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PRINCIPAL INVESTIGATOR: Dr. William D. S. Killgore

CONTRACTING ORGANIZATION: University of Arizona
Tucson, AZ 85719-4824

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A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry Following Traumatic Brain Injury

Dr. William D. S. Killgore
E-Mail: killgore@psychiatry.arizona.edu

University of Arizona
888 N. Euclid Ave.
Tucson, AZ 85719-4824

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Mild traumatic brain injury (mTBI) is one of the major health problems facing military servicemembers returning from deployments. White matter axonal damage, as measured by neuroimaging techniques like Diffusion Weighted Imaging (DWI), is one of the hypothesized mechanisms contributing to the cognitive and affective sequelae of mTBI. Presently, many of the findings in the literature examining the association between DWI and neuropsychological outcome are contradictory, possibly due to differences in stage of recovery at the time of assessment. This study will address this problem by collecting measures of white matter integrity and concomitant neuropsychological status at five time points in the first year following an mTBI. During the first year, study preparations, including ethical approval, hiring and training of new staff, purchasing of equipment and materials, and validation of neuroimaging protocols, were completed ahead of schedule. During the past year, we have collected usable data from a total of 13 participants. These data have been cleaned and preliminary analyses suggest that we are able to identify meaningful trends in the data, although the sample is still far too small to make valid conclusions.
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INTRODUCTION:

Between the years of 2000 and 2015, military personnel have sustained over 327,000 traumatic brain injuries (TBIs) (DVBIC Report, 2015). Of these injuries, the vast majority, exceeding 82% of all TBIs, are in the mild category. In addition to the impact on military readiness, mild traumatic brain injury (mTBI) represents a major health concern and economic burden in the United States (Humphreys, Wood, Phillips, & Macey, 2013). While most individuals who sustain an mTBI will recover fully within a matter of days (McCrea et al., 2003), a significant proportion of individuals with mild TBI will experience a prolonged recovery with persistent post-concussive symptoms, and it is yet unclear why some individuals will show a good injury outcome, whereas other will not (Bogdanova & Verfaellie, 2012; Lange et al., 2012; Lange, Brickell, Ivins, Vanderploeg, & French, 2013; Leong, Mazlan, Abd Rahim, & Ganesan, 2013). Structural damage to white matter axonal tracts has been suggested to underlie many of these persistent behavioral changes (Arenth, Russell, Scanlon, Kessler, & Ricker, 2013; Jorge et al., 2012; Morey et al., 2012; Spitz, Maller, O'Sullivan, & Ponsford, 2013; Yeh et al., 2013). Yet due to differences in brain imaging methods, neuropsychological testing approaches, and sample characteristics, this has not been consistently demonstrated at different recovery stages. Furthermore, the relationship between structural connectivity, functional connectivity and neuropsychological performance remains unclear. The present study aims to systematically assess structural connectivity, functional connectivity and neuropsychological functioning at five recovery stages (i.e., two weeks, one month, three months, six months and 12 months) following mild TBI relative to healthy controls. We hypothesize that structural white matter tract disintegrity will underlie abnormalities in functional connectivity, neurocognitive performance and post-concussion symptom severity, but that these metrics will vary with time since injury. The primary aim of the proposed study is therefore to investigate whether measures of white matter disintegrity following mild TBI would explain abnormalities in functional connectivity of the brain, cognition and emotional disturbance, and whether white matter integrity (or lack thereof) could serve as a reliable biomarker of mild TBI. This will allow conclusions on the utility of measures of white matter integrity in the diagnosis of mild TBI. As the study incorporates five time points of measurement to represent different recovery stages of mild TBI, this will allow conclusions on the natural recovery course of mild TBI and the utility of white matter integrity measures in the prediction of injury outcome. In brief, we aim to collect data from 180 participants, including 30 healthy controls and five separate samples of 30 participants at various time points following injury, ranging from 2 weeks to one year post-concussion (see Figure below). During this cross-sectional study, participants will attend a single assessment session comprising a series of neuroimaging scans, including diffusion tensor imaging (DTI), structural volumetric scan, and resting state functional connectivity (rsFC). Additionally,
participants will also undergo a comprehensive neuropsychological assessment battery. We will analyze differences in structural and functional connectivity across these various stages of recovery and associated differences in neurocognitive performance and symptom expression.

2. KEYWORDS:
TBI, traumatic brain injury, mTBI, mild traumatic brain injury, concussion, DWI, Diffusion Weighted Imaging, white matter, brain imaging, neuropsychological performance, neurocognitive performance, structural connectivity, brain injury, head injury

3. ACCOMPLISHMENTS:

Major Task 1: Study Preparation, Staff Hiring, and Materials Acquisition - Ongoing
- There continues to be sufficient study materials and equipment to gather data for the remainder of the project period. Study materials and research equipment remain available and ready for data collection as appointments are scheduled.
- Testing protocols have been developed and all staff members involved in the study continue to receive proper training to ensure protocols are adhered to throughout the duration of the study.
- There has continued to be normal turnover in research technicians and staff and new technicians continue to be trained to replace those who have left. The study coordinator recently left the lab to attend graduate school and a new study coordinator has assumed responsibility for the daily operation of the study.

Major Task 2: Human Subjects Approval – Complete
- The University of Arizona Institutional Review Board and the U.S. Army Human Research Protections Office (HRPO) have approved the current protocol for human subjects research. Amendments are submitted as needed and all annual continuing review reports continue to be submitted to the UA IRB Office and HRPO prior to their annual due dates.

Major Task 3: Advertisement and Subject Recruitment – Ongoing
- Recruitment for the study remains modest but consistent, with minor fluctuations throughout the year depending on school/vacation seasons.
- Recruitment flyers for the study are placed throughout local businesses, university and college campuses, federal buildings, clinics, and social media pages. The University of Arizona campus remains our most popular recruitment site, closely followed by the EPIC medical database at the Banner/University of Arizona Medical Center, and ‘word of mouth’.
- The EPIC database enables us to recruit participants recently admitted to the emergency room at the Banner/University of Arizona Medical Center in Tucson. Through the EPIC database, a letter providing information about our study is sent directly from a physician to the individual recently admitted to the Banner Emergency Department. Fourteen days after the letter has been sent, study staff will reach out to these individuals by phone to see whether they are interested in participating in the study. Since establishing this method of recruitment in the Spring of 2017, it has quickly become one of our top recruitment sources for this study. This database has also made obtaining head injury documentation more streamlined, as all individuals with a diagnosed concussion in the database have medical documentation.
• Paid advertisements over the reporting period include local newspapers and radio ads. Additionally, we have recently implemented a new paid recruitment service for clinical trials called “Studykik.” Studykik is a clinical trial recruitment company that uses social media to strategically target individuals who might qualify for our study. We’ve been using Studykik for the last month of this reporting period and have screened 57 interested individuals through this recruitment outlet, 3 of whom were eligible to participate in the study.

• For patients with reported head injuries, a total of 224 phone screens were conducted during this reporting period, resulting in 40 eligible mTBI participants.

• For healthy control individuals, 25 were phone screened resulting in 7 eligible participants. Healthy controls were recruited through flyer postings at local businesses that have previously been approved by a site authorization.

**Major Task 4: Data Collection - Ongoing**

• Data collection for the mTBI and healthy control groups has continued with good success over this past year. In this reporting year, we have enrolled a total of 24 participants. Of those enrolled, 22 completed the study and 2 were deemed ineligible after further evaluation. One mTBI subject was flagged for substance dependence on the MINI and the other, who was recruited as a healthy control, was flagged and disqualified for a past suicide attempt.

• **MTBI Sample:** Of the 40 participants deemed eligible after phone screenings during this past year:
  o 19 were enrolled (18 completed the study, and 1 was ineligible after enrollment)
  o 9 were lost to follow-up
  o 12 are scheduled for data collection next quarter.

• **Healthy Control Sample:** Of the 7 healthy control individuals that were deemed eligible after phone screenings during this past year:
  o 5 were enrolled (4 completed the study, 1 was ineligible after enrollment)
  o 2 were lost to follow-up.

• In total, 62 people completed the study since data collection started at the University of Arizona on 15 APR 2017. Each of the study groups are being populated fairly evenly. At present these groups include:
  o 20 healthy controls
  o 7 mTBI at 2-weeks post-injury
  o 11 mTBI at 1-month post-injury
  o 7 mTBI at 3-month post-injury
  o 7 mTBI at 6-month post-injury
  o 10 mTBI at 1-year post-injury

• To date, no negative outcomes have been reported by any study participants.

• Behavioral data are regularly entered into the RedCap database by two independent research assistants. This enables the study coordinator to check and correct any potential data entry errors.

• Neuroimaging data are uploaded to laboratory computers and all identifying information is removed (de-identified) the same day of scanning. Diffusion tensor imaging (DTI) data is pre-processing within 4 business days.

**Major Task 5: Quality Control Checks – Ongoing**
During this reporting year, we have increased our efforts in quality control checks after discovering a number of inconsistencies during the data during processing and preliminary data analysis.

Neuroimaging data is visually checked for movement and artifacts during data acquisition and throughout the pre-processing pipeline. This ensures proper scan sequences are selected and allows us to track corrections. Neuroimaging data are checked for correct acquisition parameters during acquisition and during the pre-processing pipeline. Any deviations from standard protocol are noted in writing. Data collected with parameters that deviate from standard are labeled and segregated for further processing.

We have begun noting any details found in head injury documentation before running subjects to confirm date of injury during study visit and avoid injury date discrepancies.

Two independent scorers check all behavioral data for completeness and correctness before entering into the database. After scoring is validated, data is entered twice into RedCap by independent research assistants and then cross-validated for correctness to avoid error.

This past year, we also focused on inter-rater reliability for our test administrators. To improve scoring reliability, additional staff training was provided by a postdoctoral researcher and clinically licensed Speech-Language Pathologist. In an effort to maintain quality data and consistencies across the data set, past files have also been re-checked for scoring and completeness.

Major Task 6: Preliminary Analysis – Ongoing

Over the past year, we have performed the following preliminary analyses. This allows us to ensure data is being collected correctly and to report emerging data to the communities affected by mTBI. The following is a summary of some of the findings from these preliminary analyses:

White Matter Pathways Associated with Post-Concussion Aggression

We have been particularly interested in the association between mTBI and aggression, as this has particular applicability to Service members who must work closely in small teams and also may find themselves expressing aggression in inappropriate circumstances with family or fellow Service members. Aggression is one of the most commonly reported post-concussive symptoms, with upwards to 40% of individuals reporting increased levels of aggression, hostility, and/or irritability after sustaining a mTBI.

Initial Sample: In an initial analysis, we examined the association between white matter axonal changes and aggression in patients at different stages of time since sustaining their injury. Specifically, we compared aggression in healthy controls (n = 16) and chronic mTBI (n = 10) using the Buss-Perry Aggression Questionnaire (BPAQ) and the Personality Assessment Inventory (PAI). Our preliminary analysis revealed elevated levels of total aggression, physical aggression, anger on the BPAQ, and elevated aggressive attitude, verbal aggression and total aggression on the PAI, in the mTBI compared to healthy control group. White matter integrity between the two groups was measured using DTI, revealing significantly reduced integrity in the bilateral anterior thalamic radiation (ATR) and corpus callosum (CC) in the mTBI compared to health control group. Finally, we examined the relationship between white matter integrity and aggression. Preliminary findings showed reduced white matter in the anterior thalamic radiation was associated with higher levels of aggression (see Figure 001). Our results suggest disrupted
frontal pathways could be part of the underlying neural mechanisms associated with impaired emotional processes. Furthermore, our findings highlight the potentially persistent nature of post-concussive symptoms in mTBI.

**Figure 001.** Significant associations were found between radial diffusivity in the body of the corpus callosum and total aggression on the Buss-Perry Aggression Questionnaire (BPAQ) (A) and fractional anisotropy in the left anterior thalamic radiation and physical aggression on the Buss-Perry Aggression Questionnaire (BPAQ) (B). Targeted tract is shown in green, overlaid on standard brain template using FSL.

**Expanded Sample:** We subsequently followed up with additional comparisons in larger samples as more data were acquired over this past year, which allowed us to examine data in the post-acute stage as well. It was hypothesized that individuals with mTBI would report higher levels of aggression, which would be associated with reduced white matter integrity in four, bilateral frontal pathways. For this analysis, 37 individuals participate, including 16 healthy controls, 11 mTBI patients in the post-acute stage (1-month or less since injury), and 10 mTBI patients in the chronic stage (6 months or longer since injury). Demographic data are listed in the table below:

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Note: Values are Mean (Standard Deviation) unless otherwise noted. WASI-II = Wechsler Abbreviated Scale of Intelligence – 2nd Edition; * p < .05
Participants completed the Buss-Perry Aggression Questionnaire (BPAQ) and underwent diffusion tensor imaging (DTI) at 3T. The Buss-Perry Aggression Questionnaire (BPAQ) is a 29-item self-report measure of overall aggression and 4 sub-scales including physical aggression, verbal aggression, anger, and hostility. Diffusion Tensor Imaging (DTI) was collected using single-shot echo planar imaging (EPI) with 78 directions using b-value of 0 and 1000 s/mm$^2$ (thickness = 2mm; voxel size = 2x2x2mm; TR = 9600ms; TE = 88ms; FOV = 100; matrix = 128 x 128 x 74). Binary masks were created for frontal pathways using the JHU ICBM-DTI-81 atlas, and targeted the corpus callosum, cingulum, uncinate fasciculus, and anterior thalamic radiation.

**Buss-Perry Aggression Questionnaire (BPAQ).** An ANCOVA, controlling for age and gender, showed significant group differences for overall aggression ($F(2,32) = 5.52, p < .01, d = 1.19$) and physical aggression ($F(2,32) = 5.83, p < .01, d = 1.22$). As shown in the figures below, the chronic mTBI group scored significantly higher on total aggression than the healthy controls. There was a trend toward greater aggression among chronic relative to post-acute mTBI, but this difference did not reach significance in the current analysis. We further explored the different facets of aggression and found that the differences were driven primarily by Physical Aggression, which was significantly higher among those in the chronic group versus the healthy controls. Other differences were not significant, but the sample sizes are still too small to draw reliable inferences, and we await confirmation as the sample sizes are increased.

![Overall Aggression](image1)

**The chronic mTBI group reported significantly higher overall aggression, compared to HCs ($p < .01$).**

![Facets of Aggression](image2)

**The chronic mTBI group reported significantly higher physical aggression, compared to HCs ($p < .01$).**

**Tract-Based Spatial Statistics (TBSS).** TBSS was used for non-linear registration to standard space and projection to an alignment-invariant 4D mean skeleton (threshold .2) on an individual subject level. Mean DTI metrics were derived from the 4D skeleton for each participant, including Fractional Anisotropy (FA), Mean Diffusivity (MD), Radial Diffusivity (RD), and Axial Diffusivity (AD). Anatomical masks were used to extract mean DTI metrics for all fiber pathways of interest, for each subject. MANCOVAs (controlling for age and gender)
were calculated for each pathway and DTI metric. No significant between-group effects were found for FA, MD, RD, or AD.

Neural Correlates of Aggression. Partial correlations, controlling for age and gender, were calculated between the BPAQ measures of aggression and white matter integrity of targeted pathways. Correlations were restricted to physical aggression and overall aggression, based on behavioral findings. As shown below, in the chronic mTBI group, increased physical aggression was significantly correlated with lower AD in the left anterior thalamic radiation \((p < .05)\). In the chronic mTBI group, increased overall aggression was significantly correlated with lower AD \((p < .05)\) and FA \((p < .05)\) in the right anterior thalamic radiation. Overall, of individuals with a mTBI, only those in the chronic stage of recovery reported elevated levels of aggression, which was associated with reduced white matter integrity in the anterior thalamic radiation. These findings suggest that the associations between tract myelination and emotion behaviors are complex and dynamic across the recovery process.

Gray Matter Morphology Differences Across Time Since Injury

One goal of this project is to identify structural changes in the brain over time following an mTBI, including changes in both white matter axonal tracts, as well as changes on gray matter morphology. Therefore, we also conducted preliminary analyses examining changes in gray matter at different time points since injury, focusing on three inter-related but distinct metrics. We compared differences in brain structure, specifically cortical thickness (CT), cortical volume (CV) and cortical surface area (CSA) in 54 individuals (mean age = 22.40±4.60 years, 33 female) who sustained a recent mTBI and 33 healthy-controls (HCs) (mean age = 24.52±3.03
years, 19 female). The figure shows a representation of these three types of morphological data. Briefly, CT reflects the two-dimensional distance between the inner and outer edge of the cortex, CSA reflects the two-dimensional area reflected at the surface of the cortex, and CV reflects the three-dimensional volume of gray matter at a particular location within the brain.

In this study, eligible individuals with mTBI were grouped into one of three sub-categories based on time-since injury - less than 3 months, between 3 to 6 months and between 6 to 18 months. Eighteen individuals experienced an mTBI (mean age = 24.56±6.09 years, 11 female) within the preceding 3 months (TP1), 22 experienced an mTBI (mean age = 21.77±3.53 years, 14 female) between 3 to 6 months prior to evaluation (TP2) and 14 experienced an mTBI (mean age = 20.61±2.56 years, 8 female) between 6 to 18 months prior to the evaluation (TP3).

By comparing structural measures between individuals with mTBI and HCs, differences in (a) CT and CV reflected brain damage in more acute stages of mTBI, and (b) CV and CSA reflected possible partial recovery in the most chronic stage of mTBI. By comparing structural measures across three mTBI groups, we identified several brain areas showing significant differences in CV and CSA.

We also examined sleep complaints among patients in this sample and found negative correlations between (a) daytime sleepiness and CV as well as CSA for the left superior frontal cortex (LSFC), (b) daytime sleepiness and CV, sleep problems and CV, and daytime sleepiness and CSA for the right caudal middle frontal cortex (RCMFC), and (c) daytime sleepiness and CV for the left precentral cortex (LPreCC). However, after correction for multiple comparisons,
these correlations were either not significant or showed a trend towards significance ($p = 0.07$). These associations are displayed in the scatterplots below:

Our findings also demonstrate the role of each structural measure in identifying brain damage during the early post-acute period and compensatory recovery during the more chronic stages of mTBI.

Gray Matter Volume of the Cerebellum is Associated with Poor Sleep Quality in mTBI

While cortical insults are common in mTBI, few studies have actually examined the role of cerebellar damage from mTBI and its association with sleep problems. To follow up on the above-mentioned sleep issues, we conducted additional analyses on the cerebellum using voxel-based morphometry. In the present study, we correlated whole-brain grey matter with Pittsburgh Sleep Quality Index (PSQI) total scores in individuals within one year of an mTBI. Here, 39 right-handed individuals with a self-reported history of mTBI (14 males; mean age: 24.17 ± 7.11y) were administered the PSQI as part of a larger on-going study. Additionally, we obtained T1 high-resolution structural scans, which were segmented and normalized (CAT12) and smoothed (SPM12) prior to voxel-based morphometric analysis. Whole-brain grey matter volume (GMV) was correlated with total PSQI scores, after controlling for age, sex, total intracranial volume, and time since most recent mTBI. GMV in significant clusters was exported for further analysis. We found that GMV in a cluster including portions of the left cerebellum’s lobules 7 and 8 positively correlated with total PSQI score (FWE corrected, $p = 0.019$), indicating worse sleep. GM volume in this cluster was additionally significantly negatively correlated with faster psychomotor vigilance task mean reaction time ($R^2 = 0.099$) and positively with PVT reaction time coefficient of variation ($R^2 = 0.137$). PSQI total scores did not correlate with any PVT measures and prevented further mediation analysis. Thus, these preliminary
findings suggest that individuals with mTBI who reported lower sleep quality had greater GMV in the left cerebellum. The lack of correlation between total PSQI and PVT performance metrics suggests that increased GMV in the cerebellum may be a compensatory mechanism for maintaining task performance in spite of perceived sleep decrement following mTBI.

Gray Matter Volume Differences Associated with Greater Number of Concussions

While our aforementioned preliminary data, and that of others, suggests that mTBI may, in fact, be associated with changes in gray matter (GM) volume, the direction, timing, and extent of these changes remain unclear. One important factor that may play a role on military concussion outcome is the number of prior concussions. Few studies have investigated the relationship between the number of past mTBIs and GM volume changes. Therefore, we attempted to quantify differences in GM volume with respect to the number of prior head injuries. In this analysis, the T1 high-resolution structural scans of 39 right-handed individuals with a self-reported history of mTBI (14 males; mean age: 24.17 ± 7.11y) were used for volume-based morphometric analysis (CAT12). Images were segmented and normalized following an automated procedure in CAT12 and smoothed prior to analysis. GM volume was correlated with the total number of self-reported past mTBIs, after controlling for age, sex, total intracranial volume, and time since most recent mTBI. Volumetric data from the single surviving cluster were exported for additional analyses. We found that GM volume in a single cluster encompassing areas of the left superior temporal and supramarginal gyri (proximal to Wernicke’s Area) positively correlated with total number of mTBIs (FWE corrected, \( p = 0.035 \)). GM volume in this cluster was additionally significantly positively correlated with Delis-Kaplan executive function system (DKEFS) tasks, including letter fluency (\( R^2 = 0.102 \)) and category switching (\( R^2 = 0.106 \)). Thus, our preliminary findings suggest that in individuals with a history of mTBI, GM volume in the left superior temporal and supramarginal gyrus was greater with increasing numbers of mTBIs. This increase in volume may reflect an adaptive neuroplastic response to increasing numbers of mTBIs that preserves aspects of language-based executive function. Longitudinal studies are needed to identify a causal relationship between mTBI and adaptive neuroplastic processes in the gray matter.

Verbal Fluency Deficits in Post-Concussion Subjects with Associated Sleep Disturbance

Changes in neuropsychological status was evaluated in mTBI to investigate the relationship between post-concussive symptom severity, associated sleep problems, and executive function abilities in a semantic memory task. We conducted a preliminary analysis on 26 mTBI volunteers who underwent a battery of neuropsychological testing including the DKEFS verbal fluency task, a questionnaire about self-perceived sleep difficulties, and a questionnaire about post-concussive symptom severity (RPCSQ). The most prevalent sleep problems included greater sleepiness during the day and greater feelings of drowsiness when concentrating. Overall, we found a significant negative correlation between category fluency and symptom severity (\( r = -.47, p<.01 \)) in patients with mTBI. However, the association only reached significance among those reporting sleep disturbances (\( r = -.38, p = .03 \)), but not in those with no sleep disturbances (\( r = -.26, p = .22 \)). While preliminary, these results raise the possibility that some executive function deficits following concussion may be secondary to sleep-related issues. Furthermore, the relationship between category fluency and symptom severity was only significant when individuals experienced sleep disturbance, providing additional support that
deficits in category fluency may relate more to sleep disturbance than post-concussive symptom severity. This will need to be explored further once the full sample has been collected.

Other Ongoing Analyses

Other preliminary analyses are underway. While not complete, we present these as areas of potential further investigation as we begin to fill in our full sample in the next year or two. These preliminary exploratory analyses include:

1. Voxel-based comparisons of cortical volume between healthy controls and patients with mTBI. Here, structural MRIs were analyzed using voxel-based morphometry methods available through SPM12/CAT12. Whole-brain statistical comparisons between healthy controls and individuals with a history of mTBI were generated using non-parametric threshold-free cluster enhancement (TFCE) and family-wise error corrected at $p < 0.05$. Individuals with a history of mTBI exhibited greater gray matter volume in the right superior temporal gyrus (Brodmann’s area 22) and left middle temporal gyrus than the healthy control participants. To date, there are no observed correlations between gray matter volume in these regions and neuropsychological or behavioral outcomes. Correcting these analyses with false discovery rate methods ($q < 0.05$) suggest wide-spread differences between healthy controls and all participants with previous mTBI. These differences based on FDR will be used in future analyses to guide region-of-interest (ROI) analyses.

2. Structural MRIs for healthy individuals and those with chronic mTBI were analyzed using multiple methods including cortical thickness measurements through Freesurfer (v. 6.0) and diffusion tensor imaging (DTI) fractional anisotropy (FA) in FSL (v. 5.0.7).

Whole-brain analyses indicate that individuals with a history of mTBI have greater cortical thickness ($p < 0.05$) in the left transverse temporal gyrus, left lateral orbito-frontal gyrus, and bilateral middle frontal gyrus. Healthy controls had greater cortical thickness in the left superior parietal gyrus, right lateral occipital gyrus, right supramarginal gyrus, and right inferior parietal gyrus. These differences do not survive after whole-brain family-wise or false discovery rate error correction. Additionally, there were no whole-brain differences in FA that survived family-wise error correction.
Methodological Advances

For the purpose of visualizing the behavioral data that have been collected, an interactive dashboard was developed. This dashboard runs in a web-interface and allows multiple simultaneous user connections. It provides basic statistical calculations on grouped variables (T-tests and one-way ANOVAs) as well as boxplots of grouped variable distributions. This is a work-in-progress, requiring manual coding for addressing other grouping categories. At present,
the dashboard provides group-level comparisons for:

1) Healthy controls vs. All mTBI
2) Healthy controls vs mTBI with loss of consciousness vs mTBI without loss of consciousness
3) Healthy controls vs mTBI at n = 6 time durations from injury
4) Healthy controls vs acute mTBI (<=3 months from injury) vs chronic mTBI (> 3 months from injury)
5) Healthy controls vs mTBI with self-reported sleep disturbance vs mTBI without self-reported sleep disturbance.

This visualization and basic inference dashboard is aimed at facilitating higher-level, hypothesis-driven inquiry into various aspects of the neuropsychological and behavioral data being collected as well as making connections between group-level differences and neural correlates.

Major Task 7: Extensive Data Analysis – Pending
• Analysis pending final data collection.

Major Task 8: Manuscript Preparation and Submission for Publication – Ongoing
• A manuscript detailing our findings on gray matter morphology differences across time since injury has been submitted and revised and resubmitted for possible publication in the journal Human Brain Mapping.
• Manuscript preparation is ongoing for the preliminary findings regarding aggression and chronic mTBI.
What opportunities for training and professional development have the project provided?

While the primary goal of this project is not to provide training and professional development, many such experiences have occurred for our team members. The present project has supported:

1 member of our lab attended lectures and presented research findings at the International Neuropsychological Society Meeting, New Orleans, LA, February 1-4, 2017.

1 member of our lab attended lectures and presented research findings at the Society of Biological Psychiatry Meeting, San Diego, CA, May 18-20, 2017.

1 member of our lab attended lectures and presented research findings at the Associated Professional Sleep Societies Meeting, Boston, MA, June 3-7, 2017.

1 member of our lab attended lectures and presented research findings at the Military Health Systems Research Symposium, Orlando, FL, August 27-30, 2017.

1 member of our lab attended the Computational Psychiatry Course at the University of Zurich (Zurich, Switzerland), August 28-September 2, 2017.

1 member of our lab attended the Neurometrika SPM neuroimaging workshop, Philadelphia, PA, July 17-21, 2017.

Multiple members of our lab have attended regular training in MRI analysis methods and safety as part of an ongoing training series offered at the University of Arizona.

Multiple members of our lab receive regular one-on-one instruction and supervision in the administration and scoring of neuropsychological assessments, psychodiagnostic testing, electrode placement, and patient interviewing.

2 high school students and 2 college undergraduate students obtained training in research methods during a summer training program in our lab this year, which was sponsored by the University of Arizona.

3 undergraduate honors students were supervised for their Senior Honors Thesis in our lab this year.

1 graduate student was supervised for his Master’s Thesis in our lab this year.

Over 10 members of our lab have undergone regular in-house training in the use of various brain-imaging software, including SPM12, Matlab, FSL, Freesurfer, TracVis, MRIcon and others.

Over 10 members of our lab have undergone basic training modules in ethical conduct, statistical analysis, and neuroanatomy.
How were the results disseminated to communities of interest?

The poster presentation at the Military symposium allowed results to be disseminated to the military community about recent findings in changes in emotion in the mTBI population in the chronic phase.

What do you plan to do during the next reporting period to accomplish the goals and objectives?

We plan to continue our existing recruitment efforts that we know are effective as well as increase the use of paid advertisements on the radio, in movie theaters, in the mall, and online in an effort to get ahead of recruitment numbers before the MRI scanner typically used is closed early next year. To avoid being negatively affected by this, we plan on actively seeking solutions to keep collecting data during the time of the MRI move. Finally, we hope to establish closer contacts with military populations in Arizona to expand recruitment to more relevant populations.

4. IMPACT:

What was the impact on the development of the principal discipline(s) of the project?

We expect that the publication of the aggression paper will impact the way people will think about mild TBI. Our findings suggest that adults with mild TBI who are at least 6-months post-injury have persistent elevated aggression symptoms, which opposes the misconception that symptoms resolve quickly after a mild TBI.

What was the impact on other disciplines?

Nothing to report.

What was the impact on technology transfer?

Nothing to report.

What was the impact on society beyond science and technology?

Nothing to report.

5. CHANGES/PROBLEMS:

Changes in approach

- No changes in approach
Actual or anticipated problems or delays

- During this reporting period, we discovered some minor inconsistencies in the data collection parameters among the behavioral and imaging data.
- Upon the discovery that the MRI scanner was collecting some inconsistent acquisition parameters in the DTI data, we immediately followed up with a more in-depth investigation across the entire data set to determine the extent of these deviations in acquisition parameters. We found that the inconsistency in acquisition parameters only affected a small portion of the more recently acquired data. We discussed the potential causes of the unusual parameters and possible remedies for the affected data with our engineers and physicists, as well as other experts in the imaging community. The source of the inconsistency appears to have been due to some inconsistency at the scanner, but we were unable to determine the precise cause of the deviation. However, implemented several pro-active procedures to mitigate any effects on the current data and protect future data moving forward. In an effort to prevent further deviations, a parameter sheet requiring manual checking of the computerized parameters at each scan acquisition was developed and is now part of our standard operating procedure.
- Among the behavioral data, some inconsistencies in subject self-report of their date of injury were observed in comparison to medically documented head injury date. To mitigate this problem, we established a medically documented date of injury into the RedCap database and document this date prior to running the Study Visit to simply confirm the correct date in patient report.

6. PRODUCTS:

- Published/Accepted Abstracts/Conference Presentations this year:


• Manuscripts under review this year:


• Manuscripts in preparation this year:


• Book Chapters Published this year:


7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name: William D. “Scott” Killgore, Ph.D.
Project Role: PI
Nearest person month worked: 2
Contribution to Project: Oversees all aspects of project progress and orchestrates data analysis and publication efforts.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-16-1-0062
Name: Anna Alkozei, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 4
Contribution to Project: Dr. Alkozei performs data analysis and processing for the project.
Funding support:  
USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Ryan Smith, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 4
Contribution to Project: Dr. Smith performs data analysis and processing for the project.
Funding support:  
USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Natalie Dailey, Ph.D., CCC-SLP
Project Role: Postdoctoral Fellow
Nearest person month worked: 2
Contribution to Project: Dr. Dailey performs data analysis and processing for the project.
Funding support:  
USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Sahil Bajaj, Ph.D.
Project Role: Postdoctoral Fellow
Nearest person month worked: 3
Contribution to Project: Dr. Bajaj performs data analysis and processing for the project.
Funding support:  
USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Sara Knight
Project Role: Lab Manager
Nearest person month worked: 3
Contribution to Project: Ms. Knight oversees the administrative needs of the study and study staff, in addition to providing regulatory support and performing periodic quality control checks.
Funding support:  
USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062
Name: Matthew Allbright
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Mr. Allbright oversees the technical aspects of the project and assists in database export, storage, and management.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-16-1-0062
USAMRAA W81XWH-12-1-0386

Name: Sarah (Markowski) Berryhill
Project Role: Research Technician
Nearest person month worked: 2
Contribution to Project: Mrs. Berryhill provides support with data collection and recruitment activities.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-16-1-0062
USAMRAA W81XWH-12-1-0386

Name: Skye Challener
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Ms. Challener provided support with data collection and recruitment activities.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-12-1-0386

Name: Brittany Forbeck
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Forbeck provided support with data collection and recruitment activities.
Funding support: USAMRAA W81XWH-14-1-0570
USAMRAA W81XWH-14-1-0571
USAMRAA W81XWH-12-1-0386

Name: Andrew Fridman
Project Role: Research Technician
Nearest person month worked: 4
Contribution to Project: Mr. Fridman provides support with data collection and recruitment activities.
Funding support: USAMRAA W81XWH-14-1-0570
Name: Melissa Gottschlich  
Project Role: Research Technician  
Nearest person month worked: 3  
Contribution to Project: Ms. Gottschlich oversees project needs and manages day-to-day aspects of project operations.  
Funding support: USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-12-1-0386

Name: Simone Hyman  
Project Role: Research Technician  
Nearest person month worked: 2  
Contribution to Project: Ms. Hyman provided support with data collection and recruitment activities.  
Funding support: USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Jacqueline Marquez  
Project Role: Research Technician  
Nearest person month worked: 3  
Contribution to Project: Ms. Marquez provided support with data collection and recruitment activities.  
Funding support: USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Melissa Millan  
Project Role: Research Technician  
Nearest person month worked: 4  
Contribution to Project: Ms. Millan oversaw project progress and managed the day-to-day needs of the project.  
Funding support: USAMRAA W81XWH-14-1-0570  
USAMRAA W81XWH-14-1-0571  
USAMRAA W81XWH-16-1-0062  
USAMRAA W81XWH-12-1-0386

Name: Anna Sanova  
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Ms. Sanova provided support with data collection and recruitment activities.
Funding support:
- USAMRAA W81XWH-14-1-0570
- USAMRAA W81XWH-14-1-0571
- USAMRAA W81XWH-16-1-0062
- USAMRAA W81XWH-12-1-0386

Name: Anmol Singh
Project Role: Research Technician
Nearest person month worked: 3
Contribution to Project: Mr. Singh provided support with data collection and recruitment activities.
Funding support:
- USAMRAA W81XWH-14-1-0570
- USAMRAA W81XWH-14-1-0571
- USAMRAA W81XWH-16-1-0062
- USAMRAA W81XWH-12-1-0386

Name: Matthew Thurston
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Mr. Thurston provided support with data collection and recruitment activities.
Funding support:
- USAMRAA W81XWH-14-1-0570
- USAMRAA W81XWH-14-1-0571
- USAMRAA W81XWH-16-1-0062
- USAMRAA W81XWH-12-1-0386

Name: Wing Ka Angela Yung
Project Role: Research Technician
Nearest person month worked: 1
Contribution to Project: Ms. Yung provided support with data collection and recruitment activities.
Funding support:
- USAMRAA W81XWH-14-1-0570
- USAMRAA W81XWH-14-1-0571
- USAMRAA W81XWH-16-1-0062
- USAMRAA W81XWH-12-1-0386

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

No change since last reporting period.
What other organizations were involved as partners?

Nothing to Report.

8. SPECIAL REPORTING REQUIREMENTS

Please see updated Quad Chart attached in Appendix.

CONCLUSION

The study continues to progress as planned. Recruitment continues to be slower than we would like, but the study is progressing forward at an adequate pace. Preliminary findings suggest that the data collection methods and procedures are effective and that valid data are continuing to be acquired. We have begun to submit manuscripts for publication based on our preliminary findings. We believe that we will soon have a large enough sample to begin more extensive and valid data analysis.
REFERENCES:


# APPENDICES

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<td>William D. “Scott” Killgore, Ph.D. Curriculum Vitae</td>
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A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry Following Traumatic Brain Injury

Study Tasks and Assessments

Day of Scan Questionnaire
Epworth Sleepiness Scale (ESS)
OSU TBI Interview
Glasgow Outcome Scale – Extended (GOS-E)
MINI International Psychiatric Interview (MINI)
California Verbal Learning Test (CVLT)
Repeateable Battery for the Assessment of Neuropsychological Status (RBANS)
Delis-Kaplan Executive Function System (D-KEFS)
Go/No Go
Brief Visual Memory Test-Revised (BVMT-R)
Buss Perry Aggression Questionnaire (BPAQ)
Psychomotor Vigilance Test (PVT)
Pittsburgh Sleep Quality Index (PSQI)
State Trait Anxiety Inventory (STAI)
Automated Neuropsychological Assessment Metrics (ANAM)
Beck Depression Inventory (BDI-II)
Wechsler Abbreviated Scale of Intelligence (WASI II)
Connor- Davidson Resilience Scale (CD-RISC)
Craig Handicap Assessment and Reporting Technique Short Form (CHART-SF)
Personality Assessment Inventory (PAI)
Alcohol Use Disorder Identification Test (AUDIT)
Rivermead Post Concussion Symptoms Questionnaire (RPCSQ)
Snaith Hamilton Pleasure Scale (SHAPS)
Satisfaction With Life Scale (SWLS)
Edinburgh Handedness Survey (EHS)
Marijuana Use Questionnaire (MUSE)
A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following Traumatic Brain Injury

PT110814
W81XWH-12-1-0386

PI: William D. Killgore, Ph.D.                   Org: University of Arizona

Award Amount: $2,272,098

Study/Product Aim(s)

• Demonstrate the extent to which structural white matter damage explains abnormalities in cognition and emotion at different recovery stages following mild traumatic brain injury (TBI).
• Demonstrate the extent to which structural white matter damage explains abnormalities in functional connectivity at different recovery stages following mild TBI.
• Determine whether white matter disintegrity could serve as an objective marker for mild TBI.

Approach

Cross-sectional study involves comprehensive neuropsychiatric and neuropsychological assessment of 30 healthy controls and 150 individuals with mild TBI, of which 30 each will be assessed at 2 weeks, 1 month, 3 months, 6 months, and 12 month post-TBI. All participants undergo diffusion-weighted imaging, resting-state functional connectivity imaging, and neurocognitive assessment.

The study investigates whether and how white matter damage at 5 different natural recovery stages contributes to functional connectivity, cognition and emotion.

Accomplishments: Study is well underway after transferring from McLean Hospital to University of Arizona. 31 participants were collected at McLean, and 33 have been collected at University of Arizona. Data collection ahead of schedule and 1/3 complete.

Goals/Milestones

CY14 Goal – Close study to enrolment and move lab to U of Arizona
✓ Completed move successfully. Funding transferred successfully

CY15 Goals – Complete preparations & launch study at UA
✓ Preparations, training, and MRI protocols successfully completed
✓ Study re-initiated in Arizona successfully!
✓ Preliminary findings published; several presentations submitted

CY16-18 Goal – Data collection, quality checks
✓ 62 Participants completed since relocation to UA; 93 participants have completed in total. Quarterly recruitment is on schedule.
☐ Collect data from approximately 60 subjects per CY

CY19 Goal – Data analysis and dissemination
☐ Conduct final data analyses and prepare data for publication

Comments/Challenges/Issues/Concerns

• None. The study is progressing on target.

Budget Expenditure to Date
Cumulative Expenditure: $1,444,428

Updated: 15 OCT 2017
DAY OF SCAN INFORMATION QUESTIONNAIRE

SUBJECT #:______     DATE: ____/____/_____

AGE     ___________ years
HEIGHT     ___________ ft/inches
WEIGHT     ___________ lbs
SEX □ MALE    □ FEMALE
For females only:
When was the start of your last menstrual period?
Be as precise as possible.
Date of period:_____________________________
or about _______ days ago.

RIGHT or LEFT-HANDED? □ RIGHT
□ LEFT
□ BOTH/NEITHER

Do you have any problems with reading? □ NO    □ YES

Version 12/04/14
**EDUCATION:** What is the highest grade or level of school you have completed or the highest degree you have obtained? Please choose one:

- [ ] 9th Grade
- [ ] 10th Grade
- [ ] 11th Grade
- [ ] 12th Grade, no diploma
- [ ] High school graduate
- [ ] GED or equivalent
- [ ] Some college, no degree
- [ ] Associate degree: occupational, technical, or vocational program
- [ ] Associate degree: academic program
- [ ] Bachelor's degree (e.g., BA, AB, BS, BBA)
- [ ] Master's degree (e.g., MA, MS, MEng, MEd, MBA)
- [ ] Professional school degree (e.g., MD, DDS, DVM, JD)
- [ ] Doctoral degree (e.g., PhD, EdD)
- [ ] Unknown

**RACE:** With what ethnicity do you identify?

- [ ] White
- [ ] Hispanic/Latino
- [ ] Black/African American
- [ ] Native American/ American Indian
- [ ] Asian/Pacific Islander
- [ ] Other

Are you currently doing shift work (e.g., working early morning, evening, or night shifts)?

- [ ] NO  [ ] YES

Do you engage in regular exercise?

- [ ] NO  [ ] YES

Which sport? __________________________________________________________

How many days per week? _____________________________________________

How many minutes per exercise session (on average)? ____________________

Version 12/04/14
CAFFEINE USE
Did you have any caffeine containing products today?
☐ NO ☐ YES  How much? ________________________________

On average, how many cups (=8oz) of caffeinated coffee do you drink per day? _________________
On average, how many cups (=8oz) of caffeinated tea do you drink per day? _________________
On average, how many cans of caffeinated soda do you drink per day? _________________
On average, how many caffeinated sports drinks do you drink per day? _________________ (brand)

Do you use any other caffeinated products (e.g. Vivarin)?
☐ NO ☐ YES  Brand? ________________________________
☐ NO ☐ YES  How much? ________________________________
☐ NO ☐ YES  How often? ________________________________

NICOTINE AND OTHER SUBSTANCE USE
Do you currently smoke cigarettes?
☐ NO ☐ YES
How many? _________________ daily / weekly / monthly / yearly (circle one)
For how long? _________________ years ________________ months
Have you tried to quit? ☐ NO ☐ YES
How many times? _________________

Have you ever smoked cigarettes in the past?
☐ NO ☐ YES
How many? _________________ daily / weekly / monthly / yearly (circle one)
For how long? _________________ years ________________ months
When did you quit? ________________________________ (approximate date)

Do you currently smoke large cigars?
☐ NO ☐ YES
How many? _________________ daily / weekly / monthly/ yearly (circle one)
For how long? _________________ years ________________ months
Have you tried to quit? ☐ NO ☐ YES
How many times? _________________

Version 12/04/14
Have you ever smoked large cigars in the past?
☐ NO  ☐ YES
How many? ________________ daily / weekly / monthly / yearly (circle one)
For how long? ________________ years ________________ months
When did you quit? ________________________________ (approximate date)

Do you currently smoke small cigars?
☐ NO  ☐ YES
How many? ________________ daily / weekly / monthly / yearly (circle one)
For how long? ________________ years ________________ months
Have you tried to quit? ☐ NO  ☐ YES
How many times? ________________

Have you ever smoked small cigars in the past?
☐ NO  ☐ YES
How many? ________________ daily / weekly / monthly / yearly (circle one)
For how long? ________________ years ________________ months
When did you quit? ________________________________ (approximate date)

Do you currently smoke cigarillos?
☐ NO  ☐ YES
How many? ________________ daily / weekly / monthly / yearly (circle one)
For how long? ________________ years ________________ months
Have you tried to quit? ☐ NO  ☐ YES
How many times? ________________

Have you ever smoked cigarillos in the past?
☐ NO  ☐ YES
How many? ________________ daily / weekly / monthly / yearly (circle one)
For how long? ________________ years ________________ months
When did you quit? ________________________________ (approximate date)

Do you currently use smokeless tobacco, such as dip or chew?

Version 12/04/14
☐ NO  ☐ YES
About how much/many? _________ daily / weekly / monthly / yearly (circle one)
For how long? ______________ years ______________ months
Have you tried to quit?  ☐ NO ☐ YES
How many times? ________________

Have you ever used smokeless tobacco in the past?
☐ NO  ☐ YES
About how much/many? _________ daily / weekly / monthly / yearly (circle one)
For how long? ______________ years ______________ months
When did you quit? ________________________________ (approximate date)

Do you currently use any other nicotine-containing products?
☐ NO  ☐ YES
Which kind? ____________________________________________
For how long? ______________ years ______________ months
How often? ____________________________daily / weekly / monthly / yearly (circle one)
Have you tried to quit?  ☐ NO ☐ YES
How many times? ________________

Have you ever used any other kind of nicotine containing products?
☐ NO  ☐ YES
Which kind? ____________________________________________
For how long? ______________ years ______________ months
How often? ____________________________daily / weekly / monthly / yearly (circle one)
Have you tried to quit?  ☐ NO ☐ YES
How many times? ________________

Are you currently taking diet pills?
☐ NO  ☐ YES
What brand? ____________________________________________
For how long? ___________ years ___________ months ___________ days
How much? ____________________________________________
How often? ____________________________ daily / weekly / monthly / yearly (circle one)

Are you currently taking any medications, vitamins, or supplements?

Version 12/04/14
☐ NO  ☐ YES

Please list:

Name: ___________________  Dosage: ____________________
Name: ___________________  Dosage: ____________________
Name: ___________________  Dosage: ____________________
Name: ___________________  Dosage: ____________________

Have you ever used any street drugs?

☐ NO  ☐ YES

What? _________________________________
How much? _________________________________
How often? ____________________________ daily/ weekly/ monthly/ yearly (circle one)

In the past year, did you use any other street drugs?

☐ NO  ☐ YES

What? _________________________________
How much? _________________________________
How often? ____________________________ daily/ weekly/ monthly/ yearly (circle one)

Do you currently use any other street drugs?

☐ NO  ☐ YES

What? _________________________________
How much? _________________________________
How often? ____________________________ daily/ weekly/ monthly/ yearly (circle one)

Do you drink alcohol?

☐ NO  ☐ YES

How many times per month? _________________________________
Using the below chart, what is the average number of drinks you consume on these occasions? _________________________________
Using the chart, what is the largest number of drinks you consume? ________________

One drink equals:

Version 12/04/14
<table>
<thead>
<tr>
<th>12 fl oz of regular beer</th>
<th>8-8.5 fl oz of malt liquor (shown in a 12-oz glass)</th>
<th>5 fl oz of table wine</th>
<th>3-4 oz of fortified wine (such as sherry or port 3.5 oz shown)</th>
<th>2-3 oz of cordial, liqueur, or aperitif (2.5 oz shown)</th>
<th>1.5 oz of brandy (a single jigger or shot)</th>
<th>1.5 fl oz shot of 80-proof spirits (&quot;hard liquor&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>about 5% alcohol</td>
<td>about 7% alcohol</td>
<td>about 12% alcohol</td>
<td>about 17% alcohol</td>
<td>about 24% alcohol</td>
<td>about 40% alcohol</td>
<td>about 40% alcohol</td>
</tr>
</tbody>
</table>
INFORMATION ON THE MOST RECENT DOCUMENTED INJURY

Injury date and time:  __ __ / __/ __ __  __ __: __ __ (24 hour clock)
                      (day /month/ year)

What happened? ________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Did you experience any symptoms or changes after the injury?

☐ NO  ☐ YES, IMMEDIATELY AFTER THE INJURY
☐ YES, NOT IMMEDIATELY AFTER THE INJURY

Which symptoms or changes did you experience?
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

At the time of the injury, were you under the influence of alcohol, medication or drugs at that time?

☐ NO  ☐ YES, ALCOHOL
☐ YES, MEDICATION (which?) ________________________________
☐ YES, DRUGS (which?) ________________________________

Were medical services received after injury?

☐ NO  ☐ DO NOT KNOW  ☐ YES

Did you “see stars” during your last concussion?

☐ NO  ☐ DO NOT KNOW  ☐ YES
Did you experience loss of consciousness?

☐ NO  ☐ DO NOT KNOW  ☐ YES

Duration of loss of consciousness:

☐ <1 minute
☐ 1-29 minutes
☐ 30-59 minutes
☐ 1-24 hours
☐ 1-7 days
☐ > 7 days
☐ Unknown

How was the loss of consciousness verified?

☐ Self-report  ☐ Witness  ☐ Medical chart

Do you have a PERSONAL memory of the event/ incident itself?

☐ YES, I FULLY REMEMBER  ☐ YES, BUT THERE ARE GAPS IN MY MEMORY
☐ NO, I DO NOT REMEMBER AT ALL

How much do you NOT remember after the injury?

☐ <1 minute
☐ 1-29 minutes
☐ 30-59 minutes
☐ 1-24 hours
☐ 1-7 days
☐ > 7 days
☐ Unknown

How was the memory loss verified?

☐ Self-report  ☐ Witness  ☐ Medical chart

After the injury, when did you feel back to yourself or 100%? Please state the approximate number of days. ____________________________________________________________

How many separate injuries do you think have you sustained in total? _________________________

How many of these were documented by a health professional, athletic trainer, coach, etc.? ________

Version 12/04/14
SLEEP HABITS

How much sleep did you get last night? _____________ HRS

Before your injury, what time did you typically awaken on:

Weekdays (Mon-Fri)? ________ AM    PM (midnight = 12 AM; noon = 12 PM)
Weekends (Sat-Sun)? ________ AM    PM

Before your injury, how long did it typically take you to fall asleep at night?

Week nights (Sun-Thur) ________ MIN    HRS (midnight = 12 AM; noon = 12 PM)
Weekends (Fri-Sat) ________ MIN    HRS

Before your injury, at what time did you normally go to bed at night on:

Week nights (Sun-Thur)? ________ AM    PM (midnight = 12 AM; noon = 12 PM)
Weekends (Fri-Sat)? ________ AM    PM

Before the injury, did you experience sleep problems?

☐ NO  ☐ YES, I had trouble falling asleep.

How often? ________ times per WEEK   MONTH   YEAR

☐ YES, I had trouble staying asleep.

How often? ________ times per WEEK   MONTH   YEAR

Since the injury, did you notice that your sleep became worse?

☐ NO  ☐ YES

What sleep problems became more noticeable to you? (check all that apply)

☐ I get sleepier during the day.
☐ I get drowsier than I used to when trying to concentrate or work.
☐ I fall asleep when I should not.
☐ It is harder to stay alert during the day.
☐ It is harder to fall asleep at night.

☐ How often? ________ times per WEEK   MONTH   YEAR (circle one)

☐ I fall asleep much later than I used to.

Version 12/04/14
I fall asleep much earlier than I used to.
I sleep later in the morning than I used to.
I have trouble staying asleep.
   How often? _______ times per WEEK   MONTH   YEAR (circle one)
I wake up much earlier in the morning than I used to.
When I do sleep, it is fitful or less restful than it used to be.
I wake up off and on throughout the night more than I used to.
I have more nightmares than I used to.

Since your injury, how much do you typically sleep on weeknights (Sun-Thur)? _____ HRS

Since your injury, how much do you typically sleep on weekend nights (Fri-Sat)? _____ HRS

Since your injury, at what time do you normally go to bed at night on:
   Week nights (Sun-Thur)? _____ AM    PM  (midnight = 12 AM; noon = 12 PM)
   Weekends (Fri-Sat)? _____ AM    PM

Since your injury, what time do you typically awaken on:
   Weekdays (Mon-Fri)? _____ AM    PM
   Weekends (Sat-Sun)? _____ AM    PM

Since your Injury, how long does it typically take you to fall asleep at night?
   Week nights (Sun-Thur)? _____ MIN    HRS
   Weekends (Fri-Sat)? _____ MIN    HRS

Since your injury,
at what time of day do you feel sleepiest? _____ AM    PM
at what time of day do you feel most alert? _____ AM    PM
how many hours do you need to sleep to feel your best? ________
if you get less than _____ hours of sleep, you notice impairment in your ability to function at work.
if you get more than _____ hours of sleep, you notice impairment in your ability to function at work.
Since your injury, do you take more than two daytime naps per month?

☐ NO  ☐ YES

How many times per week do you nap? _________

At what time? _____:____ AM/PM to _____:_____AM/PM

Do you consider yourself a light, normal, or heavy sleeper?

☐ LIGHT  ☐ NORMAL  ☐ HEAVY

Have you been told or do you think that you snore excessively?

☐ NO  ☐ YES

Have you ever been diagnosed or treated for sleep apnea or sleep disordered breathing?

☐ NO  ☐ YES

Is daytime sleepiness currently a problem for you?

☐ NO  ☐ YES
**Epworth Sleepiness Scale**

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your **usual way of life in recent times**. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

0 = would never doze  
1 = slight chance of dozing  
2 = moderate chance of dozing  
3 = high chance of dozing

<table>
<thead>
<tr>
<th>SITUATION</th>
<th>CHANCE OF DOZING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reading</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Watching TV</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting, inactive in a public place (e.g. a theater or meeting)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>As a passenger in a car for an hour without a break</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Lying down to rest in the afternoon when circumstances permit</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting and talking to someone</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>Sitting quietly after a lunch without alcohol</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>In a car, while stopped for a few minutes in the traffic</td>
<td>0 1 2 3</td>
</tr>
</tbody>
</table>

Version 12/04/14
Ohio State University TBI Identification Method Short Form*

I would like to ask you about injuries to your head or neck that you may have had at anytime in your life.

Interviewer instruction: Record cause and any details provided spontaneously in the box at the bottom of the page. DO NOT query further about LOC or other details at this stage.

1. Have you ever been hospitalized or treated in an emergency room following an injury to your head or neck? Think about any childhood injuries you remember or were told about.
   - Yes—Record cause(s) in table below
   - No

2. Have you ever injured your head or neck in a car accident or from some other moving vehicle accident (e.g. motorcycle, ATV)?
   - Yes—Record cause(s) in table below
   - No

3. Have you ever injured your head or neck in a fall or from being hit by something (e.g. falling from a bike, horse, or rollerblades, falling on ice, being hit by a rock)? Have you ever injured your head or neck playing sports or on the playground?
   - Yes—Record cause(s) in table below
   - No

4. Have you ever injured your head or neck in a fight, from being hit by someone, or from being shaken violently? Have you ever been shot in the head?
   - Yes—Record cause(s) in table below
   - No

5. Have you ever been nearby when an explosion or a blast occurred? If you served in the military, think about any combat- or training-related incidents.
   - Yes—Record cause(s) in table below
   - No

6. If all above are “no” then proceed to question 7. If answered “yes” to any of the questions above, ask the following for each injury: **Were you knocked or did you lose consciousness (LOC)? If yes, how long? If no, were you dazed or did you have a gap in your memory from the injury? How old were you? (age is only needed if there was LOC)**

<table>
<thead>
<tr>
<th>Cause</th>
<th>Loss of consciousness (LOC)/knocked out</th>
<th>Dazed/ Memory Gap</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No LOC</td>
<td>&lt; 30 min</td>
<td>30 min-24 hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


© reserved 2007, The Ohio Valley Center for Brain Injury Prevention and Rehabilitation
If more injuries with LOC: How many more? ___ Longest knocked out? ___ How many ≥ 30 mins.? ___ Youngest age? ___

7. Have you ever lost consciousness from a drug overdose or being choked? _____# overdose _____# choked

SCORING

_____ # TBI-LOC (number of TBI’s with loss of consciousness from #6a)
_____ # TBI-LOC ≥ 30 (number of TBI’s with loss of consciousness ≥ 30 minutes from #6a)
_____ age at first TBI-LOC (youngest age from #6a)
_____ TBI-LOC before age 15 (if youngest age from #7B < 15 then =1, if ≥ 15 then = 0)

_____ Worst Injury (1-5):
  If responses to #1-5 are “no” classify as 1 “improbable TBI”.
  If in response to #6a and 6b reports never having LOC, being dazed or having memory lapses classify as 1 “improbable TBI”.
  If in response to #6b reports being dazed or having a memory lapse classify as 2 “possible TBI”.
  If in response to #6a loss of consciousness (LOC) does not exceed 30 minutes for any injury classify as 3 “mild TBI”.
  If in response to #6a LOC for any one injury is between 30 minutes and 24 hours classify as 4 “moderate TBI”.
  If in response to #6a LOC for any one injury exceeds 24 hours classify as 5 “severe TBI”.
_____ # anoxic injuries (sum of incidents reported in #7)
Glasgow Outcome Scale – Extended

### CONSCIOUSNESS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Is the subject able to obey simple commands, or say words?</td>
<td>NO</td>
</tr>
</tbody>
</table>

### INDEPENDENCE IN THE HOME

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.a</td>
<td>Is assistance of another person at home essential every day for some activities of daily living?</td>
<td>NO</td>
</tr>
</tbody>
</table>

Notes.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.b</td>
<td>Do you need frequent help or someone to be around at home most of the time?</td>
<td>NO</td>
</tr>
</tbody>
</table>

(UPPER SD) (LOWER SD)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.c</td>
<td>Was assistance at home essential before the injury?</td>
<td>NO</td>
</tr>
</tbody>
</table>

Notes.

### INDEPENDENCE OUTSIDE OF HOME

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.a</td>
<td>Do you shop without assistance?</td>
<td>NO</td>
</tr>
</tbody>
</table>

(UPPER SD)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.b</td>
<td>Did you need assistance before the injury?</td>
<td>NO</td>
</tr>
</tbody>
</table>

Notes.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.a</td>
<td>Do you travel without assistance?</td>
<td>NO</td>
</tr>
</tbody>
</table>

(UPPER SD)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.b</td>
<td>Did you need assistance before the injury?</td>
<td>NO</td>
</tr>
</tbody>
</table>

Notes.
<table>
<thead>
<tr>
<th>WORK</th>
<th>5.a</th>
<th>Are you currently working to your previous capacity?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.b</td>
<td></td>
<td>How restricted are you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduced work capacity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Able to work in sheltered workshop or non-competitive job, or unable to work</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(UPPER MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(LOWER MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.c</td>
<td></td>
<td>Have you been working or seeking employment before the injury?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOCIAL &amp; LEISURE ACTIVITIES</th>
<th>6.a</th>
<th>Are you able to resume regular social and leisure activities outside home?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.b</td>
<td></td>
<td>What is the extent of the restriction?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participate a bit less: at least half as often as before injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(LOWER GR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participate much less: less than half as often</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(UPPER MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unable to participate: rarely, if ever</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(LOWER MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.c</td>
<td></td>
<td>Did you engage in regular social and leisure activities before the injury?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FAMILY &amp; FRIENDSHIPS</th>
<th>7.a</th>
<th>Have there been any psychological problems which have resulted in ongoing family disruption or disruption of friendship?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>
### SCORING

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dead</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Vegetative State</td>
<td>VS</td>
</tr>
<tr>
<td>3</td>
<td>Lower Severe Disability</td>
<td>Lower SD</td>
</tr>
<tr>
<td>4</td>
<td>Upper Severe Disability</td>
<td>Upper SD</td>
</tr>
<tr>
<td>5</td>
<td>Lower Moderate Disability</td>
<td>Lower MD</td>
</tr>
<tr>
<td>6</td>
<td>Upper Moderate Disability</td>
<td>Upper MD</td>
</tr>
<tr>
<td>7</td>
<td>Lower Good Recovery</td>
<td>Lower GR</td>
</tr>
<tr>
<td>8</td>
<td>Upper Good Recovery</td>
<td>Upper GR</td>
</tr>
</tbody>
</table>

### 7.b
What is the extent of disruption or strain?

- **Occasional:** less than weekly
- **Frequent:** once a week or more, but tolerable
- **Constant:** daily and intolerable

### 7.c
Were there problems with family or friends before the injury?

- **NO**
- **YES**

### 8.a
Are there any other current problems relating to the injury which affect daily life?

- **NO** (UPPER GR)
- **YES** (LOWER GR)

### 8.b
Were similar problems present before injury?

- **NO**
- **YES**

### RETURN TO NORMAL LIFE

Notes.
MINI INTERNATIONAL NEUROPSYCHIATRIC INTERVIEW

English Version 6.0.0

DSM-IV

USA: D. Sheehan¹, J. Janavs, K. Harnett-Sheehan, M. Sheehan, C. Gray.
   ¹University of South Florida College of Medicine- Tampa, USA

   ²Centre Hospitalier Sainte-Anne – Paris, France

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DISCLAIMER

Our aim is to assist in the assessment and tracking of patients with greater efficiency and accuracy. Before action is taken on any data collected and processed by this program, it should be reviewed and interpreted by a licensed clinician.

This program is not designed or intended to be used in the place of a full medical and psychiatric evaluation by a qualified licensed physician – psychiatrist. It is intended only as a tool to facilitate accurate data collection and processing of symptoms elicited by trained personnel.

M.I.N.I. 6.0.0 (January 1, 2009)
<table>
<thead>
<tr>
<th>MODULES</th>
<th>TIME FRAME</th>
<th>MEETS CRITERIA</th>
<th>DSM-IV-TR</th>
<th>ICD-10</th>
<th>PRIMARY DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A MAJOR DEPRESSIVE EPISODE</td>
<td>Current (2 weeks)</td>
<td>Single</td>
<td>F32.x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Past</td>
<td>Single</td>
<td>F32.x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recurrent</td>
<td>Recurrent</td>
<td>F33.x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B SUICIDALITY</td>
<td>Current (Past Month)</td>
<td>Low/Moderate/High</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C MANIC EPISODE</td>
<td>Current</td>
<td>F30.00-306.1</td>
<td>F30.x-F31.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYPOMANIC EPISODE</td>
<td>Past</td>
<td>F30.80-306.89</td>
<td>F31.8-F31.9/F34.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIPOLAR I DISORDER</td>
<td>Current</td>
<td>F30.60x-306.6x</td>
<td>F30.x-F31.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIPOLAR I DISORDER</td>
<td>Past</td>
<td>F30.60x-306.6x</td>
<td>F30.x-F31.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIPOLAR II DISORDER</td>
<td>Current</td>
<td>F30.89</td>
<td>F31.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIPOLAR DISORDER NOS</td>
<td>Past</td>
<td>F30.89</td>
<td>F31.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D PANIC DISORDER</td>
<td>Current (Past Month)</td>
<td>300.01/300.21</td>
<td>F40.01-F41.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E AGORAPHOBIA</td>
<td>Current</td>
<td>300.22</td>
<td>F40.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F SOCIAL PHOBIA (Social Anxiety Disorder)</td>
<td>Current (Past Month)</td>
<td>Generalized</td>
<td>300.23</td>
<td>F40.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Generalized</td>
<td>300.23</td>
<td>F40.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G OBSESSIVE-COMPULSIVE DISORDER</td>
<td>Current (Past Month)</td>
<td>300.3</td>
<td>F42.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H POSTTRAUMATIC STRESS DISORDER</td>
<td>Current (Past Month)</td>
<td>309.81</td>
<td>F43.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I ALCOHOL DEPENDENCE</td>
<td>Past 12 Months</td>
<td>303.9</td>
<td>F10.2x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Past 12 Months</td>
<td>305.0</td>
<td>F10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J SUBSTANCE DEPENDENCE (Non-alcohol)</td>
<td>Past 12 Months</td>
<td>304.00-305.20</td>
<td>F11.1-F19.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUBSTANCE ABUSE (Non-alcohol)</td>
<td>Past 12 Months</td>
<td>304.00-305.20</td>
<td>F11.1-F19.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K PSYCHOTIC DISORDERS</td>
<td>Lifetime</td>
<td>295.10-295.90/297.1</td>
<td>F20.xx-F29</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current</td>
<td>297.3/297.81/293.82/293.89/298.8/298.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOOD DISORDER WITH</td>
<td>Lifetime</td>
<td>296.24/296.34/296.44</td>
<td>F32.3/F33.3/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSYCHOTIC FEATURES</td>
<td>Current</td>
<td>296.24/296.34/296.44</td>
<td>F30.2/F31.2/F31.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L ANOREXIA NERVOSA</td>
<td>Current (Past 3 Months)</td>
<td>307.1</td>
<td>F50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M BULIMIA NERVOSA</td>
<td>Current (Past 3 Months)</td>
<td>307.51</td>
<td>F50.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANOREXIA NERVOSA, BINGE EATING/PURGING TYPE</td>
<td>Current</td>
<td>307.1</td>
<td>F50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N GENERALIZED ANXIETY DISORDER</td>
<td>Current (Past 6 Months)</td>
<td>300.02</td>
<td>F41.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O MEDICAL, ORGANIC, DRUG CAUSE RULED OUT</td>
<td>No/Yes/Uncertain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P ANTISOCIAL PERSONALITY DISORDER</td>
<td>Lifetime</td>
<td>301.7</td>
<td>F60.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IDENTIFY THE PRIMARY DIAGNOSIS BY CHECKING THE APPROPRIATE CHECK BOX. (Which problem troubles you the most or dominates the others or came first in the natural history?)

The translation from DSM-IV-TR to ICD-10 coding is not always exact. For more information on this topic see Schulte-Markwort. Crosswalks ICD-10/DSM-IV-TR. Hogrefe & Huber Publishers 2006.
GENERAL INSTRUCTIONS

The M.I.N.I. was designed as a brief structured interview for the major Axis I psychiatric disorders in DSM-IV and ICD-10. Validation and reliability studies have been done comparing the M.I.N.I. to the SCID-P for DSM-III-R and the CIDI (a structured interview developed by the World Health Organization). The results of these studies show that the M.I.N.I. has similar reliability and validity properties, but can be administered in a much shorter period of time (mean 18.7 ± 11.6 minutes, median 15 minutes) than the above referenced instruments. It can be used by clinicians, after a brief training session. Lay interviewers require more extensive training.

INTERVIEW:

In order to keep the interview as brief as possible, inform the patient that you will conduct a clinical interview that is more structured than usual, with very precise questions about psychological problems which require a yes or no answer.

GENERAL FORMAT:

The M.I.N.I. is divided into modules identified by letters, each corresponding to a diagnostic category.

• At the beginning of each diagnostic module (except for psychotic disorders module), screening question(s) corresponding to the main criteria of the disorder are presented in a gray box.
• At the end of each module, diagnostic box(es) permit the clinician to indicate whether diagnostic criteria are met.

CONVENTIONS:

Sentences written in « normal font » should be read exactly as written to the patient in order to standardize the assessment of diagnostic criteria.

Sentences written in « CAPITALS » should not be read to the patient. They are instructions for the interviewer to assist in the scoring of the diagnostic algorithms.

Sentences written in « bold » indicate the time frame being investigated. The interviewer should read them as often as necessary. Only symptoms occurring during the time frame indicated should be considered in scoring the responses.

Answers with an arrow above them (➔) indicate that one of the criteria necessary for the diagnosis(es) is not met. In this case, the interviewer should go to the end of the module, circle « NO » in all the diagnostic boxes and move to the next module.

When terms are separated by a slash (/) the interviewer should read only those symptoms known to be present in the patient (for example, question G6).

Phrases in (parentheses) are clinical examples of the symptom. These may be read to the patient to clarify the question.

RATING INSTRUCTIONS:

All questions must be rated. The rating is done at the right of each question by circling either Yes or No. Clinical judgment by the rater should be used in coding the responses. Interviewers need to be sensitive to the diversity of cultural beliefs in their administration of questions and rating of responses. The rater should ask for examples when necessary, to ensure accurate coding. The patient should be encouraged to ask for clarification on any question that is not absolutely clear. The clinician should be sure that each dimension of the question is taken into account by the patient (for example, time frame, frequency, severity, and/or alternatives).

Symptoms better accounted for by an organic cause or by the use of alcohol or drugs should not be coded positive in the M.I.N.I. The M.I.N.I. Plus has questions that investigate these issues.

For any questions, suggestions, need for a training session or information about updates of the M.I.N.I., please contact:

David V Sheehan, M.D., M.B.A.  Yves Lecrubier, M.D. / Christian Even, M.D.
University of South Florida College of Medicine  Centre Hospitalier Sainte-Anne
3515 East Fletcher Ave, Tampa, FL USA 33613-4706  Clinique des Maladies Mentales de l’Encéphale
tel : +1 813 974 4544; fax : +1 813 974 4575  100 rue de la Santé, 75674 Paris Cedex 14, France
e-mail : dsheehan@health.usf.edu  tel : +33 (0) 1 53 80 49 41; fax : +33 (0) 1 45 65 88 54
M.I.N.I. 6.0.0 (January 1, 2009) e-mail: vlecrubier@noos.fr or even-sainteanne@orange.fr
### A. MAJOR DEPRESSIVE EPISODE

(⇒ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

<table>
<thead>
<tr>
<th>A1</th>
<th>Were you ever depressed or down, most of the day, nearly every day, for two weeks?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IF NO, CODE NO TO A1b: IF YES ASK:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>For the past two weeks, were you depressed or down, most of the day, nearly every day?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

| A2  | Were you ever much less interested in most things or much less able to enjoy the things you used to enjoy most of the time, for two weeks? | NO   | YES  |
|     | IF NO, CODE NO TO A2b: IF YES ASK:                                               |      |      |
| b   | In the past two weeks, were you much less interested in most things or much less able to enjoy the things you used to enjoy, most of the time? | NO   | YES  |

IS A1 or A2 CODED YES?

| A3  | IF A1b or A2b = YES: EXPLORE THE CURRENT AND THE MOST SYMPTOMATIC PAST EPISODE, OTHERWISE IF A1b and A2b = NO: EXPLORE ONLY THE MOST SYMPTOMATIC PAST EPISODE |
|-----|--------------------------------------------------------------------------------|------|------|

**Over that two week period, when you felt depressed or uninterested:**

<table>
<thead>
<tr>
<th></th>
<th>Past 2 Weeks</th>
<th>Past Episode</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Was your appetite decreased or increased nearly every day? Did your weight decrease or increase without trying intentionally (i.e., by ±5% of body weight or ±8 lbs. or ±3.5 kgs., for a 160 lb./70 kg. person in a month)?</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>IF YES TO EITHER, CODE YES.</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Did you have trouble sleeping nearly every night (difficulty falling asleep, waking up in the middle of the night, early morning wakening or sleeping excessively)?</td>
<td>NO</td>
</tr>
<tr>
<td>c</td>
<td>Did you talk or move more slowly than normal or were you fidgety, restless or having trouble sitting still almost every day?</td>
<td>NO</td>
</tr>
<tr>
<td>d</td>
<td>Did you feel tired or without energy almost every day?</td>
<td>NO</td>
</tr>
<tr>
<td>e</td>
<td>Did you feel worthless or guilty almost every day?</td>
<td>NO</td>
</tr>
<tr>
<td>f</td>
<td>Did you have difficulty concentrating or making decisions almost every day?</td>
<td>NO</td>
</tr>
<tr>
<td>g</td>
<td>Did you repeatedly consider hurting yourself, feel suicidal, or wish that you were dead? Did you attempt suicide or plan a suicide?</td>
<td>NO</td>
</tr>
<tr>
<td>A4</td>
<td>Did these symptoms cause significant problems at home, at work, socially, at school or in some other important way?</td>
<td>NO</td>
</tr>
<tr>
<td>A5</td>
<td>In between 2 episodes of depression, did you ever have an interval of at least 2 months, without any significant depression or any significant loss of interest?</td>
<td>NO</td>
</tr>
</tbody>
</table>
ARE 5 OR MORE ANSWERS (A1-A3) CODED YES AND IS A4 CODED YES FOR THAT TIME FRAME?

SPECIFY IF THE EPISODE IS CURRENT AND / OR PAST.

IF A5 IS CODED YES, CODE YES FOR RECURRENT.

A6 a How many episodes of depression did you have in your lifetime? _____

Between each episode there must be at least 2 months without any significant depression.
B. SUICIDALITY

In the past month did you:

B1 Suffer any accident?  NO  YES  0
IF NO TO B1, SKIP TO B2; IF YES, ASK B1a:

B1a Plan or intend to hurt yourself in that accident either actively or passively (e.g. not avoiding a risk)?  NO  YES  0
IF NO TO B1a, SKIP TO B2; IF YES, ASK B1b:

B1b Intend to die as a result of this accident?  NO  YES  0

B2 Feel hopeless?  NO  YES  1

B3 Think that you would be better off dead or wish you were dead?  NO  YES  1

B4 Want to harm yourself or to hurt or to injure yourself or have mental images of harming yourself?  NO  YES  2

B5 Think about suicide?  NO  YES  6
IF NO TO B5, SKIP TO B7. OTHERWISE ASK:
Frequency  Intensity
Occasionally  ☐  Mild  ☐
Often  ☐  Moderate  ☐
Very often  ☐  Severe  ☐

Can you state that you will not act on these impulses during this treatment program?  NO  YES

B6 Feel unable to control these impulses?  NO  YES  8

B7 Have a suicide plan?  NO  YES  8

B8 Take any active steps to prepare to injure yourself or to prepare for a suicide attempt in which you expected or intended to die?  NO  YES  9

B9 Deliberately injure yourself without intending to kill yourself?  NO  YES  4

B10 Attempt suicide?  NO  YES  9
IF NO SKIP TO B11:
Hope to be rescued / survive  ☐
Expected / intended to die  ☐

In your lifetime:

B11 Did you ever make a suicide attempt?  NO  YES  4
IS AT LEAST 1 OF THE ABOVE (EXCEPT B1) CODED YES?

IF YES, ADD THE TOTAL POINTS FOR THE ANSWERS (B1-B11)
CHECKED ‘YES’ AND SPECIFY THE SUICIDALITY SCORE AS
INDICATED IN THE DIAGNOSTIC BOX:

MAKE ANY ADDITIONAL COMMENTS ABOUT YOUR ASSESSMENT
OF THIS PATIENT’S CURRENT AND NEAR FUTURE SUICIDALITY IN
THE SPACE BELOW:
C. MANIC AND HYPOMANIC EPISODES

(★ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN MANIC AND HYPOMANIC DIAGNOSTIC BOXES, AND MOVE TO NEXT MODULE)

Do you have any family history of manic depressive illness or bipolar disorder, or any family member who had mood swings treated with a medication like lithium, sodium valproate (Depakote) or lamotrigine (Lamictal)?

THIS QUESTION IS NOT A CRITERION FOR BIPOLAR DISORDER, BUT IS ASKED TO INCREASE THE CLINICIAN’S VIGILANCE ABOUT THE RISK FOR BIPOLAR DISORDER.

IF YES, PLEASE SPECIFY WHO:________________________________________

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>C1</td>
<td>a</td>
<td>Have you ever had a period of time when you were feeling 'up' or 'high' or 'hyper' or so full of energy or full of yourself that you got into trouble, - or that other people thought you were not your usual self? (Do not consider times when you were intoxicated on drugs or alcohol.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO  YES</td>
</tr>
</tbody>
</table>

IF PATIENT IS PUZZLED OR UNCLEAR ABOUT WHAT YOU MEAN BY 'UP' OR 'HIGH' OR 'HYPER', CLARIFY AS FOLLOWS: By 'up' or 'high' or 'hyper' I mean: having elated mood; increased energy; needing less sleep; having rapid thoughts; being full of ideas; having an increase in productivity, motivation, creativity, or impulsive behavior; phoning or working excessively or spending more money.

IF NO, CODE NO TO C1b: IF YES ASK:

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<tbody>
<tr>
<td>C1</td>
<td>b</td>
<td>Are you currently feeling ‘up’ or ‘high’ or ‘hyper’ or full of energy?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO  YES</td>
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<tr>
<td>C2</td>
<td>a</td>
<td>Have you ever been persistently irritable, for several days, so that you had arguments or verbal or physical fights, or shouted at people outside your family? Have you or others noticed that you have been more irritable or over reacted, compared to other people, even in situations that you felt were justified?</td>
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<td></td>
<td></td>
<td>NO  YES</td>
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IF NO, CODE NO TO C2b: IF YES ASK:

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<tbody>
<tr>
<td>C2</td>
<td>b</td>
<td>Are you currently feeling persistently irritable?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO  YES</td>
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</tbody>
</table>

IS C1a OR C2a CODED YES?

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<tr>
<td></td>
<td>NO  YES</td>
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</table>

C3 IF C1b OR C2b = YES: EXPLORE THE CURRENT AND THE MOST SYMPTOMATIC PAST EPISODE, OTHERWISE IF C1b AND C2b = NO: EXPLORE ONLY THE MOST SYMPTOMATIC PAST EPISODE

During the times when you felt high, full of energy, or irritable did you:

<table>
<thead>
<tr>
<th></th>
<th>Current Episode</th>
<th>Past Episode</th>
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</thead>
<tbody>
<tr>
<td>a</td>
<td>Feel that you could do things others couldn’t do, or that you were an especially important person? IF YES, ASK FOR EXAMPLES. THE EXAMPLES ARE CONSISTENT WITH A DELUSIONAL IDEA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NO  YES</td>
<td>NO  YES</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
<th>Current Episode</th>
<th>Past Episode</th>
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<tbody>
<tr>
<td>b</td>
<td>Need less sleep (for example, feel rested after only a few hours sleep)?</td>
<td></td>
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<tr>
<td></td>
<td>NO  YES</td>
<td>NO  YES</td>
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<thead>
<tr>
<th></th>
<th>Current Episode</th>
<th>Past Episode</th>
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<tr>
<td>c</td>
<td>Talk too much without stopping, or so fast that people had difficulty understanding?</td>
<td></td>
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<tr>
<td></td>
<td>NO  YES</td>
<td>NO  YES</td>
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<tr>
<th></th>
<th>Current Episode</th>
<th>Past Episode</th>
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<tbody>
<tr>
<td>d</td>
<td>Have racing thoughts?</td>
<td></td>
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<tr>
<td></td>
<td>NO  YES</td>
<td>NO  YES</td>
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### Current Episode | Past Episode
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<tr>
<td>e</td>
<td>Become easily distracted so that any little interruption could distract you?</td>
<td>NO</td>
</tr>
<tr>
<td>f</td>
<td>Have a significant increase in your activity or drive, at work, at school, socially or sexually or did you become physically or mentally restless?</td>
<td>NO</td>
</tr>
<tr>
<td>g</td>
<td>Want so much to engage in pleasurable activities that you ignored the risks or consequences (for example, spending sprees, reckless driving, or sexual indiscretions)?</td>
<td>NO</td>
</tr>
</tbody>
</table>

**C3 SUMMARY:** WHEN RATING CURRENT EPISODE:
- If C1b is NO, are 4 or more C3 answers coded YES?
- If C1b is YES, are 3 or more C3 answers coded YES?

WHEN RATING PAST EPISODE:
- If C1a is NO, are 4 or more C3 answers coded YES?
- If C1a is YES, are 3 or more C3 answers coded YES?

**RULE:** ELATION/EXPANSIVENESS requires only three C3 symptoms, while IRRITABLE MOOD ALONE requires 4 of the C3 symptoms.

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<tbody>
<tr>
<td>C4</td>
<td>What is the longest time these symptoms lasted?</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>3 days or less</td>
<td></td>
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<tr>
<td>b)</td>
<td>4 to 6 days</td>
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<tr>
<td>c)</td>
<td>7 days or more</td>
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<th></th>
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<tbody>
<tr>
<td>C5</td>
<td>Were you hospitalized for these problems?</td>
<td>NO</td>
</tr>
</tbody>
</table>

**IF YES, STOP HERE AND CIRCLE YES IN MANIC EPISODE FOR THAT TIME FRAME.**

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<tbody>
<tr>
<td>C6</td>
<td>Did these symptoms cause significant problems at home, at work, socially in your relationships with others, at school or in some other important way?</td>
<td>NO</td>
</tr>
</tbody>
</table>

**ARE C3 SUMMARY AND C5 AND C6 CODED YES AND EITHER C4a or b or c CODED YES?**

**OR**

**ARE C3 SUMMARY AND C4c AND C6 CODED YES AND IS C5 CODED NO?**

**SPECIFY IF THE EPISODE IS CURRENT AND / OR PAST.**

**ARE C3 SUMMARY AND C5 AND C6 CODED NO AND EITHER C4b OR C4c CODED YES?**

**OR**

**ARE C3 SUMMARY AND C4b AND C6 CODED YES AND IS C5 CODED NO?**

**SPECIFY IF THE EPISODE IS CURRENT AND / OR PAST.**

**MANIC EPISODE**

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<tbody>
<tr>
<td>CURRENT</td>
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<tr>
<td>PAST</td>
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</table>

**HYPOMANIC EPISODE**

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<tbody>
<tr>
<td>CURRENT</td>
<td></td>
</tr>
<tr>
<td>PAST</td>
<td></td>
</tr>
</tbody>
</table>
ARE C3 SUMMARY AND C4a CODED YES AND IS C5 CODED NO? NO YES

SPECIFY IF THE EPISODE IS CURRENT AND / OR PAST.

C7

a) IF MANIC EPISODE IS POSITIVE FOR EITHER CURRENT OR PAST ASK:
   Did you have 2 or more manic episodes (C4c) in your lifetime (including the current episode if present)? NO YES

b) IF HYPOMANIC EPISODE IS POSITIVE FOR EITHER CURRENT OR PAST ASK:
   Did you have 2 or more hypomanic EPISODES (C4b) in your lifetime (including the current episode)? NO YES

c) IF PAST “HYPOMANIC SYMPTOMS” IS CODED POSITIVE ASK:
   Did you have 2 or more episodes of hypomanic SYMPTOMS (C4a) in your lifetime (including the current episode if present)? NO YES
## D. PANIC DISORDER

(● MEANS: CIRCLE NO IN D5, D6 AND D7 AND SKIP TO E1)

<table>
<thead>
<tr>
<th>D1</th>
<th>Have you, on more than one occasion, had spells or attacks when you <strong>suddenly</strong> felt anxious, frightened, uncomfortable or uneasy, even in situations where most people would not feel that way?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Did the spells surge to a peak within 10 minutes of starting?</td>
<td></td>
<td></td>
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</tbody>
</table>

| D2   | At any time in the past, did any of those spells or attacks come on unexpectedly or occur in an unpredictable or unprovoked manner? | NO | YES |

| D3   | Have you ever had one such attack followed by a month or more of persistent concern about having another attack, or worries about the consequences of the attack - or did you make a significant change in your behavior because of the attacks (e.g., shopping only with a companion, not wanting to leave your house, visiting the emergency room repeatedly, or seeing your doctor more frequently because of the symptoms)? | NO | YES |

<table>
<thead>
<tr>
<th>D4</th>
<th><strong>During the worst attack that you can remember:</strong></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Did you have skipping, racing or pounding of your heart?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have sweating or clammy hands?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Were you trembling or shaking?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have shortness of breath or difficulty breathing?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have a choking sensation or a lump in your throat?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have chest pain, pressure or discomfort?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have nausea, stomach problems or sudden diarrhea?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you feel dizzy, unsteady, lightheaded or faint?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did things around you feel strange, unreal, detached or unfamiliar, or did you feel outside of or detached from part or all of your body?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you fear that you were losing control or going crazy?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you fear that you were dying?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have tingling or numbness in parts of your body?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Did you have hot flushes or chills?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

| D5   | **ARE BOTH D3, AND 4 OR MORE D4 ANSWERS, CODED YES?**                                          | NO | YES |
|      | **IF YES TO D5, SKIP TO D7.**                                                                    |    |     |

| D6   | **IF D5 = NO, ARE ANY D4 ANSWERS CODED YES?**                                                   | NO | YES |
|      | **THEN SKIP TO E1.**                                                                            |    |     |

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In the past month, did you have such attacks repeatedly (2 or more), and did you have persistent concern about having another attack, or worry about the consequences of the attacks, or did you change your behavior in any way because of the attacks?  

**E. AGORAPHOBIA**

**E1** Do you feel anxious or uneasy in places or situations where help might not be available or escape might be difficult, like being in a crowd, standing in a line (queue), when you are alone away from home or alone at home, or when crossing a bridge, or traveling in a bus, train or car or where you might have a panic attack or the panic-like symptoms we just spoke about?  

<table>
<thead>
<tr>
<th>NO</th>
<th>YES</th>
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</table>

**IF E1 = NO, CIRCLE NO IN E2.**

**E2** Do you fear these situations so much that you avoid them, or suffer through them, or need a companion to face them?  

<table>
<thead>
<tr>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

**IS E2 (CURRENT AGORAPHOBIA) CODED YES**  
and  
**IS D7 (CURRENT PANIC DISORDER) CODED YES?**  

**IS E2 (CURRENT AGORAPHOBIA) CODED NO**  
and  
**IS D7 (CURRENT PANIC DISORDER) CODED YES?**  

**IS E2 (CURRENT AGORAPHOBIA) CODED YES**  
and  
**IS D5 (PANIC DISORDER LIFETIME) CODED NO?**  

**NO**  
**YES**  
**PANIC DISORDER with Agoraphobia CURRENT**  

**NO**  
**YES**  
**PANIC DISORDER without Agoraphobia CURRENT**  

**NO**  
**YES**  
**AGORAPHOBIA, CURRENT without history of Panic Disorder**
# F. SOCIAL PHOBIA (Social Anxiety Disorder)

(➔ MEANS: GO TO THE DIAGNOSTIC BOX, CIRCLE NO AND MOVE TO THE NEXT MODULE)

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>TRUE</th>
<th>FALSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>In the past month, did you have persistent fear and significant anxiety at being watched, being the focus of attention, or of being humiliated or embarrassed? This includes things like speaking in public, eating in public or with others, writing while someone watches, or being in social situations.</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>F2</td>
<td>Is this social fear excessive or unreasonable and does it almost always make you anxious?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>F3</td>
<td>Do you fear these social situations so much that you avoid them or suffer through them most of the time?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>F4</td>
<td>Do these social fears disrupt your normal work, school or social functioning or cause you significant distress?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

**SUBTYPES**

Do you fear and avoid 4 or more social situations?

If YES  Generalized social phobia (social anxiety disorder)

If NO   Non-generalized social phobia (social anxiety disorder)

**EXAMPLES OF SUCH SOCIAL SITUATIONS TYPICALLY INCLUDE**

- INITIATING OR MAINTAINING A CONVERSATION,
- PARTICIPATING IN SMALL GROUPS,
- DATING,
- SPEAKING TO AUTHORITY FIGURES,
- ATTENDING PARTIES,
- PUBLIC SPEAKING,
- EATING IN FRONT OF OTHERS,
- URINATING IN A PUBLIC WASHROOM, ETC.

**NOTE TO INTERVIEWER:** PLEASE ASSESS WHETHER THE SUBJECT’S FEARS ARE RESTRICTED TO NON-GENERALIZED (“ONLY 1 OR SEVERAL”) SOCIAL SITUATIONS OR EXTEND TO GENERALIZED (“MOST”) SOCIAL SITUATIONS. “MOST” SOCIAL SITUATIONS IS USUALLY OPERATIONIALIZED TO MEAN 4 OR MORE SOCIAL SITUATIONS, ALTHOUGH THE DSM-IV DOES NOT EXPLICITLY STATE THIS.
### G. OBSESSIVE-COMPULSIVE DISORDER

<table>
<thead>
<tr>
<th>Question</th>
<th>NO</th>
<th>YES</th>
<th>IS G3 OR G4 CODED YES?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G1</strong> In the past month, have you been bothered by recurrent thoughts,</td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>impulses, or images that were unwanted, distasteful, inappropriate,</td>
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<tr>
<td>intrusive, or distressing? - (For example, the idea that you were dirty,</td>
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<tr>
<td>contaminated or had germs, or fear of contaminating others, or fear of</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>harming someone even though it disturbs or distresses you, or fear you</td>
<td></td>
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<tr>
<td>would act on some impulse, or fear or superstitions that you would</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>be responsible for things going wrong, or obsessions with sexual thoughts,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>images or impulses, or hoarding, collecting, or religious obsessions.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(DO NOT INCLUDE SIMPLY EXCESSIVE WORRIES ABOUT REAL LIFE PROBLEMS. DO NOT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCLUDE OBSESSIONS DIRECTLY RELATED TO EATING DISORDERS, SEXUAL DEVIATIONS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PATHOLOGICAL GAMBLING, OR ALCOHOL OR DRUG ABUSE BECAUSE THE PATIENT MAY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DERIVE PLEASURE FROM THE ACTIVITY AND MAY WANT TO RESIST IT ONLY BECAUSE OF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITS NEGATIVE CONSEQUENCES.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>G2</strong> Did they keep coming back into your mind even when you tried to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ignore or get rid of them?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>G3</strong> Do you think that these obsessions are the product of your own</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mind and that they are not imposed from the outside?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>G4</strong> In the past month, did you do something repeatedly without being</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>able to resist doing it, like washing or cleaning excessively, counting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or checking things over and over, or repeating, collecting, arranging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>things, or other superstitious rituals?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IS G3 OR G4 CODED YES?**

**G5** At any point, did you recognize that either these obsessive thoughts or these compulsive behaviors were excessive or unreasonable?

**G6** In the past month, did these obsessive thoughts and/or compulsive behaviors significantly interfere with your normal routine, your work or school, your usual social activities, or relationships, or did they take more than one hour a day?
### H. POSTTRAUMATIC STRESS DISORDER

*Current* (Means: Go to the Diagnostic Box, Circle No, and Move to the Next Module)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Have you ever experienced or witnessed or had to deal with an extremely traumatic event that included actual or threatened death or serious injury to you or someone else?</td>
</tr>
<tr>
<td></td>
<td>EXAMPLES OF TRAUMATIC EVENTS INCLUDE: SERIOUS ACCIDENTS, SEXUAL OR PHYSICAL ASSAULT, A TERRORIST ATTACK, BEING HELD HOSTAGE, KIDNAPPING, FIRE, DISCOVERING A BODY, WAR, OR NATURAL DISASTER, WITNESSING THE VIOLENT OR SUDDEN DEATH OF SOMEONE CLOSE TO YOU, OR A LIFE THREATENING ILLNESS.</td>
</tr>
<tr>
<td>H2</td>
<td>Did you respond with intense fear, helplessness or horror?</td>
</tr>
<tr>
<td>H3</td>
<td>During the past month, have you re-experienced the event in a distressing way (such as in dreams, intense recollections, flashbacks or physical reactions) or did you have intense distress when you were reminded about the event or exposed to a similar event?</td>
</tr>
<tr>
<td>H4</td>
<td>In the past month:</td>
</tr>
<tr>
<td>a</td>
<td>Have you avoided thinking about or talking about the event?</td>
</tr>
<tr>
<td>b</td>
<td>Have you avoided activities, places or people that remind you of the event?</td>
</tr>
<tr>
<td>c</td>
<td>Have you had trouble recalling some important part of what happened?</td>
</tr>
<tr>
<td>d</td>
<td>Have you become much less interested in hobbies or social activities?</td>
</tr>
<tr>
<td>e</td>
<td>Have you felt detached or estranged from others?</td>
</tr>
<tr>
<td>f</td>
<td>Have you noticed that your feelings are numbed?</td>
</tr>
<tr>
<td>g</td>
<td>Have you felt that your life will be shortened or that you will die sooner than other people?</td>
</tr>
<tr>
<td></td>
<td>ARE 3 OR MORE H4 ANSWERS CODED YES?</td>
</tr>
<tr>
<td>H5</td>
<td>In the past month:</td>
</tr>
<tr>
<td>a</td>
<td>Have you had difficulty sleeping?</td>
</tr>
<tr>
<td>b</td>
<td>Were you especially irritable or did you have outbursts of anger?</td>
</tr>
<tr>
<td>c</td>
<td>Have you had difficulty concentrating?</td>
</tr>
<tr>
<td>d</td>
<td>Were you nervous or constantly on your guard?</td>
</tr>
<tr>
<td>e</td>
<td>Were you easily startled?</td>
</tr>
<tr>
<td></td>
<td>ARE 2 OR MORE H5 ANSWERS CODED YES?</td>
</tr>
<tr>
<td>H6</td>
<td>During the past month, have these problems significantly interfered with your work, school or social activities, or caused significant distress?</td>
</tr>
</tbody>
</table>
## I. ALCOHOL DEPENDENCE / ABUSE

(⇒ MEANS: GO TO DIAGNOSTIC BOXES, CIRCLE NO IN BOTH AND MOVE TO THE NEXT MODULE)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>In the past 12 months, have you had 3 or more alcoholic drinks, - within a 3 hour period, - on 3 or more occasions?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I2</td>
<td>In the past 12 months:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Did you need to drink a lot more in order to get the same effect that you got when you first started drinking or did you get much less effect with continued use of the same amount?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>b</td>
<td>When you cut down on drinking did your hands shake, did you sweat or feel agitated? Did you drink to avoid these symptoms (for example, “the shakes”, sweating or agitation) or to avoid being hungover?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>IF YES TO ANY, CODE YES.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>During the times when you drank alcohol, did you end up drinking more than you planned when you started?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>d</td>
<td>Have you tried to reduce or stop drinking alcohol but failed?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>e</td>
<td>On the days that you drank, did you spend substantial time in obtaining alcohol, drinking, or in recovering from the effects of alcohol?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>f</td>
<td>Did you spend less time working, enjoying hobbies, or being with others because of your drinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>g</td>
<td>If your drinking caused you health or mental problems, did you still keep on drinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

ARE 3 OR MORE I2 ANSWERS CODED YES?

* IF YES, SKIP I3 QUESTIONS AND GO TO NEXT MODULE. “DEPENDENCE PREEMPTS ABUSE” IN DSM IV TR.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I3</td>
<td>In the past 12 months:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Have you been intoxicated, high, or hungover more than once when you had other responsibilities at school, at work, or at home? Did this cause any problems? (CODE YES ONLY IF THIS CAUSED PROBLEMS.)</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>b</td>
<td>Were you intoxicated more than once in any situation where you were physically at risk, for example, driving a car, riding a motorbike, using machinery, boating, etc.?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>c</td>
<td>Did you have legal problems more than once because of your drinking, for example, an arrest or disorderly conduct?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>d</td>
<td>If your drinking caused problems with your family or other people, did you still keep on drinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>
ARE 1 OR MORE I3 ANSWERS CODED YES?

ALCOHOL ABUSE CURRENT
# J. SUBSTANCE DEPENDENCE / ABUSE (NON-ALCOHOL)

(⇒ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

| Now I am going to show you / read to you a list of street drugs or medicines. |
| J1 | a | In the past 12 months, did you take any of these drugs more than once, to get high, to feel elated, to get “a buzz” or to change your mood? | NO | YES |

CIRCLE EACH DRUG TAKEN:

- **Stimulants**: amphetamines, "speed", crystal meth, “crank”, "rush", Dexedrine, Ritalin, diet pills.
- **Cocaine**: snorting, IV, freebase, crack, "speedball".
- **Narcotics**: heroin, morphine, Dilaudid, opium, Demerol, methadone, Darvon, codeine, Percodan, Vicoden, OxyContin.
- **Hallucinogens**: LSD ("acid"), mescaline, peyote, psilocybin, STP, "mushrooms", “ecstasy”, MDA, MDMA.
- **Phencyclidine**: PCP ("Angel Dust", "PeaCe Pill", “Tranq”, “Hog”), or ketamine ("special K").
- **Inhalants**: "glue", ethyl chloride, “rush”, nitrous oxide ("laughing gas"), amyl or butyl nitrate ("poppers").
- **Cannabis**: marijuana, hashish ("hash"), THC, "pot", "grass", "weed", "reefer".
- **Tranquilizers**: Quaalude, Seconal ("reds"), Valium, Xanax, Librium, Ativan, Dalmame, Halcion, barbiturates, Miltown, GHB, Roofinol, "Roofies".
- **Miscellaneous**: steroids, nonprescription sleep or diet pills. Cough Medicine? Any others?

Specify the most used drug(s):

Which drug(s) cause the biggest problems?

First explore the drug causing the biggest problems and most likely to meet dependence / abuse criteria.

If meets criteria for abuse or dependence, skip to the next module. Otherwise, explore the next most problematic drug.

**J2**

Considering your use of (name the drug / drug class selected), in the past 12 months:

a. Have you found that you needed to use much more (name of drug / drug class selected) to get the same effect that you did when you first started taking it? NO YES

b. When you reduced or stopped using (name of drug / drug class selected), did you have withdrawal symptoms (aches, shaking, fever, weakness, diarrhea, nausea, sweating, heart pounding, difficulty sleeping, or feeling agitated, anxious, irritable, or depressed)? Did you use any drug(s) to keep yourself from getting sick (withdrawal symptoms) or so that you would feel better?

IF YES TO EITHER, CODE YES.

c. Have you often found that when you used (name of drug / drug class selected), you ended up taking more than you thought you would? NO YES

d. Have you tried to reduce or stop taking (name of drug / drug class selected) but failed? NO YES

e. On the days that you used (name of drug / drug class selected), did you spend substantial time (>2 HOURS), obtaining, using or in recovering from the drug, or thinking about the drug? NO YES

f. Did you spend less time working, enjoying hobbies, or being with family or friends because of your drug use? NO YES

g. If (name of drug / drug class selected) caused you health or mental problems, did you still keep on using it? NO YES
ARE 3 OR MORE J2 ANSWERS CODED YES?

SPECIFY DRUG(S): ________________________________

* IF YES, SKIP J3 QUESTIONS, MOVE TO NEXT DISORDER.
“DEPENDENCE PREEMPTS ABUSE” IN DSM IV TR.

are you using (NAME THE DRUG CLASS SELECTED), in the past 12 months:

J3 a Have you been intoxicated, high, or hungover from (NAME OF DRUG / DRUG CLASS SELECTED) more than once, when you had other responsibilities at school, at work, or at home? Did this cause any problem?

(CODE YES ONLY IF THIS CAUSED PROBLEMS.)

b Have you been high or intoxicated from (NAME OF DRUG / DRUG CLASS SELECTED) more than once in any situation where you were physically at risk (for example, driving a car, riding a motorbike, using machinery, boating, etc.)?

c Did you have legal problems more than once because of your drug use, for example, an arrest or disorderly conduct?

d If (NAME OF DRUG / DRUG CLASS SELECTED) caused problems with your family or other people, did you still keep on using it?

ARE 1 OR MORE J3 ANSWERS CODED YES?

SPECIFY DRUG(S): ________________________________
### K. PSYCHOTIC DISORDERS AND MOOD DISORDER WITH PSYCHOTIC FEATURES

Ask for an example of each question answered positively. Code **YES** only if the examples clearly show a distortion of thought or of perception or if they are not culturally appropriate. Before coding, investigate whether delusions qualify as "bizarre".

Delusions are "bizarre" if: clearly implausible, absurd, not understandable, and cannot derive from ordinary life experience.

Hallucinations are scored "bizarre" if: a voice comments on the person’s thoughts or behavior, or when two or more voices are conversing with each other.

The purpose of this module is to exclude patients with psychotic disorders. This module needs experience.

Now I am going to ask you about unusual experiences that some people have.

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
<th>Bizarre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K1</strong> a</td>
<td>Have you ever believed that people were spying on you, or that someone was plotting against you, or trying to hurt you?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K1</strong> b</td>
<td>IF YES OR YES BIZARRE: do you currently believe these things?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K2</strong> a</td>
<td>Have you ever believed that someone was reading your mind or could hear your thoughts, or that you could actually read someone’s mind or hear what another person was thinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K2</strong> b</td>
<td>IF YES OR YES BIZARRE: do you currently believe these things?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K3</strong> a</td>
<td>Have you ever believed that someone or some force outside of yourself put thoughts in your mind that were not your own, or made you act in a way that was not your usual self? Have you ever felt that you were possessed?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K3</strong> b</td>
<td>IF YES OR YES BIZARRE: do you currently believe these things?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K4</strong> a</td>
<td>Have you ever believed that you were being sent special messages through the TV, radio, newspapers, books or magazines or that a person you did not personally know was particularly interested in you?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K4</strong> b</td>
<td>IF YES OR YES BIZARRE: do you currently believe these things?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K5</strong> a</td>
<td>Have your relatives or friends ever considered any of your beliefs odd or unusual?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K5</strong> b</td>
<td>IF YES OR YES BIZARRE: do they currently consider your beliefs strange?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K6</strong> a</td>
<td>Have you ever heard things other people couldn’t hear, such as voices?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K6</strong> b</td>
<td>IF YES TO VOICE HALLUCINATION: Was the voice commenting on your thoughts or behavior or did you hear two or more voices talking to each other?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K6</strong> b</td>
<td>IF YES OR YES BIZARRE TO K6a: have you heard sounds / voices in the past month?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td><strong>K6</strong> b</td>
<td>IF YES TO VOICE HALLUCINATION: Was the voice commenting on your thoughts or behavior or did you hear two or more voices talking to each other?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>
K7  a Have you ever had visions when you were awake or have you ever seen things other people couldn’t see?

   CLINICIAN: CHECK TO SEE IF THESE ARE CULTURALLY INAPPROPRIATE.

   NO    YES

b  IF YES: have you seen these things in the past month?

   NO    YES

   CLINICIAN'S JUDGMENT

K8  b IS THE PATIENT CURRENTLY EXHIBITING INCOHERENCE, DISORGANIZED SPEECH, OR MARKED LOOSENING OF ASSOCIATIONS?

   NO    YES

K9  b IS THE PATIENT CURRENTLY EXHIBITING DISORGANIZED OR CATATONIC BEHAVIOR?

   NO    YES

K10 b ARE NEGATIVE SYMPTOMS OF SCHIZOPHRENIA, E.G. SIGNIFICANT AFFECTIVE FLATTENING, POVERTY OF SPEECH (ALOGIA) OR AN INABILITY TO INITIATE OR PERSIST IN GOAL-DIRECTED ACTIVITIES (AVOLITION), PROMINENT DURING THE INTERVIEW?

   NO    YES

K11 a ARE 1 OR MORE « a » QUESTIONS FROM K1a TO K7a CODED YES OR YES BIZARRE AND IS EITHER:

   MAJOR DEPRESSIVE EPISODE, (CURRENT, RECURRENT OR PAST)
   OR
   MANIC OR HYPOMANIC EPISODE, (CURRENT OR PAST) CODED YES?

   NO    YES

   IF NO TO K11 a, CIRCLE NO IN BOTH 'MOOD DISORDER WITH PSYCHOTIC FEATURES' DIAGNOSTIC BOXES AND MOVE TO K13.

   NO    YES

b  You told me earlier that you had period(s) when you felt (depressed/high/persistently irritable).

   Were the beliefs and experiences you just described (SYMPTOMS CODED YES FROM K1a TO K7a) restricted exclusively to times when you were feeling depressed/high/irritable?

   IF THE PATIENT EVER HAD A PERIOD OF AT LEAST 2 WEEKS OF HAVING THESE BELIEFS OR EXPERIENCES (PSYCHOTIC SYMPTOMS) WHEN THEY WERE NOT DEPRESSED/HIGH/IRRITABLE, CODE NO TO THIS DISORDER.

   IF THE ANSWER IS NO TO THIS DISORDER, ALSO CIRCLE NO TO K12 AND MOVE TO K13

K12 a ARE 1 OR MORE « b » QUESTIONS FROM K1b TO K7b CODED YES OR YES BIZARRE AND IS EITHER:

   MAJOR DEPRESSIVE EPISODE, (CURRENT)
   OR
   MANIC OR HYPOMANIC EPISODE, (CURRENT) CODED YES?

   IF THE ANSWER IS YES TO THIS DISORDER (LIFETIME OR CURRENT), CIRCLE NO TO K13 AND K14 AND MOVE TO THE NEXT MODULE.

   NO    YES

   MOOD DISORDER WITH PSYCHOTIC FEATURES

   LIFETIME

   NO    YES

   MOOD DISORDER WITH PSYCHOTIC FEATURES

   CURRENT
K13 ARE 1 OR MORE « b » QUESTIONS FROM K1b TO K6b, CODED YES BIZARRE?

OR

ARE 2 OR MORE « b » QUESTIONS FROM K1b TO K10b, CODED YES (RATHER THAN YES BIZARRE)?

AND DID AT LEAST TWO OF THE PSYCHOTIC SYMPTOMS OCCUR DURING THE SAME 1 MONTH PERIOD?

K14 IS K13 CODED YES

OR

ARE 1 OR MORE « a » QUESTIONS FROM K1a TO K6a, CODED YES BIZARRE?

OR

ARE 2 OR MORE « a » QUESTIONS FROM K1a TO K7a, CODED YES (RATHER THAN YES BIZARRE)

AND DID AT LEAST TWO OF THE PSYCHOTIC SYMPTOMS OCCUR DURING THE SAME 1 MONTH PERIOD?
**L. ANOREXIA NERVOSA**

**(› MEANS: GO TO THE DIAGNOSTIC BOX, CIRCLE NO, AND MOVE TO THE NEXT MODULE)**

<table>
<thead>
<tr>
<th>L1</th>
<th>a. How tall are you?</th>
<th>ft</th>
<th>in.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b. What was your lowest weight in the past 3 months?</td>
<td>lbs.</td>
<td>kgs.</td>
</tr>
<tr>
<td></td>
<td>c. Is patient's weight equal to or below the threshold corresponding to his/her height? (see table below)</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

**In the past 3 months:**

| L2 | In spite of this low weight, have you tried not to gain weight? | NO | YES |
| L3 | Have you intensely feared gaining weight or becoming fat, even though you were underweight? | NO | YES |

| L4 | a. Have you considered yourself too big / fat or that part of your body was too big / fat? | NO | YES |
|    | b. Has your body weight or shape greatly influenced how you felt about yourself? | NO | YES |
|    | c. Have you thought that your current low body weight was normal or excessive? | NO | YES |

| L5 | Are 1 or more items from L4 coded YES? | NO | YES |

| L6 | For women only: During the last 3 months, did you miss all your menstrual periods when they were expected to occur (when you were not pregnant)? | NO | YES |

**FOR WOMEN: ARE L5 AND L6 CODED YES?**

**FOR MEN: IS L5 CODED YES?**

---

**HEIGHT / WEIGHT TABLE CORRESPONDING TO A BMI THRESHOLD OF 17.5 KG/M²**

<table>
<thead>
<tr>
<th>Height/Weight</th>
<th>ft/in</th>
<th>4'9</th>
<th>4'10</th>
<th>4'11</th>
<th>5'0</th>
<th>5'1</th>
<th>5'2</th>
<th>5'3</th>
<th>5'4</th>
<th>5'5</th>
<th>5'6</th>
<th>5'7</th>
<th>5'8</th>
<th>5'9</th>
<th>5'10</th>
</tr>
</thead>
<tbody>
<tr>
<td>lbs.</td>
<td></td>
<td>81</td>
<td>84</td>
<td>87</td>
<td>89</td>
<td>92</td>
<td>96</td>
<td>99</td>
<td>102</td>
<td>105</td>
<td>108</td>
<td>112</td>
<td>115</td>
<td>118</td>
<td>122</td>
</tr>
<tr>
<td>cm</td>
<td></td>
<td>145</td>
<td>147</td>
<td>150</td>
<td>152</td>
<td>155</td>
<td>158</td>
<td>160</td>
<td>163</td>
<td>165</td>
<td>168</td>
<td>170</td>
<td>173</td>
<td>175</td>
<td>178</td>
</tr>
<tr>
<td>kgs</td>
<td></td>
<td>37</td>
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<table>
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<th>Height/Weight</th>
<th>ft/in</th>
<th>5'11</th>
<th>6'0</th>
<th>6'1</th>
<th>6'2</th>
<th>6'3</th>
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<td>lbs.</td>
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<td>180</td>
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<td>57</td>
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The weight thresholds above are calculated using a body mass index (BMI) equal to or below 17.5 kg/m² for the patient’s height. This is the threshold guideline below which a person is deemed underweight by the DSM-IV and the ICD-10 Diagnostic Criteria for Research for Anorexia Nervosa.
## M. BULIMIA NERVOSA

(➤ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

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<tr>
<th></th>
<th></th>
<th>➤</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>In the past three months, did you have eating binges or times when you ate a very large amount of food within a 2-hour period?</td>
<td>NO</td>
<td>YES</td>
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<tr>
<td>M2</td>
<td>In the last 3 months, did you have eating binges as often as twice a week?</td>
<td>NO</td>
<td>YES</td>
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<tr>
<td>M3</td>
<td>During these binges, did you feel that your eating was out of control?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>M4</td>
<td>Did you do anything to compensate for, or to prevent a weight gain from these binges, like vomiting, fasting, exercising or taking laxatives, enemas, diuretics (fluid pills), or other medications?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>M5</td>
<td>Does your body weight or shape greatly influence how you feel about yourself?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>M6</td>
<td>DO THE PATIENT’S SYMPTOMS MEET CRITERIA FOR ANOREXIA NERVOSA?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>M7</td>
<td>Do these binges occur only when you are under ( ____ lbs./kgs.)? INTERVIEWER: WRITE IN THE ABOVE PARENTHESIS THE THRESHOLD WEIGHT FOR THIS PATIENT’S HEIGHT FROM THE HEIGHT / WEIGHT TABLE IN THE ANOREXIA NERVOSA MODULE.</td>
<td>NO</td>
<td>YES</td>
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</tbody>
</table>

### M8

IS M5 CODED YES AND IS EITHER M6 OR M7 CODED NO?

IS M7 CODED YES?

#### NO YES

**BULIMIA NERVOSA CURRENT**

#### NO YES

**ANOREXIA NERVOSA**

*Binge Eating/Purging Type CURRENT*
## N. GENERALIZED ANXIETY DISORDER

(➤ MEANS: GO TO THE DIAGNOSTIC BOX, CIRCLE NO, AND MOVE TO THE NEXT MODULE)

<table>
<thead>
<tr>
<th>N1</th>
<th>a. Were you excessively anxious or worried about several routine things, over the past 6 months?</th>
<th>➤</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IN ENGLISH, IF THE PATIENT IS UNCLEAR ABOUT WHAT YOU MEAN, PROBE BY ASKING (Do others think that you are a “worry wart”) AND GET EXAMPLES.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Are these anxieties and worries present most days?</td>
<td>➤</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>ARE THE PATIENT’S ANXIETY AND WORRIES RESTRICTED EXCLUSIVELY TO, OR BETTER EXPLAINED BY, ANY DISORDER PRIOR TO THIS POINT?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| N2   | Do you find it difficult to control the worries?                                                | ➤ | NO | YES |

| N3   | FOR THE FOLLOWING, CODE NO IF THE SYMPTOMS ARE CONFINED TO FEATURES OF ANY DISORDER EXPLORED PRIOR TO THIS POINT. | ➤ | NO | YES |

### When you were anxious over the past 6 months, did you, most of the time:

| a. Feel restless, keyed up or on edge?                                                          | NO | YES |
| b. Have muscle tension?                                                                         | NO | YES |
| c. Feel tired, weak or exhausted easily?                                                         | NO | YES |
| d. Have difficulty concentrating or find your mind going blank?                                  | NO | YES |
| e. Feel irritable?                                                                              | NO | YES |
| f. Have difficulty sleeping (difficulty falling asleep, waking up in the middle of the night, early morning wakening or sleeping excessively)? | ➤ | NO | YES |

ARE 3 OR MORE N3 ANSWERS CODED YES?

| N4   | Do these anxieties and worries disrupt your normal work, school or social functioning or cause you significant distress? | ➤ | NO | YES |

### O. RULE OUT MEDICAL, ORGANIC OR DRUG CAUSES FOR ALL DISORDERS

IF THE PATIENT CODES POSITIVE FOR ANY CURRENT DISORDER ASK:

**Just before these symptoms began:**

| O1a  | Were you taking any drugs or medicines?                                                         | ☐ No  | ☐ Yes  | ☐ Uncertain |
| O1b  | Did you have any medical illness?                                                              | ☐ No  | ☐ Yes  | ☐ Uncertain |

IN THE CLINICIAN’S JUDGMENT: ARE EITHER OF THESE LIKELY TO BE DIRECT CAUSES OF THE PATIENT’S DISORDER?

IF NECESSARY ASK ADDITIONAL OPEN-ENDED QUESTIONS.

| O2   | SUMMARY: HAS AN ORGANIC CAUSE BEEN RULED OUT?                                                  | ☐ No  | ☐ Yes  | ☐ Uncertain |

M.I.N.I. 6.0.0 (January 1, 2009)
P. ANTISOCIAL PERSONALITY DISORDER

((DIR) MEANS : GO TO THE DIAGNOSTIC BOX AND CIRCLE NO)

P1 Before you were 15 years old, did you:

a repeatedly skip school or run away from home overnight? NO YES

b repeatedly lie, cheat, "con" others, or steal? NO YES

c start fights or bully, threaten, or intimidate others? NO YES

d deliberately destroy things or start fires? NO YES

e deliberately hurt animals or people? NO YES

f force someone to have sex with you? NO YES

ARE 2 OR MORE P1 ANSWERS CODED YES? NO YES

DO NOT CODE YES TO THE BEHAVIORS BELOW IF THEY ARE EXCLUSIVELY POLITICALLY OR RELIGIOUSLY MOTIVATED.

P2 Since you were 15 years old, have you:

a repeatedly behaved in a way that others would consider irresponsible, like failing to pay for things you owed, deliberately being impulsive or deliberately not working to support yourself? NO YES

b done things that are illegal even if you didn't get caught (for example, destroying property, shoplifting, stealing, selling drugs, or committing a felony)? NO YES

c been in physical fights repeatedly (including physical fights with your spouse or children)? NO YES

d often lied or "conned" other people to get money or pleasure, or lied just for fun? NO YES

e exposed others to danger without caring? NO YES

f felt no guilt after hurting, mistreating, lying to, or stealing from others, or after damaging property? NO YES

ARE 3 OR MORE P2 QUESTIONS CODED YES? NO YES

ANTISOCIAL PERSONALITY DISORDER LIFETIME

THIS CONcludes THE INTERVIEW
REFERENCES


Scientific committee for the MINI 6.0.0:
A. Carlo Altamura, Milano, Italy
Cyril Hoschli, Praha, Czech Republic
George Papadimitriou, Athens, Greece
Hans Ågren, Göteborg, Sweden
Hans-Jürgen Möller, München, Germany
Hans-Ulrich Wittchen, Dresden, Germany
István Bitter, Budapest, Hungary
Jean-Pierre Lépine, Paris, France
Jules Angst, Zurich, Switzerland
Julio Bobes, Oviedo, Spain
Luciano Conti, Pisa, Italy
Marelli Colon-Soto MD, Puerto Rico, United States
Michael Van Ameringen MD, Toronto, Canada
Rosario Hidalgo MD, Tampa, United States
Siegfried Kasper, Vienna, Austria
Thomas Schläepfer, Bonn, Germany

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<th>Translations</th>
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M.I.N.I. 6.0.0 (January 1, 2009) 27
A validation study of this instrument was made possible, in part, by grants from SmithKline Beecham and the European Commission. The authors are grateful to Dr. Pauline Powers for her advice on the modules on Anorexia Nervosa and Bulimia.
MOOD DISORDERS: DIAGNOSTIC ALGORITHM

Consult Modules:
- A Major Depressive Episode
- C (Hypo) manic Episode
- K Psychotic Disorders

MODULE K:

1a IS K11b CODED YES? NO YES
1b IS K12a CODED YES? NO YES

MODULES A and C:

2a CIRCLE YES IF A DELUSIONAL IDEA IS IDENTIFIED IN A3e? YES YES
2b CIRCLE YES IF A DELUSIONAL IDEA IS IDENTIFIED IN C3a? YES YES

c Is a Major Depressive Episode coded YES (current or past)?
and is Manic Episode coded NO (current and past)?
and is Hypomanic Episode coded NO (current and past)?
and is “Hypomanic Symptoms” coded NO (current and past)?

Specify:
- If the depressive episode is current or past or both
- With Psychotic Features Current: If 1b or 2a (current) = YES
  With Psychotic Features Past: If 1a or 2a (past) = YES

d Is a Manic Episode coded YES (current or past)?

Specify:
- If the Bipolar I Disorder is current or past or both
- With Single Manic Episode: If Manic episode (current or past) = YES
  and MDE (current and past) = NO
- With Psychotic Features Current: If 1b or 2a (current) or 2b (current) = YES
  With Psychotic Features Past: If 1a or 2a (past) or 2b (past) = YES
- If the most recent episode is manic, depressed, mixed or hypomanic or unspecified (all mutually exclusive)
- Unspecified if the Past Manic Episode is coded YES AND
  Current (C3 Summary AND C4a AND C6 AND O2) are coded YES

MAJOR DEPRESSIVE DISORDER

current past
MDD 

With Psychotic Features
Current
Past

BIPOLAR I DISORDER

current past
Bipolar I Disorder
Single Manic Episode

With Psychotic Features
Current
Past

Most Recent Episode
Manic
Depressed
Mixed
Hypomanic
Unspecified

M.I.N.I. 6.0.0 (January 1, 2009) 29
e Is Major Depressive Episode coded YES (current or past)?
and
Is Hypomanic Episode coded YES (current or past)?
and
Is Manic Episode coded NO (current and past)?

Specify:
• If the Bipolar Disorder is current or past or both
• If the most recent mood episode is hypomanic or depressed (mutually exclusive)

f Is MDE coded NO (current and past)
and
Is Manic Episode coded NO (current and past)?
and is either:

1) C7b coded YES for the appropriate time frame?
or

2) C3 Summary coded YES for the appropriate time frame?
and
C4a coded YES for the appropriate time frame?
and
C7c coded YES for the appropriate time frame?

Specify if the Bipolar Disorder NOS is current or past or both
M.I.N.I. PLUS

The shaded modules below are additional modules available in the MINI PLUS beyond what is available in the standard MINI. The un-shaded modules below are in the standard MINI.

These MINI PLUS modules can be inserted into or used in place of the standard MINI modules, as dictated by the specific needs of any study.

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<td>A MAJOR DEPRESSIVE EPISODE</td>
<td>Current (2 weeks) Past Recurrent</td>
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<td>MOOD DISORDER DUE TO A GENERAL MEDICAL CONDITION</td>
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<td>SUBSTANCE INDUCED MOOD DISORDER</td>
<td>Current Past</td>
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<tr>
<td>MDE WITH MELANCHOLIC FEATURES</td>
<td>Current (2 weeks)</td>
</tr>
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<td>MDE WITH ATYPICAL FEATURES</td>
<td>Current (2 weeks)</td>
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<td>MDE WITH CATATONIC FEATURES</td>
<td>Current (2 weeks)</td>
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<td>B DYSTHYMIA</td>
<td>Current (Past 2 years) Past</td>
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<tr>
<td>C SUICIDALITY</td>
<td>Current (Past Month) Risk: Q Low Q Medium Q High</td>
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<td>D MANIC EPISODE</td>
<td>Current Past</td>
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<td>HYPOMANIC EPISODE</td>
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<td>BIPOLAR I DISORDER</td>
<td>Current Past</td>
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<td>BIPOLAR II DISORDER</td>
<td>Current Past</td>
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<td>BIPOLAR DISORDER NOS</td>
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<td>E PANIC DISORDER</td>
<td>Current (Past Month) Lifetime</td>
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<td>F AGORAPHOBIA</td>
<td>Current</td>
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<td>G SOCIAL PHOBIA (Social Anxiety Disorder)</td>
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<td>H SPECIFIC PHOBIA</td>
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<td>I OBSESSIVE-COMPULSIVE DISORDER</td>
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<td>SUBSTANCE INDUCED OCD</td>
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<td>J POSTTRAUMATIC STRESS DISORDER</td>
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<td>K ALCOHOL DEPENDENCE</td>
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<td><strong>O</strong> BULIMIA NERVOSA</td>
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<td><strong>P</strong> GENERALIZED ANXIETY DISORDER</td>
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California Verbal Learning Test—Second Edition
Dean C. Delis  Joel H. Kramer  Edith Kaplan  Beth A. Ober

ID#: __________________  Examiner: __________________

Sex: □ F  □ M  Race/Ethnicity: __________________________  Education (years): ___________
Handedness: □ R  □ L  □ Ambidextrous  Hearing adequate? □ Y  □ N  Hearing aid? □ Y  □ N
First language: ________________  Preferred language: ____________  Effort appear adequate? □ Y  □ ?  □ N
Affect and mood: ____________________________  Physical appearance: __________________________
Other behaviors: ____________________________
Major complaints: ____________________________
Diagnostic history: ____________________________
Current medications: ____________________________

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</tr>
<tr>
<td>Trial 4 Free Recall</td>
<td>Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 5 Free Recall</td>
<td>Correct</td>
<td></td>
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</tr>
<tr>
<td>Trials 1–5 Free Recall Total</td>
<td>Correct</td>
<td>(T score)</td>
<td>Total Repetitions</td>
<td>(All Recall Trials)</td>
</tr>
<tr>
<td>List B Free Recall</td>
<td>Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-Delay Free Recall</td>
<td>Correct</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Short-Delay Cued Recall</td>
<td>Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Delay Free Recall</td>
<td>Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Delay Cued Recall</td>
<td>Correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free-Recall Intrusions (Immediate &amp; Delayed, All Types)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cued-Recall Intrusions (All Types)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Intrusions (All Recall Trials, All Types)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Delay Yes/No Recognition Hits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Delay Yes/No Recognition False-Positives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Delay Forced-Choice Recognition Accuracy</td>
<td>(# hits _____ /16) × 100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Product Number 0154035742
List A Immediate Free Recall Trial 1
I'm going to read a list of words to you. Listen carefully, because when I'm through, I want you to tell me as many of the words as you can. You can say them in any order, just say as many of them as you can. Are you ready?

Read List A at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. Then say: Go ahead.

<table>
<thead>
<tr>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
<th>Trial 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>truck</td>
<td>bookcase</td>
<td>cabinet</td>
<td>boat</td>
<td></td>
</tr>
<tr>
<td>spinach</td>
<td>giraffe</td>
<td>zebra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>giraffe</td>
<td>submarine</td>
<td>lamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>onion</td>
<td>celery</td>
<td>cow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>motorcycle</td>
<td>desk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cabinet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>zebra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>subway</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lamp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>celery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>desk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>boat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List A Immediate Free Recall

Record all responses verbatim, in the order recalled. Prompt only once (e.g., Anything else?) at the end of each free and cued recall trial (i.e., after 15 seconds with no response or when the examinee says he/she cannot remember more words).
List B Immediate Free Recall
Now I'm going to read a second list of words to you. When I'm through, I want you to tell me as many words from this second list as you can, in any order. Don't tell me words from the first list, just this second list.

Read List B at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. Then say: Go ahead.

List B
- violin
- cucumber
- elephant
- closet
- turnip
- guitar
- basement
- sheep
- clarinet
- garage
- corn
- rabbit
- patio
- saxophone
- tiger
- radishes

List A Short-Delay Free Recall
Now I want you to tell me all the words you can from the first list, the one I read to you several times. Don't tell me words from the second list, just the first list. Go ahead.

List A
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

List A Short-Delay Cued Recall
Tell me all the words from the first list that are furniture.
Tell me all the words from the first list that are vegetables.
Tell me all the words from the first list that are ways of traveling.
Tell me all the words from the first list that are animals.

Furniture
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Vegetables
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Ways of Traveling
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Animals
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

Total Correct C
Total Repetitions R
Total Intrusions I

There should be approximately a 20-minute delay between the completion of Short-Delay Cued Recall and the start of Long-Delay Free Recall. Do not inform the examinee that there will be later CVLT-II trials.
List A Long-Delay Free Recall
I read two different lists of words to you earlier: a first list that I read to you several times, and a second list that I read to you once. Tell me all the words you can that were from the first list. Don’t tell me words from the second list, just the first list. Go ahead.

List A

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
</table>

List A Long-Delay Cued Recall
Tell me all the words from the first list that are furniture. Tell me all the words from the first list that are vegetables. Tell me all the words from the first list that are ways of traveling. Tell me all the words from the first list that are animals.

<table>
<thead>
<tr>
<th>Furniture</th>
<th>Resp Type</th>
<th>Vegetables</th>
<th>Resp Type</th>
<th>Ways of Traveling</th>
<th>Resp Type</th>
<th>Animals</th>
<th>Resp Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
<td></td>
<td>2</td>
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</tr>
<tr>
<td>3</td>
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<td>3</td>
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<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
<td></td>
<td>4</td>
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<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
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<td>5</td>
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<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
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<td>6</td>
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<tr>
<td>7</td>
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<td>7</td>
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</tr>
<tr>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Total Correct C
Total Repetitions R
Total Intrusions I

List A Long-Delay Yes/No Recognition
Now I’m going to read more words to you. After I read each one, say “Yes” if that word was from the first list, or say “No” if it was not from the first list.

<table>
<thead>
<tr>
<th>Response</th>
<th>Item Type</th>
<th>Response</th>
<th>Item Type</th>
<th>Response</th>
<th>Item Type</th>
<th>Response</th>
<th>Item Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>wallet</td>
<td>Y N UN</td>
<td>violin</td>
<td>Y N BN</td>
<td>dog</td>
<td>Y N PR</td>
<td>turnip</td>
<td>Y N BS</td>
</tr>
<tr>
<td>boat</td>
<td>Y N T</td>
<td>cow</td>
<td>Y N T</td>
<td>bookcase</td>
<td>Y N T</td>
<td>cabinet</td>
<td>Y N T</td>
</tr>
<tr>
<td>saxophone</td>
<td>Y N BN</td>
<td>fork</td>
<td>Y N UN</td>
<td>matches</td>
<td>Y N UN</td>
<td>onion</td>
<td>Y N T</td>
</tr>
<tr>
<td>cucumber</td>
<td>Y N BS</td>
<td>bus</td>
<td>Y N PR</td>
<td>spinach</td>
<td>Y N T</td>
<td>lion</td>
<td>Y N PR</td>
</tr>
<tr>
<td>giraffe</td>
<td>Y N T</td>
<td>celery</td>
<td>Y N T</td>
<td>clarinet</td>
<td>Y N BN</td>
<td>camera</td>
<td>Y N UN</td>
</tr>
<tr>
<td>carrot</td>
<td>Y N PR</td>
<td>lamp</td>
<td>Y N T</td>
<td>truck</td>
<td>Y N T</td>
<td>guitar</td>
<td>Y N BN</td>
</tr>
<tr>
<td>patio</td>
<td>Y N BN</td>
<td>radishes</td>
<td>Y N BS</td>
<td>rabbit</td>
<td>Y N BS</td>
<td>subway</td>
<td>Y N T</td>
</tr>
<tr>
<td>cabbage</td>
<td>Y N T</td>
<td>table</td>
<td>Y N PR</td>
<td>chair</td>
<td>Y N PR</td>
<td>tiger</td>
<td>Y N BS</td>
</tr>
<tr>
<td>desk</td>
<td>Y N T</td>
<td>rose</td>
<td>Y N UN</td>
<td>corn</td>
<td>Y N BS</td>
<td>coffee</td>
<td>Y N UN</td>
</tr>
<tr>
<td>bracelet</td>
<td>Y N UN</td>
<td>motorcycle</td>
<td>Y N T</td>
<td>seashell</td>
<td>Y N UN</td>
<td>zebra</td>
<td>Y N T</td>
</tr>
<tr>
<td>car</td>
<td>Y N PR</td>
<td>sheep</td>
<td>Y N BS</td>
<td>garage</td>
<td>Y N BN</td>
<td>lettuce</td>
<td>Y N PR</td>
</tr>
<tr>
<td>elephant</td>
<td>Y N BS</td>
<td>basement</td>
<td>Y N BN</td>
<td>squirrel</td>
<td>Y N T</td>
<td>closet</td>
<td>Y N BN</td>
</tr>
</tbody>
</table>

T = Target
Distractor Types: BS = List B Shared; BN = List B Non-Shared; PR = Prototypical; UN = Unrelated

There should be approximately a 10-minute delay between the completion of Yes/No Recognition and the start of Forced-Choice Recognition. Do not inform the examinee that there will be a later CVLT-II trial.
List A Long-Delay Forced-Choice Recognition (Optional)

Earlier, I read some lists of words to you, remember? Now I am going to read some words two at a time. After I read both words, say which of the words was from the first list, the one I read to you several times. It may be difficult to remember which one to pick, but even if it's hard for you, just try your best. Ready?

Was boat or flag on the first list?

Was ____ or ____ on the first list?

Circle the examinee's responses.

If the examinee says "I don't know," say, "I know it may be difficult, but just take your best guess."

<table>
<thead>
<tr>
<th>word</th>
<th>distractor</th>
<th>type</th>
</tr>
</thead>
<tbody>
<tr>
<td>boat</td>
<td>flag</td>
<td>C</td>
</tr>
<tr>
<td>cake</td>
<td>desk</td>
<td>C</td>
</tr>
<tr>
<td>majority</td>
<td>cow</td>
<td>A</td>
</tr>
<tr>
<td>celery</td>
<td>aspirin</td>
<td>C</td>
</tr>
<tr>
<td>bookcase</td>
<td>silence</td>
<td>A</td>
</tr>
<tr>
<td>blender</td>
<td>truck</td>
<td>C</td>
</tr>
<tr>
<td>onion</td>
<td>logic</td>
<td>A</td>
</tr>
<tr>
<td>baseball</td>
<td>zebra</td>
<td>C</td>
</tr>
<tr>
<td>instruction</td>
<td>cabinet</td>
<td>A</td>
</tr>
<tr>
<td>squirrel</td>
<td>direction</td>
<td>A</td>
</tr>
<tr>
<td>blanket</td>
<td>cabbage</td>
<td>C</td>
</tr>
<tr>
<td>subway</td>
<td>technique</td>
<td>A</td>
</tr>
<tr>
<td>height</td>
<td>spinach</td>
<td>A</td>
</tr>
<tr>
<td>giraffe</td>
<td>towel</td>
<td>C</td>
</tr>
<tr>
<td>subject</td>
<td>motorcycle</td>
<td>A</td>
</tr>
<tr>
<td>lamp</td>
<td>sprinkler</td>
<td>C</td>
</tr>
</tbody>
</table>

Distractor types: C = concrete; A = abstract

Total Hits

Total Accuracy: (_____/16) × 100 = ____%
## Record Form A

**Subject #**

**Age**

**Sex**

**Education Level**

**Examiner**

**Date of Testing**

**Ethnicity**

**Observations:**

<table>
<thead>
<tr>
<th>Immediate Memory</th>
<th>Visuospatial/Constructional</th>
<th>Language</th>
<th>Attention</th>
<th>Delayed Memory</th>
<th>Total Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confidence Interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Percentile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index Score</th>
<th>Percentile Rank</th>
<th>Total Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>&gt;99.9</td>
<td>160</td>
</tr>
<tr>
<td>155</td>
<td>&gt;99.9</td>
<td>155</td>
</tr>
<tr>
<td>150</td>
<td>&gt;99.9</td>
<td>150</td>
</tr>
<tr>
<td>145</td>
<td>&gt;99.9</td>
<td>145</td>
</tr>
<tr>
<td>140</td>
<td>99.9</td>
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</tr>
<tr>
<td>50</td>
<td>&lt;0.1</td>
<td>50</td>
</tr>
<tr>
<td>45</td>
<td>&lt;0.1</td>
<td>45</td>
</tr>
<tr>
<td>40</td>
<td>&lt;0.1</td>
<td>40</td>
</tr>
</tbody>
</table>
## List Learning

**Trial 1**
Say *I am going to read you a list of words. I want you to listen carefully and, when I finish, repeat back as many words as you can. You don’t have to say them in the same order that I do—just repeat back as many words as you can remember, in any order. Okay?*

**Trials 2–4**
Say *I am going to read the list again. When I finish, repeat back as many words as you can, even if you have already said them before. Okay?*

Record responses in order.
Scoring: 1 point for each word correctly recalled on each trial.

<table>
<thead>
<tr>
<th>List</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Package</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elbow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Story</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bubble</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saddle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powder</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number Correct</th>
<th>Total Trial 1</th>
<th>Total Trial 2</th>
<th>Total Trial 3</th>
<th>Total Trial 4</th>
<th>Total Score Range=0–40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Story Memory**

**Trial 1**
Say *I am going to read you a short story. I'd like you to listen carefully and, when I finish, repeat back as much of the story as you can remember. Try and use the same wording, if you can. Okay?*
Read the story below, then say *Now repeat back as much of that story as you can.*

**Trial 2**
Say *I am going to read that same story again. When I finish, I want you to again repeat back as much of the story as you can remember. Try to repeat it as exactly as you can.*
Read the story below, then say *Now repeat back as much of that story as you can.*

Scoring: 1 point for verbatim recall of bold, italic words or alternatives, shown below in color within parentheses. Record intrusions or variations in the Responses column.

<table>
<thead>
<tr>
<th>Story</th>
<th>Responses</th>
<th>Trial 1 Score (0 or 1)</th>
<th>Trial 2 Score (0 or 1)</th>
<th>Item Score (0–2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On <em>Tuesday,</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. <em>May</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. <em>Fourth,</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. in <em>Cleveland,</em> Ohio,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. a <em>3 alarm</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. <em>fire</em> broke out.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. <em>Two</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. <em>hotels</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. and a <em>restaurant</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. were <em>destroyed</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. before the <em>firefighters (firemen)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. were able to <em>extinguish it (put it out).</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Score (Trial 1 + Trial 2)
Range=0–24
Figure Copy

Fold this page back and present the Figure Copy Drawing Page along with the stimulus. Ask the examinee to make an exact copy of the figure. Tell the examinee that he or she is being timed, but that the score is based only on the exactness of his or her copy.

Scoring: 1 point for correctness and completeness (drawing), and 1 point for proper placement. See Appendix 1 in Stimulus Booklet A for complete scoring criteria and scoring examples.

---

**Figure Copy Criteria**
*(Fold back for use.)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Drawing (0 or 1)</th>
<th>Placement (0 or 1)</th>
<th>Score (0, 1, or 2)</th>
<th>Scoring Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. rectangle</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: lines are unbroken and straight; angles 90 degrees; top/bottom lines 25% longer than sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: not rotated more than 15 degrees</td>
</tr>
<tr>
<td>2. diagonal cross</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: lines are unbroken and straight and should approximately bisect each other</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: ends of lines should meet corners of the rectangle without significant overlap or measurable distance between the ends of the lines and the corners</td>
</tr>
<tr>
<td>3. horizontal line</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: line is unbroken and straight; should not exceed 1/2 the length of the rectangle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: should bisect left side of the rectangle at approximately a right angle and intersect the diagonal cross</td>
</tr>
<tr>
<td>4. circle</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: round, unbroken and closed; diameter should be approximately 1/4–1/3 height of rectangle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: placed in appropriate segment; not touching any other part of figure</td>
</tr>
<tr>
<td>5. 3 small circles</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: round, unbroken and closed; equal size; triangular arrangement; not touching each other</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: in appropriate segment; not touching figure; triangle formed not rotated more than 15 degrees</td>
</tr>
<tr>
<td>6. square</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: must be closed; 90 degree angles; lines straight and unbroken; height is 1/4–1/3 height of rectangle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: in appropriate segment; not touching any other part of figure; not rotated more than 15 degrees</td>
</tr>
<tr>
<td>7. curving line</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: 2 curved segments are approximately equal in length and symmetrical; correct direction of curves</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: ends of line touch diagonal; do not touch corner of rectangle or intersection of diagonal lines</td>
</tr>
<tr>
<td>8. outside cross</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: vertical line of the outside cross is parallel to side of rectangle; &gt;1/2 the height of rectangle; horizontal line crosses vertical at 90 degree angle and is between 20–50% of length of vertical line</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: horizontal line of outside cross touches rectangle higher than 2/3 the height of rectangle, but below top; does not penetrate the rectangle</td>
</tr>
<tr>
<td>9. triangle</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: angle formed by 2 sides of triangle is between 60–100 degrees; sides are straight, unbroken and meet in a point; distance on vertical side of rectangle subsumed by triangle is approximately 50% of the height of vertical side</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: roughly centered on the left vertical side of the rectangle</td>
</tr>
<tr>
<td>10. arrow</td>
<td></td>
<td></td>
<td></td>
<td>Drawing: straight and unbroken; lines forming arrow are approximately equal in length and not more than 1/3 length of staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Placement: must protrude from appropriate corner of rectangle such that staff appears to be continuation of diagonal cross</td>
</tr>
</tbody>
</table>

Total Score
Range=0–20
### Line Orientation

Present the sample item, and say *These two lines down here* (indicate) *match two of the lines on top. Can you tell me the numbers, or point to the lines that they match?* Correct any errors and make sure the examinee understands the task. Continue with items 1–10.

**Scoring:** 1 point for each line correctly identified.

<table>
<thead>
<tr>
<th>Item</th>
<th>Responses</th>
<th>Correct Responses</th>
<th>Score (0, 1, or 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td></td>
<td>1, 7</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>10, 12</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>4, 11</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>6, 9</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>8, 13</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>2, 4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Responses</th>
<th>Correct Responses</th>
<th>Score (0, 1, or 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td></td>
<td>1, 6</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>3, 10</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td>5, 8</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td>1, 3</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td>11, 13</td>
<td></td>
</tr>
</tbody>
</table>

**Total Score**

**Range:** 0–20

### Picture Naming

Ask the examinee to name each picture. Give the semantic cue only if the picture is obviously misperceived.

**Scoring:** 1 point for each item that is correctly named spontaneously or following semantic cue.

<table>
<thead>
<tr>
<th>Item</th>
<th>Semantic Cue</th>
<th>Responses</th>
<th>Score (0 or 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. chair</td>
<td>a piece of furniture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. pencil</td>
<td>used for writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. well</td>
<td>you get water from it</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. giraffe</td>
<td>an animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. sailboat</td>
<td>used on the water (if “boat,” query “what kind”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. cannon</td>
<td>a weapon, used in war</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. pliers</td>
<td>a tool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. trumpet</td>
<td>a musical instrument (&quot;cornet&quot; okay)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. clothespin</td>
<td>used to hold laundry on a line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. kite</td>
<td>it's flown in the air</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Score**

**Range:** 0–10
**Semantic Fluency**

Say  *Now I'd like you to tell me the names of all of the different kinds of fruits and vegetables that you can think of. I'll give you one minute to come up with as many as you can. Ready?*

Scoring: 1 point for each correct response.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. 
18. 
19. 
20. 
21. 
22. 
23. 
24. 
25. 
26. 
27. 
28. 
29. 
30. 
31. 
32. 
33. 
34. 
35. 
36. 
37. 
38. 
39. 
40. 

Total Score
Range=0–40

**Digit Span**

Say  *I am going to say some numbers, and I want you to repeat them after me. Okay?*  
Read the numbers at the rate of 1 per second. Only read the second string in each set if the first string was failed. Discontinue after failure of both strings in any set.

Scoring: 2 points for the first string correct, 1 point for the second string correct, and 0 points for both strings failed.

<table>
<thead>
<tr>
<th>Item</th>
<th>First String</th>
<th>String Score (0 or 2)</th>
<th>Second String</th>
<th>String Score (0 or 1)</th>
<th>Item Score (0–2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>4–9</td>
<td></td>
<td>5–3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>8–3–5</td>
<td></td>
<td>2–4–1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>7–2–4–6</td>
<td></td>
<td>1–6–3–8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>5–3–9–2–4</td>
<td></td>
<td>3–8–4–9–1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>6–4–2–9–3–5</td>
<td></td>
<td>9–1–5–3–7–6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Score
Range=0–16
Say **Look at these boxes** (indicate key). **For each one of these marks there is a number that goes with it. Down here there are marks, but no numbers. I want you to fill in the number that goes with each mark.**

Demonstrate the first three. Say **Now I would like you to fill in the rest of these boxes up to the double lines** (indicate) **for practice.** Correct any errors as they are made. Make sure that the examinee understands the task and has correctly completed the sample items before you begin timing.

Say **Now I would like you to continue to fill in the numbers that match the marks. Go as quickly as you can without skipping any. When you reach the end of the line, go on to the next one. Ready? Go ahead.**

Redirect the examinee to the task if he or she becomes distracted. If the examinee is unable to comprehend the task, the subtest score is 0.

Scoring: 1 point for each item correctly coded within 90 seconds (do not score the sample items).

**Note:** Familiarize yourself with these instructions before administering this subtest.
### List Recall

Say *Do you remember the list of words that I read to you in the beginning? Tell me as many of those words as you can remember now.*

Scoring: 1 point for each word correctly recalled.

<table>
<thead>
<tr>
<th>List (Do not read)</th>
<th>Response</th>
<th>Score (0 or 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Package</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elbow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Story</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bubble</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saddle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powder</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Score
Range=0–10

### List Recognition

Say *I'm going to read you some words. Some of these words were on that list, and some of them weren't. I want you to tell me which words were on the list.* For each word, ask *Was ________ on the list?*

Scoring: 1 point for each word correctly identified. Circle the letter corresponding to examinee's response (y = yes, n = no); bold, capitalized (Y, N) letter indicates correct response.

<table>
<thead>
<tr>
<th></th>
<th>List</th>
<th>Circle One</th>
<th>List</th>
<th>Circle One</th>
<th>List</th>
<th>Circle One</th>
<th>List</th>
<th>Circle One</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>honey</td>
<td>y N</td>
<td>7.</td>
<td>velvet</td>
<td>y N</td>
<td>12.</td>
<td>prairie</td>
<td>y N</td>
</tr>
<tr>
<td>5.</td>
<td>fabric</td>
<td>y N</td>
<td>10.</td>
<td>Elbow</td>
<td>y N</td>
<td>15.</td>
<td>student</td>
<td>y N</td>
</tr>
</tbody>
</table>

Total Score
Range=0–20
### Story Recall

Say: *Do you remember that story about a fire that I read to you earlier? Tell me as many details from the story as you can remember now.*

Scoring: 1 point for each verbatim recall of bold, italic words or alternatives, shown below in color within parentheses. Record intrusions or variations in the Responses column.

<table>
<thead>
<tr>
<th>Story (Do not read.)</th>
<th>Responses</th>
<th>Item Score (0 or 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On <strong>Tuesday</strong>,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. <strong>May</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. <strong>Fourth,</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. in <strong>Cleveland</strong>, Ohio,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. a <strong>3 alarm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. <strong>fire</strong> broke out.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. <strong>Two</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. <strong>hotels</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. and a <strong>restaurant</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. were <strong>destroyed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. before the <strong>firefighters (firemen)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. were able to <strong>extinguish it (put it out)</strong>.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Score**
Range=0–12
Figure Recall

Say  **Do you remember that figure that I had you copy? I want you to draw as much of it as you can remember now. If you remember a part, but you’re not sure where it goes, put it anywhere. Try to draw as much of it as you can.**

Now, present the Figure Recall Drawing Page.

Scoring: 1 point for correctness and completeness (drawing), and 1 point for proper placement. See Appendix 1 in Stimulus BookletA for complete scoring criteria and scoring examples.

---

**Figure Recall Criteria**

(Fold back for use.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Drawing (0 or 1)</th>
<th>Placement (0 or 1)</th>
<th>Score (0, 1, or 2)</th>
<th>Scoring Criteria</th>
</tr>
</thead>
</table>
| 1. rectangle |                  |                    |                    | Drawing: lines are unbroken and straight; angles 90 degrees; top/bottom lines 25% longer than sides  
               |                  |                    |                    | Placement: not rotated more than 15 degrees                                                                                                       |
| 2. diagonal cross |            |                    |                    | Drawing: lines are unbroken and straight and should approximately bisect each other  
               |                  |                    |                    | Placement: ends of lines should meet corners of the rectangle without significant overlap or measurable distance between the ends of the lines and the corners |
| 3. horizontal line |                |                    |                    | Drawing: line is unbroken and straight; should not exceed 1/2 the length of the rectangle  
               |                  |                    |                    | Placement: should bisect left side of the rectangle at approximately a right angle and intersect the diagonal cross |
| 4. circle   |                  |                    |                    | Drawing: round, unbroken and closed; diameter should be approximately 1/4-1/3 height of rectangle  
               |                  |                    |                    | Placement: placed in appropriate segment; not touching any other part of figure                                                                  |
| 5. 3 small circles |              |                    |                    | Drawing: round, unbroken and closed; equal size; triangular arrangement; not touching each other  
               |                  |                    |                    | Placement: in appropriate segment; not touching figure; triangle formed not rotated more than 15 degrees                                         |
| 6. square   |                  |                    |                    | Drawing: must be closed; 90 degree angles; lines straight and unbroken; height is 1/4-1/3 height of rectangle  
               |                  |                    |                    | Placement: in appropriate segment; not touching any other part of figure; not rotated more than 15 degrees                                         |
| 7. curving line |                |                    |                    | Drawing: 2 curved segments are approximately equal in length and symmetrical; correct direction of curves  
               |                  |                    |                    | Placement: ends of line touch diagonal; do not touch corner of rectangle or intersection of diagonal lines |
| 8. outside cross |               |                    |                    | Drawing: vertical line of the outside cross is parallel to side of rectangle; >1/2 the height of rectangle;  
               |                  |                    |                    | horizontal line crosses vertical at 90 degree angle and is between 20-50% of length of vertical line  
               |                  |                    |                    | Placement: horizontal line of outside cross touches rectangle higher than 2/3 the height of rectangle, but below top; does not penetrate the rectangle |
| 9. triangle |                  |                    |                    | Drawing: angle formed by 2 sides of triangle is between 60–100 degrees; sides are straight, unbroken  
               |                  |                    |                    | and meet in a point; distance on vertical side of rectangle subsumed by triangle is approximately 50% of the  
               |                  |                    |                    | height of vertical side  
               |                  |                    |                    | Placement: roughly centered on the left vertical side of the rectangle                                                                 |
| 10. arrow   |                  |                    |                    | Drawing: straight and unbroken; lines forming arrow are approximately equal in length and not more than  
               |                  |                    |                    | 1/3 length of staff  
               |                  |                    |                    | Placement: must protrude from appropriate corner of rectangle such that staff appears to be continuation  
               |                  |                    |                    | of diagonal cross                                                                                                                                   |

---

Total Score
Range=0–20
Delis–Kaplan Executive Function System
Dean C. Delis  Edith Kaplan  Joel H. Kramer

Standard Record Form

ID: __________________________  Examiner: __________________________

Sex: ☐ F  ☐ M  Handedness: ☐ R  ☐ L  ☐ Ambidextrous

Highest Level of Education (years): __________

Current Grade (if applicable): __________

School (if applicable): __________________________

Date Tested

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
</table>

Age at Testing

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
</table>

Referral Source/Reason for Referral/Presenting Complaints:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Attitude Toward Testing: __________________________

__________________________________________________________________________

Affect and Mood: __________________________

__________________________________________________________________________

Unusual Behaviors and Comments: __________________________

__________________________________________________________________________

Physical Appearance: __________________________

__________________________________________________________________________

Visual/Auditory/Motor Problems: __________________________

__________________________________________________________________________

Language Background: __________________________

__________________________________________________________________________

Diagnostic History: __________________________

__________________________________________________________________________

__________________________________________________________________________

Current Medications: __________________________

__________________________________________________________________________
D-KEFS Trail Making Test: Summary of Scores

Primary Measures: Completion Times

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
</tr>
<tr>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
</tr>
</tbody>
</table>

Primary Combined Measure: Completion Times

Combined Number Sequencing + Letter Sequencing

Scaled Score + Scaled Score = Sum of Scaled Scores

Primary Contrast Measures: Completion Times

Switching: Scaled Score

<table>
<thead>
<tr>
<th>Condition</th>
<th>Scaled Score Difference</th>
<th>Contrast Scaled Score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Scanning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number Sequencing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Letter Sequencing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number Sequencing vs. Number Sequencing*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Letter Sequencing vs. Letter Sequencing*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Number Sequencing vs. Number-Letter Switching vs. Letter Sequencing*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Combined Number Sequencing + Letter Sequencing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Motor Speed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* A low or high contrast scaled score may reflect different cognitive problems; see examiner’s manual.

Optional Measures: Error Analysis

Condition 1: Visual Scanning

<table>
<thead>
<tr>
<th>Omission Errors</th>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
</table>

Condition 2: Number Sequencing

<table>
<thead>
<tr>
<th>Sequencing Errors</th>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
</table>

Condition 3: Letter Sequencing

<table>
<thead>
<tr>
<th>Set-Loss Errors</th>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
</table>

Condition 4: Number-Letter Switching

<table>
<thead>
<tr>
<th>Time-Discontinue Errors</th>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
</table>

Condition 5: Motor Speed

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
</table>

Note: Cumulative percentile ranks for the D-KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
D-KEFS Verbal Fluency Test

Condition 1: Letter Fluency

<table>
<thead>
<tr>
<th>First Interval: 1–15 Seconds</th>
<th>15–30&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second Interval: 16–30 Seconds</td>
<td>31–45&quot;</td>
</tr>
<tr>
<td>Third Interval: 31–45 Seconds</td>
<td>46–60&quot;</td>
</tr>
<tr>
<td>Fourth Interval: 46–60 Seconds</td>
<td>15–60&quot;</td>
</tr>
</tbody>
</table>

**F**
- Total Correct Responses
- Total Set-Loss Errors
- Total Repetition Errors

**A**
- Total Correct Responses
- Total Set-Loss Errors
- Total Repetition Errors

**S**
- Total Correct Responses
- Total Set-Loss Errors
- Total Repetition Errors

Letter Fluency: Total Responses* (Correct + Incorrect)

*Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total responses measure.
D-KEFS Verbal Fluency Test (continued)
Condition 2: Category Fluency

**Animals**

- **First Interval:** 1–15 Seconds
- **Second Interval:** 16–30 Seconds
- **Third Interval:** 31–45 Seconds
- **Fourth Interval:** 46–60 Seconds

**Boys’ Names**

- **First Interval:** 1–15 Seconds
- **Second Interval:** 16–30 Seconds
- **Third Interval:** 31–45 Seconds
- **Fourth Interval:** 46–60 Seconds

Category Fluency: Total Responses
(Correct + Incorrect)*

*Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total responses measure.*
D-KEFS Verbal Fluency Test (continued)

Condition 3: Category Switching

Fruits / Furniture

First Interval: 1–15 Seconds

Second Interval: 16–30 Seconds

Third Interval: 31–45 Seconds

Fourth Interval: 46–60 Seconds

Category Switching: Total Switching Accuracy

Fruits Total Correct Responses*

Furniture Total Correct Responses*

1°–15° Fruits + Furniture Correct Responses*

16°–30° Fruits + Furniture Correct Responses*

31°–45° Fruits + Furniture Correct Responses*

46°–60° Fruits + Furniture Correct Responses*

1°–60° Category Switching: Total Correct Responses*

Raw Score

Total Set-Loss Errors

Total Repetition Errors

* Correct responses are summed independent of switching accuracy.

** Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total responses measure.
D-KEFS Verbal Fluency Test: Summary of Scores

Primary Measures

<table>
<thead>
<tr>
<th>Condition 1: Letter Fluency</th>
<th>Condition 2: Category Fluency</th>
<th>Condition 3: Category Switching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Correct</td>
<td>Total Correct</td>
<td>Total Correct Responses</td>
</tr>
<tr>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
</tr>
<tr>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
</tr>
</tbody>
</table>

Primary Contrast Measures

Letter Fluency vs. Category Fluency*

\[
\text{Letter Fluency: Total Correct} - \text{Category Fluency: Total Correct} = \text{Scaled Score}^* \\
\text{Scaled Score} \quad \quad \quad \quad \quad \quad \text{Scaled Score}^* \\
\]

Category Switching vs. Category Fluency*

\[
\text{Category Switching: Total Correct Responses} - \text{Category Fluency: Total Correct} = \text{Scaled Score}^* \\
\text{Scaled Score} \quad \quad \quad \quad \quad \quad \text{Scaled Score}^* \\
\]

* A low or high contrast scaled score may reflect different cognitive problems; see examiner’s manual.

Optional Measures: Conditions 1–3 Combined

\[
\begin{align*}
\text{First Interval (1"–15")}: \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad = \quad \text{Total Correct} \\
\text{Second Interval (16"–30")}: \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad = \quad \text{Total Correct} \\
\text{Third Interval (31"–45")}: \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad = \quad \text{Total Correct} \\
\text{Fourth Interval (46"–60")}: \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad + \quad \text{Total Correct} & \quad = \quad \text{Total Correct} \\
\text{Set-Loss Errors} & \quad + \quad \text{Set-Loss Errors} & \quad + \quad \text{Set-Loss Errors} & \quad = \quad \text{Set-Loss Errors} \\
\text{Repetition Errors} & \quad + \quad \text{Repetition Errors} & \quad + \quad \text{Repetition Errors} & \quad = \quad \text{Repetition Errors} \\
\text{Total Responses} (\text{Correct + Incorrect})^* & \quad + \quad \text{Total Responses} & \quad + \quad \text{Total Responses} & \quad = \quad \text{Total Responses} \\
\end{align*}
\]

* Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total responses measure.

\[
\begin{align*}
\text{Percent Set-Loss Errors} & = \frac{\text{Total Set-Loss Errors}}{\text{Total Responses}^*} \times 100 \\
\text{Percent Repetition Errors} & = \frac{\text{Total Repetition Errors}}{\text{Total Responses}^*} \times 100 \\
\end{align*}
\]

\[
\begin{align*}
\text{Category Switching: Percent Switching Accuracy} (\text{Condition 3 Only}) & = \left( \frac{\text{Total Switching Accuracy}}{\text{Raw Score}} + 1 \right) \div \left( \frac{\text{Total Responses} \text{ Condition 3 Only}^*}{\text{Raw Score}} \right) \times 100 \\
\end{align*}
\]

* Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total responses measure.
D-KEFS Design Fluency Test: Summary of Scores

Primary Measures

Condition 1
Filled Dots: Total Correct  
Condition 2
Empty Dots Only: Total Correct  
Condition 3
Switching: Total Correct  
Design Fluency: Total Correct

Raw Score  +  Raw Score  +  Raw Score  =  Raw Score

Scaled Score  +  Scaled Score  +  Scaled Score  =  Scaled Score

Primary Combined Measure: Filled Dots + Empty Dots

Combined
Filled Dots + Empty Dots: Total Correct

Condition 1  
Condition 2  
Sum of
Scaled Scores  
Composite
Scaled Score

Filled Dots  +  Empty Dots

Scaled Score  +  Scaled Score  =  Scaled Score

Primary Contrast Measure

Switching vs. Combined
Filled Dots + Empty Dots*

Condition 3  
Conditions 1 + 2
Combined

Switching: Total Correct  
Scaled Score  -  Composite
Scaled Score  =  Scaled Score

Optional Measures

Condition 1
Filled Dots  
Condition 2
Empty Dots Only  
Condition 3
Switching

Total Set-Loss Designs  
Total Set-Loss Designs  
Total Set-Loss Designs

Total Set-Loss Designs
Raw Score  +  Raw Score  +  Raw Score  =  Raw Score

Repeated Designs  
Repeated Designs  
Repeated Designs

Total Repeated Designs
Raw Score  +  Raw Score  +  Raw Score  =  Raw Score

Attempted Designs  
Attempted Designs  
Attempted Designs

Total Attempted Designs*
Raw Score  +  Raw Score  +  Raw Score  =  Raw Score

* A low or high contrast scaled score may reflect different cognitive problems; see examiner's manual.

Percent Design Accuracy

Design Fluency: Total Correct  
Total Attempted Designs

Raw Score  ÷  Raw Score  × 100  =  Raw Score

* Note: Some repetition errors are coded also as set-loss errors; each double-coded error counts as only one response for the total attempted designs measure.
D-KEFS Color-Word Interference Test

Ages 8–89
Materials: Record Form, Stimulus Booklet (Flat Position), Stopwatch

Condition 1: Color Naming

Discontinue
Discontinue if the examinee has marked difficulty or makes four uncorrected errors on the practice lines. Otherwise, discontinue the scored task after 90 seconds.

Administration and Recording
Place the stimulus booklet flat on the table in a horizontal (landscape) position directly in front of the examinee so that the two practice lines of Condition 1 are positioned at the top of the page from the examinee's perspective. Say,

This page has patches of color on it. I'd like you to say the colors as quickly as you can without skipping any or making mistakes. When you finish this line (sweep across the first practice line of five squares with your finger), go on to this one (point to the first square of the second row). Now try these first two lines for practice.

If the examinee is able to complete the two practice lines, say, Good. Now, when I say begin, I want you to say the rest of the colors. Begin here (point to the first square on the first line of 10 squares below the practice lines) and say each color, one after the other, without skipping any. When you finish this line (sweep across the first row with your finger), go on to this one (point to the first square of the second row). Keep saying the colors until you reach the end of the last line (point). Say the colors as quickly as you can without making mistakes. Ready? Begin.

Start timing. Follow the examinee's progress item by item. Record errors by writing the first letter of the incorrect color name beneath the correct response and record any nonsense words (e.g., "bleen") verbatim. Indicate self-corrections by drawing a slash mark through the letter or word. Record total completion time in seconds.

Allow the examinee to use a finger to maintain his or her place on the stimulus page. If the examinee skips a line accidentally, point out the error immediately and redirect the examinee to the correct line. Keep the stopwatch running while pointing out line-skipping errors.

If the examinee does not complete the task at the end of 90 seconds, say, Stop. Indicate the last item attempted and record 90 seconds as the total completion time. Items to which the examinee did not respond because the time limit was reached are not counted as errors. Turn the page in the stimulus booklet to Condition 2: Word Reading.

```
  green  red  blue  green  blue
     red  blue  green  blue  green
  red  blue  red  green  red  blue  green  blue  red  green
  blue  green  red  green  red  green  blue  red  blue  green
  red  green  blue  red  green  red  green  blue  green  red
  blue  red  green  blue  red  green  blue  red  blue  green
  red  blue  red  green  blue  green  blue  red  blue  green
```

Condition 1: Color Naming

<table>
<thead>
<tr>
<th>Total Uncorrected Errors</th>
<th>Total Self-Corrected Errors</th>
<th>Total Time To Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D-KEFS Color-Word Interference Test (continued)

Condition 2: Word Reading

Discontinue
Discontinue if the examinee has marked difficulty or makes four uncorrected errors on the two practice lines. Otherwise, discontinue the scored task after 90 seconds.

Administration and Recording
Place the stimulus booklet flat on the table in a horizontal (landscape) position directly in front of the examinee, with the rows of words printed in black ink facing the examinee. Say,

Now look at this page with words printed on it. I'd like you to read the words aloud as quickly as you can without skipping any or making mistakes. When you finish this line (sweep across the first practice line of five words with your finger), go on to this one (point to the first word of the second row). Now try reading these first two lines for practice.

If the examinee is able to complete the two practice lines, say,

Good. Now, when I say begin, I want you to read the rest of the words. Begin here (point to the first word on the first line of 10 words below the practice lines) and read each word, one after the other, without skipping any. Keep reading the words until you reach the end (point to the last word on the last line). Read the words as quickly as you can without making mistakes. Ready? Begin.

Start timing. Follow the examinee's progress item by item. Record errors by writing the first letter of the incorrect word beneath the correct response and record any nonsense words (e.g., "bleen") verbatim. Indicate self-corrections by drawing a slash mark through the letter or word. Record total completion time in seconds.

Allow the examinee to use a finger to maintain his or her place on the stimulus page. If the examinee skips a line accidentally, point out the error immediately and redirect the examinee to the correct line. Keep the stopwatch running while pointing out line-skipping errors.

If the examinee does not complete the task at the end of 90 seconds, say, Stop. Indicate the last item attempted and record 90 seconds as the total completion time. Items to which the examinee did not respond because the time limit was reached are not counted as errors. Turn the page in the stimulus booklet to Condition 3: Inhibition.

red blue green red blue

green blue green red green

green red blue green blue red blue green blue green

red green blue green blue green red blue red green

red green blue green red blue green red blue red

blue green red blue green red blue green blue red

green red blue red blue green red blue red green

Condition 2: Word Reading

<table>
<thead>
<tr>
<th>Total Uncorrected Errors</th>
<th>Total Self-Corrected Errors</th>
<th>Total Time To Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Color
Condition 3: Inhibition

Discontinue
Discontinue if the examinee has marked difficulty or requires four corrections on the two practice lines. Otherwise, discontinue the scored task after 180 seconds.

Administration and Recording
Place the stimulus booklet flat on the table in a horizontal (landscape) position directly in front of the examinee, with the rows of words printed in dissonant ink colors facing the examinee. Say,

Now look at this page. It's going to be a little harder than the other pages because the color names are printed in a different-colored ink. For example (point to the first word on the first practice line of five words), do you see how the word red is printed in green ink here? This time, you are to name the color of the ink that the letters are printed in and not read the word. So, what would you say for this one? (Point again to the first word on the first practice line and allow the examinee to respond. Correct any errors.) Good. And this one? (Point to the next two practice items. Correct any errors.) Good. Now try these first two lines for practice.

If the examinee has difficulty understanding the task, you may demonstrate it by naming the ink colors on the first practice line, then inviting the examinee to respond to the second line. If the examinee requires four corrections on the two practice lines, discontinue the condition and do not administer Condition 4: Inhibition/Switching.

If the examinee is able to complete the two practice lines, say,

Good. Now, when I say begin, I want you to do the same thing for the rest of them. Say the color of the ink the letters are printed in; do not read the words. Begin here (point to the first word on the first line of 10 words below the practice lines) and say each ink color, one after the other, without skipping any. Keep saying the ink colors until you reach the end (point to the last word of the last line). Say the ink colors as quickly as you can without making mistakes. Ready? Begin.

Start timing. Follow the examinee's progress by item. The single letter (r for red, b for blue, g for green) printed in parentheses next to each correct response represents the error response if the examinee reads the word rather than naming the ink color. Record errors by circling the letter or by writing the initial letter of other incorrect colors beneath the correct response. Also record any nonsense words (e.g., "bleen") verbatim. Indicate self-corrections by drawing a slash through the letter or word. Record total completion time in seconds.

Allow the examinee to use a finger to maintain his or her place on the stimulus page. If the examinee skips a line accidentally, point out the error immediately and redirect the examinee to the correct line. Keep the stopwatch running while pointing out line-skipping errors.

If the examinee makes three consecutive errors of reading the words, prompt him or her to name the ink color. Provide this prompt only once during this condition and keep the stopwatch running.

If the examinee does not complete the task at the end of 180 seconds, say, Stop. Indicate the last item attempted and record 180 seconds as the total completion time. Items to which the examinee did not respond because the time limit was reached are not counted as errors. Turn the page in the stimulus booklet to Condition 4: Inhibition/Switching.

| green(r) | red(b) | blue(g) | green(b) | red(g) |
| blue(r) | red(b) | green(r) | red(g) | green(r) |
| red(b) | blue(g) | red(b) | green(r) | red(b) | blue(r) | green(b) | red(b) | green(r) |
| red(b) | blue(g) | green(b) | blue(g) | green(r) | blue(g) | red(b) | green(r) | red(b) | blue(g) |
| green(r) | blue(g) | green(r) | red(b) | blue(g) | green(r) | red(g) | blue(r) | green(b) | red(g) |
| green(b) | blue(g) | red(b) | green(r) | blue(g) | red(b) | green(r) | blue(g) | green(r) | red(g) |
| blue(g) | green(b) | blue(r) | red(b) | blue(g) | green(r) | red(b) | blue(g) | green(r) | red(b) |

Condition 3: Inhibition

| Total Uncorrected Errors | Total Self-Corrected Errors | Total Time To Complete | Color |
D-KEFS Color-Word Interference Test (continued)

Condition 4: Inhibition/Switching

Discontinue
Do not administer Condition 4 if the examinee had marked difficulty or did not finish before the time limit was reached on Condition 3: Inhibition. Discontinue if the examinee has marked difficulty or requires four corrections on the practice lines of Condition 4. Otherwise, discontinue the scored task after 180 seconds.

Administration and Recording
Place the stimulus booklet flat on the table in a horizontal (landscape) position directly in front of the examinee, with the rows of words printed in dissolvent ink colors, half of which are contained in rectangles, facing the examinee. Say,

This is the fourth and last page. This time, for many of the words, you are to do the same thing you just did: Name the color of the ink and do not read the words. But if a word is inside a little box, you should read the word and not name the ink color. (Point to the first three items in the first practice line of five words.) For example, what would you say for these first three words? (Allow the examinee to respond and provide corrections if necessary.) Good. Now try these first two lines for practice.

If the examinee has difficulty understanding the task, you may demonstrate it by responding to the items on the first practice line, then inviting the examinee to respond to the second line. If the examinee requires four corrections on the two practice lines, discontinue this condition. If the examinee is able to complete the practice lines, say,

Very good. Now, when I say begin, I want you to do the same thing for the rest of them. Say the color of the ink the letters are printed in or read the word if it is in a box. Begin here (point to the first word on the first line of 10 words below the practice lines) and keep going until you reach the end (point to the last word of the last line). Say the ink colors or words as quickly as you can without making mistakes. Ready? Begin.

Start timing. Follow the examinee’s progress item by item. The single letter (r for red, b for blue, g for green) printed in parentheses next to each correct response represents the error response if the examinee either (a) reads the word rather than naming the ink color for an item not contained in a rectangle or (b) names the ink color rather than reading the word for an item contained in a rectangle. Record errors by circling the letter or by writing the initial letter of other incorrect colors beneath the correct response. Also record any nonsense words (e.g., “bleen”) verbatim. Indicate self-corrections by drawing a slash through the letter or word. Record total completion time in seconds.

Allow the examinee to use a finger to maintain his or her place on the stimulus page. If the examinee skips a line accidentally, point out the error immediately and redirect the examinee to the correct line. Keep the stopwatch running while pointing out line-skipping errors.

If the examinee makes three consecutive errors, prompt him or her either to name the ink color or to read the word in the rectangle. Provide this prompt only once during this condition and keep the stopwatch running.

If the examinee does not complete the task at the end of 180 seconds, say, Stop. Indicate the last item attempted and record 180 seconds as the total completion time. Items to which the examinee did not respond because the time limit was reached are not counted as errors.

```plaintext
red(b)  blue(r)  green(g)  blue(r)  green(b)
blue(g)  red(g)  blue(g)  green(r)  blue(r)
red(g)  blue(g)  red(g)  green(b)  red(b)  green(r)  blue(r)  green(r)  blue(r)  green(r)  blue(r)
red(b)  blue(r)  green(r)  red(g)  blue(g)  red(g)  green(b)  red(b)  green(b)  red(b)  green(b)  red(b)
```

Condition 4: Inhibition/Switching

<table>
<thead>
<tr>
<th>Total Uncorrected Errors</th>
<th>Total Self-Corrected Errors</th>
<th>Total Time To Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D-KEFS Color-Word Interference Test: Summary of Scores

### Primary Measures: Completion Times

<table>
<thead>
<tr>
<th>Condition 1: Color Naming</th>
<th>Condition 2: Word Reading</th>
<th>Condition 3: Inhibition</th>
<th>Condition 4: Inhibition/Switching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
</tr>
<tr>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
<td>Scaled Score</td>
</tr>
</tbody>
</table>

### Primary Combined Measure: Completion Times

Combined Naming + Reading

\[
\text{Scaled Score} + \text{Scaled Score} = \text{Composite Scaled Score}
\]

### Primary Contrast Measures: Completion Times

**Inhibition vs. Color Naming**

\[
\text{Inhibition} - \text{Color Naming} = \text{Contrast Scaled Score}
\]

**Inhibition/Switching vs. Combined Naming + Reading**

\[
\text{Inhibition/Switching} - \text{Combined Naming + Reading} = \text{Composite}
\]

**Inhibition/Switching vs. Inhibition**

\[
\text{Inhibition/Switching} - \text{Inhibition} = \text{Composite}
\]

* A low or high contrast scaled score may reflect different cognitive problems; see examiner's manual.

### Optional Contrast Measures: Completion Times

**Inhibition/Switching vs. Color Naming**

\[
\text{Inhibition/Switching} - \text{Color Naming} = \text{Contrast Scaled Score}
\]

**Inhibition/Switching vs. Word Reading**

\[
\text{Inhibition/Switching} - \text{Word Reading} = \text{Contrast Scaled Score}
\]

* A low or high contrast scaled score may reflect different cognitive problems; see examiner's manual.

### Optional Measures: Error Analysis

<table>
<thead>
<tr>
<th>Condition 1: Color Naming</th>
<th>Condition 2: Word Reading</th>
<th>Condition 3: Inhibition</th>
<th>Condition 4: Inhibition/Switching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Errors</td>
<td>Corrected Errors</td>
<td>Corrected Errors</td>
<td>Corrected Errors</td>
</tr>
<tr>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Uncorrected Errors</td>
<td>Uncorrected Errors</td>
<td>Uncorrected Errors</td>
<td>Uncorrected Errors</td>
</tr>
<tr>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
<td>Raw Score</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**Total Errors**

Raw Score + Cumulative Percentile Rank

Note: Cumulative percentile ranks for the D-KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
D-KEFS Sorting Test
Screening Pretest

Words Incorrectly Read: ____________ Raw Score: ____________
Words Not Understood: ____________ Raw Score: ____________

Condition 1–Free Sorting: Card Set 1

Discontinue administration of Card Set 1 after either (a) the examinee indicates that he or she cannot identify any more sorts, even after receiving the single prompt to keep trying; (b) 240 seconds (4 minutes) of cumulative sorting time have elapsed; or (c) the examinee has completed 10 attempted sorts.

First Sort

Description:

Sorting Time (Seconds) ____________

Sort:

Animals | Air | Transportation
-----------|-----|------------------
Land | 1 Syllable | Large
1 Syllable | Curved | Uppercase
2 Syllables | Straight | Blue

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

Second Sort

Description:

Cumulative Sorting Time (Seconds) ____________

Sort:

Animals | Air | Transportation
-----------|-----|------------------
Land | 1 Syllable | Large
1 Syllable | Curved | Uppercase
2 Syllables | Straight | Blue

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

Third Sort

Description:

Cumulative Sorting Time (Seconds) ____________

Sort:

Animals | Air | Transportation
-----------|-----|------------------
Land | 1 Syllable | Large
1 Syllable | Curved | Uppercase
2 Syllables | Straight | Blue

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger
### Fourth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Sort:**

- **Verbal Sorts**
  - Animals Transportation
  - Air Land
  - 1 Syllable
- **Perceptual Sorts**
  - Large Small
  - Curved Straight
  - Uppercase Lowercase
  - Blue Yellow
  - White Red

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

### Fifth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Sort:**

- **Verbal Sorts**
  - Animals Transportation
  - Air Land
  - 1 Syllable
- **Perceptual Sorts**
  - Large Small
  - Curved Straight
  - Uppercase Lowercase
  - Blue Yellow
  - White Red

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

### Sixth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Sort:**

- **Verbal Sorts**
  - Animals Transportation
  - Air Land
  - 1 Syllable
- **Perceptual Sorts**
  - Large Small
  - Curved Straight
  - Uppercase Lowercase
  - Blue Yellow
  - White Red

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

### Seventh Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Sort:**

- **Verbal Sorts**
  - Animals Transportation
  - Air Land
  - 1 Syllable
- **Perceptual Sorts**
  - Large Small
  - Curved Straight
  - Uppercase Lowercase
  - Blue Yellow
  - White Red

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger
Free Sorting: Card Set 1 (continued)

Eighth Sort

Description: 

Cumulative Sorting Time (Seconds)

Sort:

Animals Transportation | Air Land | 1 Syllable 2 Syllables
Large | Curved | Uppercase | Lowercase | Blue | White

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

Ninth Sort

Description: 

Cumulative Sorting Time (Seconds)

Sort:

Animals Transportation | Air Land | 1 Syllable 2 Syllables
Large | Curved | Uppercase | Lowercase | Blue | White

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

Tenth Sort

Description: 

Cumulative Sorting Time (Seconds)

Sort:

Animals Transportation | Air Land | 1 Syllable 2 Syllables
Large | Curved | Uppercase | Lowercase | Blue | White

Verbal Sorts

Perceptual Sorts

For an incorrect sort, mark the cards of one group: Airplane Bus Car Duck Eagle Tiger

Free Sorting: Card Set 1

Raw Score

Total Description Score

Number of Confirmed Correct Sorts
Condition 1–Free Sorting: Card Set 2

Discontinue administration of Card Set 2 after either (a) the examinee indicates that he or she cannot identify any more sorts, even after receiving the single prompt to keep trying; (b) 240 seconds (4 minutes) of cumulative sorting time have elapsed; or (c) the examinee has completed 10 attempted sorts.

### First Sort

**Description:**

**Sort:**

- Clothing
- Body Parts
- Head
- Feet
- Plural
- Singular
- Filled Triangles
- Empty Triangles
- Cursive
- Printed
- Slope Up
- Slope Down
- Triangles Above
- Triangles Below
- Diagonals Close
- Diagonals Apart

**Verbal Sorts**

**Perceptual Sorts**

For an **incorrect** sort, mark the cards of one group: Ears Hat Mouth Shoe Socks Toes

### Second Sort

**Description:**

**Sort:**

- Clothing
- Body Parts
- Head
- Feet
- Plural
- Singular
- Filled Triangles
- Empty Triangles
- Cursive
- Printed
- Slope Up
- Slope Down
- Triangles Above
- Triangles Below
- Diagonals Close
- Diagonals Apart

**Verbal Sorts**

**Perceptual Sorts**

For an **incorrect** sort, mark the cards of one group: Ears Hat Mouth Shoe Socks Toes

### Third Sort

**Description:**

**Sort:**

- Clothing
- Body Parts
- Head
- Feet
- Plural
- Singular
- Filled Triangles
- Empty Triangles
- Cursive
- Printed
- Slope Up
- Slope Down
- Triangles Above
- Triangles Below
- Diagonals Close
- Diagonals Apart

**Verbal Sorts**

**Perceptual Sorts**

For an **incorrect** sort, mark the cards of one group: Ears Hat Mouth Shoe Socks Toes
### Eighth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
</table>

**Sort:**

<table>
<thead>
<tr>
<th>Clothing</th>
<th>Head</th>
<th>Feet</th>
<th>Plural</th>
<th>Singular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filled Triangles</td>
<td>Empty Triangles</td>
<td>Cursive</td>
<td>Printed</td>
<td>Slope Up</td>
</tr>
</tbody>
</table>

**Verbal Sorts**

**Perceptual Sorts**

For an incorrect sort, mark the cards of one group:

- Ears
- Hat
- Mouth
- Shoe
- Socks
- Toes

### Ninth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
</table>

**Sort:**

<table>
<thead>
<tr>
<th>Clothing</th>
<th>Head</th>
<th>Feet</th>
<th>Plural</th>
<th>Singular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filled Triangles</td>
<td>Empty Triangles</td>
<td>Cursive</td>
<td>Printed</td>
<td>Slope Up</td>
</tr>
</tbody>
</table>

**Verbal Sorts**

**Perceptual Sorts**

For an incorrect sort, mark the cards of one group:

- Ears
- Hat
- Mouth
- Shoe
- Socks
- Toes

### Tenth Sort

**Description:**

<table>
<thead>
<tr>
<th>Cumulative Sorting Time (Seconds)</th>
</tr>
</thead>
</table>

**Sort:**

<table>
<thead>
<tr>
<th>Clothing</th>
<th>Head</th>
<th>Feet</th>
<th>Plural</th>
<th>Singular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Parts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filled Triangles</td>
<td>Empty Triangles</td>
<td>Cursive</td>
<td>Printed</td>
<td>Slope Up</td>
</tr>
</tbody>
</table>

**Verbal Sorts**

**Perceptual Sorts**

For an incorrect sort, mark the cards of one group:

- Ears
- Hat
- Mouth
- Shoe
- Socks
- Toes

---

**Free Sorting: Card Set 2**

**Raw Score**

- Total Description Score
- Number of Confirmed Correct Sorts
Condition 2–Sort Recognition: Card Set 1

Administer all eight target sorts to the examinee. Discontinue administration of each sort after either (a) the examinee provides a correct or incorrect description, (b) the examinee indicates that he or she cannot identify the sorting rules, or (c) 45 seconds have elapsed after the examiner made the sort and the examinee failed to initiate a description response.

<table>
<thead>
<tr>
<th>First Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RULE</strong></td>
<td></td>
</tr>
<tr>
<td>Small Cards</td>
<td>Large Cards</td>
</tr>
<tr>
<td>(Bus Car Eagle)</td>
<td>(Airplane Duck Tiger)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Sort</th>
<th>Verbal Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RULE</strong></td>
<td></td>
</tr>
<tr>
<td>Animals</td>
<td>Transportation</td>
</tr>
<tr>
<td>(Duck Eagle Tiger)</td>
<td>(Airplane Bus Car)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RULE</strong></td>
<td></td>
</tr>
<tr>
<td>Straight Outer Edges</td>
<td>Curved Outer Edges</td>
</tr>
<tr>
<td>(Airplane Bus Tiger)</td>
<td>(Car Duck Eagle)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Sort</th>
<th>Verbal Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RULE</strong></td>
<td></td>
</tr>
<tr>
<td>One-Syllable Words</td>
<td>Two-Syllable Words</td>
</tr>
<tr>
<td>(Bus Car Duck)</td>
<td>(Airplane Eagle Tiger)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fifth Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RULE</strong></td>
<td></td>
</tr>
<tr>
<td>Blue Cards</td>
<td>Yellow Cards</td>
</tr>
<tr>
<td>(Bus Duck Tiger)</td>
<td>(Airplane Car Eagle)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>
Sort Recognition: Card Set 1 (continued)

Sixth Sort

RULE

Air
(Airplane Duck Eagle)

Land
(Bus Car Tiger)

Verbal Sort

Description:

<table>
<thead>
<tr>
<th>PRIMARY DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Group Description Score</td>
</tr>
<tr>
<td>2nd Group Description Score</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTIONAL DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect Description</td>
</tr>
<tr>
<td>Repeated Description</td>
</tr>
<tr>
<td>No/Don't Know Response</td>
</tr>
<tr>
<td>Noncredit Description</td>
</tr>
<tr>
<td>Overly Abstract Description</td>
</tr>
<tr>
<td>Description Type</td>
</tr>
</tbody>
</table>

Seventh Sort

RULE

Red Label
(Airplane Bus Duck)

White Label
(Car Eagle Tiger)

Perceptual Sort

Description:

<table>
<thead>
<tr>
<th>PRIMARY DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Group Description Score</td>
</tr>
<tr>
<td>2nd Group Description Score</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTIONAL DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect Description</td>
</tr>
<tr>
<td>Repeated Description</td>
</tr>
<tr>
<td>No/Don't Know Response</td>
</tr>
<tr>
<td>Noncredit Description</td>
</tr>
<tr>
<td>Overly Abstract Description</td>
</tr>
<tr>
<td>Description Type</td>
</tr>
</tbody>
</table>

Eighth Sort

RULE

Uppercase Letters
(Bus Duck Eagle)

Lowercase Letters
(Airplane Car Tiger)

Perceptual Sort

Description:

<table>
<thead>
<tr>
<th>PRIMARY DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Group Description Score</td>
</tr>
<tr>
<td>2nd Group Description Score</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPTIONAL DESCRIPTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect Description</td>
</tr>
<tr>
<td>Repeated Description</td>
</tr>
<tr>
<td>No/Don't Know Response</td>
</tr>
<tr>
<td>Noncredit Description</td>
</tr>
<tr>
<td>Overly Abstract Description</td>
</tr>
<tr>
<td>Description Type</td>
</tr>
</tbody>
</table>

Sort Recognition: Card Set 1

Raw Score

Total Description Score

20
Condition 2–Sort Recognition: Card Set 2

Administer all eight target sorts to the examinee. Discontinue administration of each sort after either (a) the examinee provides a correct or incorrect description, (b) the examinee indicates that he or she cannot identify the sorting rules, or (c) 45 seconds have elapsed after the examiner made the sort and the examinee failed to initiate a description response.

<table>
<thead>
<tr>
<th>First Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULE</td>
<td></td>
</tr>
<tr>
<td>Diagonals Close</td>
<td>Diagonals Apart</td>
</tr>
<tr>
<td>(Ears Shoe Socks)</td>
<td>(Hat Mouth Toes)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Sort</th>
<th>Verbal Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULE</td>
<td></td>
</tr>
<tr>
<td>Body Parts</td>
<td>Clothing</td>
</tr>
<tr>
<td>(Ears Mouth Toes)</td>
<td>(Hat Shoe Socks)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULE</td>
<td></td>
</tr>
<tr>
<td>Triangles Above Word</td>
<td>Triangles Below Word</td>
</tr>
<tr>
<td>(Ears Mouth Socks)</td>
<td>(Hat Shoe Toes)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fourth Sort</th>
<th>Perceptual Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULE</td>
<td></td>
</tr>
<tr>
<td>Cursive Letters</td>
<td>Printed Letters</td>
</tr>
<tr>
<td>(Ears Hat Toes)</td>
<td>(Mouth Shoe Socks)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fifth Sort</th>
<th>Verbal Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULE</td>
<td></td>
</tr>
<tr>
<td>Plural Words</td>
<td>Singular Words</td>
</tr>
<tr>
<td>(Ears Socks Toes)</td>
<td>(Mouth Shoe Hat)</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
</tbody>
</table>
Sort Recognition: Card Set 2 (continued)

Sixth Sort

Rule
Diagonals Slope Up
Diagonals Slope Down
(Ears Hat Shoe) (Mouth Socks Toes)

Description:

Perceptual Sort

Primary Description Measures
1st Group Description Score 0 1 2
2nd Group Description Score 0 1 2

Optional Description Measures
Incorrect Description Y
Repeted Description Y
No/Don't Know Response Y
Noncredit Description Y
Overly Abstract Description Y
Description Type V P

Seventh Sort

Rule
Related to Head
Related to Feet
(Ears Hat Mouth) (Shoe Socks Toes)

Description:

Verbal Sort

Primary Description Measures
1st Group Description Score 0 1 2
2nd Group Description Score 0 1 2

Optional Description Measures
Incorrect Description Y
Repeted Description Y
No/Don't Know Response Y
Noncredit Description Y
Overly Abstract Description Y
Description Type V P

Eighth Sort

Rule
Filled Triangles
Empty Triangles
(Ears Mouth Shoe) (Hat Socks Toes)

Description:

Perceptual Sort

Primary Description Measures
1st Group Description Score 0 1 2
2nd Group Description Score 0 1 2

Optional Description Measures
Incorrect Description Y
Repeted Description Y
No/Don't Know Response Y
Noncredit Description Y
Overly Abstract Description Y
Description Type V P

Sort Recognition: Card Set 2

Raw Score

Total Description Score
# D-KEFS Sorting Test: Summary of Scores

## Primary Measures

<table>
<thead>
<tr>
<th>Condition</th>
<th>Raw Score</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card Set 1 + Card Set 2</td>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>

### Condition 1: Free Sorting

- **Confirmed Correct Sorts**
  - Raw Score + Raw Score = |
- **Free Sorting Description Score**
  - Raw Score + Raw Score = |

### Condition 2: Sort Recognition

- **Sort Recognition Description Score**
  - Raw Score + Raw Score = |

### Combined Conditions 1 + 2

<table>
<thead>
<tr>
<th>Condition 1: Free Sorting</th>
<th>Condition 2: Sort Recognition</th>
<th>Sum of Scaled Scores</th>
<th>Composite Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description Score</td>
<td>Description Score</td>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>
- **Combined Description Score**
  - Scaled Score + Scaled Score = |

## Contrast Measure: Sort Recognition Versus Free Sorting Description Score

<table>
<thead>
<tr>
<th>Condition 2: Sort Recognition</th>
<th>Condition 1: Free Sorting</th>
<th>Scaled-Score Difference</th>
<th>Contrast Scaled Score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description Score</td>
<td>Description Score</td>
<td>=</td>
<td></td>
</tr>
</tbody>
</table>
- **Scaled Score**
  - Scaled Score - Scaled Score = |

* A low or high contrast scaled score may reflect different cognitive problems; see examiner's manual.

## Optional Measures

### Screening Pretest

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Word Reading Errors</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Word Comprehension Errors</strong></td>
<td></td>
</tr>
</tbody>
</table>
Condition 1: Free Sorting Sorting Measures (Optional)

Confirmed Correct Sorts: Card Set 1
Raw Score → Scaled Score

Confirmed Correct Sorts: Card Set 2
Raw Score → Scaled Score

Card Set 1 + Card Set 2 = Total Raw Score Scaled Score

Confirmed Correct Verbal Sorts
Raw Score + Raw Score = Raw Score

Confirmed Correct Perceptual Sorts
Raw Score + Raw Score = Raw Score

Confirmed/Unconfirmed Target Sorts
Raw Score + Raw Score = Raw Score

Repeated Sorts
Raw Score + Raw Score = Raw Score

Set-Loss Sorts
Raw Score + Raw Score = Raw Score

Nontarget Even Sorts
Raw Score + Raw Score = Raw Score

Attempted Sorts
Raw Score + Raw Score = Raw Score

Percent Sorting Accuracy
\[
\left( \frac{\text{Confirmed Correct Sorts}}{\text{Total Raw Score}} + \frac{\text{Attempted Sorts}}{\text{Total Raw Score}} \right) \times 100
\]

Cumulative Sorting Time
Cards Sets 1 + 2

Attempted Sorts

Time-Per-Sort Ratio**
\[
\frac{\text{Total Raw Score}}{\text{Attempted Sorts}}
\]

Condition 1: Free Sorting Description Measures (Optional)

Free Sorting Description Score: Card Set 1
Raw Score → Scaled Score

Free Sorting Description Score: Card Set 2
Raw Score → Scaled Score

Card Set 1 + Card Set 2 = Total Raw Score

Free Sorting Incorrect Descriptions*
Raw Score + Raw Score = Raw Score

Free Sorting Repeated Descriptions*
Raw Score + Raw Score = Raw Score

Percent Description Accuracy
\[
\left( \frac{\text{Free Sorting Description Score}}{\text{Total Raw Score}} + \frac{\text{Attempted Sorts}}{\text{Total Raw Score}} \right) \times 4 \times 100
\]

Percent Raw Score

* No/Don't Know responses are not included in these measures.

** A low or high ratio scaled score may reflect different cognitive problems; see examiner's manual.
Optional Measures (continued)

Condition 2: Sort Recognition Description Measures (Optional)

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sort Recognition Description Score: Card Set 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sort Recognition Description Score: Card Set 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Card Set 1 + Card Set 2 = Total Raw Score</td>
<td></td>
</tr>
<tr>
<td>Sort Recognition Incorrect Descriptions*</td>
<td></td>
</tr>
<tr>
<td>Raw Score + Raw Score =</td>
<td></td>
</tr>
<tr>
<td>Sort Recognition Repeated Descriptions*</td>
<td></td>
</tr>
<tr>
<td>Raw Score + Raw Score = Cumulative Percentile Rank</td>
<td></td>
</tr>
</tbody>
</table>

Combined Conditions 1 + 2: Description Measures (Optional)

| Condition 1: Free Sorting Total + Condition 2: Sort Recognition Total = Combined Raw Score Scaled Score |
|---------------------------------------------------------------|---------------------------------------------------------------|
| Condition 1: Free Sorting Incorrect Descriptions = Sum of Scaled Scores Composite Scaled Score |
| Combined Incorrect Descriptions* = Scaled Score + Scaled Score |                       |
| Combined Repeated Descriptions* = Total Raw Score Cumulative Percentile Rank |                       |

* No/Don't Know responses are not included in these measures

Note: Cumulative percentile ranks for the D-KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
D-KEFS Twenty Questions Test

Ages 8–89

Materials
- Record Form
- Stimulus Booklet (Flat Position)

Discontinue
Do not discontinue. Administer all four items to examinees in the order in which they appear here. Discontinue each item after the examinee either has identified the target object or has asked 20 yes/no questions without identifying the target object. Do not reveal the target object if the examinee has failed to identify it after asking 20 questions.

Administration and Recording
Position the stimulus booklet flat on the table in a horizontal (landscape) position directly in front of the examinee's midline, with the pictures facing the examinee.

Say,

Now we are going to do something where you ask me questions. I have picked one of these pictures, and I want you to figure out which one it is by asking me questions. You can only ask questions that I can answer yes or no. You can ask any question at all, as long as I can answer it yes or no. Try to guess the picture that I have picked with the fewest number of questions you can. I'm going to write down your questions so I can remember them. Go ahead and ask me the fewest number of yes/no questions you can to figure out which picture I have selected.

Record verbatim each of the examinee's questions in the order that they are asked. Answer Yes if the examinee's question encompasses or identifies the target item or No if it does not. Circle Y (for yes) or N (for no) to indicate your answer to each of the examinee's questions.

Whether or not the examinee correctly identifies the target object for Item 1 after asking 20 yes/no questions or fewer, say,

Good. Let's try the next one. I've picked a new picture, and I want you to ask me the fewest number of yes/no questions you can to figure out which one it is. Go ahead.

Repeat these administration and recording procedures for each of Items 2–4.

COMMON PROMPTS
- If an examinee's first question for an item refers only to one object (e.g., "Is it the elephant?"). record and answer the question. Then say, Remember, try to ask the fewest number of questions you can. Provide this prompt only once for each item.

- When answering questions, respond only with yes or no as much as possible. In deciding how to answer, base your response on how most people would respond to the same question. If the question could possibly be answered either way, you may say, Most people would say yes or Most people would say no. If an answer is true or untrue for an item most of the time, you may say, Usually yes or Usually no.

- If you do not know the answer to an examinee's question, say, That's an excellent question. I'm not sure I know the answer. Try another question. Do not count this question as one of the 20 questions.

- If an examinee asks a compound question (e.g., "Is it red and a plant?"). record the response and say, I can answer only one of those questions. Which one do you want me to answer? If the examinee asks an either/or question (e.g., "Is it an animal or a fruit?"). ask him or her to rephrase it as a yes/no question. After these prompts, if the examinee provides a yes/no question that clarifies the compound or either/or question, consider both responses as representing one yes/no question.

- If you are unsure of how to answer a spatial question, say, Show me the ones you mean. Pointing to the target object is an acceptable correct response.

- Some common types of questions ("Is it living?" or "Is it dead?") can be difficult to answer yes or no for some target items. If the object is organic or natural, say, Yes, it is or once was living. If the object is inorganic or human-made, say, No, it never was alive.

- If the examinee's question is vague (e.g., "Is it big?"). say, Could you make your question more specific? Consider both the vague question and any additional specific question as representing only one question.

- If an examinee fails to identify the target object after 20 questions but wants to know which one it is, say, I can't tell you, but try to guess the next one.

SPECIAL CONSIDERATIONS
- If an examinee has difficulty perceiving an object on the stimulus page because of visual problems and asks for clarification (e.g., "Is that a fork?"). record and answer the question; however, do not score or count it as one of the 20 questions allowed for that item.

- An examinee may have difficulty remembering previously asked questions, your yes/no answers to those questions, or both, and request that the information be repeated. You may provide such information as often as it is requested.

- If an examinee points to the correct target object but misnames it, the response is still considered correct.
D-KEFS Twenty Questions Test

Discontinue each item after the examinee asks 20 questions without identifying the target object.

<table>
<thead>
<tr>
<th>Item 1 (banana)</th>
<th>Item 2 (spoon)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Questions Asked (Circle One)</strong></td>
<td><strong>Total Questions Asked (Circle One)</strong></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Y N 1</td>
</tr>
<tr>
<td>3</td>
<td>Y N 1</td>
</tr>
<tr>
<td>4</td>
<td>Y N 2</td>
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<td>Y N 4</td>
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<td>Y N 3</td>
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<td>Y N 3</td>
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<td>Y N 3</td>
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<td>Y N 2</td>
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<td>13</td>
<td>Y N 2</td>
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<tr>
<td>14</td>
<td>Y N 2</td>
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<td>Y N 1</td>
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<td>16</td>
<td>Y N 1</td>
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<td>20</td>
<td>Y N 1</td>
</tr>
<tr>
<td>21</td>
<td>Failed to guess in 20 questions</td>
</tr>
</tbody>
</table>

**Initial Abstraction Score**

**Optional Scores:**
- Spatial Questions
- Repeated Questions
- Set-Loss Questions

**Raw Score**

---

* Minimum number of objects eliminated by the first question asked regardless of the yes or no answer.
### D-KEFS Twenty Questions Test (continued)

Discontinue each item after the examinee asks 20 questions without identifying the target object.

<table>
<thead>
<tr>
<th>Item 3 (owl)</th>
<th>Item 4 (helicopter)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Questions Asked</strong></td>
<td><strong>Total Questions Asked</strong></td>
</tr>
<tr>
<td>(Circle One)</td>
<td>(Circle One)</td>
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<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Y N</td>
<td>Y N</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Y N</td>
<td>Y N</td>
</tr>
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<td>3</td>
<td>3</td>
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<tr>
<td>Y N</td>
<td>Y N</td>
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<tr>
<td>Y N</td>
<td>Y N</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Failed to guess in 20 questions</td>
<td>Failed to guess in 20 questions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Raw Score</th>
</tr>
</thead>
</table>

**Initial Abstraction Score**

**Optional Scores:**
- # Spatial Questions
- # Repeated Questions
- # Set-Loss Questions

**Raw Score**

**Initial Abstraction Score**

**Optional Scores:**
- # Spatial Questions
- # Repeated Questions
- # Set-Loss Questions

**Raw Score**

---

*Minimum number of objects eliminated by the first question asked regardless of the yes or no answer.*

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D-KEFS Twenty Questions Test: Summary of Scores

Primary Measures

Initial Abstraction Score*  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Scaled Score

* Minimum number of objects eliminated by the first question asked regardless of the yes or no answer.

Total Questions Asked  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Scaled Score

Total Weighted Achievement Score  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Scaled Score

Optional Measures

Spatial Questions  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Cumulative Percentile Rank

Repeated Questions  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Cumulative Percentile Rank

Set-Loss Questions  
Item 1 Raw Score + Item 2 Raw Score + Item 3 Raw Score + Item 4 Raw Score = Total Raw Score → Cumulative Percentile Rank

Note: Cumulative percentile ranks for the D-KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
D-KEFS Word Context Test

Practice Item: sev (apple)

Examinee's Responses:
1. 
2. 
3. 
4. 
5. 

1. prifa (eat)

Examinee's Responses:
1. 
2. 
3. 
4. 
5. 

Incorrect responses on all sentences: 0
Incorrect response on Sentence 5: 0

2. enton (dance)

Examinee's Responses:
1. 
2. 
3. 
4. 
5. 

Incorrect responses on all sentences: 0
Incorrect response on Sentence 5: 0
3. delz (voice)

Examinee's Responses:

1. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 5  
   1st Sentence Correctly Consecutively Correct (Circle One): 5  

2. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 4  
   1st Sentence Correctly Consecutively Correct (Circle One): 4  

3. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 3  
   1st Sentence Correctly Consecutively Correct (Circle One): 3  

4. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 2  
   1st Sentence Correctly Consecutively Correct (Circle One): 2  

5. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 1  
   1st Sentence Correctly Consecutively Correct (Circle One): 1  

Incorrect responses on all sentences: 0  
Incorrect response on Sentence 5: 0  

4. vern (horse)

Examinee's Responses:

1. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 5  
   1st Sentence Correctly Consecutively Correct (Circle One): 5  

2. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 4  
   1st Sentence Correctly Consecutively Correct (Circle One): 4  

3. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 3  
   1st Sentence Correctly Consecutively Correct (Circle One): 3  

4. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 2  
   1st Sentence Correctly Consecutively Correct (Circle One): 2  

5. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 1  
   1st Sentence Correctly Consecutively Correct (Circle One): 1  

Incorrect responses on all sentences: 0  
Incorrect response on Sentence 5: 0  

5. netzen (make)

Examinee's Responses:

1. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 5  
   1st Sentence Correctly Consecutively Correct (Circle One): 5  

2. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 4  
   1st Sentence Correctly Consecutively Correct (Circle One): 4  

3. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 3  
   1st Sentence Correctly Consecutively Correct (Circle One): 3  

4. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 2  
   1st Sentence Correctly Consecutively Correct (Circle One): 2  

5. 
   Response Correct: Y  N  
   1st Sentence Correct (Circle One): 1  
   1st Sentence Correctly Consecutively Correct (Circle One): 1  

Incorrect responses on all sentences: 0  
Incorrect response on Sentence 5: 0  

---

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### 6. gesh (fill)

**Examinee's Responses:**

<table>
<thead>
<tr>
<th></th>
<th>Response Correct</th>
<th>1st Sentence Correct (Circle One)</th>
<th>1st Sentence Consecutively Correct (Circle One)</th>
<th>Optional:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Y N</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Y N</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
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<td>3.</td>
<td>Y N</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Y N</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Y N</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Incorrect responses on all sentences: **0**

Incorrect response on Sentence 5: **0**

### 7. luri (motor, engine)

**Examinee's Responses:**

<table>
<thead>
<tr>
<th></th>
<th>Response Correct</th>
<th>1st Sentence Correct (Circle One)</th>
<th>1st Sentence Consecutively Correct (Circle One)</th>
<th>Optional:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Y N</td>
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<td>Y N</td>
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</tr>
<tr>
<td>4.</td>
<td>Y N</td>
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<td>2</td>
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<tr>
<td>5.</td>
<td>Y N</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Incorrect responses on all sentences: **0**

Incorrect response on Sentence 5: **0**

### 8. krame (tooth, teeth)

**Examinee's Responses:**

<table>
<thead>
<tr>
<th></th>
<th>Response Correct</th>
<th>1st Sentence Correct (Circle One)</th>
<th>1st Sentence Consecutively Correct (Circle One)</th>
<th>Optional:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Y N</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Y N</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Y N</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Y N</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Y N</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Incorrect responses on all sentences: **0**

Incorrect response on Sentence 5: **0**
9. kapla (word)

Examinee's Responses:

<table>
<thead>
<tr>
<th>Response Correct</th>
<th>1st Sentence Correct (Circle One)</th>
<th>1st Sentence Consecutively Correct (Circle One)</th>
<th>Optional:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>5</td>
<td>5</td>
<td># Repeated Incorrect</td>
</tr>
<tr>
<td>N</td>
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<td># No/OK Responses</td>
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<td></td>
<td></td>
<td>Raw Score</td>
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<td>Y</td>
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<td>3</td>
<td># Correct-To-Incorrect</td>
</tr>
<tr>
<td>N</td>
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</tr>
<tr>
<td>N</td>
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<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Incorrect responses on all sentences: 0
Incorrect response on Sentence 5: 0

10. grot (curtain)

Examinee's Responses:

<table>
<thead>
<tr>
<th>Response Correct</th>
<th>1st Sentence Correct (Circle One)</th>
<th>1st Sentence Consecutively Correct (Circle One)</th>
<th>Optional:</th>
</tr>
</thead>
<tbody>
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<td>5</td>
<td>5</td>
<td># Repeated Incorrect</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td>Raw Score</td>
</tr>
<tr>
<td>Y</td>
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<td>4</td>
<td># No/OK Responses</td>
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</tr>
<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Incorrect responses on all sentences: 0
Incorrect response on Sentence 5: 0

D–KEFS Word Context Test: Summary of Scores

Primary Measure

Total Consecutively Correct

Optional Measures

Consistently Correct Ratio

\[
\text{Consistently Correct Ratio} = \frac{\text{Total Consecutively Correct Score}}{\text{Total First Sentence Correct Score}} \times 100
\]

Repeated Incorrect Responses

\[\text{Repeated Incorrect Responses} = \frac{\text{Total Raw Score}}{\text{Scaled Score}}\]

No/Don't Know Responses

\[\text{No/Don't Know Responses} = \frac{\text{Total Raw Score}}{\text{Cumulative Percentile Rank}}\]

Total Correct-To-Incorrect Errors

\[\text{Total Correct-To-Incorrect Errors} = \frac{\text{Total Raw Score}}{\text{Cumulative Percentile Rank}}\]

Note: Cumulative percentile ranks for the D–KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
### D-KEFS Tower Test

Discontinue after three consecutive item failures. Disk Labels: 1 = Smallest to 5 = Largest.

#### Item 1: Two Disks

<table>
<thead>
<tr>
<th>Time Limit: 30&quot;</th>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 1)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

Demonstrate 1-move solution if examinee fails to solve item in 1 move.

**Achievement Score**

<table>
<thead>
<tr>
<th>Correct Within Time Limit</th>
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</thead>
<tbody>
<tr>
<td>Failed Moves</td>
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</table>

#### Item 2: Two Disks

<table>
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<th>Time Limit: 30&quot;</th>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 2)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
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Demonstrate 2-move solution if examinee fails to solve item in 2 moves.

**Achievement Score**

<table>
<thead>
<tr>
<th>Correct Within Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed Moves</td>
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</table>

#### Item 3: Two Disks

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<th>1st Move Time</th>
<th>Total # Moves (Min. = 3)</th>
<th># Rule Violations</th>
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</table>

**Achievement Score**

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<th>Correct Within Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed Moves</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

#### Item 4: Three Disks

<table>
<thead>
<tr>
<th>Time Limit: 60&quot;</th>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 4)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Achievement Score**

<table>
<thead>
<tr>
<th>Correct Within Time Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed Moves</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>
### Item 5: Three Disks

**Time Limit:** 120"

**Starting Position (Examiner's View):**

<table>
<thead>
<tr>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 7)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
</table>

**Achievement Score**

- Correct Within Time Limit
  - >9 Moves
  - 9 Moves
  - 8 Moves
  - 7 Moves

**Correct Tower**

- Y
- N

### Item 6: Four Disks

**Time Limit:** 120"

**Starting Position (Examiner's View):**

<table>
<thead>
<tr>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 9)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
</table>

**Achievement Score**

- Correct Within Time Limit
  - >1 Moves
  - 11 Moves
  - 10 Moves
  - 9 Moves

**Correct Tower**

- Y
- N

### Item 7: Four Disks

**Time Limit:** 180"

**Starting Position (Examiner's View):**

<table>
<thead>
<tr>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 13)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
</table>

**Achievement Score**

- Correct Within Time Limit
  - >5 Moves
  - 15 Moves
  - 14 Moves
  - 13 Moves

**Correct Tower**

- Y
- N

### Item 8: Five Disks

**Time Limit:** 240"

**Starting Position (Examiner's View):**

<table>
<thead>
<tr>
<th>1st Move Time</th>
<th>Total # Moves (Min. = 20)</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
</table>

**Achievement Score**

- Correct Within Time Limit
  - >24 Moves
  - 23-24 Moves
  - 21-22 Moves
  - 20 Moves

**Correct Tower**

- Y
- N

---

**Tower**

---

35
Item 9: Five Disks

Time Limit: 240"

Starting Position (Examiner's View)

Ending Position:

<table>
<thead>
<tr>
<th>1st Move</th>
<th>Total # Moves</th>
<th># Rule Violations</th>
<th>Item Completion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>(Min. = 26)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Achievement Score

Correct Within Time Limit

Failed Moves

>32

30-32

27-29

26

Moves

Moves

Moves

Moves

D-KEFS Tower Test: Summary of Scores

Totals for Items Administered

<table>
<thead>
<tr>
<th>Total # Items Administered</th>
<th>Total 1st-Move Time</th>
<th>Total # Moves</th>
<th>Total # Rule Violations</th>
<th>Total Item Completion Times</th>
<th>Total Achievement Score</th>
</tr>
</thead>
</table>

Primary Measure

Total Achievement Score

Total Raw Score

Scaled Score

Optional Measures

Mean First-Move Time* =

Time-Per-Move Ratio* =

Move Accuracy Ratio* =

Total Rule Violations

Rule-Violations-Per-Item Ratio

Total Cumulative Minimum Moves Possible

<table>
<thead>
<tr>
<th>Number of Items Administered</th>
<th>Cumulative Minimum Moves Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>8</td>
<td>59</td>
</tr>
<tr>
<td>9</td>
<td>85</td>
</tr>
</tbody>
</table>

* A low or high ratio scaled score on these measures may reflect different cognitive problems; see examiner's manual.
<table>
<thead>
<tr>
<th>Proverbs</th>
<th>Condition 1: Free Inquiry</th>
<th>Condition 2: Multiple Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. You can’t judge a book by its cover.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: b 1&lt;br&gt;2 Points: a 0, d 2&lt;br&gt;4 Points: c 4</td>
</tr>
<tr>
<td>2. Don’t count your chickens before they are hatched.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: c 1&lt;br&gt;2 Points: b 0, d 2&lt;br&gt;4 Points: a 4</td>
</tr>
<tr>
<td>3. Rome wasn’t built in a day.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: a 1&lt;br&gt;2 Points: d 0, c 2&lt;br&gt;4 Points: b 4</td>
</tr>
<tr>
<td>4. Too many cooks spoil the soup.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: d 1&lt;br&gt;2 Points: a 0, b 2&lt;br&gt;4 Points: c 4</td>
</tr>
<tr>
<td>5. People who live in glass houses shouldn’t throw stones.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: a 1&lt;br&gt;2 Points: c 0, b 2&lt;br&gt;4 Points: d 4</td>
</tr>
<tr>
<td>6. An old ox plows a straight row.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: d 1&lt;br&gt;2 Points: c 0, a 2&lt;br&gt;4 Points: b 4</td>
</tr>
<tr>
<td>7. A small leak will sink a large ship.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: b 1&lt;br&gt;2 Points: d 0, a 2&lt;br&gt;4 Points: c 4</td>
</tr>
<tr>
<td>8. No bread is without a crust.</td>
<td>Accuracy Score: 0&lt;br&gt;Abstraction Score: 2</td>
<td>0 Points: d 1&lt;br&gt;2 Points: c 0, a 2&lt;br&gt;4 Points: b 4</td>
</tr>
</tbody>
</table>
# D-KEFS Proverb Test: Summary of Scores

## Primary Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total Raw Score</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Achievement Score: Free Inquiry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Achievement Score: Multiple Choice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Optional Measures: Free Inquiry

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total Raw Score</th>
<th>Scaled Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Proverb Achievement Score: Free Inquiry Items 1–5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncommon Proverb Achievement Score: Free Inquiry Items 6–8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy Only Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstraction Only Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/Don't Know Responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated Responses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Optional Measures: Multiple Choice

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total Raw Score</th>
<th>Cumulative Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Proverb Achievement Score: Multiple Choice Items 1–5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncommon Proverb Achievement Score: Multiple Choice Items 6–8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Correct Abstract Choices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Correct Concrete Choices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Incorrect Phonemic Choices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Incorrect Unrelated Choices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Incorrect Phonemic + Unrelated Choices</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Cumulative percentile ranks for the D-KEFS were scaled to reflect the percentage of the normative sample that obtained raw scores equal to or worse than the raw score obtained by the examinee.
Trail-Making Test

Practice

Condition 1
Visual Scanning

Name ____________________ Age ______________
ID ______________________ Date ______________
Examiner ____________________
Notes ____________________

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Trail Making Test

Condition 2
Number Sequencing

Practice

End
5

4

B

C

Start
1

3

2

D

A

E
Trail Making Test

Condition 3
Letter Sequencing

Practice

Start
End

A
B
C
D
E

1
2
3
4
5
Trail Making Test

Condition 4
Number–Letter Switching

Practice

Start 1
End D

A B C D

2 3 4
Trail Making Test

Condition 5
Motor Speed

Practice

Start

End

Name __________________________ Age ________________
ID __________________________ Date ________________
Examiner ________________________
Notes __________________________
Design Fluency Test

Condition 1
Filled Dots

Practice

Name ____________________ Age ____________

ID ______________________ Date _____________

Examiner ____________________

Notes ______________________

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Practice
Go/No-Go Task

Go

Go

Go

No Go
**Brief Visuospatial Memory Test- Revised**

**Response Form**

Ralph H. B. Benedict, PhD

<table>
<thead>
<tr>
<th>ID#</th>
<th>Test Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Handedness</td>
</tr>
<tr>
<td></td>
<td>Age</td>
</tr>
<tr>
<td>Education</td>
<td>Examiner</td>
</tr>
</tbody>
</table>

**Form Administered:** 1 2 3 4 5 6 (circle one)

<table>
<thead>
<tr>
<th></th>
<th>Raw score</th>
<th>T score</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Recall(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Retained(^3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Hits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition False Alarms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Discrimination Index(^4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Response Bias</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy (optional)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Normative table/comparison group**

\(^1\)Total Recall = (Trial 1 raw score + Trial 2 raw score + Trial 3 raw score).

\(^2\)Learning = (Higher value of Trial 2 raw score or Trial 3 raw score) – Trial 1 raw score.

\(^3\)Percent Retained = [Delayed Recall raw score ÷ (higher value of Trial 2 raw score or Trial 3 raw score)] x 100.

\(^4\)Recognition Discrimination Index = Recognition Hits raw score – Recognition False Alarms raw score.

**Delay Interval Table**

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Trial 3 completed</td>
</tr>
<tr>
<td>Time Delayed Recall started</td>
</tr>
<tr>
<td>Delay interval (minutes)</td>
</tr>
</tbody>
</table>
Form Administered:  1  2  3  4  5  6  (circle one)

<table>
<thead>
<tr>
<th></th>
<th>Raw score</th>
<th>T score</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Recall(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent Retained(^3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Hits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition False Alarms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Discrimination Index(^4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Response Bias</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy (optional)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Normative table/comparison group

---

\(^1\)Total Recall = (Trial 1 raw score + Trial 2 raw score + Trial 3 raw score).

\(^2\)Learning = (Higher value of Trial 2 raw score or Trial 3 raw score) – Trial 1 raw score.

\(^3\)Percent Retained = [Delayed Recall raw score ÷ (higher value of Trial 2 raw score or Trial 3 raw score)] × 100.

\(^4\)Recognition Discrimination Index = Recognition Hits raw score – Recognition False Alarms raw score.

Delay Interval Table

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Trial 3 completed</td>
</tr>
<tr>
<td>Time Delayed Recall started</td>
</tr>
<tr>
<td>Delay interval (minutes)</td>
</tr>
</tbody>
</table>
DR
CT
Please rate each of the following items in terms of how characteristic they are of you. Use the following scale for answering these items.

<table>
<thead>
<tr>
<th>1 extremely uncharacteristic of me</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 extremely characteristic of me</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once in a while I can’t control the urge to strike another person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Given enough provocation, I may hit another person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>If somebody hits me, I hit back.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I get into fights a little more than the average person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>If I have to resort to violence to protect my rights, I will.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>There are people who pushed me so far that we came to blows.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I can think of no good reason for ever hitting a person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have threatened people I know.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have become so mad that I have broken things.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I tell my friends openly when I disagree with them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I often find myself disagreeing with people.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>When people annoy me, I may tell them what I think of them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I can’t help getting into arguments when people disagree with me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My friends say that I’m somewhat argumentative.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I flare up quickly but get over it quickly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>When frustrated, I let my irritation show.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I sometimes feel like a powder keg ready to explode.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I am an even-tempered person.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Some of my friends think I’m a hothead.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sometimes I fly off the handle for no good reason.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have trouble controlling my temper.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I am sometimes eaten up with jealousy.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>At times I feel I have gotten a raw deal out of life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Other people always seem to get the breaks.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I wonder why sometimes I feel so bitter about things.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I know that “friends” talk about me behind my back.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I am suspicious of overly friendly strangers.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Psychomotor Vigilance Test

Press the spacebar every time an “x” appears on the screen.
PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:
The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?
   BED TIME __________

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
   NUMBER OF MINUTES __________

3. During the past month, what time have you usually gotten up in the morning?
   GETTING UP TIME __________

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)
   HOURS OF SLEEP PER NIGHT __________

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .
   a) Cannot get to sleep within 30 minutes
      Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____ 
   b) Wake up in the middle of the night or early morning
      Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____ 
   c) Have to get up to use the bathroom
      Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____
d) Cannot breathe comfortably
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

e) Cough or snore loudly
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

f) Feel too cold
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

g) Feel too hot
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

h) Had bad dreams
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

i) Have pain
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

j) Other reason(s), please describe___________________________________________________________
_____________________________________________________________________________________

How often during the past month have you had trouble sleeping because of this?
Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

6. During the past month, how would you rate your sleep quality overall?

Very good ___________
Fairly good ___________
Fairly bad ___________
Very bad ___________
During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

<table>
<thead>
<tr>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>

During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

<table>
<thead>
<tr>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- No problem at all
- Only a very slight problem
- Somewhat of a problem
- A very big problem

Do you have a bed partner or room mate?

- No bed partner or room mate
- Partner/room mate in other room
- Partner in same room, but not same bed
- Partner in same bed

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring

<table>
<thead>
<tr>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>

b) Long pauses between breaths while asleep

<table>
<thead>
<tr>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>

c) Legs twitching or jerking while you sleep

<table>
<thead>
<tr>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>
d) Episodes of disorientation or confusion during sleep

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____  

e) Other restlessness while you sleep; please describe__________________________________________  

______________________________________________________________________________  

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____
**DIRECTIONS:** A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, THAT IS, at this moment.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not at all</th>
<th>Somewhat so</th>
<th>Moderately so</th>
<th>Very much so</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel calm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I feel secure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I am tense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I feel regretful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I feel at ease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I feel upset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I am presently worrying over possible misfortunes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I feel rested.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I feel anxious</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I feel comfortable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I feel self-confident.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I feel nervous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. I am jittery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I feel &quot;high strung&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I am relaxed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. I feel content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. I am worried</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. I feel over-excited and &quot;rattled&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. I feel joyful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. I feel pleasant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STAI Form T

Subject # ___________________________ DATE ___________________________

RECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you generally feel.

There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

21. I feel pleasant ........................................ 1 2 3 4

22. I tire quickly ........................................ 1 2 3 4

23. I feel like crying ..................................... 1 2 3 4

24. I wish I could be as happy as others seem to be. .................... 1 2 3 4

25. I am losing out on things because I can't make up my mind soon enough .......................... 1 2 3 4

26. I feel rested .......................................... 1 2 3 4

27. I am "calm, cool, and collected" ........................................ 1 2 3 4

28. I feel that difficulties are piling up so that I cannot overcome them .......................... 1 2 3 4

29. I worry too much over something that really doesn't matter .......................... 1 2 3 4

30. I am happy .......................................... 1 2 3 4

31. I am inclined to take things hard .................................. 1 2 3 4

32. I lack self-confidence ........................................ 1 2 3 4

33. I feel secure ........................................ 1 2 3 4

34. I try to avoid facing a crises or difficulty .......................... 1 2 3 4

35. I feel blue .......................................... 1 2 3 4

36. I am content ........................................ 1 2 3 4

37. Some unimportant thought runs through my mind and bothers me .............. 1 2 3 4

38. I take disappointments so keenly that I can't put them out of my mind .................................. 1 2 3 4

39. I am a steady person ........................................ 1 2 3 4

40. I get in a state of tension or turmoil as I think over my recent concerns and interests .......................... 1 2 3 4
**Scope of This Document**

This is a quick start reference to familiarize a first-time user with the basic concepts and operations of the ANAM4™ software.

**Disclaimer**

The ANAM4™ testing system does not constitute the practice of medicine or the provision of professional health care advice. The information provided by ANAM4™ software is of a general nature and does not represent medical advice, a diagnosis, or prescription for treatment. You are advised to seek the advice of a qualified medical professional or researcher for interpretation of test results. C-SHOP and the University of Oklahoma are not responsible for any decisions made based on information obtained using ANAM4™ software. Your qualified medical professional has the sole responsibility for establishing diagnosis and suggesting appropriate treatment.

**Further Reading**

For additional information regarding ANAM4™ or ANAM4™ data files, please refer to the ANAM4™ User Guide.
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11 **Chapter 4: ANAM4™ Tests**
11 ANAM4™ Test Names, Modules, and Extensions
Requirements

Hardware Requirements

The ANAM4™ system is designed for use on personal computer systems. Minimum hardware requirements include the following:

- **Processor speed:** Pentium 90 MHz microprocessor.
- **Memory:** 32 MB RAM.
- **Storage:** The core ANAM4™ test system requires a minimum of approximately 25MB. Due to data storage requirements and to ensure optimal performance, at least 150MB of free space is highly recommended. A full ANAM4™ installation including ancillary modules (ADEPT™/APR™) requires approximately 50MB of space (130MB if the .NET Framework v2.0 is not already present). Due to data storage requirements and to ensure optimal performance, at least 300MB of free space prior to installation is highly recommended.
- **Response device:** Most standard input devices are supported, including a serial mouse, USB mouse and keyboard, and PS/2 mouse and keyboard. When using laptop computers, most internal keyboards and pointing devices will be adequate for most ANAM4 test modules, but the use of external input devices is highly recommended when practical.

Software Requirements

- **Operating system:** Windows 95/98/2000, NT4.0, or XP. To date, ANAM4™ has not been fully tested on Windows ME or Windows Vista.
- **Windows updates:** Application of all Windows updates. Updates are available at: [http://update.microsoft.com](http://update.microsoft.com)
- **Flash animation:** For operating systems older than Windows XP, Adobe Flash Player is required to view the opening logo screen. Flash may be acquired via free download: [http://www.adobe.com/go/getflashplayer](http://www.adobe.com/go/getflashplayer)

  **Note:** When installing Flash Player via the website, uncheck the accompanying Yahoo toolbar before clicking "Install Now" unless you desire the toolbar.
Installing and Running ANAM4™

The ANAM4™ test system consists of a library of tests designed for a broad spectrum of clinical and research applications. This library of computer-based tests was constructed to meet the need for precise measurement of cognitive processing efficiency in a variety of psychological assessment contexts that include neuropsychology, readiness to perform, neurotoxicology, pharmacology, and human factors research.

ANAM4™ will be automatically installed from the installation CD. If the installation does not begin automatically, click Start > Run on the task bar. Type your CD drive letter followed by :\ Setup (e.g., D:\ Setup or E:\ Setup). Finally, click OK to proceed with the installation.

The default installation directory is C:\ Program Files\ C-SHOP\ ANAM4.

Upon installation, a desktop icon for ANAM4™ will be created.

To run ANAM4™, double-click on the ANAM4™ icon located on your desktop, the AnamMenu.exe file located in the C:\ Program Files\ C-SHOP\ ANAM4 directory, or the ANAM4 program listed in start->Programs->ANAM4.
Starting ANAM4™

1. Double-click the ANAM4 icon on your desktop.

Selecting a Battery and Entering the User ID

The Battery Selection screen allows the user to choose a battery, specify an ID number, and specify data directories.

1. Use the up/down cursor keys or mouse to select the desired ANAM4™ battery.

2. Enter a user ID. The user ID can be any alphanumeric character string.
Note: If a test ID is entered that has never been used on this computer, you will be asked to verify that you are creating a new participant ID. If this is correct, click Yes. If the session is a repeat administration for this person (thus, the participant ID has been used previously), you will not receive this prompt.

Changing Data Directories (Folders)
The default data storage directory is C:\anamdata. All data files will be stored in this directory unless specified otherwise.

To change the Primary Data Directory or Individual Data Directory:

1. Press <Alt><F1>. This will unlock the Primary Data Directory and Individual Data Directory fields for modification.
2. Type the path location of the directory for data storage or click Browse. If you select Browse, navigate to the directory where you would like to store the ANAM data files.

After confirming all information on the Battery Selection screen, Press Enter or click Next to continue.

Confirming Date, Time, ID, and Session Number

1. Confirm that the Date and Time on your computer are accurately set. If not, click on No, close the Battery Selection screen that reappears by clicking on the red close button at the upper right corner, correct the Date/Time setting, and restart ANAM4™.
2. Confirm that the correct Session number is about to be run. If you are certain that it needs to be changed, press <Alt><F1> to unlock the field and enter the desired session number.
Restarting a Previously Cancelled Battery

1. If the specified Session was previously canceled before completion, you may see the following screen asking if you wish to Start from First Test or Continue from Last Test Completed. You are also allowed to go back to the Battery Selection screen.

![Restart Battery](image)

2. Once you have selected the desired option, click on Next to continue.

Selecting Test Settings

The Test Settings screen allows the user to customize the ANAM4™ test session.

![Test Settings Screen](image)

**Note:** After using the battery a few times for a particular person, you may wish to turn off instructions by deselecting the "Instructions" box. Make sure it is checked On the first time through.

1. If you have a participant who uses the computer mouse with the left hand and you wish to obtain responses using the left hand, press <Alt><F1> to unlock the Mouse Hand setting and select Left.
2. If the Test Settings are correct, press Enter or click on Next to begin the testing.
Selecting a Specific Test or Subset of Tests

1. If you wish to select a single test or subset of tests, press `<Alt><F2>` and then click on `Select` under Type of Run.

2. Press `Enter` or click on `Next` to continue. The list of tests within the battery will appear on the next screen.
3. After selecting the desired test or set of tests using the instructions at the bottom of the screen, press Enter or click on Next to continue.

**Proceeding through the Battery**

1. Tests will proceed in sequence.

   **Note:** If instructions are On, the typical sequence for each test is one or more pages of instructions, a screen with the test name, the test itself, and (if selected from the Test Settings screen) a feedback screen summarizing individual Test Results.

2. If you wish to abort from any test (end the test without collecting data), press <Alt><F1> at any time following the instructions screen(s).

   **Note:** The <Alt><F1> exit function works ONLY after the display of test instructions is complete.

3. After the test aborts, you will see the above window. If you wish to cancel the rest of the battery, click Yes. If you wish to continue with the remaining tests, click No.

4. At the conclusion of the battery, you will see a "Thank You" message informing you that the Test Battery is complete.
Four types of data files are generated following test administration through the ANAM4™ test system as follows:

- **Summary Data Files in Text Format (CSV)** – summary statistics computed across all items/trials of a given test (without variable labels)
- **Raw Data Files in Text Format (CSV)** – individual item/trial information (without variable labels)
- **Summary Data Files in XML Format** – summary statistics computed across all items/trials of a given test (with variable labels)
- **Raw Data Files in XML Format** – Individual item/trial information (with variable labels).

**File Naming**

Data filenames are coded in the following manner. The first letter represents the type of file as follows:

- **S** for summary data in text format
- **R** for raw data in text format
- **X** for summary data in XML format
- **Z** for raw data in XML format.

The next sequence of characters corresponds to the participant ID code (of variable length). The ID code is followed by a P or T designating a Practice or Test session, respectively. The final portion of the filename indicates the session number. A three-letter file extension is used to identify the specific test. A list of test extensions can be found in **Chapter 4**.

Example: **S32545T01.SRT** is a summary data file for participant 32545 for Test Session number 1 of the Simple Reaction Time test.

**ANAM4™ Data Directories**

The default Primary Data Directory is C:\anamdata. Data from all completed tests will be saved in this directory. By default, no Individual Data Directory is specified. For information on changing the Primary Data Directory or Individual Data Directory, see **Chapter 2**.
### ANAM4™ Test Names, Modules, and Extensions

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Module Name (.exe)</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Choice Reaction Time</td>
<td>2choice</td>
<td>.2ch</td>
</tr>
<tr>
<td>4-Choice Reaction Time</td>
<td>4choice</td>
<td>.4ch</td>
</tr>
<tr>
<td>Code Substitution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>codesub</td>
<td>.cds</td>
</tr>
<tr>
<td>Immediate</td>
<td>codesub</td>
<td>.cdi</td>
</tr>
<tr>
<td>Delayed</td>
<td>codesub</td>
<td>.cdd</td>
</tr>
<tr>
<td>Demographics</td>
<td>demog</td>
<td>.sub</td>
</tr>
<tr>
<td>Digit Reaction Time</td>
<td>digitrt</td>
<td>.drt</td>
</tr>
<tr>
<td>Dual Task (Tracking / Memory)</td>
<td>dualtask</td>
<td>.dtn</td>
</tr>
<tr>
<td>Grammatical Reasoning</td>
<td>gram</td>
<td>.gmr</td>
</tr>
<tr>
<td>Logical Relations</td>
<td>logical</td>
<td>.lrs</td>
</tr>
<tr>
<td>Manikin</td>
<td>manikin</td>
<td>.mkn</td>
</tr>
<tr>
<td>Matching Grids</td>
<td>matching</td>
<td>.mtg</td>
</tr>
<tr>
<td>Matching to Sample</td>
<td>mat2samp</td>
<td>.m2s</td>
</tr>
<tr>
<td>Mathematical Processing</td>
<td>math</td>
<td>.mth</td>
</tr>
<tr>
<td>Memory Search</td>
<td>stem</td>
<td>.stn</td>
</tr>
<tr>
<td>Mental State Exam</td>
<td>mse</td>
<td>.mse</td>
</tr>
<tr>
<td>Mood Scale</td>
<td>mood</td>
<td>.moo</td>
</tr>
<tr>
<td>Procedural Reaction Time</td>
<td>procr</td>
<td>.pro</td>
</tr>
<tr>
<td>Pursuit Tracking</td>
<td>pursuit</td>
<td>.pur</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>react</td>
<td>.rct</td>
</tr>
<tr>
<td>Relative Judgment</td>
<td>reljudg</td>
<td>.rlj</td>
</tr>
<tr>
<td>Running Memory CPT</td>
<td>runcpt</td>
<td>.cpt</td>
</tr>
<tr>
<td>Simple Reaction Time</td>
<td>simplert</td>
<td>.srt</td>
</tr>
<tr>
<td>Sleepiness Scale</td>
<td>sleepsc</td>
<td>.slp</td>
</tr>
<tr>
<td>Spatial Processing - Simultaneous</td>
<td>dspat</td>
<td>.spd</td>
</tr>
<tr>
<td>Spatial Processing - Delayed</td>
<td>spat</td>
<td>.spa</td>
</tr>
<tr>
<td>Standard CPT</td>
<td>stdcpt</td>
<td>.scp</td>
</tr>
<tr>
<td>Stroop Test</td>
<td>stroop</td>
<td>.str</td>
</tr>
<tr>
<td>Switching</td>
<td>switch</td>
<td>.swt</td>
</tr>
<tr>
<td>Symbolic Reaction Time</td>
<td>symbolrt</td>
<td>.sym</td>
</tr>
<tr>
<td>Tapping</td>
<td>tapping</td>
<td>.tpl, .tpr</td>
</tr>
<tr>
<td>Tower Puzzle</td>
<td>tower</td>
<td>.atp</td>
</tr>
<tr>
<td>Unstable Tracking</td>
<td>track</td>
<td>.trk</td>
</tr>
<tr>
<td>Visual Vigilance</td>
<td>visvig</td>
<td>.vis</td>
</tr>
</tbody>
</table>
For More Information

ANAM4™ User Manual

Quick Start Guide for the ADEPT™ Software
www.c-shop.ou.edu/literature/ADEPTquickstart.pdf

Quick Start Guide for the APR™ Software
www.c-shop.ou.edu/literature/APRquickstart.pdf

ANAM4™ Technical Literature
www.c-shop.ou.edu

Technical Support
www.c-shop.ou.edu
### Instructions:
This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

<table>
<thead>
<tr>
<th>1. Sadness</th>
<th>6. Punishment Feelings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 I do not feel sad.</td>
<td>0 I don’t feel I am being punished.</td>
</tr>
<tr>
<td>1 I feel sad much of the time.</td>
<td>1 I feel I may be punished.</td>
</tr>
<tr>
<td>2 I am sad all the time.</td>
<td>2 I expect to be punished.</td>
</tr>
<tr>
<td>3 I am so sad or unhappy that I can’t stand it.</td>
<td>3 I feel I am being punished.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Pessimism</th>
<th>7. Self-Dislike</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 I am not discouraged about my future.</td>
<td>0 I feel the same about myself as ever.</td>
</tr>
<tr>
<td>1 I feel more discouraged about my future than I used to be.</td>
<td>1 I have lost confidence in myself.</td>
</tr>
<tr>
<td>2 I do not expect things to work out for me.</td>
<td>2 I am disappointed in myself.</td>
</tr>
<tr>
<td>3 I feel my future is hopeless and will only get worse.</td>
<td>3 I dislike myself.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Past Failure</th>
<th>8. Self-Criticalness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 I do not feel like a failure.</td>
<td>0 I don’t criticize or blame myself more than usual.</td>
</tr>
<tr>
<td>1 I have failed more than I should have.</td>
<td>1 I am more critical of myself than I used to be.</td>
</tr>
<tr>
<td>2 As I look back, I see a lot of failures.</td>
<td>2 I criticize myself for all of my faults.</td>
</tr>
<tr>
<td>3 I feel I am a total failure as a person.</td>
<td>3 I blame myself for everything bad that happens.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Loss of Pleasure</th>
<th>9. Suicidal Thoughts or Wishes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 I get as much pleasure as I ever did from the things I enjoy.</td>
<td>0 I don’t have any thoughts of killing myself.</td>
</tr>
<tr>
<td>1 I don’t enjoy things as much as I used to.</td>
<td>1 I have thoughts of killing myself, but I would not carry them out.</td>
</tr>
<tr>
<td>2 I get very little pleasure from the things I used to enjoy.</td>
<td>2 I would like to kill myself.</td>
</tr>
<tr>
<td>3 I can’t get any pleasure from the things I used to enjoy.</td>
<td>3 I would kill myself if I had the chance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Guilty Feelings</th>
<th>10. Crying</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 I don’t feel particularly guilty.</td>
<td>0 I don’t cry any more than I used to.</td>
</tr>
<tr>
<td>1 I feel guilty over many things I have done or should have done.</td>
<td>1 I cry more than I used to.</td>
</tr>
<tr>
<td>2 I feel quite guilty most of the time.</td>
<td>2 I cry over every little thing.</td>
</tr>
<tr>
<td>3 I feel guilty all of the time.</td>
<td>3 I feel like crying, but I can’t.</td>
</tr>
</tbody>
</table>
11. Agitation
0 I am no more restless or wound up than usual.
1 I feel more restless or wound up than usual.
2 I am so restless or agitated that it’s hard to stay still.
3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest
0 I have not lost interest in other people or activities.
1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It’s hard to get interested in anything.

13. Indecisiveness
0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14. Worthlessness
0 I do not feel I am worthless.
1 I don’t consider myself as worthwhile and useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15. Loss of Energy
0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don’t have enough energy to do very much.
3 I don’t have enough energy to do anything.

16. Changes in Sleeping Pattern
0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day.
3b I wake up 1–2 hours early and can’t get back to sleep.

17. Irritability
0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18. Changes in Appetite
0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than usual.
3a I have no appetite at all.
3b I crave food all the time.

19. Concentration Difficulty
0 I can concentrate as well as ever.
1 I can’t concentrate as well as usual.
2 It’s hard to keep my mind on anything for very long.
3 I find I can’t concentrate on anything.

20. Tiredness or Fatigue
0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of the things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.
**Record Form**

**Calculation of Examinee's Age**

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ID:**

**Sex:** □ F □ M

**Handedness:** □ R □ L

**Address/School/Testing Site:**

**Highest Education/Grade:**

**Examiner Name:**

---

### Total Raw Score to T-Score Conversion

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Raw Score</th>
<th>T-Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matrix Reasoning</td>
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<td></td>
</tr>
<tr>
<td>Similarities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sum of T-Scores**

<table>
<thead>
<tr>
<th>Verbal Comp.</th>
<th>Perc.</th>
<th>Full Scale-4</th>
<th>Full Scale-2</th>
</tr>
</thead>
</table>

---

### Examinee Visual/Hearing Aids During Testing

- Check type of aid examinee needed:
  - □ Glasses
  - □ Prescription Lenses
  - □ Assisted Listening Device
  - □ Other:

---

### Sum of T-Scores to Composite Score Conversion

<table>
<thead>
<tr>
<th>Scale</th>
<th>Sum of T Scores</th>
<th>Composite Score</th>
<th>Percentile Rank</th>
<th>Confidence Interval: 90% or 90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Comp.</td>
<td></td>
<td>VCI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perc. Rsn.</td>
<td></td>
<td>PRI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Scale-4</td>
<td></td>
<td>FSIQ-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Scale-2</td>
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<td>FSIQ-2</td>
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<td></td>
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</tbody>
</table>

### Subtest T-Score Profile

<table>
<thead>
<tr>
<th>Subtest</th>
<th>T-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Comprehension</td>
<td>VCI</td>
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<tr>
<td>Perception Reasoning</td>
<td>PRI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Composite Score Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCI</td>
</tr>
<tr>
<td>PRI</td>
</tr>
<tr>
<td>FSIQ</td>
</tr>
</tbody>
</table>

### Ranges of Expected Scores

<table>
<thead>
<tr>
<th>Scores</th>
<th>Confidence Level</th>
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<tr>
<td></td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td>68%</td>
</tr>
<tr>
<td>FSIQ-4</td>
<td></td>
</tr>
</tbody>
</table>

---

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Product Number 0158981596
### 1. Block Design

**Start** Ages 6–8: Item 1
Ages 9–90: Item 3

**Reverse** Ages 9–90: Does not obtain a perfect score on either Item 3 or Item 4, administer the preceding items in reverse order until two consecutive perfect scores are obtained.

**Stop** Ages 6–8: After item 11.

**Record & Score** Items 1–4:
Score 0, 1, or 2 points.
Items 5–13:
Score 0, 4, 5, 6, or 7 points.

<table>
<thead>
<tr>
<th>Design</th>
<th>Presentation Method</th>
<th>Time Limit</th>
<th>Completion Time</th>
<th>Constructed Design</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>6–8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Examinee</td>
<td>Model and Picture</td>
<td>30&quot;</td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td>2.</td>
<td>Examinee</td>
<td>Model and Picture</td>
<td>30&quot;</td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td>9–90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Examiner</td>
<td>Model and Picture</td>
<td>45&quot;</td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td>4.</td>
<td>Examiner</td>
<td>Model and Picture</td>
<td>45&quot;</td>
<td>Trial 1</td>
<td>Trial 2</td>
</tr>
<tr>
<td>5.</td>
<td>Examiner</td>
<td>Picture</td>
<td>60&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Examiner</td>
<td>Picture</td>
<td>60&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Examiner</td>
<td>Picture</td>
<td>60&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Examiner</td>
<td>Picture</td>
<td>60&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Examiner</td>
<td>Picture</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Examiner</td>
<td>Picture</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Examiner</td>
<td>Picture</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Examiner</td>
<td>Picture</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Examiner</td>
<td>Picture</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Raw Score**
Ages 6–8: 57
Ages 9–90: 71

**Block Design Total Raw Score**

---

*WASI-II Record Form*
### 2. Vocabulary

- **Start Ages 6-90:** Item 4
- **Reverse:** Ages 6-50: Does not obtain a perfect score on either Item 4 or Item 5, administer the preceding items in reverse order until two consecutive perfect scores are obtained.
- **Discontinue After 3 consecutive scores of 0.**
- **STOP:**
  - Age 6: After Item 22.
  - Ages 7-11: After Item 25.
  - Ages 12-14: After Item 28.
- **Record & Score:**
  - Items 1-3: Score 0 or 1 point.
  - Items 4-5: Score 0 or 2 points.
  - Items 6-31: Score 0, 1, or 2 points.
  - See the Manual for sample responses.

<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fish</td>
<td>0 1</td>
</tr>
<tr>
<td>2.</td>
<td>Shovel</td>
<td>0 1</td>
</tr>
<tr>
<td>3.</td>
<td>Shell</td>
<td>0 1</td>
</tr>
<tr>
<td>4.</td>
<td>Shirt</td>
<td>0 2</td>
</tr>
<tr>
<td>5.</td>
<td>Car</td>
<td>0 2</td>
</tr>
<tr>
<td>6.</td>
<td>Lamp</td>
<td>0 1  2</td>
</tr>
<tr>
<td>7.</td>
<td>Bird</td>
<td>0 1  2</td>
</tr>
<tr>
<td>8.</td>
<td>Tongue</td>
<td>0 1  2</td>
</tr>
<tr>
<td>9.</td>
<td>Pet</td>
<td>0 1  2</td>
</tr>
<tr>
<td>10.</td>
<td>Lunch</td>
<td>0 1  2</td>
</tr>
<tr>
<td>11.</td>
<td>Bell</td>
<td>0 1  2</td>
</tr>
<tr>
<td>12.</td>
<td>Calendar</td>
<td>0 1  2</td>
</tr>
<tr>
<td>13.</td>
<td>Alligator</td>
<td>0 1  2</td>
</tr>
<tr>
<td>14.</td>
<td>Dance</td>
<td>0 1  2</td>
</tr>
</tbody>
</table>

*If the examinee provides a 2-point response that requires feedback or gives an incorrect (0 point) response, provide corrective feedback as instructed in the Manual.*

---

**WASI-II Record Form 3**
<table>
<thead>
<tr>
<th>Item</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Summer</td>
<td>0 1 2</td>
</tr>
<tr>
<td>16. Reveal</td>
<td>0 1 2</td>
</tr>
<tr>
<td>17. Decade</td>
<td>0 1 2</td>
</tr>
<tr>
<td>18. Entertain</td>
<td>0 1 2</td>
</tr>
<tr>
<td>19. Tradition</td>
<td>0 1 2</td>
</tr>
<tr>
<td>20. Enthusiastic</td>
<td>0 1 2</td>
</tr>
<tr>
<td>21. Improvise</td>
<td>0 1 2</td>
</tr>
<tr>
<td>22. Haste</td>
<td>0 1 2</td>
</tr>
<tr>
<td>23. Trend</td>
<td>0 1 2</td>
</tr>
<tr>
<td>24. Impulse</td>
<td>0 1 2</td>
</tr>
<tr>
<td>25. Ruminate</td>
<td>0 1 2</td>
</tr>
<tr>
<td>26. Mollify</td>
<td>0 1 2</td>
</tr>
<tr>
<td>27. Extirpate</td>
<td>0 1 2</td>
</tr>
<tr>
<td>28. Panacea</td>
<td>0 1 2</td>
</tr>
</tbody>
</table>
2. Vocabulary (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>29. Perfunctory</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td>30. Insipid</td>
<td>0 1 2</td>
<td></td>
</tr>
<tr>
<td>31. Pavid</td>
<td>0 1 2</td>
<td></td>
</tr>
</tbody>
</table>

Maximum Raw Score
- Age 6: 41
- Ages 7–11: 47
- Ages 12–14: 53
- Ages 15–90: 59

3. Matrix Reasoning

```
<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1 2 3 4 5</td>
<td>0 1</td>
</tr>
<tr>
<td>2</td>
<td>1 2 3 4 5</td>
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<td>0 1</td>
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<td>5</td>
<td>1 2 3 4 5</td>
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<td>6</td>
<td>1 2 3 4 5</td>
<td>0 1</td>
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<tr>
<td>7</td>
<td>1 2 3 4 5</td>
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<tr>
<td>30</td>
<td>1 2 3 4 5</td>
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</table>
```

Matrix Reasoning

Maximum Raw Score
- Ages 6–8: 24
- Ages 9–90: 30
4. Similarities

<table>
<thead>
<tr>
<th>Start</th>
<th>Ages 6–8:</th>
<th>Item 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ages 9–90: Item 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reverse Ages 9–90: Does not obtain a perfect score on either Item 4 or Item 5, administer the preceding items in reverse order until two consecutive perfect scores are obtained.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discontinue After 3 consecutive scores of 0.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stop Ages 6–8: After item 22.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Record &amp; Score Items 1–3: Score 0 or 1 point. Correct responses are in color. Items 4–5: Score 0 or 2 points. Items 6–24: Score 0, 1, or 2 points. See Manual for sample responses.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Picture Item</th>
<th>Response</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>6–8 11.</td>
<td>1 2 3 4 5</td>
<td>0 1</td>
</tr>
<tr>
<td>2.</td>
<td>1 2 3 4 5</td>
<td>0 1</td>
</tr>
<tr>
<td>3.</td>
<td>1 2 3 4 5</td>
<td>0 1</td>
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</table>

<table>
<thead>
<tr>
<th>Verbal Items</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>4. Green–Blue</td>
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<tr>
<td>0 2</td>
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<td></td>
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<tr>
<td>5.</td>
<td>5. Square–Triangle</td>
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<tr>
<td>0 2</td>
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<td></td>
</tr>
<tr>
<td>6.</td>
<td>Cow–Bear</td>
<td></td>
</tr>
<tr>
<td>0 1 2</td>
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<td></td>
</tr>
<tr>
<td>7.</td>
<td>Shirt–Jacket</td>
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</tr>
<tr>
<td>0 1 2</td>
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</tr>
<tr>
<td>8.</td>
<td>Pen–Crayon</td>
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</tr>
<tr>
<td>0 1 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Hat–Umbrella</td>
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</tr>
<tr>
<td>0 1 2</td>
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<td></td>
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<td>10.</td>
<td>Airplane–Bus</td>
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<tr>
<td>0 1 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Door–Window</td>
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<tr>
<td>0 1 2</td>
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<tr>
<td>12.</td>
<td>Child–Adult</td>
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<tr>
<td>0 1 2</td>
<td></td>
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</tbody>
</table>

$\$If the examinee provides a response that suggests he or she does not understand the task, provide the specified prompt in the Manual. 
†If the examinee provides a 2-point response that requires feedback or provides an incorrect (0 point) response, provide corrective feedback as instructed in the Manual.
<table>
<thead>
<tr>
<th>Verbal Item</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Shoulder–Ankle</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>14. Love–Hate</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>15. Smooth–Rough</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>16. Hand–Flag</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>17. Wall–Line</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>18. Heat–Wind</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>19. More–Less</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>20. Shadow–Echo</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>21. Tradition–Habit</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>22. Peace–War</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>23. Time–Progress</td>
<td></td>
<td>0 1 2</td>
</tr>
<tr>
<td>24. Memory–Practice</td>
<td></td>
<td>0 1 2</td>
</tr>
</tbody>
</table>

Maximum Raw Score

- Ages 6–8: 41
- Ages 9–90: 45

Total Raw Score
Behavioral Observations

Referral source/Reason for referral/Presenting complaint(s)

Physical appearance

Language (e.g., first/native language, other language, English fluency, expressive and receptive language ability, articulation)

Attention and concentration

Attitude toward testing (e.g., rapport, eager to speak, working habits, interest, motivation, reaction to success/failure)

Affect/Mood

Unusual behaviors/Verbalizations (e.g., perseverations, stereotypic movements, bizarre and atypical verbalizations)

Other notes
Think about how you have been feeling over the past month. Using the scale below, please rate each of the following statements for how well they describe you DURING THE PAST MONTH.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>not true at all</td>
<td>rarely true</td>
<td>sometimes true</td>
<td>often true</td>
<td>true nearly all the time</td>
</tr>
</tbody>
</table>

1. ______ Able to adapt to change
2. ______ Close and secure relationships
3. ______ Sometimes fate or God can help
4. ______ Can deal with whatever comes
5. ______ Past success gives confidence for new challenge
6. ______ See the humorous side of things
7. ______ Coping with stress strengthens
8. ______ Tend to bounce back after illness or hardship
9. ______ Things happen for a reason
10. ______ Best effort no matter what
11. ______ You can achieve your goals
12. ______ When things look hopeless, I don't give up
13. ______ Know where to turn for help
14. ______ Under pressure, focus and think clearly
15. ______ Prefer to take the lead in problem solving
16. ______ Not easily discouraged by failure
17. ______ Think of self as strong person
18. ______ Make unpopular or difficult decisions
19. ______ Can handle unpleasant feelings
20. ______ Have to act on a hunch
21. ______ Strong sense of purpose
22. ______ In control of your life
23. ______ I like challenges
24. ______ You work to attain your goals
25. ______ Pride in your achievements
Craig Handicap Assessment and Reporting Technique Scoring Short Form

1. How many hours in a typical 24-hour day do you have someone with you to provide physical assistance for personal care activities such as eating, bathing, dressing, toileting and mobility?

   _____ hours paid assistance      _____ hours unpaid (family, others)

A. Total the hours of paid and unpaid care, multiply by 4, and subtract that number from 100.

   100 minus ______ =

   [Blank]

PHYSICAL INDEPENDENCE

2. How much time is someone with you in your home to assist you with activities that require remembering, decision making, or judgment?

   1 ______ Someone else is always with me to observe or supervise.
   2 ______ Someone else is always around, but they only check on me now and then.
   3 ______ Sometimes I am left alone for an hour or two.
   4 ______ Sometimes I am left alone for most of the day.
   5 ______ I have been left alone all day and all night, but someone checks in on me.
   6 ______ I am left alone without anyone checking on me.

A. Assign points as follows: response #1 = 0 points; response #2 = 1 point; response #3 = 2 points; response #4 = 3 points; response #5 = 4 points; and response #6 = 5 points.

   ______ x11 =

   [Blank]

B. Multiply points in “A” by 11.

   +

COGNITIVE INDEPENDENCE

3. How much of the time is someone with you to help you with remembering, decision making, or judgment when you go away from your home?

   1 ______ I am restricted from leaving, even with someone else.
   2 ______ Someone is always with me to help with remembering, decision making or judgment when I go anywhere.
   3 ______ I go to places on my own as long as they are familiar.
   4 ______ I do not need help going anywhere.

A. Assign points as follows: response #1 = 0 points; response #2 = 1 point; response #3 = 2 points; and response #4 = 3 points.

   ______ x15 =

   [Blank]

B. Multiply points in “A” by 15.

   +

Add the sums of “B” and “D”. If the total sum is greater than 100, enter 100.

   [Blank]
4. On a **typical day**, how many hours are you out of bed? _______ hours

5. In a typical **week**, how many days do you get out of your house and go somewhere? _______ days

6. In the last **year**, how many nights have you spent away from your home (excluding hospitalizations?)
   - none
   - 1-2
   - 3-4
   - 5 or more

   C. Assign points as follows: no nights out = 0; 1-2 nights out = 10; 3-4 nights out = 15; 5 or more nights = 20. If the total sum is greater than 100, enter 100.

   Add the sums of “A”, “B”, and “C”. If the total sum is greater than 100, enter 100.

---

7. How many hours per week do you spend working in a job for which you get paid? hours _______

8. How many hours per week do you spend in school working toward a degree or in an accredited technical training program (including hours in class and studying)? hours _______

9. How many hours per week do you spend in active homemaking including parenting, housekeeping, and food preparation? _________ hours

10. How many hours per week do you spend in home maintenance activities such as gardening, house repairs or home improvement? _________ hours

11. How many hours per week do you spend in recreational activities such as sports, exercise, playing cards, or going to movies? Please do not include time spent watching TV or listening to the radio. _______ hours

   E. Multiply the number of recreational activities by 1.25 _________

   Add the sums of “A”, “B”, “C”, “D”, and “E”. If the total sum is greater than 100, enter 100.
12. How many people do you live with?

13. Is one of them your spouse or significant other?

14. Of the people you live with, how many are relatives?

15. How many business or organizational associates do you visit, phone, or write to at least once a month? ________ Associates

16. How many friends (non-relatives contacted outside business or organizational settings) do you visit, phone, or write to at least once a month? ________ Friends

17. With how many strangers have you initiated a conversation in the last month (for example, to ask information or place an order)?
   - none
   - 1-2
   - 3-5
   - 6 or more

### SOCIAL INTEGRATION

A. Assign 38 points if living with spouse/partner OR assign 25 points if living with unrelated roommate and/or an attendant. Add an additional six points for every relative that lives in the household.

B. Multiply number of business associates by 2.5. A maximum score for this component is 25 points.

C. If living with more than one roommate, add extra roommate to number of friends contacted monthly. Multiply by 13. A maximum score for this component is 65 points.

D. Assign points as follows: none = 0 points; 1-2 = 15 points; 3-5 = 23 points; 6 or more = 30 points.

Add the sums from “A”, “B”, “C”, and “D”. If the total sum is greater than 100, enter 100.
18. Approximately what was the combined annual income, in the last year, of all family members in your household? (Consider all sources including wages and earnings, disability benefits, pensions and retirement income, income from court settlements, investments and trust funds, child support and alimony, contributions from relatives, and any other source.)

   a. Less than 25,000 - If no ask e; if yes ask b
   b. Less than 20,000 - If no code 22500; if yes ask c
   c. Less than 15,000 - If no code 17500; if yes ask d
   d. Less than 10,000 - If no code 12500; if yes code 5000
   e. Less than 35,000 - If no code 30000
   f. Less than 50,000 - If no code 42500
   g. Less than 75,000 - If no code h; if yes code 62500
   h. 75,000 or more code 80000

A. Calculate family size by adding respondent, plus partner (if living with respondent), plus other relatives in household.

19. Approximately how much did you pay last year for medical care expenses? (Consider any amounts paid by yourself or the family members in your household and not reimbursed by insurance or benefits.)

   a. Less than 1000 if "no" ask b if "yes" code 500.
   b. Less than 2500 if "no" ask c if "yes" code 1750.
   c. Less than 5000 if "no" ask d if "yes" code 3750.
   d. Less than 10000 if "no" code e if "yes" code 7500.
   e. 10000 or more code 15000

B. Subtract the unreimbursed medical expenses from the annual income (amount in question #19 minus amount in question #20).

C. Determine poverty level from family size calculated in "A".

D. Divide the value from “B” by the poverty level from “C”.

E. Multiply by 50

If the total sum is greater than 100, enter 100.
Personality Assessment Inventory (PAI)

Purpose:
22 nonoverlapping full scales provide a comprehensive assessment of adult psychopathology in ages 18 years and older.

Age Range:
Adult
Elder Adult

Admin:
Individual or group

Time:
50-60 minutes to administer; 15-20 minutes to score

Qualification:
C

Sample Reports:
N/A

Related Products:
PAI® Professional Report Service
PAI® Software Portfolio
Personality Assessment Inventory™-Adolescent

With its newly revised Professional Manual, Profile Form Adults-Revised, and Critical Items Form-Revised, the PAI® continues to raise the standard for the assessment of adult psychopathology. This objective inventory of adult personality assesses psychopathological syndromes and provides information relevant for clinical diagnosis, treatment planning, and screening for psychopathology. Since its introduction, the PAI has been heralded as one of the most important innovations in the field of clinical assessment.

PAI® Scales and Subscales
The 344 PAI items constitute 22 nonoverlapping scales covering the constructs most relevant to a broad-based assessment of mental disorders: 4 validity scales, 11 clinical scales, 5 treatment scales, and 2 interpersonal scales. To facilitate interpretation and to cover the full range of complex clinical constructs, 10 scales contain conceptually derived subscales.

The PAI Clinical scales were developed to provide information about critical diagnostic features of 11 important clinical constructs. These 11 scales may be divided into three broad classes of disorders: those within the neurotic spectrum, those within the psychotic spectrum, and those associated with behavior disorder or impulse control problems.

The Treatment scales were developed to provide indicators of potential complications in treatment that would not necessarily be apparent from diagnostic information. These five scales include two indicators of potential for harm to self or others, two measures of the respondent's environmental circumstances, and one indicator of the respondent's motivation for treatment.

The Interpersonal scales were developed to provide an assessment of the respondent's interpersonal style along two dimensions: a warmly affiliative versus a cold rejecting style, and a dominating/controlling versus a meekly submissive style. These axes provide a useful way of conceptualizing many different mental disorders: persons at the extremes of these dimensions may present with a variety of disorders. A number of studies provide evidence that diagnostic groups differ on these dimensions.

The PAI includes a Borderline Features scale and an Antisocial Features scale. Both of these scales specifically assess character pathology. The Borderline Features scale is the only PAI scale that has four subscales, reflecting the factorial complexity of the construct. The Antisocial Features scale includes a total of three facets: one assessing antisocial behaviors, and the other two assessing antisocial traits.
The following questions concern your alcohol consumption. Place an X in one box that best describes your answer to each question.

<table>
<thead>
<tr>
<th>Questions</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often do you have a drink containing alcohol?</td>
<td>Never</td>
<td>Monthly or less</td>
<td>2-4 times a month</td>
<td>2-3 times a week</td>
<td>4 or more times a week</td>
</tr>
<tr>
<td>2. How many drinks containing alcohol do you have on a typical day when you are drinking?</td>
<td>1 or 2</td>
<td>3 or 4</td>
<td>5 or 6</td>
<td>7 to 9</td>
<td>10 or more</td>
</tr>
<tr>
<td>3. How often do you have six or more drinks on one occasion?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>4. How often during the last year have you found that you were not able to stop drinking once you had started?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>5. How often during the last year have you failed to do what was normally expected of you because of drinking?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>7. How often during the last year have you had a feeling of guilt or remorse after drinking?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>8. How often during the last year have you been unable to remember what happened the night before because of your drinking?</td>
<td>Never</td>
<td>Less than monthly</td>
<td>Monthly</td>
<td>Weekly</td>
<td>Daily or almost daily</td>
</tr>
<tr>
<td>9. Have you or someone else been injured because of your drinking?</td>
<td>No</td>
<td>Yes, but not in the last year</td>
<td>Yes, during the last year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?</td>
<td>No</td>
<td>Yes, but not in the last year</td>
<td>Yes, during the last year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total |
After a head injury or accident some people experience symptoms that can cause worry or nuisance. We would like to know if you now suffer any of the symptoms given below. Because many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each symptom listed below please circle the number that most closely represents your answer.

0 = not experienced at all
1 = no more of a problem
2 = a mild problem
3 = a moderate problem
4 = a severe problem

Compared with **before** the accident, do you **now** (i.e., over the last 24 hours) suffer from:

<table>
<thead>
<tr>
<th></th>
<th>not experienced</th>
<th>no more of a problem</th>
<th>mild problem</th>
<th>moderate problem</th>
<th>severe problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headaches</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feelings of dizziness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nausea and/or vomiting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Noise sensitivity (easily upset by loud noise)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Fatigue, tiring more easily</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Being irritable, easily angered</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feeling depressed or tearful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feeling frustrated or impatient</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Forgetfulness, poor memory</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Poor concentration</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Taking longer to think</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Light sensitivity (easily upset by bright light)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Double vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Restlessness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Are you experiencing any other difficulties? Please specify, and rate as above.

1. 0 1 2 3 4
2. 0 1 2 3 4

**Administration only:**

**RPQ-3 (total for first three items)**

**RPQ-13 (total for next 13 items)**
Administration only

Individual item scores reflect the presence and severity of post concussive symptoms. Post concussive symptoms, as measured by the RPQ, may arise for different reasons subsequent to (although not necessarily directly because of) a traumatic brain injury. The symptoms overlap with broader conditions, such as pain, fatigue and mental health conditions such as depression.

The questionnaire can be repeated to monitor a patient’s progress over time. There may be changes in the severity of symptoms, or the range of symptoms. Typical recovery is reflected in a reduction of symptoms and their severity within three months.

Scoring

The scoring system has been modified from Eyres, 2005.

The items are scored in two groups. The first group (RPQ-3) consists of the first three items (headaches, feelings of dizziness and nausea) and the second group (RPQ-13) comprises the next 13 items. The total score for RPQ-3 items is potentially 0–12 and is associated with early symptom clusters of post concussive symptoms. If there is a higher score on the RPQ-3, earlier reassessment and closer monitoring is recommended.

The RPQ-13 score is potentially 0–52, where higher scores reflect greater severity of post concussive symptoms. The RPQ-13 items are associated with a later cluster of symptoms, although the RPQ-3 symptoms of headaches, dizziness and nausea may also be present. The later cluster of symptoms is associated with having a greater impact on participation, psychosocial functioning and lifestyle. Symptoms are likely to resolve within three months. A gradual resumption of usual activities is recommended during this period, appropriate to symptoms. If the symptoms do not resolve within three months, consideration of referral for specialist assessment or treatment services is recommended.

References:


Snaith-Hamilton Pleasure Scale

This questionnaire is designed to measure your ability to experience pleasure in the last few days. It is important to read each statement very carefully. Circle the answer that corresponds to how much you agree or disagree with each statement.

1. I would enjoy my favorite television or radio program. ............Strongly Disagree
   Disagree Agree Strongly Agree

2. I would enjoy being with my family or close friends. ............Definitely Agree
   Agree Disagree Strongly Disagree

3. I would find pleasure in my hobbies and past-times. ............Strongly Disagree
   Disagree Agree Strongly Agree

4. I would be able to enjoy my favorite meal. .........................Definitely Agree
   Agree Disagree Strongly Disagree

5. I would enjoy a warm bath or refreshing shower. ....................Definitely Agree
   Agree Disagree Strongly Disagree

6. I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread. ....................Strongly Disagree
   Disagree Agree Strongly Agree

7. I would enjoy seeing other people’s smiling faces. .............Definitely Agree
   Agree Disagree Strongly Disagree

8. I would enjoy looking smart when I have made an effort with my appearance. ....................Strongly Disagree
   Disagree Agree Strongly Agree

9. I would enjoy reading a book, magazine, or newspaper. .............Definitely Agree
   Agree Disagree Strongly Disagree

10. I would enjoy a cup of tea or coffee or my favorite drink. ....Strongly Disagree
    Disagree Agree Strongly Agree

11. I would find pleasure in small things, e.g. bright sunny day, a telephone call from a friend. ....................Strongly Disagree
    Disagree Agree Strongly Agree

12. I would be able to enjoy a beautiful landscape or view. ............Definitely Agree
    Agree Disagree Strongly Disagree

13. I would get pleasure from helping others. .....................Strongly Disagree
    Disagree Agree Strongly Agree

14. I would feel pleasure when I receive praise from other people. ....Definitely Agree
    Agree Disagree Strongly Disagree
Satisfaction with Life Scale

Below are five statements with which you may agree or disagree. Indicate your agreement with each item by placing the appropriate number on the line preceding that item.

Please be open and honest in your responding.

The 7-point scale is as follows:

1 = strongly disagree
2 = disagree
3 = slightly disagree
4 = neither agree nor disagree
5 = slightly agree
6 = agree
7 = strongly agree

__ 1. In most ways my life is close to my ideal.
__ 2. The conditions of my life are excellent.
__ 3. I am satisfied with my life.
__ 4. So far I have gotten the important things I want in life.
__ 5. If I could live my life over, I would change almost nothing.
EDINBURGH HANDEDNESS SURVEY

Subject ID#:_________________

Date: ______________

Please indicate your preferences in the use of hands in the following activities by putting a + in the appropriate column. Where the preference is so strong that you would never try to use the other hand unless absolutely forced to, put ++. If in any case you are really indifferent put + in both columns.

Some of the activities require both hands. In these cases the part of the task, or object, for which the hand preference is wanted is indicated in brackets.

Please try to answer all the questions, and only leave a blank if you have no experience at all of the object or task.

<table>
<thead>
<tr>
<th></th>
<th>LEFT</th>
<th>RIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Writing</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drawing</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Throwing</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Scissors</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Toothbrush</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Knife [without fork]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Spoon</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Broom [upper hand]</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Striking Match [match]</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Opening Box [lid]</td>
<td></td>
</tr>
</tbody>
</table>

Do not write below this line

L.Q.:_______________     DECILE: ______________
Have you ever used marijuana?

*For our purposes, marijuana usage is considered any instance in which you intentionally consumed (smoked, ingested, etc.) any quantity of marijuana.*

☐ NO  ☐ YES

At what age did you start? ________________________________________________

At what specific age (in years) was your marijuana usage the heaviest? __________

During your lifetime, approximately how many occasions have you used marijuana?

☐ 0-50  ☐ 51-100  ☐ 101-500  ☐ 501s-1000  ☐ 1001-5000  ☐ over 5000

Consider the extent of marijuana use throughout your lifetime. Please approximate the number of times per month on average which you used marijuana at the following ages:

<table>
<thead>
<tr>
<th>Age Range</th>
<th>16-18 years of age</th>
<th>19-21 years of age</th>
<th>22-24 years of age</th>
<th>25-27 years of age</th>
<th>28-30 years of age</th>
<th>30+ years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

During your lifetime, on average, how many times per month have you used marijuana?

_______________

In the past four weeks, did you use marijuana?

☐ NO  ☐ YES

How often? ________________________________ daily / weekly (*circle one*)

On average, how much do you consume per occasion? ____________________

If YES, please review the printed calendar reflecting all the days in the past month. Indicate the number of times you used marijuana on each of these days. If you abstained from marijuana use during a given day, please write a “0” on that day. Please fill out every day in the calendar with your best guess of marijuana use.
Dear Author,

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A BRIEF OVERVIEW OF THE NEUROPATHOLOGY OF MULTIPLE SCLEROSIS

Multiple sclerosis (MS) is an acquired progressive inflammatory demyelinating condition affecting the central nervous system (CNS) that often presents with a relapsing and remitting course. To understand the symptoms and presentation of MS, it is crucial to first understand the basic neuropathology and associated neuroanatomy that is affected by the disease. MS generally involves neuropathology affecting three primary features of the neuron and surrounding tissue. These features are lesions, inflammation, and damage to the myelin sheath that surrounds the axons of a neuron. As shown in Fig. 3.1, a neuron is composed of cell body with branch-like dendrites and a longer fiber projection called an axon. It is the axons that permit neural communication over significant distances within the nervous system. A neural signal originating in the cell body travels along the axon and terminates at the synaptic bouton, where neurotransmitters are released into the synapse to stimulate adjacent neurons. The terms gray matter (GM) and white matter (WM) are often used to describe various aspects of these neuronal tissues. Specifically, brain tissue such as the cerebral cortex is often labeled as GM because it comprises dense clustering of the cell bodies of neurons, leading to a characteristic grayish appearance to the naked eye or when seen on standard T1 magnetic resonance imaging (MRI) scans. WM comprises the axons and their surrounding myelin insulation. The axon is a protoplasmic projection from the cell body that allows rapid transduction of an electrochemical signal, known as an action potential, across longer distances of the nervous system. In humans, axons are insulated by a fatty white-appearing covering called myelin. The layer of myelin is produced by the attachment of glial cells to the axon (oligodendrocytes in the CNS and Schwann cells in the peripheral nervous system, PNS). The myelin sheath covering is discontinuous and the gaps between the myelin sheath on axon are known as nodes of Ranvier. These gaps allow exchange of ions with the extracellular space which helps regeneration of action potential across the axon. The myelin covering enables faster conduction...
of the action potential across neurons by permitting the neural impulse to propagate rapidly from node to node. In brief, the pathology of MS involves damage to the myelin sheath, which results in disturbances in conduction of nerve impulses, which in turn affects motor, sensory, visual, and autonomic systems. These disturbances may manifest in several ways. First, lesions (or plaques) to the WM, brain stem, basal ganglia, optic nerve, and spinal cord are among the most commonly observed. These lesions are a result of demyelination and subsequent attempts of remyelination, which builds up plaques along the damaged axons eventually. MS also is associated with the loss of oligodendrocytes, which are responsible for the production of myelin in the CNS. Second, MS can lead to a disruption of the blood–brain barrier, which allows T cells to enter the CNS and initiate a cascade of other immune responses, which in turn commences inflammation. There are four clinical subtypes of MS: (1) relapsing remitting (RR) type—which is the most common pattern and involves periods of flair-ups followed by periods of relative dormancy; (2) secondary progressive (SP) type—which involves a slow worsening of symptoms over time, often with a relapsing and remitting progression; (3) primary progressive (PP) type—which involves a slow but fairly consistent worsening of symptoms over time, without a clear relapse/remission pattern; and (4) progressive relapsing type—which involves a progressive worsening of symptoms with acute periods of exacerbations without clear remissions.

NEUROIMAGING IN MS

MS is a challenging disease when it comes to diagnosis and treatment. Over the past decade, the development of new imaging modalities such as MRI has revolutionized the management of this disease, particularly with regard to diagnosis and monitoring disease progression. In this chapter, we briefly outline the use of standard clinical MRI scans for diagnosis and monitoring, and introduce the investigational use of newer cutting edge neuroimaging technologies, such as diffusion tensor imaging (DTI) and fiber tractography, which hold the promise of rapidly advancing understanding of this debilitating disease.

MRI is a widely used imaging modality that provides excellent resolution of the lesions common to MS. Standard MRI scans work on basic principles of quantum mechanics. In brief, during a typical MRI scan, the body part of interest is placed within a strong magnetic field, which aligns a large number of the hydrogen protons in the direction of the magnetic field. By applying a radio frequency (RF) pulse to the body part, the orientation of the protons can be momentarily reoriented. After cessation of the RF pulse, the realignment of the protons with the magnetic field will lead to a change in magnetic flux which can be captured by the receiver coil in the scanner and used to reconstruct three-dimensional images of the body part. Depending on the pulse sequences and imaging parameters used, the MRI can produce various sequences such as T1-weighted (T1WI), T1 contrast-enhanced (T1C), T2-weighted (T2WI), fluid-attenuated inversion recovery (FLAIR), DTI, and magnetic resonance spectroscopy (MRS), each providing meaningful information about the health and structure of the tissues and structures being imaged. Fig. 3.2 shows examples of T2WI scans showing MS lesions. MRI scans can be used clinically to make a diagnosis of MS. The McDonald criteria, currently considered the most reliable method of MS diagnosis, rely upon MRI to demonstrate the dissemination of lesions in time and space. Table 3.1 represents the most recent (2011) version of these criteria for using T2WI MRI images to diagnose MS. In the next
few paragraphs, we outline some of the major findings on each type of MRI scan in patients with MS.

### T1-Weighted Imaging

While T1WI provide exquisite detail of the brain and show clear demarcation between GW and WM, they are not as sensitive as T2WI for detecting MS. In general, T1WI findings vary on the basis of duration and severity of the disease. Axonal loss or destruction in early stages of disease can appear as hypointense or isointense ovoid, rounded or linear shaped lesions, appearing as dark spots on the scan. These are usually seen along the callososeptal interface or periventricular area and are referred to as T1 black holes. Sometimes, as the disease progresses the black holes may be marked by a peripheral rim of hyperintensity due to macrophage infiltration and lipid peroxidation of the surrounding tissues. This gives the lesions a beveled or a lesion-within-lesion appearance. In advanced stages of disease, thinning of corpus callosum (CC) with or without generalized brain atrophy can be seen on T1WI.

### T2-Weighted Imaging and FLAIR

The T2 sequence, especially FLAIR, is considered to be the most sensitive MRI scan for detecting MS plaques. These images are helpful for identifying lesions because they suppress the appearance of cerebrospinal fluid, which allows for greater resolution in detecting lesions in the periventricular regions. Multiple hyperintense lesions, sometimes surrounded by hypointense peripheral rim with perilesional edema, can be seen. The lesions can be ovoid (as shown in Fig. 3.2), linear, circular, or triangular in shape. A triangular shaped lesion with the base of triangle adjacent to the lateral ventricle and apex pointing toward the cortex is one of the typical findings of MS. Perivenular collection of inflammatory cells along medullary veins can be seen as hyperintensities.

### Revised McDonald Criteria

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<tr>
<th>Dissemination in Space</th>
<th>Dissemination in Time</th>
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<td>≥1 T2 lesions in two or more of the following locations:</td>
<td>≥1 T2 lesion and/or gadolinium enhancing or nonenhancing T2 lesion on any one scan</td>
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<td>• Periventricular</td>
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<td>• Juxtacortical</td>
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<td>• Infratentorial</td>
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<td>• Spinal cord</td>
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<td>• If a patient has a brain stem/spinal cord syndrome, the symptomatic lesion(s) are excluded from the criteria, not contributing to the lesion count</td>
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**TABLE 3.1 Revised McDonald Criteria**

Dissemination in Space

- ≥1 T2 lesions in two or more of the following locations:
  - Periventricular
  - Juxtacortical
  - Infratentorial
  - Spinal cord

Dissemination in Time

- ≥1 T2 lesion and/or gadolinium enhancing or nonenhancing T2 lesion on any one scan

**FIGURE 3.2** T2 weighted structural scans showing an oval shaped hyperintense lesion in the left forceps minor region on (A) axial view, (B) sagittal view, and (C) coronal view. Reprinted with permission from www.radiopaedia.org; image courtesy of Dr. Ahmed Abi Rabou.
3. WHITE MATTER ABNORMALITIES IN MS: ADVANCES IN DIFFUSION TENSOR IMAGING/TRACTOGRAPHY

Brain injury, to MS. DTI measures the movement of water molecules within the living tissue, permitting inference regarding the underlying structure of the tissues and their membranes. The motion of water molecules can be described in geometric terms as either resembling a sphere or an elongated ellipsoid and is characterized as being either isotropic or anisotropic in nature, respectively. Isotropic movement occurs when water molecules are unconstrained and free to move in any direction equally, and would thus be best defined as a spherical diffusion pattern. On the other hand, water moving in a tube or garden hose would move preferentially in one direction much more than in other directions, and would therefore be better characterized as anisotropic (i.e., an ellipsoid) pattern of diffusion. For instance, due to the lack of axons within the brain ventricles that would have restricted the movement otherwise, the water is free to move in any direction and hence the movement within these structures would be described as being isotropic. In the brain WM, on the other hand, the presence of axons restricts the movement of water molecules in a particular direction and therefore movement within WM regions is predominantly anisotropic in nature.

Axons are not always perfectly aligned along one axis and in order to avoid having to measure diffusion along an impractically large number of axes, a concept of diffusion ellipsoid has been developed. The diffusion ellipsoid is defined using three eigenvectors that have three eigenvalues, which describe their physical length. The longest, medium, and shortest eigenvectors are represented by \( \lambda_1 \), \( \lambda_2 \), and \( \lambda_3 \) respectively. Fig. 3.3 shows the relationships between these three eigenvectors for isotropic and anisotropic shapes.

A number of diffusion measurements have been developed in an attempt to characterize diffusion patterns within the brain WM. Fractional anisotropy (FA) is a global diffusivity measure that measures the degree of anisotropy and is used to evaluate WM integrity. FA is defined by the following formula:

\[
FA = \sqrt{\frac{1}{2} \left( \frac{(\lambda_1 - \lambda_2)^2 + (\lambda_2 - \lambda_3)^2 + (\lambda_3 - \lambda_1)^2}{\lambda_1^2 + \lambda_2^2 + \lambda_3^2} \right)}
\]

FA values range from 0 to 1, with higher values indicating higher anisotropy (i.e., water diffuses more along one axis relative to the others). Mean diffusivity (MD) has also frequently been used to measure the overall diffusivity and represents the average of the three eigenvalues:

\[
MD = \frac{\lambda_1 + \lambda_2 + \lambda_3}{3}
\]

Two other DTI metrics that have been proposed to further explain changes in the global measures (i.e., FA

**FIGURE 3.3** Illustrative example of prototypical water diffusion. Isotropic diffusion means that water molecules can diffuse equally in all directions, as illustrated by a spherical pattern. Anisotropic diffusion means that water molecules are constrained and diffuse more readily in one direction (\( \lambda_1 \)) than in the other two directions (\( \lambda_2 \) and \( \lambda_3 \)).

**Magnetic Resonance Spectroscopic Imaging**

Proton MRS is one of the unique applications of the MRI technique. It yields the information about the chemical composition of different metabolites in the tissues rather than information about anatomical structure or function. Biochemical changes are common within a tissue that is affected by certain disease states. These changes are then compared with the normal distribution of the chemicals to assess the degree and extent of damage within that tissue. While the range of neurochemicals that can be assessed with MRS is limited, there are some that may be particularly important in the case of MS. In particular, N-acetyl aspartate (NAA) is an extremely abundant chemical in the brain, particularly within myelin, so it could be an indicator of WM damage in MS. In fact, evidence reported in 2014 supports the suggestion that in primary and SP type of MS the MRS shows decreased levels of NAA, suggesting a biomarker of axonal damage. Other neurochemicals have been found to be elevated in acute lesions of MS, including the levels of myoinositol, choline, and glutamate.

**Diffusion Tensor Imaging**

DTI is a relatively new neuroimaging technique that has been used to study WM alterations in a great variety of conditions, ranging from depression, to traumatic
and MD) are radial diffusivity (RD) and axonal diffusivity (AD). RD is used to measure diffusion across the axon whereas AD describes movement of water molecules along the axon. Changes within these metrics have been attributed to demyelination and axonal damage, respectively. In their pioneering studies, Song and colleagues showed that loss of myelin following retinal ischemia in mouse optic nerve was associated with increased RD and unchanged axial diffusivity. \(^{22-24}\) Moreover, they showed that axonal degeneration observed during histological analysis was concurrently associated with reduced AD and unaltered RD. \(^{22}\) Therefore, these metrics have been used to describe potential reasons for changes within the global diffusivity measures. RD is defined in the following way\(^{23}\):

\[
\lambda_{\perp} = \frac{\lambda_2 + \lambda_3}{2}
\]

AD is represented by \(\lambda||=\lambda_1^{23}\).

DTI Findings in MS

Using conventional MRI, earlier studies were able to demonstrate macrostructural damage, such as WM lesions, that underlie the physical and cognitive disturbances that are commonly observed in MS. With application of DTI to a wider range of illnesses including MS, both physicians and scientists were able to better understand this condition on a macrostructural level. One of the earliest studies by Werring, Clark, Barker, Thompson, and Miller\(^{28}\) showed reduced FA and high MD in normal-appearing white matter (NAWM) in frontal, parietal, temporal, and occipital regions. Based on the earlier description, this suggests that MS is associated with regions of greater spherically shaped diffusion, potentially suggesting poorer axonal integrity or disruption of myelin (see Fig. 3.4B and C). An important implication from these findings is the notion that WM changes may start occurring before clinical symptoms emerge and remain undetectable using conventional MRI and hence potentially delay clinical interventions that could affect the onset of the illness or reduce its severity.

More recent studies have rectified this earlier limitation by investigating individual WM fiber bundles with the advent of WM tractography (Fig. 3.4A), an outgrowth of DTI procedures. This technique allows a more accurate identification and description of WM architecture. As shown in Fig. 3.4, it is possible to use the FA values at individual locations throughout the brain to determine the probable fiber pathways representing large bundles of axons and plot them for visual representation. Fink et al.\(^{9}\) have investigated coherence within a number of WM regions including the uncinate fasciculus (UF), superior longitudinal fasciculus, fornix, and cingulum in a group of MS patients. The left UF showed reduced FA and increased MD while the right UF was characterized by increased RD. Increase in RD has been frequently interpreted to signal demyelination. \(^{22}\) In addition, there was a bilateral reduction in FA within the fornix. Similar to the UF findings, increased RD was observed in the left cingulum.

Similarly, Hecke et al.\(^{7}\) used voxel-based morphometry that implements whole-brain approach to studying brain WM to examine WM microstructure in RR and SP MS. They have demonstrated reduced FA in a number of WM tracts including the inferior longitudinal fasciculus (ILF), capsule interna, and forceps major in MS patients. There were also changes in AD that were consistent with the FA findings such that lower AD was observed in the ILF and capsule interna, as well as in the body of the CC and corona radiata (CR). Increased MD and RD were observed in the ILF, the capsule interna and externa, genu, body, and splenium of the CC, forceps major, and CR. These findings therefore indicate that MS is characterized by both axonal damage and demyelination, although the precise location of the damage varies by tract.

Kern, Sarcona, Montag, Giesser, and Sicotte\(^{9}\) studied the relationship between WM integrity and motor function in RR MS using whole-brain DTI analysis as well as probabilistic tractography. This study observed 7.1% decrease in FA in the CC, CR, cingulum, and internal capsule, with concurrent 24.95% increase in RD within these regions, thus suggesting demyelination. Other regions with reduced RD included the cortico-spinal tract, right cerebellar peduncle, right external capsule, and left cerebellum. These changes in WM metrics were related to performance of motor tasks. In particular, reduced FA and increased RD in the body of the CC and mid-posterior CR was associated with reduced right-hand performance on the nine-hole peg test (NHPT). Increased RD in cortical WM adjacent to the left motor and right frontal cortices also predicted poor right-hand performance on the NHPT. Furthermore, worse left-hand performance was related to the reduced FA in the body of the CC and a region of occipital WM. These results suggest that at least motor dysfunction observed in MS is differentially affected by WM compromise due to asymmetry. Finally, increased RD at baseline predicted decrease in performance on the NHPT.

In 2015, Asaf, Evan, and Anat\(^{1}\) studied a large sample of RR MS participants using whole-brain analysis approach in order to examine temporal timeframe of WM degeneration. This study included participants with MS at different stages of the disease duration: less than 1 year (short duration), 1 year (medium duration) and over 1 year (up to 6 years; long duration). Compared to medium disease duration, long disease duration was characterized by diffuse reduction in FA, especially in the body of the CC, by 22%. In the short disease duration...
3. WHITE MATTER ABNORMALITIES IN MS: ADVANCES IN DIFFUSION TENSOR IMAGING/TRACTOGRAPHY

Similarly, Sigal, Shmuel, Mark, Gil, and Anat\textsuperscript{21} showed an association between disease duration and changes in diffusivity measures. Specifically, this study observed a positive correlation between disease duration and rate of relapse and average diffusivity coefficient (ADC). Moreover, lower FA and increased AD and RD were observed in the MS group compared to healthy controls in the whole CC but not within its subregions. These findings further suggest that WM degeneration is temporally contingent. Taken together, these observations led researchers to explore the association between this trend and corresponding cognitive deterioration.

**Relationship Between DTI Measures and Cognitive Profile of MS**

Following the initial investigations into the WM changes in MS, researchers became interested in examining the effects that these neural changes have on the cognitive profile associated with this condition. Koenig et al.\textsuperscript{10} used probabilistic tractography to investigate the relationship between the WM and cognitive function in RR and SP MS. This study observed reduced FA and increased RD, AD, and MD in the posterior cingulate bundle in the MS group compared to controls. The findings also indicated that episodic memory, as measured by the Brief Visuospatial Memory Test-R (BVMT), was a significant predictor of RD in the posterior cingulate bundle. Moreover, speed of processing, as measured by the Symbol Digit Modalities Test (SDMT), was a strong predictor of RD in the posterior limb of the internal capsule and posterior cingulate bundle. Taken together, these findings indicate that MS is associated with WM abnormalities within tracts that have traditionally been implicated in emotion, attention, and memory. These alterations were, in turn, manifested by memory and attention problems.

Memory problems are frequently observed in MS and have therefore been studied in relation to WM microstructure. Hecke et al.\textsuperscript{7} studied working memory in a group of RR MS patients using whole-brain voxel-based morphometry. They observed reduction in FA in the group of MS patients compared to healthy controls in a number of major WM tracts, including the ILF, capsula interna, and forceps major and concurrently reduced AD in the ILF, capsula interna, body of CC, and CR. Additionally, there was an increase in RD and MD in the ILF, capsula interna and externa, genu, body, and splenium of the CC, forceps major, and CR. These diffusion measures were also shown to be related to performance on working memory tasks, such as Paced Auditory Serial Addition Test (PASAT). In particular, there was a significant positive correlation between PASAT and FA in the left ILF, forceps minor, the capsula interna and externa, genu of the CC, left cingulum, superior longitudinal fasciculus (SLF), and CR. This pattern of results was also observed in a study by Syc et al.\textsuperscript{26} who used continuous...
tractography method to study the microstructure of the cingulum and fornix. This study observed 19% reduction in FA in a group of RR, SP, and PP MS in the fornix, with a concurrent increase in RD, AD, and MD. There was also an increase in RD, AD, and MD within the left and right cingulum, with no significant changes within FA. In the left cingulum, there was a significant association between the diffusivity measures and performance on the PASAT of information processing and attention, where lower scores on the test were associated with lower FA and higher MD and RD.

Contrary to Syc et al., using the same tractography method, Ozturk et al. studied microarchitecture of the subregions of the CC in relation to performance on the PASAT in a sample of RR, SP and PP MS patients. The findings of that study showed reduced FA and increased RD and MD in the whole CC in MS compared to healthy controls. When subregions of the CC were studied individually, a positive correlation was observed between FA and the body and splenium of the CC. This finding not only suggests the involvement of multiple tracts in performance of PASAT but is also indicative of heterogeneous changes within different portions of the CC in this condition. Caligiuri et al. have examined the role of the callosal subregions in cognitive function in MS. They observed an association between FA in the genu and splenium of the CC and cognitive function where cognitive impairment was significantly related to reduction in FA. Since the study by Caligiuri et al. used a compound score to measure cognitive function, it cannot be directly compared to the results of the study by Ozturk et al. who observed change in different subregions of the CC in relation to performance on the PASAT.

Another test that is frequently used to assess cognitive difficulties observed in MS is California Verbal Learning Test (CVLT), a task specifically designed to assess short- and long-term verbal memory. Performance on this assessment has recently been studied in conjunction with WM damage observed in MS. Using tractography, Fink et al. studied microarchitecture of the UF, SLF, cingulum, and fornix and observed that RD within the UF predicted performance on the encoding subscale of the CVLT. Moreover, this study also showed a significant positive correlation between the recognition subscale of the CVLT and PD in the right fornix. These results indicate that in this clinical population, different aspects of verbal memory are differently affected depending on the specificity of WM damage as assessed by DTI techniques.

In particular, depression is one of the most frequently reported psychiatric sequelae. The lifetime prevalence of depression in MS is estimated to be 25–50%. Pujol et al. studied structural alterations in the frontal and temporal regions in depressed MS patients. Their results showed an association between lesions in the arcuate fasciculus and greater depressive symptoms. These lesions predicted approximately 17% of variance in depressive scores. Feinstein et al. studied NAWM in MS patients. Their results showed greater reduction in FA in the left anterior NAWM in the depressed MS compared to nondepressed MS. Additionally, increased MD was observed in the right inferior frontal lobe.

In a DTI study reported in 2014, Gobbi et al. performed a whole-brain analysis looking at both PP and SP forms of MS. They observed reduced FA in the forceps minor in the depressed subgroup compared to the nondepressed participants. This finding is of a particular significance given that this region of the CC connects parts of the dorso-medial prefrontal cortex (DMPFC) and has been implicated in the pathogenesis of depression. Pujol et al. studied the microstructure of the arcuate fasciculus in patients with MS and showed that lesions within this tract were associated with cognitive expression of mood in these patients. After controlling for cognitive deficits, lesions in the arcuate fasciculus predicted 26% of variance in the Beck Depression Inventory (BDI) scores. Shen et al. used whole-brain analysis to examine the association between WM architecture and the Hamilton Rating Scale for Depression (HAM-D). This study has showed a positive association between the scores on HAM-D and FA in a number of WM regions including the right precentral gyrus, cingulate gyrus, and posterior cingulate. This is inconsistent with past research showing decreased WM integrity with increased depressive symptoms. This finding may be attributable to the compensatory mechanisms that have been previously observed.

**CONCLUSIONS**

MS is a progressive and debilitating disease that affects the myelin sheath of axonal pathways. Traditional clinical imaging, particularly T2-weighted MRI, has revolutionized the ability of researchers and clinicians to diagnose and track disease progression. These types of MRI scans provide clear evidence of the characteristic lesions of MS. Nonetheless, advances in MRI technology, particularly DTI and fiber tractography are providing even greater resolution and understanding of how MS affects specific fiber tracts and may allow an even more precise monitoring of disease progression. While these

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**Relationship Between DTI Measures and Psychiatric Profile of MS**

Apart from the cognitive complaints, emotional problems have also been observed in patients with MS.
newer DTI methods are still primarily investigational, they hold great promise for furthering understanding of MS and its underlying pathology.

References


Abstract
Multiple sclerosis (MS) is a chronic debilitating disorder affecting the central nervous system (CNS), particularly the white matter. Over the years, there have been significant advances made in the management of MS including diagnosis and treatment. Magnetic resonance imaging (MRI) is one if the neuroimaging modalities which has revolutionized the diagnosis and early detection of the disease. MRI has also proven useful to monitor disease progression in patients with MS and estimate its prognosis. In this chapter we have described the neuroimaging findings in MS using various methods of MRI. On the basis of sequence and imaging parameters applied, MRI scans can provide T1-weighted, T2-weighted, fluid-attenuated inversion recovery (FLAIR), diffusion tensor imaging (DTI), and proton magnetic resonance spectroscopy (MRS) images, all of which may have applicability in the evaluation of patients with MS. Some of these sequences, especially DTI and MRS, have proven particularly helpful in understanding the pathology of this disease from a new perspective. We focus extensively on the recent development and application of DTI and fiber tractography in understanding and characterizing the white matter lesions that occur in MS. The application of these methods holds considerable promise for advancing our understanding of MS.

Keywords: Autoimmune; Demyelination; Diffusion tensor imaging (DTI); Diffusion weighted imaging (DWI); Fluid-attenuated inversion recovery (FLAIR); Fractional anisotropy (FA); Magnetic resonance imaging (MRI); Multiple sclerosis; Neuroimaging; Neuron; Tractography.
Curriculum Vitae

DATE PREPARED:    October 15, 2017

NAME:             WILLIAM DALE (SCOTT) KILLGORE

Department of Psychiatry  
University of Arizona HSC  
1501 North Campbell Ave.  
PO Box 245002  
Tucson, AZ 85724  United States

HOME ADDRESS:

WORK PHONE:

WORK EMAIL:

WORK FAX:

USA

CHRONOLOGY OF EDUCATION

8/83 - 5/85    A.A. (Liberal Arts), San Antonio College  
8/83 - 5/85    A.A.S (Radio-TV-Film), San Antonio College  
8/85 - 5/90    B.A. (Psychology), Summa cum laude with Distinction, University of New Mexico  
8/90 - 5/92    M.A. (Clinical Psychology), Texas Tech University  
8/92 - 8/96    Ph.D. (Clinical Psychology), Texas Tech University  

Dissertation Title: Development and validation of a new instrument for the measurement of transient mood states: The facial analogue mood scale (FAMS). Lubbock, TX: Texas Tech University;1995. Advisor: Bill Locke, Ph.D.

POST-DOCTORAL TRAINING

8/95 - 7/96    Predoctoral Fellow, Clinical Psychology, Yale School of Medicine  
8/96 - 7/97    Postdoctoral Fellow, Clinical Neuropsychology, University of OK Health Sciences Center  
8/97 - 7/99    Postdoctoral Fellow, Clinical Neuropsychology, University of Pennsylvania Medical School  
7/99 - 9/00    Research Fellow, Neuroimaging, McLean Hospital/ Harvard Medical School  
9/13 - 5/14    Certificate in Applied Biostatistics, Harvard Medical School

LICENSURE/CERTIFICATION

2001 -    Licensed Psychologist, #966, State of New Hampshire
CHRONOLOGY OF EMPLOYMENT

Academic Appointments

10/00 - 8/02  Instructor in Psychology in the Department of Psychiatry
              Harvard Medical School, Boston, MA
9/02 - 7/07   Clinical Instructor in Psychology in the Department of Psychiatry
              Harvard Medical School, Boston, MA
8/07 - 10/10  Instructor in Psychology in the Department of Psychiatry
              Harvard Medical School, Boston, MA
4/08-         Faculty Affiliate, Division of Sleep Medicine
              Harvard Medical School, Boston, MA
10/10 - 10/12 Assistant Professor of Psychology in the Department of Psychiatry
              Harvard Medical School, Boston, MA
10/12 - 6/14  Associate Professor of Psychology in the Department of Psychiatry
              Harvard Medical School, Boston, MA
7/14-         Associate Professor of Psychology in the Department of Psychiatry (part-time)
              Harvard Medical School, Boston, MA
7/14-         Professor of Psychiatry—Tenured
              University of Arizona College of Medicine, Tucson, AZ
7/14-         Professor of Medical Imaging—Non TE
              University of Arizona College of Medicine, Tucson, AZ
9/14         Professor of Psychology—Non TE
              University of Arizona College of Science, Tucson, AZ

Hospital/Clinical/Institutional Appointments

10/00 - 8/02  Assistant Research Psychologist, McLean Hospital, Belmont, MA
8/02 - 7/04   Research Psychologist, Department of Behavioral Biology, Walter Reed Army Institute of Research, Silver Spring, MD
7/04 - 10/07  Chief, Neurocognitive Performance Branch, Walter Reed Army Institute of Research, Silver Spring, MD
10/07 - 3/10  Chief Psychologist, GovSource, Inc., U.S. Department of Defense (DoD) Contractor
8/08         Consulting Psychologist, The Brain Institute, University of Utah
9/02 - 4/05   Special Volunteer, National Institute on Deafness and Other Communication Disorders (NIDCD), National Institutes of Health (NIH), Bethesda, MD
9/02 - 7/07   Research Consultant, McLean Hospital, Belmont, MA
8/05 - 5/06   Neuropsychology Postdoctoral Research Program Training Supervisor, Walter Reed Hospital, Washington, DC
8/07 -       Research Psychologist, McLean Hospital, Belmont, MA
7/11 - 6/14   Director, Social Cognitive, and Affective Neuroscience (SCAN) Laboratory, McLean Hospital, Belmont, MA
7/14-         Director, Social, Cognitive, and Affective Neuroscience (SCAN) Laboratory, University of Arizona, Tucson, AZ

Military Positions

11/01 - 8/02  First Lieutenant, Medical Service Corps, United States Army Reserve (USAR)
8/02 - 7/05  Captain, Medical Service Corps, United States Army-Active Regular Army (RA)
8/05 - 10/07 Major, Medical Service Corps, United States Army-Active Regular Army (RA)
10/07 - 7/12 Major, Medical Service Corps, United States Army Reserve (USAR)
7/12 -  Lieutenant Colonel, Medical Service Corps, United States Army Reserve (USAR)

HONORS AND AWARDS

1990  Outstanding Senior Honors Thesis in Psychology, University of New Mexico
1990-1995 Maxey Scholarship in Psychology, Texas Tech University
2001  Rennick Research Award, Co-Author, International Neuropsychological Society
2002  Honor Graduate, AMEDD Officer Basic Course, U.S. Army Medical Department Center and School
2002  Lynch Leadership Award Nominee, AMEDD Officer Basic Course, U.S. Army Medical Department Center and School
2003  Outstanding Research Presentation Award, 2003 Force Health Protection Conference, U.S. Army Center for Health Promotion and Preventive Medicine
2003  Who’s Who in America
2004  Who’s Who in Medicine and Healthcare
2005  Edward L. Buescher Award for Excellence in Research by a Young Scientist, Walter Reed Army Institute of Research (WRAIR) Association
2009  Merit Poster Award, International Neuropsychological Society
2009  Outstanding Research Presentation Award, 2009 Force Health Protection Conference, U.S. Army Center for Health Promotion and Preventive Medicine
2010  Best Paper Award, Neuroscience, 27th U.S. Army Science Conference
2011  Published paper included in Best of Sleep Medicine 2011
2011  Blue Ribbon Finalist, 2011 Top Poster Award in Clinical and Translational Research, Society of Biological Psychiatry
2012  Defense Advance Research Projects Agency (DARPA) Young Faculty Award in Neuroscience
2014  Blue Ribbon Finalist, 2014 Top Poster Award in Basic Neuroscience, Society of Biological Psychiatry
2014  Harvard Medical School Excellence in Mentoring Award Nominee
2014  AASM Young Investigator Award (co-author), Honorable Mention, American Academy of Sleep Medicine

SERVICE/OUTREACH

Local/State Service/Outreach

2003  Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
2005  Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
2012-  McLean Hospital Research Committee, McLean Hospital, Belmont, MA

National/International Service/Outreach
2004 University of Alabama, Clinical Nutrition Research Center (UAB CNRC) Pilot/Feasibility Study Program Review Committee
2006 U.S. Small Business Administration, Small Business Technology Transfer (STTR) Program Review Committee
2006 Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program Funding Panel
2006 Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program Funding Panel
2008 United States Army Medical Research and Materiel Command (USAMRMC) Congressionally Directed Medical Research Programs (CDMRP) Extramural Grant Review Panel
2009 NIH-CSR Brain Disorders and Clinical Neuroscience N02 Member Study Conflict Section Review Panel
2009 Sleep Physiology and Fatigue Interventions Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program
2009 Scotland, UK, Biomedical and Therapeutic Research Committee, Grant Reviewer
2010 Canada, Social Sciences and Humanities Research Council of Canada, Grant Reviewer
2011 National Science Foundation (NSF) Grant Reviewer
2011 National Network of Depression Centers (NNDC), Military Task Group
2011 Israel, Israel Science Foundation (ISF), Grant Reviewer
2011 Scientific Review Committee, US Army Institute of Environmental Medicine (USARIEM)
2012 National Science Foundation (NSF) Grant Reviewer
2012 American Academy of Sleep Medicine, Member
2013 Israel, Israel Science Foundation (ISF), Grant Reviewer
2014 Organization for Human Brain Mapping, Member
2015 Human Affectome Project Advisory Board Member

**Departmental Committees**

2006 Chair, Undergraduate Honors Thesis Committee, Jessica Richards, Department of Psychology, University of Maryland, Baltimore County, MD
2012- Member, Research Committee, McLean Hospital, Belmont, MA
2014 Psychiatry Senior Research Manager Candidate Search Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2014-2015 Member, Faculty Search Committee, Department of Psychology, University of Arizona, Tucson, AZ.
2014-2016 Member, Comprehensive Examination Committee, Natalie Bryant, Department of Psychology, University of Arizona, Tucson, AZ
2014-2015 Chair/Research Faculty Mentor, Undergraduate Honors Thesis Committee, Haley Kent, Department of Biochemistry, University of Arizona, Tucson, AZ
2014- Member, Psychiatry Research Investigator Committee, Department of Psychiatry, University of Arizona, Tucson, AZ.
2015 Member, Dissertation Committee, Ryan S. Smith, Ph.D., Department of Psychology, University of Arizona, Tucson AZ.
2015- Member, Mentoring Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2016 Member, Dissertation Committee, Brian Arizmendi, Department of Psychology,
University of Arizona, Tucson, AZ

2016  Member, Masters Thesis Committee, Saren Seeley, Department of Psychology, University of Arizona, Tucson, AZ
2016  Member, Masters Thesis Committee, Mairead McConnell, Department of Psychology, University of Arizona, Tucson, AZ
2016  Faculty Advisor, Undergraduate Honor Thesis Committee, Matthew Nettles, Neuroscience/Cognitive Science, University of Arizona, Tucson, AZ

University Committees

2006  External Member, Doctoral Thesis Committee, Belinda J. Liddle, Ph.D., University of Sydney, Australia
2014  Ad Hoc Member, Interview Committee for Defense and Security Research Institute Director Position, University of Arizona, Tucson, AZ.
2014-  Member, Mechanisms of Emotion, Social Relationships, and Health Interdisciplinary Developing Research Program, Clinical and Translational Science Institute, BIO5, University of Arizona, Tucson, AZ
2015  Vice President’s Executive Committee for Defense and Security Strategic Planning, University of Arizona, Tucson, AZ
2015  Imaging Excellence Cluster Hire Search Committee, University of Arizona, Tucson, AZ
2015-2016  Member, Neuroimaging Cluster Hire Faculty Search Committee, University of Arizona, Tucson, AZ

Editorial Board Membership

2009-  Editorial Board Member, International Journal of Eating Disorders
2012-  Editorial Board Member, Dataset Papers in Neuroscience
2012-  Editorial Board Member, Dataset Papers in Psychiatry
2012-  Editor, Journal of Sleep Disorders: Treatment and Care

Ad Hoc Journal Reviewer

2001-2012  Reviewer, Psychological Reports
2001-2012  Reviewer, Perceptual and Motor Skills
2002  Reviewer, American Journal of Psychiatry
2002-2013  Reviewer, Biological Psychiatry
2003  Reviewer, Clinical Neurology and Neurosurgery
2004-2016  Reviewer, NeuroImage
2004-2006  Reviewer, Neuropsychologia
2004-2016  Reviewer, Journal of Neuroscience
2004  Reviewer, Consciousness and Cognition
2005  Reviewer, Experimental Brain Research
2005  Reviewer, Schizophrenia Research
2005-2012  Reviewer, Archives of General Psychiatry
2005  Reviewer, Behavioral Brain Research
2005-2009  Reviewer, Human Brain Mapping
2005-2013  Reviewer, Psychiatry Research: Neuroimaging
2006 Reviewer, Journal of Abnormal Psychology
2006 Reviewer, Psychopharmacology
2006 Reviewer, Developmental Science
2006 Reviewer, Acta Psychologica
2006, 2015 Reviewer, Neuroscience Letters
2006-2016 Reviewer, Journal of Sleep Research
2006-2016 Reviewer, Physiology and Behavior
2006-2014 Reviewer, SLEEP
2007 Reviewer, Journal of Clinical and Experimental Neuropsychology
2008 Reviewer, European Journal of Child and Adolescent Psychiatry
2008 Reviewer, Judgment and Decision Making
2008-2010 Reviewer, Aviation, Space, & Environmental Medicine
2008 Reviewer, Journal of Psychophysiology
2008 Reviewer, Brazilian Journal of Medical and Biological Research
2008 Reviewer, The Harvard Undergraduate Research Journal
2008 Reviewer, Bipolar Disorders
2008-2013 Reviewer, Chronobiology International
2008 Reviewer, International Journal of Obesity
2009 Reviewer, European Journal of Neuroscience
2009 Reviewer, Psychophysiology
2009 Reviewer, Traumatology
2009 Reviewer, Clinical Medicine: Therapeutics
2009 Reviewer, Acta Pharmacologica Sinica
2009 Reviewer, Collegium Antropologicum
2009 Reviewer, Journal of Psychopharmacology
2009-2014 Reviewer, Obesity
2009 Reviewer, Scientific Research and Essays
2009 Reviewer, Child Development Perspectives
2009-2010 Reviewer, Personnality and Individual Differences
2009-2010 Reviewer, Noise and Health
2009-2010 Reviewer, Sleep Medicine
2010 Reviewer, Nature and Science of Sleep
2010 Reviewer, Psychiatry and Clinical Neurosciences
2010 Reviewer, Learning and Individual Differences
2010 Reviewer, Cognitive, Affective, and Behavioral Neuroscience
2010 Reviewer, BMC Medical Research Methodology
2010-2011 Reviewer, Journal of Adolescence
2010-2012 Reviewer, Brain Research
2011 Reviewer, Brain
2011 Reviewer, Social Cognitive and Affective Neuroscience
2011 Reviewer, Journal of Traumatic Stress
2011 Reviewer, Social Neuroscience
2011-2014 Reviewer, Brain and Cognition
2011 Reviewer, Frontiers in Neuroscience
2011-2012 Reviewer, Sleep Medicine Reviews
2012 Reviewer, Journal of Experimental Psychology: General
2012 Reviewer, Ergonomics
2012 Reviewer, Behavioral Sleep Medicine
2012 Reviewer, Neuropsychology
2012 Reviewer, Emotion
2012 Reviewer, JAMA
2012 Reviewer, BMC Neuroscience
2012-2015 Reviewer, Cognition and Emotion
2012 Reviewer, Journal of Behavioral Decision Making
2012 Reviewer, Psychosomatic Medicine
2012-2014 Reviewer, PLoS One
2012 Reviewer, American Journal of Critical Care
2012-2014 Reviewer, Journal of Sleep Disorders: Treatment and Care
2013 Reviewer, Experimental Psychology
2013 Reviewer, Clinical Interventions in Aging
2013 Reviewer, Frontiers in Psychology
2013 Reviewer, Brain Structure and Function
2013 Reviewer, Appetite
2013-2016 Reviewer, JAMA Psychiatry
2014 Reviewer, Acta Psychologica
2014 Reviewer, Neurology
2014 Reviewer, Applied Neuropsychology: Child
2014-2016 Reviewer, Journal of Applied Psychology
2015 Reviewer, Early Childhood Research Quarterly
2015 Reviewer, Behavioral Neuroscience
2015 Reviewer, Scientific Reports
2016 Reviewer, Neuroscience & Biobehavioral Reviews
2016 Reviewer, Psychological Science
2016 Reviewer, Medicine & Science in Sports and Exercise
2016 Reviewer, Archives of Clinical Neuropsychology

PUBLICATIONS/CREATIVE ACTIVITY

Refereed Journal Articles


75. **Killgore, WD**, & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses during non-conscious perception of facial affect in adolescent and pre-adolescent children. Cogn Neurosci,


82. Rupp, TL, Killgore, WD, & Balkin, TJ. Socializing by day may affect performance by night: Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Sleep, 33: 1475-1485, 2010.


89. Killgore, WD, Capaldi, VF, & Guerrero, ML. Nocturnal polysomnographic correlates of daytime sleepiness. Psychol Rep, 110(10), 63-72, 2012.


113. Webb, CA, DelDonno, S, & **Killgore, WD**. The role of cognitive versus emotional intelligence in Iowa Gambling Task performance: What’s emotion got to do with it? Intelligence, 44, 112-119,
2014.


**Book Chapters/Editorials**


16. **Killgore, WD.** Lighting the way to better sleep and health (Editorial). Journal of Sleep Disorders: Treatment and Care, 5:1.


**Published U.S. Government Technical Reports**


**WORKS IN PROGRESS**


4. **Killgore, WD.** Individual differences in rested activation of the ventral striatum predicts overeating during sleep deprivation. (in preparation).


8. Sneider, JT, Jensen, JE, Silveri, MM, & **Killgore, WD.** Prefrontal GABA predicts resistance to


CONFERENCES/SCHOLARLY PRESENTATIONS

Colloquia

2000 The Neurobiology of Emotion in Children, McLean Hospital, Belmont, MA [Invited Lecture]

2001 The Neurobiology of Emotion in Children and Adolescents, McLean Hospital, Belmont, MA [Invited Lecture]

2002 Cortico-Limbic Activation in Adolescence and Adulthood, Youth Advocacy Project, Cape Cod, MA [Invited Lecture]

2008 Lecture on Sleep Deprivation, Executive Function, and Resilience to Sleep Loss; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2008 Lecture on The Role of Research Psychology in the Army; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2008 Lecture on Combat Stress Control: Basic Battlemind Training; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2009 Lecture entitled Evaluate a Casualty, Prevent Shock, and Prevent Cold Weather injuries; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2009 Lecture on Combat Exposure and Sleep Deprivation Effects on Risky Decision-Making; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2009 Lecture on the Sleep History and Readiness Predictor (SHARP); 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2009 Lecture on The Use of Actigraphy for Measuring Sleep in Combat and Military Training; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]
2010 Lecture entitled *Casualty Evaluation*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2010 Lecture entitled *Combat Stress and Risk-Taking Behavior Following Deployment*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2010 Lecture entitled *Historical Perspectives on Combat Medicine at the Battle of Gettysburg*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2010 Lecture entitled *Sleep Loss, Stimulants, and Decision-Making*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2010 Lecture entitled *PTSD: New Insights from Brain Imaging*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2011 Lecture entitled *Effects of bright light therapy on sleep, cognition and brain function after mild traumatic brain injury*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2011 Lecture entitled *Laboratory Sciences and Research Psychology in the Army*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2011 Lecture entitled *Tools for Assessing Sleep in Military Settings*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]


2011 Lecture entitled *The Brain Altering Effects of Traumatic Experiences*; 105th Reinforcement Training Unit (RTU), U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2012 Lecture entitled *Sleep Loss, Caffeine, and Military Performance*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2012 Lecture entitled *Using Light Therapy to Treat Sleep Disturbance Following Concussion*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2013 Lecture entitled *Brain Responses to Food: What you See Could Make you Fat*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2013 Lecture entitled *Predicting Resilience Against Sleep Loss*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2014 Lecture entitled *Get Some Shut-Eye or Get Fat: Sleep Loss Affects Brain Responses to Food*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]
2014  Lecture entitled *Emotional Intelligence: Developing a Training Program*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2014  Lecture entitled *Supporting Cognitive and Emotional Health in Warfighters*. Presented to the Senior Vice President for the Senior Vice President for Health Sciences and Dean of the Medical School, University of Arizona, Tucson, AZ. [Invited Lecture]

2015  Lecture entitled *Understanding the Effects of Mild TBI (Concussion) on the Brain*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2015  Presentation entitled Superhuman Brains: The Neurocircuitry that Underlies the Ability to Resist Sleep Deprivation. Presented at the Neuroscience Datablitz, University of Arizona, Tucson, AZ. [Invited Lecture]

2015  Presentation entitled: SCAN Lab Traumatic Stress Study. Presented at the Tucson Veteran Center, Tucson AZ [Invited Lecture]

2016  Presentation entitled: SCAN Lab Overview. Presented at the University of Arizona 2016 Sleep workshop, Tucson, AZ [Invited Lecture]

2016  Lecture entitled *Trauma Exposure and the Brain*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

2016  Presentation entitled *Supporting Cognitive and Emotional Health in Warfighters*. UAHS Development Team, University of Arizona Health Sciences Center, Tucson, AZ [Invited Lecture]

2016  Lecture entitled Novel Approaches for Reducing Depression in the Military; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [Invited Lecture]

**Seminars**

2001  *Using Functional MRI to Study the Developing Brain*, Judge Baker Children’s Center, Harvard Medical School, Boston, MA [Invited Lecture]

2002  Lecture on the *Changes in the Lateralized Structure and Function of the Brain during Adolescent Development*, Walter Reed Army Institute of Research, Washington, DC [Invited Lecture]


2005  Lecture on *The Sleep History and Readiness Predictor*: Presented to the Medical Research and Materiel Command, Ft. Detrick, MD [Invited Lecture]
2006 Lecture on *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Brain Imaging Center, McLean Hospital, Belmont MA [Invited Lecture]


2010 Lecture on *Patterns of Cortico-Limbic Activation Across Anxiety Disorders*, Center for Anxiety, Depression, and Stress, McLean Hospital, Belmont, MA [Invited Lecture]

2010 Lecture on *Cortico-Limbic Activation Among Anxiety Disorders*, Neuroimaging Center, McLean Hospital, Belmont, MA [Invited Lecture]

2011 Lecture on *Shared and Differential Patterns of Cortico-Limbic Activation Across Anxiety Disorders*, McLean Research Day Brief Communications, McLean Hospital, Belmont, MA [Invited Lecture]

2014 Lecture entitled *Supporting Cognitive and Emotional Health in Warfighters*. Presented to the Senior Vice President for Health Sciences and Dean of the Medical School, University of Arizona, Tucson, AZ [Invited Lecture]

2015 Lecture entitled *Sleep Loss and Brain Responses to Food*. Presented for the Sleep Medicine Lecture Series, University of Arizona Medical Center, Tucson, AZ [Invited Lecture]

2015 Presentation entitled *Superhuman Brains: The Neurocircuitry that Underlies the Ability to Resist Sleep Deprivation*. Presented at the Neuroscience Datablitz, University of Arizona, Tucson, AZ [Invited Lecture]


2005 Briefing to the Chairman of the National Research Council (NRC) Committee on Strategies to Protect the Health of Deployed U.S. Forces, John H. Moxley III, on the *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Walter Reed Army Institute of Research, Washington, DC [Invited Lecture]


2007 Lecture on *Cerebral Responses During Visual Processing of Food*, U.S. Army Institute of Environmental Medicine, Natick, MA [Invited Lecture]

2007 Lecture on *The Effects of Fatigue and Pharmacological Countermeasures on Judgment and Decision-Making*, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL [Invited Lecture]

2008 Lecture on the *Validation of Actigraphy and the SHARP as Methods of Measuring Sleep and Performance in Soldiers*, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL [Seminar]


2009 Lecture Entitled *Influences of Combat Exposure and Sleep Deprivation on Risky Decision-Making*, Evans U.S. Army Hospital, Fort Carson, CO [Invited Lecture]

2009 Lecture on *Making Bad Choices: The Effects of Combat Exposure and Sleep Deprivation on Risky Decision-Making*, 4th Army, Division West, Quarterly Safety Briefing to the Commanding General and Staff, Fort Carson, CO [Invited Lecture]

2011 Lecture Entitled *The effects of emotional intelligence on judgment and decision making*, Military Operational Medicine Research Program Task Area C, R & A Briefing, Walter Reed Army Institute of Research, Silver Spring, MD [Invited Lecture]

2011 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program Task Area C, R & A Briefing, Walter Reed Army Institute of Research, Silver Spring, MD [Invited Lecture]

2012 Briefing to GEN (Ret) George Casey Jr., former Chief of Staff of the U.S. Army, entitled *Research for the Soldier*. McLean Hospital, Belmont, MA. [Invited Lecture]

2012 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2013 Lecture Entitled *Update on the Effects of Bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2013 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command,
Fort Detrick, MD [Invited Lecture]

2013 Seminar Entitled *Predicting Resilience Against Sleep Loss*, United States Military Academy at West Point, West Point, NY [Invited Symposium].

2014 Lecture entitled *Sleep Loss, Brain Function, and Cognitive Performance*, presented to the Psychiatric Genetics and Translational Research Seminar, Massachusetts General Hospital/Harvard Medical School, Boston, MA [Invited Lecture]


2014 Psychology Department Colloquium entitled *Sleep Loss, Brain Function, and Performance of the Emotional-Executive System*. University of Arizona Department of Psychology, Tucson, AZ [Invited Lecture]


2015 Lecture Entitled Multimodal Neuroimaging to Predict Resistance to Sleep Deprivation, presented at the Pulmonary Research Conference, Department of Medicine, Sleep Medicine Sleep Lecture Series, University of Arizona College of Medicine, Tucson, AZ [Invited Lecture].


2015 Lecture Entitled *Effects of bright light therapy on sleep, cognition, brain function, and neurochemistry following mild traumatic brain injury*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2015 Lecture Entitled *A Non-Pharmacologic Method for Enhancing Sleep in PTSD*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2015 Lecture Entitled *Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function*, Military Operational Medicine
Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2015

Lecture Entitled Operating Under the Influence: The Effects of Sleep Loss and Stimulants on Decision-Making and Performance. Presented at the annual SAFER training for interns and residents, University of Arizona Department of Psychiatry, Tucson AZ. [Invited Lecture]

2016


2016

Lecture entitled Supporting Cognitive and Emotional Health in Warfighters. Presented at the Department of Behavioral Biology, Walter Reed Army Institute of Research, Silver Spring, MD. [Invited Lecture]

2016

Lecture Entitled Internet Based Cognitive Behavioral Therapy: Effects on Depressive Cognitions and Brain Function, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2016

Lecture Entitled A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following TBI, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

2016

Lecture Entitled Refinement and Validation of a Military Emotional Intelligence Training Program, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [Invited Lecture]

Symposia/Conferences

1999

Oral Platform Presentation entitled Functional MRI lateralization during memory encoding predicts seizure outcome following anterior temporal lobectomy, 27th Annual Meeting of the International Neuropsychological Society, Boston, MA. [Submitted Presentation]

2000

Lecture on the Neurobiology of Emotional Development in Children, 9th Annual Parents as Teachers Born to Learn Conference, St. Louis, MO [Invited Lecture]

2001

Oral Platform Presentation entitled Sex differences in functional activation of the amygdala during the perception of happy faces, 29th Annual Meeting of the International Neuropsychological Society, Chicago, IL. [Submitted Presentation]

2002

Oral Platform Presentation entitled Developmental changes in the lateralized activation of the prefrontal cortex and amygdala during the processing of facial affect, 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada.


2004  Lecture on the *Regional Cerebral Blood Flow Correlates of Electroencephalographic Activity During Stage 2 and Slow Wave Sleep: An H215O PET Study*: Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Detrick, MD, U.S. Army Medical Research and Materiel Command [Invited Lecture]


2006  Lecture on *The Sleep History and Readiness Predictor*: Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Rucker, AL, U.S. Army Medical Research and Materiel Command [Invited Lecture]


2008  Lecture on *Sleep Deprivation, Executive Function, & Resilience to Sleep Loss*, First Franco-American Workshop on War Traumatism, IMNSSA, Toulon, France [Invited Lecture]

2009  Symposium Entitled *Sleep Deprivation, Judgment, and Decision-Making*, 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, WA [Invited Symposium]

2009  Symposium Session Moderator for *Workshop on Components of Cognition and Fatigue: From Laboratory Experiments to Mathematical Modeling and Operational Applications*, Washington State University, Spokane, WA [Invited Speaker]

2009  Lecture on *Comparative Studies of Stimulant Action as Countermeasures for Higher Order Cognition and Executive Function Impairment that Results from Disrupted Sleep Patterns*, Presented at the NIDA-ODS Symposium entitled: Caffeine: Is the Next Problem Already Brewing, Rockville, MD [Invited Lecture]

2010  Oral Platform Presentation entitled *Sleep deprivation selectively impairs emotional aspects of cognitive functioning*, 27th Army Science Conference, Orlando, FL. [Submitted Presentation]
2010 Oral Platform Presentation entitled *Exaggerated amygdala responses to masked fearful faces are specific to PTSD versus simple phobia*, 27th Army Science Conference, Orlando, FL. [Submitted Presentation]

2012 Oral Symposium Presentation entitled *Shared and distinctive patterns of cortico-limbic activation across anxiety disorders*, 32nd Annual Conference of the Anxiety Disorders Association of America, Arlington, VA. [Invited Symposium]

2012 Oral Platform Presentation entitled *Shared and unique patterns of cortico-limbic activation across anxiety disorders*. 40th Meeting of the International Neuropsychological Society, Montreal, Canada. [Submitted Presentation]

2013 Lecture entitled *Brain responses to visual images of food: Could your eyes be the gateway to excess?* Presented to the NIH Nutrition Coordinating Committee and the Assistant Surgeon General of the United States, Bethesda, MD [Invited Lecture]

2014 Symposium Entitled *Operating Under the Influence: The Effects of Sleep Loss and Stimulants on Decision-Making and Performance*, Invited Faculty Presenter at the 34th Annual Cardiothoracic Surgery Symposium (CREF), San Diego, CA [Invited Symposium].

2014 Symposium Entitled *The Effects of Sleep Loss on Food Preference*, SLEEP 2014, Minneapolis, MN [Invited Symposium]

2015 Symposium Entitled *The Neurobiological Basis and Potential Modification of Emotional Intelligence in Military Personnel*. Invited presentation at the Yale Center for Emotional Intelligence, New Haven, CT [Invited Lecture]

2015 Lecture Entitled *Predicting Resilience to Sleep Loss with Multi-Modal Neuroimaging*. Invited presentation at the DARPA Sleep Workshop 2015, Arlington, VA [Invited Lecture]

2015 Symposium Entitled: *The Brain and Food: How your (sleepy) Eyes Might be the Gateway to Excess*, Invited Faculty Presenter at the 2015 University of Arizona Update on Psychiatry, Tucson, AZ [Invited Symposium].

2015 Oral Platform presentation entitled *Multimodal Neuroimaging to Predict Resistance to Sleep Deprivation*, Associated Professional Sleep Societies (APSS) SLEEP meeting, Seattle, WA [Submitted Presentation]


2016 Oral Platform presentation entitled *Default Mode Activation Predicts Vulnerability to Sleep Deprivation in the Domains of Mood, Sleepiness, and Vigilance*, Associated Professional Sleep Societies (APSS) SLEEP meeting, Denver, CO [Submitted Presentation]

**Peer Reviewed Published Abstracts**


11. Killgore, WD, Glosser, G, King, D, French, JA, Baltuch, G, & Detre, JA. Functional MRI


33. **Killgore, WD**, Young, AD, Femia, LA, Bogorodzki, P, Rogowska, J, & Yurgelun-Todd, DA.


42. Belenky, G, Reichardt, R, Thorne, D, **Killgore, WD, Balkin, T, & Wesensten, N.** Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation. III. Effect on recovery sleep and post-recovery sleep performance [abstract]. Oral paper presentation at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9,


52. Killgore, WD, Balkin, TJ, & Wesensten, NJ. Decision-making is impaired following 2-days of sleep deprivation. Poster presented at the 34th Meeting of the International


59. Huck, NO, Kendall, AP, McBride, SA, **Killgore, WD.** The perception of facial emotion is enhanced by psychostimulants following two nights of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A136.

60. O’Sullivan, M, Reichardt, RM, Krugler, AL, Killgore, DB, & **Killgore, WD.** Premorbid intelligence correlates with duration and quality of recovery sleep following sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A372.


62. McBride, SA, Killgore DB, Balkin, TJ, Kamimori, GH, & **Killgore, WD.** Sleepy people smell worse: Olfactory decrements as a function of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June


Richards, J, & Killgore, WD. The effect of caffeine, dextroamphetamine, and modafinil on alertness and mood during sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A43.


72. Killgore, DB, Kahn-Green, E, Balkin, TJ, Kamimori, GH, & Killgore, WD. 56 hours of wakefulness is associated with a sub-clinical increase in symptoms of psychopathology [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A130.


74. Reichardt, RM, Killgore, DB, Lipizzi, EL, Li, CJ, Krugler, AL, & Killgore, WD. The effects of stimulants on recovery sleep and post-recovery verbal performance following 61-hours of sleep deprivation [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A42.

75. Bailey, JD, Richards, J, & Killgore, WD. Prediction of mood fluctuations during sleep deprivation with the SAFTE Model [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A60.

76. Kendall, AP, McBride, S. A, & Killgore, WD. Visuospatial perception of line orientation is resistant to one night of sleep loss [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A369.

77. Kendall, AP, McBride, SA, Kamimori, GH, & Killgore, WD. The interaction of coping skills and stimulants on sustaining vigilance: Poor coping may keep you up at night [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A129.

78. Muckle, A, Killgore, DB, & Killgore, WD. Gender differences in the effects of stimulant medications on the ability to estimate unknown quantities when sleep deprived [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A369.


89. Richards, JM, Lipizzi, EL, Kamimori, GH, & **Killgore, WD.** Extroversion predicts change in attentional lapses during sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A137.

90. Lipizzi, EL, Richards, JM, Balkin, TJ, Grugle, NL, & **Killgore, WD.** Morningness-Eveningness and Intelligence [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A345.


92. McBride, SA, Ganesan, G, Kamimori, GH, & **Killgore, WD.** Odor identification ability predicts vulnerability to attentional lapses during 77 hours of sleep deprivation [abstract]. Abstract


98. Rupp, TL, Grugle, NL, Krugler, AL, Balkin, TJ, & Killgore, WD. Caffeine, dextroamphetamine, and modafinil improve PVT performance after sleep deprivation and recovery sleep [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A44.


100. Killgore, WD, Richards, JM, Balkin, TJ, Grugle, NL, & Killgore DB. The effects of sleep deprivation and stimulants on risky behavior [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A41.

102. Richards, JM, Lipizzi, EL, Balkin, TJ, Grugle, NL, & Killgore, WD. Objective alertness predicts mood changes during 44 hours of sleep deprivation [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A56.


104. Estrada, A, Killgore, WD, Rouse, T, Balkin, TJ, & Wildzunas, RM. Total sleep time measured by actigraphy predicts academic performance during military training [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A134.


107. Reid, CT, Smith, K, Killgore, WD, Rupp, TL, & Balkin, TJ. Higher intelligence is associated with less subjective sleepiness during sleep restriction [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A375.


110. Lipizzi, EL, Killgore, WD, Rupp, TL, & Balkin, TJ. Risk-taking behavior is elevated during recovery from sleep restriction [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A376.

111. Lipizzi, EL, Rupp, TL, Killgore, WD, & Balkin, TJ. Sleep restriction increases risk-taking behavior [abstract]. Poster presented at the 11th Annual Force Health Protection Conference,


122. **Killgore, WD**, Rupp, TL, Killgore, DB, Grugle, NL, and Balkin, TJ. Differential effects of

123. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. When being smart is a liability: More intelligent individuals may be less resistant to sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.


133. Killgore, DB, **Killgore, WD,** Grugle, NL, & Balkin, TJ. Executive functions predict the ability to sustain psychomotor vigilance during sleep loss. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 2009.

134. **Killgore, WD,** & Yurgelun-Todd, DA. Trouble falling asleep is associated with reduced activation of dorsolateral prefrontal cortex during a simple attention task. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 2009.


142. **Killgore, WD** & Balkin, TJ. Vulnerability to sleep loss is affected by baseline executive function capacity. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.


146. **Killgore, WD** & Yurgelun-Todd, DA. Self-reported insomnia is associated with increased activation within the default-mode network during a simple attention task. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.


153. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Extraverts may be more vulnerable than introverts to


164. Rupp, TL, Killgore, WD, & Balkin, TJ. Evaluation of personality and social exposure as


185. Schwab, ZJ, Weiner, MR, Rauch, SL, & Killgore, WD. Emotional and cognitive intelligence:


197. Song, CH, Kizielewicz, J, Schwab, ZJ, Weiner, MR, Rauch, SL, & Killgore, WD. Time is of the essence: The Design Organization Test as a valid, reliable, and brief measure of visuospatial...


219. DelDonno, S, Schwab, ZJ, Kipman, M, Weber, M, & **Killgore, WD.** Weekend sleep is related to greater coping and resilience capacities. Abstract presented at the 26th Annual Meeting of the


225. Killgore WD. Multimodal neuroimaging to predict cognitive resilience against sleep loss. Abstract presented at the DARPA Young Faculty Award 2012 Meeting, Arlington, VA, July 30-31, 2012. [*Winner Young Faculty Award in Neuroscience]*


261. Olson, EA, Weber, M, Tkachenko, O, & Killgore, WD. Daytime sleepiness is associated with decreased integration of remote outcomes on the IGT. Abstract presented at the Annual


270. **Cui, J, Tkachenko, O, & Killgore, WD.** Can the activation of anterior cingulate predict the emotional suppression? An fMRI study with masked faces. Abstract presented at the 36nd Annual Conference of the Anxiety Disorders Association of America, Chicago, IL, March 27-30, 2014.


Neuropsychological Society, Denver, CO, February 4-7, 2015.


322. Sneider, JT, Jensen JE, Silveri, MM, & **Killgore, WD**. Prefrontal GABA predicts resistance to


327. **Alkozei, A & Killgore, WD.** Exposure to blue wavelength light is associated with increased dorsolateral prefrontal cortex responses during a working memory task. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.


331. **Smith, R, Alkozei, A, Bao, J, & Killgore, WD.** Successful goal-directed memory suppression is associated with increased inter-hemispheric coordination between right and left fronto-parietal control networks. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

332. **Singh, P, Fridman, A, Pisner, D, Singh, A, & Killgore, WD.** A voxel based morphometric analysis of ventromedial prefrontal cortex volume related with executive function task


361. Alkozei, A, Pisner, D, Markowski, SM, Vanuk, JR, Fridman, A, Shane, BR, Knight, SA, Grandner, MA, & Killgore, WD. Exposure to blue wavelength light is associated with


Rhee, JU, Haynes, P, Chakravorty, S, Patterson, F, Killgore, WD, Gallagher, RA, Carrazco, N,


AWARDED GRANTS AND CONTRACTS

Completed

NIH, 1R03HD41542-01
Pl: Killgore ($79,000.)

U.S. Army Medical Research and Materiel Command (USAMRMC) Competitive Medical Research Proposal Program (CMRP); Intramural Funding,
Pl: Killgore (Total Award: $1,345,000.)

2004-2005  Sleep/wake Schedules in 3ID Aviation Brigade Soldiers.
Defense Advanced Research Projects Agency (DARPA)
Pl: Killgore (Total Award: $60,000.)

2005-2006  Functional Neuroimaging Studies of Neural Processing Changes with Sleep and Sleep Deprivation.
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
Task Area C (Warfighter Judgment and Decision Making) Program Funding
Pl: Killgore (Total Award: $219,400.)

2006-2007  Establishing Normative Data Sets for a Series of Tasks to Measure the Cognitive Effects of Operationally Relevant Stressors.
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
Task Area C (Warfighter Judgment and Decision Making) Program Funding,
Pl: Killgore (Total Award: $154,000.)

2006-2007  Military Operational Medicine Research Program (MOM-RP), Development of the Sleep History and Readiness Predictor (SHARP).
U.S. Army Medical Research and Materiel Command (USAMRMC); Intramural Funding
Pl: Killgore (Total Award:$291,000.)

2009-2014  The Neurobiological Basis and Potential Modification of Emotional Intelligence through Affective Behavioral Training (W81XWH-09-1-0730).
U.S. Army Medical Research and Materiel Command (USAMRMC),
Pl: Killgore (Total Award: $551,961.)
Major Goal: To identify the neurobiological basis of cognitive and emotional intelligence using functional and structural magnetic resonance imaging.
2011-2014  **Effects of Bright Light Therapy on Sleep, Cognition, and Brain Function following Mild Traumatic Brain Injury (W81XWH-11-1-0056).**  
U.S. Army Medical Research and Materiel Command (USAMRMC),  
PI: **Killgore** (Total Award: $941,924)  
Major Goal: To evaluate the effectiveness of morning exposure to bright light as a treatment for improving sleep patterns among individuals with post-concussive syndrome. Effects of improved sleep on recovery due to this treatment will be evaluated using neurocognitive testing as well as functional and structural neuroimaging.

2012-2014  **Neural Mechanisms of Fear Extinction Across Anxiety Disorders**  
NIH NIMH  
PI: Milad, M. Site Subcontract PI: **Killgore** (Subcontract Award: $505,065)  
Major Goal: To examine the neurocircuitry involved in fear conditioning, extinction, and extinction recall across several major anxiety disorders.

2012-2014  **Multimodal Neuroimaging to Predict Cognitive Resilience Against Sleep Loss**  
Defense Advance Research Projects Agency (DARPA) Young Faculty Award in Neuroscience (D12AP00241)  
PI: **Killgore** (Total Award: $445,531)  
Major Goal: To combine several neuroimaging techniques, including functional and structural magnetic resonance imaging, diffusion tensor imaging, and magnetic resonance spectroscopy to predict individual resilience to 24 hours of sleep deprivation.

2012-2015  **Internet Based Cognitive Behavioral Therapy Effects on Depressive Cognitions and Brain function (W81XWH-12-1-0109).**  
U.S. Army Medical Research and Materiel Command (USAMRMC),  
PI: Rauch, SL; Co-PI: **Killgore** (Total Award: $1,646,045)  
Major Goal: To evaluate the effectiveness of an internet-based cognitive behavioral therapy treatment program on improving depressive symptoms, coping and resilience skills, cognitive processing and functional brain activation patterns within the prefrontal cortex.

**Current**

2012-2016  **A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following Traumatic Brain Injury (W81WH-12-0386)**  
Congressionally Directed Medical Research Program (CDMRP), Psychological Health/Traumatic Brain Injury (PH/TBI) Research Program: Applied Neurotrauma Research Award.  
PI: **Killgore** (Total Award: $2,272,098)  
Percent Effort: 25%  
Major Goal: To evaluate the relation between axonal damage and neurocognitive performance in patients with traumatic brain injury at multiple points over the recovery trajectory, in order to predict recovery.

2014-2017  **Bright Light Therapy for Treatment of Sleep Problems following Mild TBI (W81XWH-14-1-0571).**
Psychological Health and Traumatic Brain Injury Research Program (PH/TBI RP) Traumatic Brain Injury Research Award-Clinical Trial.
PI: Killgore (Total Award: $1,853,921)
Percent Effort: 40%
Major Goal: To verify the effectiveness of morning exposure to bright light as a treatment for improving in sleep patterns, neurocognitive performance, brain function, and brain structure among individuals with a recent mild traumatic brain injury.

2014-2018 A Non-pharmacologic Method for Enhancing Sleep in PTSD (W81XWH-14-1-0570)
Military Operational Medicine Research Program (MOMRP) Joint Program Committee 5 (JPC-5), FY13 Basic and Applied Psychological Health Award (BAPHA)
PI: Killgore (Total Award: $3,821,415)
Percent Effort: 35%
Major Goal: To evaluate the effectiveness of blue light exposure to modify sleep in PTSD and its effects on fear conditioning/extinction, symptom expression, and brain functioning.

2015 Effects of Blue Light on Melatonin Levels and EEG Power Density Spectrum
Arizona Area Health Education Centers (AHEC) Program
Co-PI: Alkozei, A.; Co-PI: Killgore (Total Award: $4,373)
Percent Effort: 0%
Major Goal: Adjunctive intramural funding to add a melatonin collection to an ongoing study of the effects of blue wavelength light on alertness and brain function.

2014-2018 Refinement and Validation of a Military Emotional Intelligence Training Program (JW150005)
Joint Warfighter Medical Research Program 2015
PI: Killgore (Total Award: $5,977,570)
Percent Effort: 45%
Major Goal: To develop and validate a new internet-based training program to enhance emotional intelligence capacities in military Service Members.

LIST OF COLLABORATORS ON GRANTS AND PUBLICATIONS FROM LAST FIVE YEARS

Acharya, D. Buchholz, Jennifer L.
Alkozei, Anna Capaldi, Vincent F.
Athey, A. J. Castro, Carl A.
Baker, Justin. T. Chosak, A.
Balkin, Thomas J. Cohen-Gilbert, Julia E.
Bark, John S. Conrad, Turner A.
Brennan, Brian P. Covell, Michael J.
Britton, Jennifer C. Crowley, David J.
Bruyere, J. Cui, Jiaolong
Price, Lauren M.  Simon, Naomi M.
Racine, Megan T.  Smith, Kacie L.
Ragan, J.  Smith, Ryan S.
Raison, Charles L.  Sneider, Jennifer T.
Rauch, Scott L.  Song, Christina H.
Rauch, Shiela  Song, H.
Reichardt, Rebecca M.  Steward, S. E.
Renshaw, Perry F.  Thomas, Jennifer J.
Rizzo, Albert (Skip)  Tkachenko, Olga
Rohan, Michael  Trksak, George H.
Ross, Amy J.  Vanuk, John R.
Rosso, Isabelle M.  Webb, Christian A.
Rupp, Tracy L.  Weber, Mareen
Ryan, E. M.  Weihs, Karen
Sagar, Kelly A.  Weiner, Melissa R.
Schoenberg, Michael R.  Whte, C. N.
Schwab, Zachary J.  Wilhelm, S.
Shane, Bradley R.  Yurgelun-Todd, Deborah, A.
Silveri, Marisa M.  Zai, D.

**GRADUATE, POSTDOCTORAL, THESIS ADVISORS OR SPONSORS**

Steven W. Gangestad, Ph.D.—Undergraduate Senior Honors Thesis Advisor
Lawrence Overby, III, Ph.D.—Masters Thesis Advisor
Bill J. Locke, Ph.D.—Doctoral Thesis Advisor
Keith A. Hawkins, Ph.D.—Doctoral Internship Advisor
Russell L. Adams, Ph.D.—Postdoctoral Fellowship Advisor
James G. Scott, Ph.D.—Postdoctoral Fellowship Advisor
Guila Glosser, Ph.D.—Postdoctoral Fellowship Advisor
Deborah A. Yurgelun-Todd, Ph.D.—Postdoctoral Fellowship Advisor

*This is a true and accurate statement of my activities and accomplishments. I understand that misrepresentation in securing promotion and tenure may lead to dismissal or suspension under ABOR Policy 6-201 J.1.b.*