. MACIALINO, J. C. ARANGO LASPRILLA. Normative data for test of attention and executive function in a sample of European Portuguese adult population.

Objective: The main goal of this study was to produce normative data for the Portuguese population on five neuropsychological tests frequently used to assess executive functions and attention.

Participant and methods: The study included 300 individuals aged between 18 and 92 years ($M = 50.4$, $SD = 21.2$), who had educational backgrounds ranging from 3 to 25 years ($M = 10.4$, $SD = 5.2$) from the north region of Portugal. The Modified Wisconsin Card Sorting Test (M-WCST), the Stroop Color and Word Test, the Trail Making Test (TMT), the Brief Test of Attention (BTA), and the Symbol Digit Modality Test (SDMT) were administered as part of a larger comprehensive neuropsychological battery. Multiple linear regression analyses were used to generate the normative data taking into account age, education, and sex.

Results: For M-WCST results indicated that quadratic age and quadratic education were significantly related to the performance of M-WCST categories, perseverative errors and total errors. For Stroop Test, Stroop Word was significantly associated with quadratic age and quadratic education. The performance on Stroop Color was significantly related to quadratic age and education. Stroop Word-Color performance was associated with age, education and the interaction between sex and age. However, the performance on interference was only significantly related to age. The performance on TMT and SDMT was significantly influenced by quadratic age and quadratic education. A Microsoft Excel-based calculator was created to help clinicians to obtain the normative data on this test.

Conclusions: The normative data are presented as regression-based algorithms to adjust direct and derived test scores for sex, age, and education. This study provides a calculator of normative data, derived from the results of the regression models.

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Keywords: normative data, attention, executive functions

S. G. VICENTE, D. RAMOS USUGA, F. BARBOSA, N. GASPAR, A. R. DORES, D. RIVERA, J. C. ARANGO LASPRILLA. Regression-based norms for the Hopkins verbal learning test-revised and the Rey-Osterrieth complex figure in a sample of Portuguese adult population.

Objective: To produce sociodemographic-adjusted normative data for European Portuguese native speakers from Portugal on two neuropsychological tests widely used to assess learning and memory: the Hopkins Verbal Learning Test-Revised (HVLTR) and the Rey-Osterrieth Complex Figure Test (ROCF).

Participants and Method: The study included 300 participants aged between 18 and 92 years ($M = 50.4$; $SD = 21.2$), who had educational backgrounds ranging from 3 to 25 years ($M = 10.4$; $SD = 5.2$). Multiple linear regression analyses taking into account age, education, and gender were used to generate the normative data.

Results: HVLTR Total Recall, Delayed Recall, and Recognition scores were negatively influenced by age, quadratic education, and sex, women performing better than men. Moreover, ROCF Copy score was negatively influenced by quadratic age and quadratic education, while, ROCF Immediate Recall score was negatively affected by age and increased linearly as a function of education. These demographic variables accounted for 61% of variance for HVLTR Total Recall, 54% for HVLTR Delayed Recall, 18% for HVLTR Recognition, 55% for ROCF Copy, and 39% for ROCF Immediate Recall.

Conclusions: The normative data are presented as regression-based algorithms to adjust direct and derived test scores for age, education, and sex. This data would improve the accuracy of the assessment process of the Portuguese population.

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Keywords: assessment, normative data

Withdrawn Symposia Abstracts

L. KAUFMANN, G. WOOD. EEG-Neurofeedback in various clinical applications: Efficacy, specificity, and limitations.

Aim of this symposium is to present the emerging field of EEG-neurofeedback (NF) as a rehabilitation tool in various methodological settings and clinical applications. Generally, NF is used as a training method for altering brain and associated functional activity. However, despite its frequent use in clinical settings and

the growing scientific interest in NF, its efficacy and specificity remain hotly debated. Moreover, our current understanding of the neurofunctional underpinnings of thus far reported NF training effects is patchy. In this symposium, we will present 'classical' EEG-based NF as well as sophisticated techniques of NF training using different brain imaging methods and signals (enabling us to measure NF-induced changes of brain activity).

In the *first talk* Silvia Kober will present the findings of a near-infrared spectroscopy (NIRS)-based NF training that ought to ameliorate swallowing deficits in patients suffering from dysphagia. The *second talk* by Cindy Lor will describe adaptive NF training that was coupled to the use of real-time functional magnetic resonance imaging (fMRI) aiming at decreasing craving for nicotine and thus, to support smoking cessation. The *third talk* by Guilherme Wood will be dedicated to individual differences regarding the efficacy of NF studies training the upregulation of sensorimotor rhythm (SMR) which is one of the most popular NF training protocols to enhance attention and memory functions, among others. In the *final talk*, Renate Drechsler will examine whether NF-induced treatment effects are specific in children with attention-deficit hyperactivity-disorder (ADHD).

All speakers will highlight methodological issues that have to be considered when employing NF-based training methods to ameliorate cognitive states and clinical symptoms; to investigate issues of efficacy, specificity and individual differences; and to identify the neurocognitive underpinnings of NF-induced training effects.

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S. E. KOBER. NIRS-based neurofeedback to improve swallowing function.

Introduction: Receiving real-time feedback of activation patterns in motor brain areas during neurofeedback training when imagining hand or food movements proved to enhance motor function. In this context, we addressed the question whether this principle is also valid for imagining swallowing movements.

Methods: Neurologic patients with swallowing difficulties performed repeated neurofeedback training. They received visual feedback of changes in the hemodynamic response in swallowing related brain areas while imagining how it feels to swallow. The hemodynamic response of the brain was measured with near-infrared spectroscopy (NIRS). Before and after the training, brain activation patterns during active swallowing as well as the swallowing function were assessed.

Results: Our first results in neurologic patients with dysphagia show that successful modulation of the NIRS signal during neurofeedback training led to improvements in swallowing function. Patients also showed changes in maladaptive brain activation patterns elicited by active swallowing due to neurofeedback training.

Conclusions: These results indicate the potential value of NIRS-based neurofeedback using motor imagery of swallowing to treat swallowing difficulties in neurologic patients.

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C. LOR, A. HAUGG, M. HABEGGER, A. SPECKERT, S. MEIER, R. SLADKY, P. STAEMPFLI, E. VAN MAREN, A. WATVE, A. MANOLIU, E. SEIFRITZ, M. KIRSCHNER, M. HERDENER, B. B. QUEDNOW, F. SCHARNOWSKI. Adaptive neurofeedback stimulation to support smoking cessation.

Objective: Controlling cigarette craving is key to quit smoking. To help smokers tolerate cigarette craving better and to support smoking cessation, we used a novel adaptive neurofeedback stimulation paradigm for downregulating cue-induced craving activation in the anterior cingulate cortex (ACC).

Participants and Methods: 64 smokers were recruited and randomly assigned to either the experimental group (EG, N=32) or a control group (CG, N=32).

Subjects in the EG were instructed to downregulate their ACC activity, an area responsive to our Open Access database of craving-related images (<https://smocuda.github.io>). During training, they were exposed to images whose craving intensity was dynamically coupled to ongoing brain activity in their ACC. The better the subjects were, the more intense the smoking cues became (i.e., the downregulation task became more difficult as in classical shaping). In the CG, cue intensity was coupled to the activity in the angular gyrus, which is not associated with nicotine craving.

All subjects underwent 10 real-time fMRI neurofeedback training runs spread over two sessions. Before and after training, clinical and behavioral assessments were performed, including a follow-up session six weeks after training.

Results: Subjects in the EG reduced consumption by ~40 cigarettes a week ($p < 0.001$) and Fagerström scores by 1.72 points ($p < 0.001$). This reduction was significantly greater than that of the CG ($p < 0.05$) and was correlated with reduced craving ($r = 0.36$, $p < 0.05$). Ongoing analyses of pre-post-training resting-state, fMRI-craving-task data, neurofeedback training and transfer run data will help uncovering neuro-underpinnings of our large clinical effects.

Conclusion: Our results suggest that fMRI-based neurofeedback used for brain-controlled adaptive nicotine cue exposure can support smoking cessation by reducing craving and might be a promising novel therapeutic tool in addiction.

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G. WOOD, C. NEUPER, S. E. KOBER. Individual differences in training outcomes regarding the sensorimotor rhythm (12-15 Hz) of EEG.

Objectives: The sensorimotor rhythm of EEG (SMR) has been trained with neurofeedback for over half a century. Typically, a large proportion of participants fail to learn to upregulate the SMR rhythm. In previous studies, mindfulness, control beliefs, sex of participant, sex of experimenter, and spirituality have been connected with the outcomes of SMR training.

Participants and Methods: A large number of young healthy participants ($n = 249$) took part in a single session of SMR upregulation training and answered to questionnaires measuring mindfulness, control beliefs towards technology, and spirituality. SMR upregulation was trained for six runs of 3 minutes. Participants received points only when the SMR power was above average and online artifact detection did not detect any artifacts.

Results: About 50 % of participants was unable to upregulate the SMR. A main effect of sex of experimenter on SMR learning was observed, which could not be explained by any of the covariates measured in the present study. A positive correlation between mindfulness and learning outcomes was also observed.

Conclusions: SMR learning outcomes seem to be related to the individual capacity to focus on their present experience (training session). Psychosocial effects on neurofeedback training outcomes can be observed after one single session of neurofeedback training. These results support the view, that more central cognitive control functions influence the efficacy of SMR upregulation training.

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R. DRECHSLER, F. MINDER, A. ZUBERER, D. BRANDEIS. EEG-neurofeedback training for children with ADHD: Are treatment effects specific?

Objectives: EEG neurofeedback training (NF) is a widely used treatment approach for children with ADHD. Nevertheless, its efficacy continues to be a matter of debate. Most meta-analyses on NF for children with ADHD report significant controlled improvements of ADHD symptoms according to parent ratings, some also according to teacher ratings. However, these reviews usually neglect the fundamental questions of specificity and underlying mechanisms. For a “specific effect”, clinical improvement should be related to

training-induced changes of electrophysiological target parameters. While many NF studies for ADHD have used pre-post training EEG measures to analyse specificity, learning of EEG-self regulation or changes of pre-session qEEG across NF training sessions seem more directly related to NF training performance. Methodological criteria on how to measure or interpret electrophysiological change during NF for children with ADHD still need to be developed.

Participants and method: Children and adolescents with ADHD (N=38) participated in slow cortical potential NF in the context of a randomized controlled trial. ADHD-symptoms were rated according to DSM-IV criteria by parents and teacher. EEG was recorded during NF training sessions and as pre-session baseline.

Results: Participants showed EEG learning across NF sessions depending on moderating factors. In older participants, EEG learning was enhanced by stimulant medication. Pre-session baseline, but not EEG learning was related to clinical outcome.

Discussion: The results do not lend strong support for specificity of treatment effects. In the interpretation of NF-induced electrophysiological change, parameter specificity, possible carry-over effects and changes induced by attentional demands of the training need to be considered.

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M. IRISH. Navigating the changing landscape of episodic memory research.

Episodic memory represents one of the most sophisticated and dynamic expressions of human cognition, allowing us to recollect richly detailed experiences from the past and to mentally project ourselves forward in time to envisage the future. The relative ease with which we mentally transport ourselves back and forth across subjective time, however, belies the incredible complexity of this process. This symposium highlights recent advances in episodic memory research from a multidisciplinary perspective to explore the foundational mechanisms that support this multifaceted capacity. The first paper by **Richter** explores the use of continuous memory measures in healthy individuals to provide new insights into the nature of recollection, with implications for how we conceptualise and assess memory in clinical populations. Next, **Lah** will present novel data collected from >100 typically developing children and adolescents exploring how the developmental trajectory of autobiographical memory relates to behavioural and social functioning. Incorporating insights from neurodegenerative populations, **Ramanan** will then examine the contribution of the parietal lobes to contextually rich episodic retrieval by studying how autobiographical memory is disrupted across typical and atypical variants of Alzheimer's disease. Finally, in recognition of the close link between memory for the past and the capacity to envisage the future, **Irish** will present data exploring episodic past and future thinking in the syndrome of semantic dementia, revealing the critical interplay between episodic and semantic processes. To conclude the session, our discussant **Renoult** will distil key findings across these talks to highlight recent theoretical refinements in relation to episodic memory, implications of such advances for the assessment of memory in clinical populations, and the many important future directions for this work.

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F. R RICHTER. Precise and imprecise memories may fool you: continuous memory measures provide insights into different kinds of memory errors.

Objective: Recognition memory can be faulty. Participants sometimes incorrectly judge unseen stimuli as seen before (false alarms, FAs), or seen stimuli as not seen (misses). However, the sources of these memory

errors remain poorly understood. This study combined an old/similar/new recognition memory task with a continuous memory precision task to explore sources of recognition memory errors.

Participants and Methods: Across ten blocks 38 participants studied object images to be subsequently tested on these items, similar lures, and completely novel images. Importantly, participants did not only encode the identity of the objects but also their location on an invisible circle. After encoding they first conducted an old/similar/new recognition memory test, in which they had to indicate whether a presented image was identical to a previously seen one ('old'), whether it was similar but not identical ('similar') or whether they had not seen this type of image before ('new'). In a next step participants were asked to recreate the object's location, providing an independent and sensitive measure of the precision of their memories.

Results: The results demonstrate that while FAs to similar but unseen items are associated with surprisingly high memory precision, incorrect classification of identical items as 'similar' is associated with a marked decline in memory precision. Lastly, incorrect 'new' ratings to both identical and similar items showed most severely decreased memory precision, over and above that seen for other memory misclassifications.

Conclusions: These results provide novel insights into the source of misses (including incorrect 'similar' ratings to identical items), which appear to be due to memory decay processes. FAs, in contrast, and consistent with previous findings, seem to stem from recollection-based interference between stimuli. These findings lay the groundwork for future studies to explore specific memory deficits in different populations.

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M. IRISH, S. RAMANAN, J. R. HODGES. Episodic-semantic interactions across past and future temporal contexts.

Objective: The capacity to mentally envisage personally-relevant future events represents a sophisticated cognitive endeavour, typically held to rely upon episodic memory integrity. Far less is known, however, regarding the contribution of semantic memory to constructive processes. The syndrome of semantic dementia (SD) offers a unique opportunity to explore how progressive deterioration of the semantic knowledge base impacts the capacity for complex expressions of memory.

Participants and Methods: Fourteen individuals with predominantly left-lateralised SD were contrasted with 18 age- and education-matched healthy Controls on a semi-structured interview assessing autobiographical memory retrieval for the Past and constructive simulation of the Future. Temporal distance was manipulated across four conditions: Last year, 10 years ago, Next year, 10 years ahead, to differentially tax episodic and semantic contributions to construction. In addition, an implausible condition was included in which participants were required to simulate a highly unlikely event – spending a day on the moon.

Results: Relative to Controls, SD patients displayed intact recent memory retrieval in the context of marked remote memory deficits. Future simulation was compromised irrespective of temporal context, however, disproportionate impairments were observed for implausible event construction (a day on the moon). Correlation analyses revealed robust associations between measures of episodic memory and semantic association in response to event novelty.

Conclusions: Our findings add to a growing body of evidence emphasising the pivotal role of semantic memory in remembering the past and envisaging the future. Notably, loss of semantic memory disproportionately impacts the construction of novel events, and suggests a foundational role for conceptual knowledge in supporting acts of creative cognition.

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