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Abstract: The present study investigated the efficacy of a non-pharmacological intervention for insomnia in 20 volunteers (aged 19-39) with self-reported sleep problems. Using a counterbalanced, double-blind, crossover study design, we suppressed activation of the left lateral parietal node of the default mode network (DMN) with 40 seconds of continuous theta burst (cTBS) transcranial magnetic stimulation (TMS) versus sham. Active cTBS significantly improved polysomnographically (PSG) measured total sleep time (TST), latency to stage N3 deep sleep, sleep efficiency (SE), and sleep-based arousal index compared to sham. Within-network functional connectivity of the DMN was significantly altered by cTBS versus sham. Active cTBS also modulated DMN connectivity with other brain regions including the globus pallidus, supplementary motor cortex, and parietal operculum, which each correlated with PSG sleep outcomes. TMS had no meaningful effect on attention, vigilance, memory performance, or adverse side effects relative to sham. These preliminary findings suggest that cTBS of the DMN appears to alter brain connectivity and improve objectively measured sleep without adverse cognitive side effects or symptoms.					
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TABLE OF CONTENTS

	<u>Page</u>
1. Introduction	4
2. Keywords	5
3. Accomplishments	6
4. Impact	71
5. Changes/Problems	73
6. Products	74
7. Participants & Other Collaborating Organizations	78
8. Special Reporting Requirements	81
9. Appendices	82

1. INTRODUCTION:

Insufficient sleep is a common part of military life. Recent evidence suggests that up to 85% of military Service members meet criteria for a clinically relevant sleep disorder, with approximately 25% having a primary complaint of insomnia (i.e., difficulty falling or staying asleep) (Mysliwiec et al., 2013). Furthermore, about 42% of military personnel regularly obtain five hours of sleep or less per night, a level of sleep curtailment that is likely to lead to deficits in alertness, vigilance, and decision-making, potentially reducing the readiness and lethality of the force (Mysliwiec et al., 2013). While pharmacologic sleep medications can be helpful, they can become habit forming and can lead to cognitive impairments if an individual is awakened too soon after administration. These drawbacks make pharmacologic sleeping aids undesirable for many operational settings. There is, therefore, a critical need to identify effective nonpharmacologic approaches to facilitate and enhance sleep in military personnel. One innovative possibility is to use a type of repetitive transcranial magnetic stimulation (rTMS) known as continuous theta burst (cTBS) to slightly suppress functioning within the brain's Default Mode Network (DMN), a system of cortical regions that tends to be most active during mind-wandering, daydreaming, and self-referential cognition (Raichle et al., 2001). Among healthy individuals, the DMN shows altered connectivity during sleepiness, sleep deprivation, and sleep, suggesting that increased sleep pressure is normally associated with reduced functional connectivity of this network. Conversely, individuals with psychophysiological insomnia show greater waking functional connectivity within the DMN compared to healthy individuals. It has been postulated that excessive activation and connectivity of the DMN may be associated with ruminative thinking and internally generated arousal, which makes it difficult to fall asleep. In other words, we hypothesize that individuals with insomnia struggle to “turn down the volume” of the “mental chatter” that is ongoing when they try to fall asleep, which would be reflected in excessive DMN activity. Therefore, the overall objective of this proposal was to temporarily suppress the strength of connectivity within the DMN using cTBS before sleep and determine its effects on subsequent sleep. Our central hypothesis is that precision guided cTBS, targeted toward a single node of the DMN in the lateral inferior parietal cortex would reduce functional connectivity within the network and this would be associated with shorter latency to sleep onset, reduced wake after sleep onset, greater sleep efficiency, and longer total sleep time. This project was envisioned as a pilot study to obtain sufficient data to expand this approach to a larger clinical trial. Therefore, we recruited $n = 20$ otherwise healthy individuals with evidence of insomnia to participate in two overnight laboratory sleep studies, each involving two neuroimaging scan protocols and a polysomnographically (PSG) measured overnight sleep session. At each of the two study sessions, separated by at least 5 days, participants underwent either active cTBS or sham stimulation in a double-blind, counterbalanced, crossover design. As described in greater detail in subsequent sections, the rTMS protocol was successful, with cTBS leading to significant changes in functional connectivity of the DMN and correlated improvements in PSG measures of sleep, including improvements in total sleep time, sleep efficiency, latency to N3 deep sleep, and a lower arousal index compared to their matched sessions following sham treatment. As the 40-second intervention significantly improved objective measures of sleep and brain function, with no significant adverse effects on cognition or symptom presentation, our findings suggest that future research on this promising approach is warranted.

2. KEYWORDS:

Repetitive Transcranial Magnetic Stimulation
Continuous Theta Burst Stimulation
Insomnia
Sleep Disturbance
Sleep Quality
Total Sleep Time
Sleep Efficiency
Rapid Eye Movement Sleep
Deep Sleep
Arousal Index
Polysomnography
Neuroimaging
Functional Connectivity
Default Mode Network
Inferior Parietal Cortex
Psychomotor Vigilance Test
Attention
Verbal Memory
Mood
Intervention

3. ACCOMPLISHMENTS:

3A. What were the major goals of the project?

Specific Aim 1: Determine the effects of cTBS targeted to the DMN on sleep quality, brain neurochemistry, functional connectivity, and next-day cognitive performance.

- **Major Task 1:** Obtain IRB/HRPO approval, hire staff, and procure equipment
 - **Subtask 1:** Prepare regulatory documents and research protocol
 - Refine eligibility criteria, exclusion criteria, and screening protocol **(completed 7/27/20)**
 - Finalize consent form and human subjects protocol **(completed 7/27/20)**
 - Submit protocol for local UA IRB Review **(completed 9/08/2020)**
 - Submit protocol for Military 2nd level IRB review (ORP/HRPO) **(completed 9/30/20)**
 - Submit amendments, adverse events and protocol deviations as needed **(ongoing, latest amendment submitted 04/26/2022)**
 - Complete annual IRB/HRPO continuing review report
 - **Subtask 2:** Hire Staff and Acquire Testing Materials
 - Train research staff on study-related protocols **(100% complete)**
 - Acquire and organize research materials and equipment **(100% complete)**
 - Perform test runs of data collection activities to refine and perfect data collection protocols and procedures **(100% complete)**
- **Major Task 2:**
 - **Subtask 1:** Collect data for n=20 participants (10 male, 10 female) **(100%, completed)**
 - Place advertisements for participant recruitment
 - Prescreen and determine eligibility for all interested potential participants
 - Enroll and run eligible subjects through all study activities **(100% complete)**
 - Clean, score, process, and prepare data for analysis **(100% complete)**
- **Major Task 3:** Analyze data and disseminate results **(ongoing)**
 - **Subtask 1:** Perform statistical analyses
 - Conduct statistical analyses of data using SPSS
 - **Subtask 2:** Publish findings and submit final report
 - Submit abstracts and manuscripts for publication
 - Prepare final report describing study findings

3B. What was accomplished under these goals?

Major Activities:

Recruitment

Figure 1 summarizes methods for recruitment for the present study. Most personnel interested in participating in the study were informed through online social media platforms such as Instagram (n=729) and Facebook (n=145). Posting flyers within the vicinity of Tucson and the University of Arizona campus also yielded a higher number of potential recruits (n=278). Other methods such as listservs, external websites, newspapers, and radio ads did not yield as many potential recruits for the present study despite success with these methods in our previous studies.

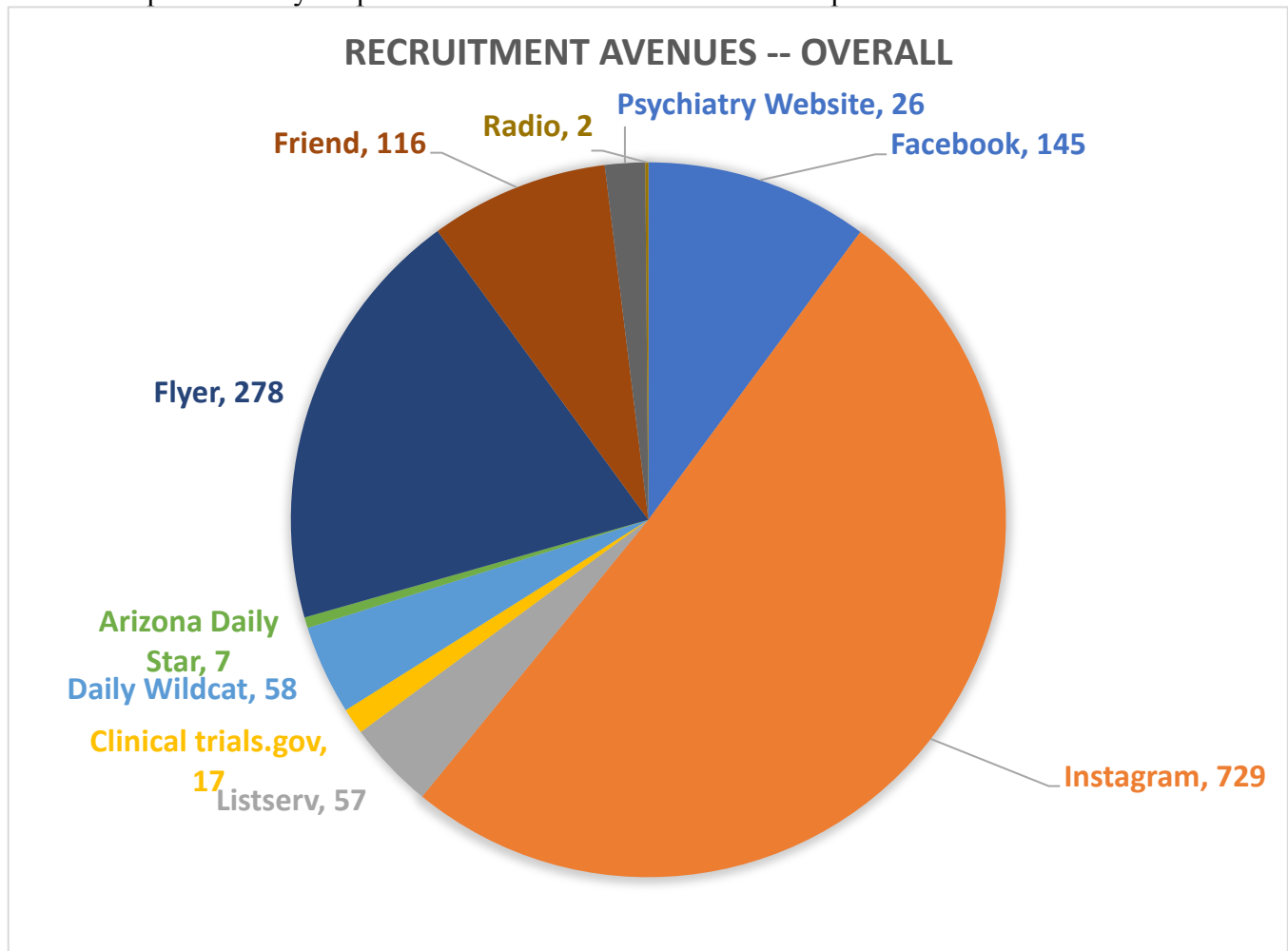


Figure 1. Summary of Recruitment Methods

Figure 2 summarizes recruitment progress for the present study. During the online screening process, the majority of personnel were found ineligible to participate due to meeting exclusionary criteria (n=1272). Of potentially eligible personnel, 71 potential participants were lost to contact during the recruitment process and 31 participants were excluded from the study upon further screening. Our final sample yielded 20 participants. Before closing recruitment and completing the present study, there were 120 additional submissions for recruitment and 12 other participants who were eligible to participate.

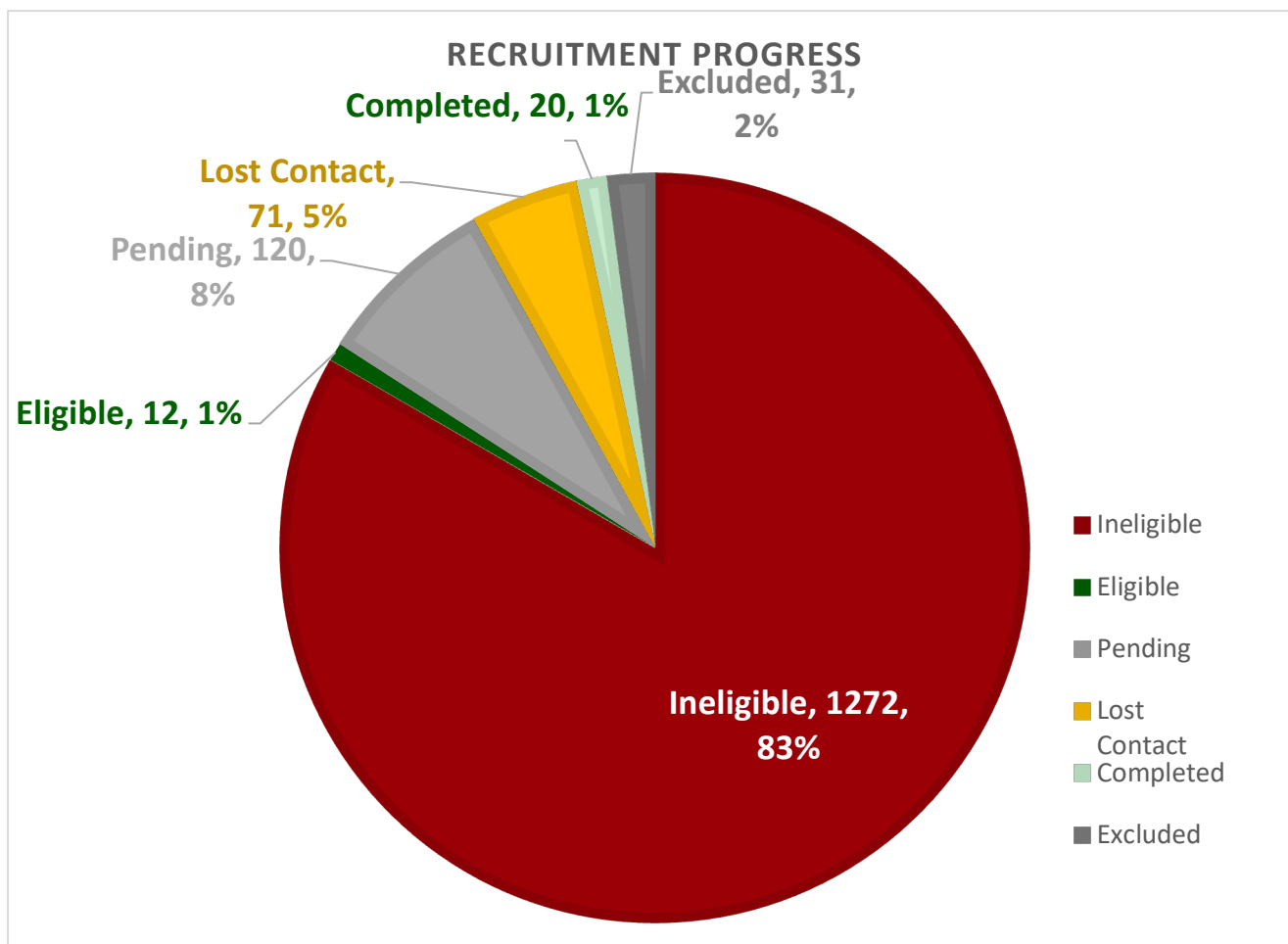


Figure 2. Summary of Recruitment Progress

Figure 3 summarizes recruitment processes for personnel who were ineligible to participate in the study based on exclusion criteria during online screening. The majority of personnel were excluded during the screening process due to their health background (n=890). We also found that many potential recruits were unable to partake in the study due to risks associated with receiving TMS (n=446) or MRI (n=412). Because we were interested in personnel with clinical insomnia, personnel were asked to complete the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and the Insomnia Severity Index (ISI). To be included in the study, potential recruits had to score at a clinical threshold on two out of the three inventories. Our recruitment results demonstrate that most personnel were deemed ineligible during screening due to sub-threshold scores on the ESS and ISI (n=252). We found that most personnel met clinical thresholds for

insomnia according to the PSQI. The figure listed below also includes other exclusionary criteria to include mental health history, use of illicit drugs, and alcohol use.

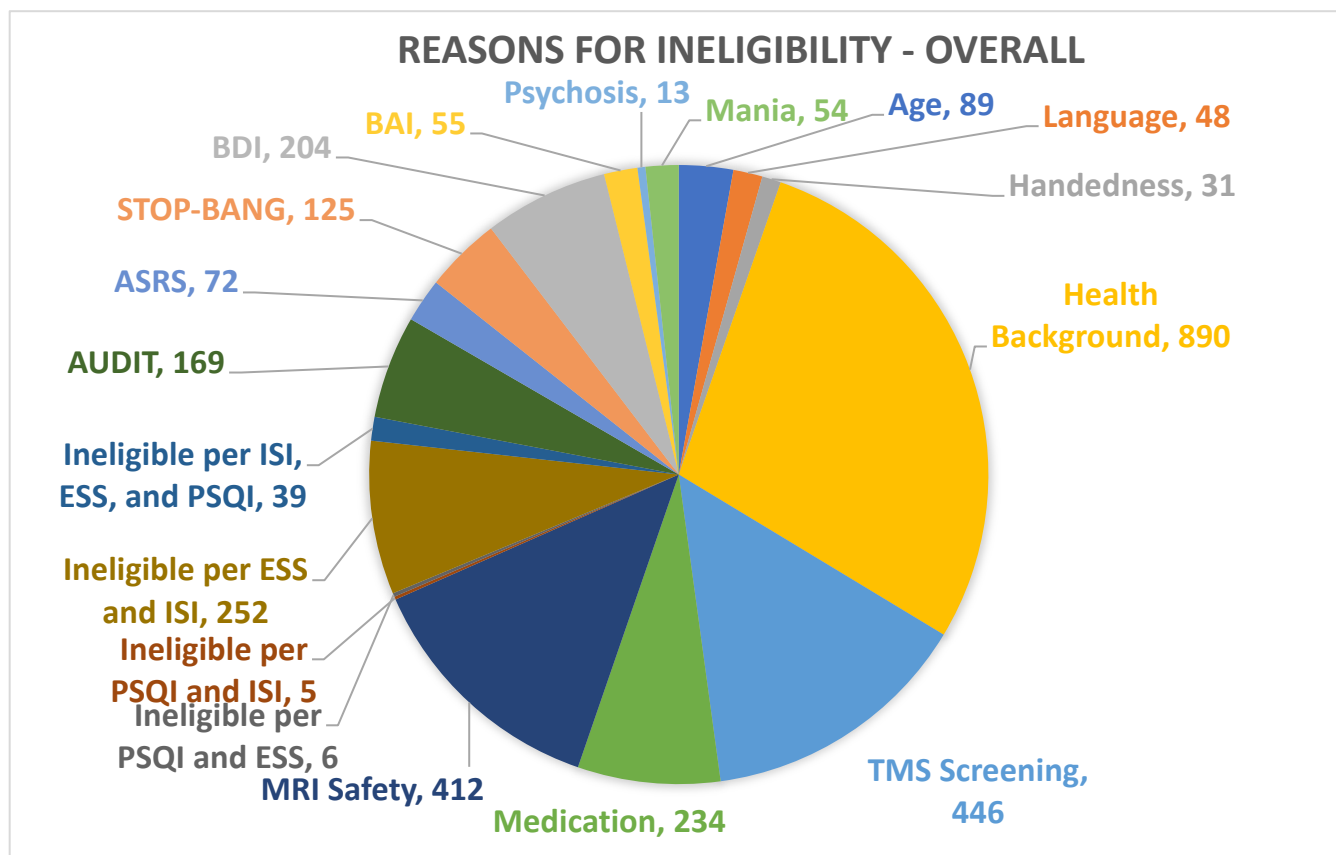


Figure 3. Summary of Ineligibility During Screening

Figure 4 summarizes the recruitment processes for participants included in the study in the form of a Consort Diagram. As described above, a total of $n = 1152$ individuals filled out an online interest form, but most interested individuals were excluded during the online screening based on a variety of exclusionary criteria. Cumulatively, there were 62 individuals who completed a telephone screening after online screening to assess eligibility for the study. Of these 62 individuals, 39 individuals were deemed ineligible for the study due to not meeting eligibility criteria, declining to participate, or did not show up for scheduled enrollment visit. Of the 23 participants who were randomized and allocated to an intervention, 20 received their allocated intervention while 3 participants did not receive their intervention due to discontinuing the study. 2 participants completed their first overnight visit, but chose to withdraw midway through the study. 1 participant was removed by the PI due to safety concerns after the first overnight visit.

CONSORT Flow Diagram

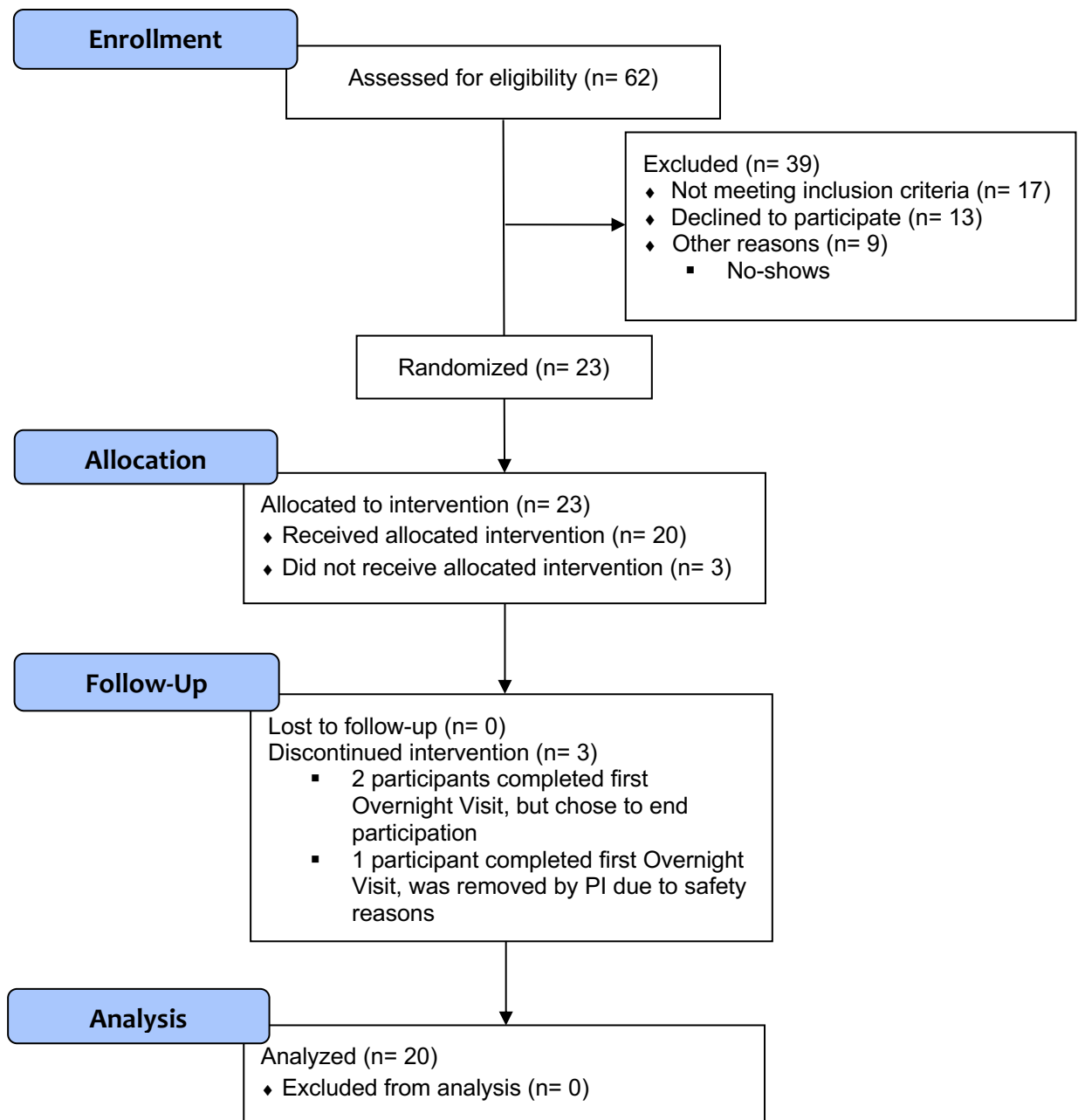


Figure 4. Consort diagram of the present study, final sample size included 20 completed participants.

Figures 5 and 6 summarize the demographics for the sample included within the study. In our original proposal we aimed for a representative sample of approximately 50% males and 50% females. Our final sample was 60% female and 40% male. Additionally, within the original grant proposal, we aimed for a minimum of 33% of our sample being reflective of minority populations

within the military. In total our sample consisted of a 65% minority population sample with the majority of the participants identifying as Hispanic/Latino, Black/African-American, or American Indian/Alaskan Native.

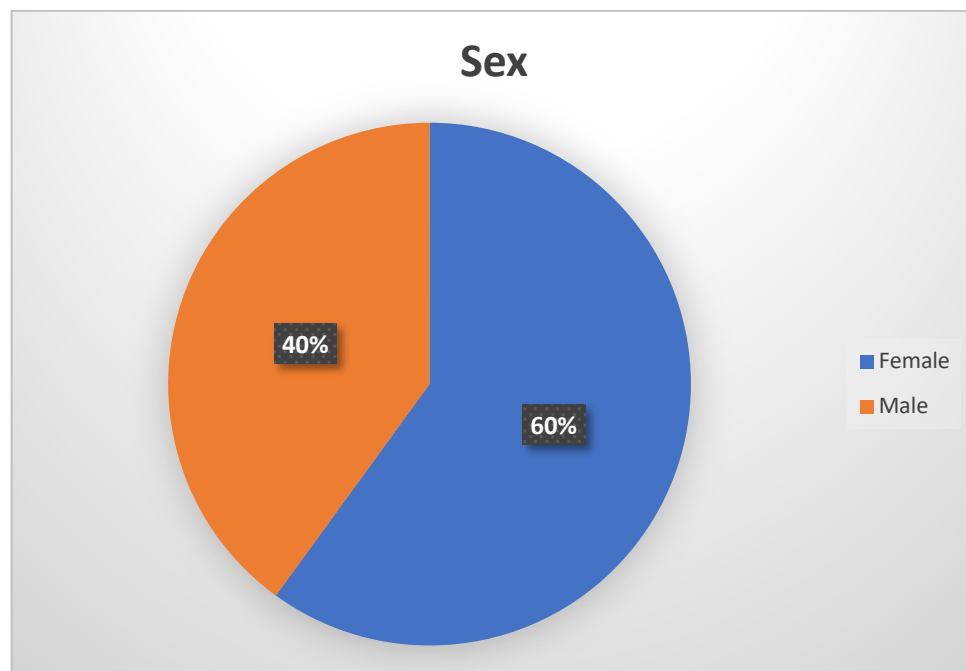


Figure 5. Sex demographics of present study, final sample size included 12 Females and 8 males.

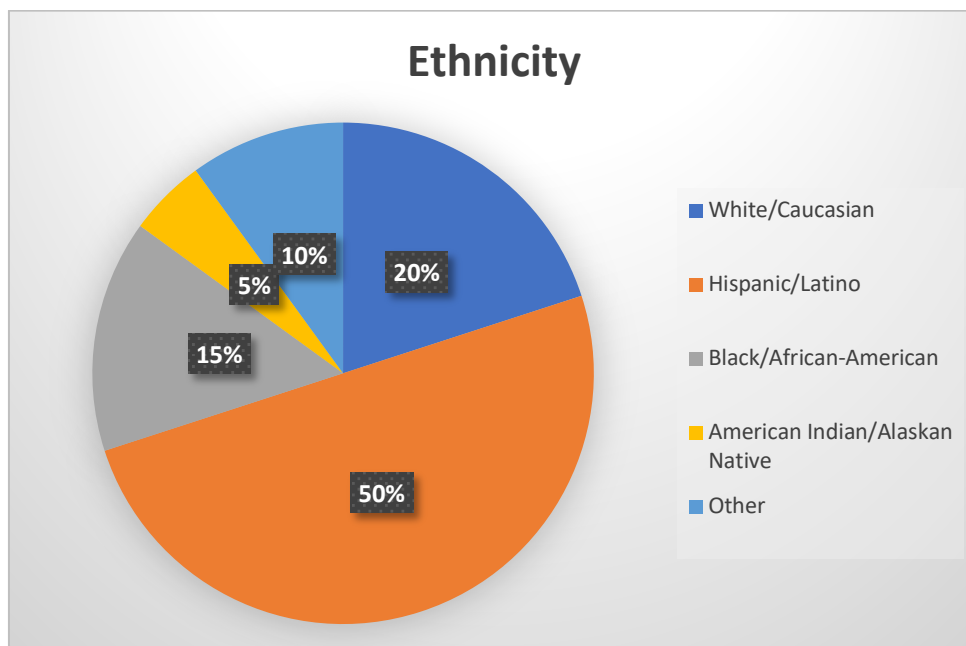


Figure 6. Ethnicity demographics of present study, final sample size included 4 White/Caucasian Participants, 10 Hispanic/Latino Participants, 3 Black/African-American Participants, 1 American Indian/Alaskan Native Participant, and 2 Participants who identified as other.

Data Collection Methods

Participants: The final sample included a total of $n = 20$ participants who completed both overnights and received active and placebo transcranial magnetic stimulation (TMS) treatments. All participants were otherwise healthy participants meeting diagnostic criteria for primary insomnia (8 males; 12 females) with normal bedtime sleep schedules (i.e., bedtime between 10:00 p.m. and 12:00 a.m.; rise time between 6:00 a.m. and 8:00 a.m. on weekdays). All volunteers underwent initial online screening (i.e., Insomnia Severity Index; Epworth Sleepiness Scale; Pittsburgh Sleep Quality Index) and a follow-up telephone screening to determine insomnia symptoms and rule out past or present history of breathing-related disorders, major medical, substance use, or psychiatric problems that would contraindicate a sleep study, other standard contraindications for magnetic resonance imaging (MRI) and TMS. The **inclusion/exclusion criteria** are listed below:

Inclusion Criteria:

- Healthy men and non-pregnant, non-lactating women 18-50 (inclusive) years of age, free from contraindicated diseases, medications, devices, and conditions as described in section 5.2.
- Participants must meet the criteria for primary insomnia as determined by scores on the ISI, PSQI, and ESS. Participants must obtain two out of three of the following required scores for each questionnaire:
 - Greater than or equal to 15 for ISI (Gagnon, Belanger, Ivers, & Morin, 2013)
 - Greater than or equal to 6 for PSQI (Buysse et al 1989)
 - Greater than or equal to 11 for ESS (Johns, 2000)

Exclusion Criteria:

- Presence of any metal implant or medical device which may pose a safety risk for MRI or TMS (see below for examples) (MRI Safety Questionnaire.docx; TMS REDCap Screening.docx)
 - Cardiac pacemakers
 - Metal clips on blood vessels (also called stents)
 - Artificial heart valves
 - Artificial arms, hands, legs, etc.
 - Brain stimulator devices
 - Implanted drug pumps
 - Ear implants
 - Eye implants or known metal fragments in eyes
 - Exposure to shrapnel or metal filings (wounded in military combat, sheet metal workers, welders, and others)
 - Other metallic surgical hardware in vital areas
 - Certain tattoos with metallic ink
 - Certain transdermal (skin) patches such as NicoDerm (nicotine for tobacco dependence), Transderm Scop (scopolamine for motion sickness), or Ortho Evra (birth control)

- Self-reported past or present medical diagnosis of sleep or breathing-related disorders such as sleep apnea.
- Travel outside the time zone within the one week prior to enrollment visit and at any point while active in the study (Health Background Questionnaire.docx).
- Self-reported major medical problems including past or present history of heart problems and/or neurological problems (to include but not limited to heart murmur, heart attack, TBI, stroke, tumor, epilepsy or another seizure disorder) (Health Background Questionnaire.docx).
- Self-reported past or present history of cardiovascular disease (to include but not limited to arrhythmias, valvular heart disease, congestive heart failure, history of sudden cardiac death or myocardial infarction) (Health Background Questionnaire.docx)
- Self-reported past or present history of neurological disorder (to include but not limited to traumatic brain injury including concussions, strokes, tumors, epilepsy or another seizure disorder, amnesia for any reason, hydrocephalus, multiple sclerosis) (Health Background Questionnaire.docx)
- Self-reported past or present history of any seizures or seizure disorders (Health Background Questionnaire.docx)
- Self-reported first-degree family history (like a mother, father, or sibling) of a seizure or seizure disorder
- Self-reported underlying acute or chronic pulmonary disease (Health Background Questionnaire.docx)
- Self-reported history of fainting spells or syncope (Health Background Questionnaire.docx)
- Self-reported past (at any point in the participant's history) or present psychiatric problems not including depression and/or anxiety disorders (to include but not limited to bipolar, mania, ADHD, or psychotic disorders; Health Background Questionnaire.docx)
- Self-reported history of medically diagnosed depression and/or anxiety disorders (Health Background Questionnaire.docx)
- Self-reported suicidal ideation as indicated by a score equal to or greater than 2 on question 9 of the BDI (BDI-II.docx).
- Self-reported current use of certain prescription medications including Ambien, benzodiazepines, stimulants (amphetamines, medication for narcolepsy), antidepressants (SSRIs, SNRIs), antipsychotics, blood pressure medications, thyroid medications. (TMS Screening Questionnaire.docx)
- Self-reported current use of supplements that may affect sleep (to include but not limited to melatonin, valerian root, kava root) (Health Background Questionnaire.docx)
- Self-reported caffeine use in excess of 300 mg (e.g., approximately 8 caffeinated sodas or approximately 3-4 12-oz cups of coffee) per day on average (Preston Caffeine Consumption Questionnaire.docx)
- Self-reported or suspected regular nicotine use (or addiction) (defined as more than 1 cigarette or equivalent per week within the last 1 year) (Health Background Questionnaire.docx)
- Self-reported or suspected heavy alcohol use (minimum limit to define heavy alcohol use is 14 drinks per week for males, 7 drinks per week for females) (Health Background Questionnaire.docx, AUDIT.docx)

- Self-reported or suspected use of illicit drugs (to include but not limited to benzodiazepines, amphetamines, cocaine, opioids) (Health Background Questionnaire.docx)
- (Females only) Positive urine pregnancy result (Urine HCG Test results)
- (Females only) Self-reported or suspected current breast-feeding or collecting breast-milk (Health Background Questionnaire.docx)
- First learned English past age 3 (TMS REDCap Screening.docx)
- Speaking English as a non-primary language (TMS REDCap Screening.docx)
- Less than 9th grade education (TMS REDCap Screening.docx)
- Unusual sleep schedules in past six months (TMS REDCap Screening.docx)
- Overnight shift work (TMS REDCap Screening.docx)
- Inability to read and sign consent
- Failure to cooperate with requirements of the study

Procedure: Enrollment Day—Participants meeting basic eligibility requirements were invited for an in-person baseline data collection session that lasted approximately 2-3 hours. Upon completion of the informed consent process, the participant underwent a baseline assessment, including measurement of intellectual capacity with the Wechsler Abbreviated Scale of Intelligence (WASI-II) either over a video call (depending on COVID-related restrictions) or face-to-face with a research team member, subjective sleep assessment including the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Functional Outcomes of Sleep Questionnaire (FOSQ), and other cognitive assessments. Upon completion of the assessments, participants were fitted with a wrist actigraphic sleep monitor (Actiwatch 2 or Actiwatch Spectrum), which they wore for at least one week prior to returning for the in-laboratory assessment session.

At-Home Actigraphy Week—After their enrollment visit, participants wore the actigraphic sleep monitor continuously for the duration of their participation in the study, including at home, and will complete a daily online sleep diary that contains electronic time stamps to ensure compliance. Participants were required to maintain a regular sleep schedule for the week prior to the in-laboratory session and were not permitted to use caffeine products for 48 hours prior to the overnight stay. Two nights before their scheduled overnight session, participants received a reminder email, text, and/or phone call to ensure that they maintained required bedtimes/durations before the in-laboratory session.

Overnight Laboratory Sessions—Participants completed **two** ~18-hour in-laboratory assessment sessions in a double-blind counterbalanced crossover design, with each session separated by at least five days. Participants served as their own controls during rTMS, with one session involving *active continuous theta burst (cTBS) rTMS* and one session involving *sham placebo TBS (sham) rTMS*. On the first day of each overnight visit, participants arrived at a predetermined evening appointment time. After settling in, participants completed an approximately two-hour cognitive testing period. During cognitive testing, participants completed the 10-minute Psychomotor Vigilance Testing (PVT) and Karolinska Sleepiness Scale (KSS) approximately once every hour in addition to the Visual Analog Mood Scale, State-Trait Anxiety Inventory – State only (STAI-S), Beck Depression Inventory (BDI-II), California Verbal Learning Task 3 (CVLT3), Shoot/No-Shoot Task, Repeatable Battery for the Assessment of

Neuropsychological Status (RBANS) Symbol Digit Test, RBANS Digit Span, RBANS Story Memory Test, and Glasgow Content of Thoughts Inventory (GCTI). **Figure 7** provides a graphical overview of the overnight laboratory session.

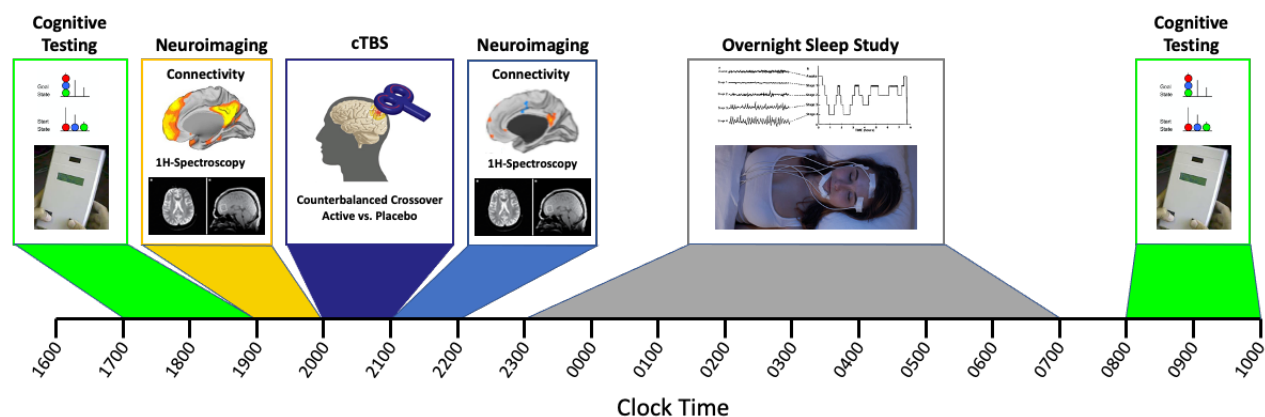


Figure 7. Protocol for the initial Discovery Award rTMS session. Participants completed a baseline cognitive assessment, neuroimaging session, and stimulation with cTBS rTMS. Afterward, they underwent a second neuroimaging session followed by a night of in-lab sleep that was monitored by polysomnography. Upon awakening, participants again completed a cognitive testing session.

Prior to entering the scanner, participants repeated the TMS Screening questionnaire, MRI Screening questionnaire and Health Background Screening previously administered during the online screening in order to ensure safety. Participants then underwent an approximately one-hour protocol to examine structural brain characteristics, functional connectivity, functional activation, and neurochemistry. After exiting the scanner, participants were escorted to the TMS stimulation lab in the next room and were administered either the active cTBS or sham cTBS protocol (described below). After completion of the stimulation procedure, participants were then escorted again to the MRI scanner and underwent the same one-hour neuroimaging protocol as before.

After the two neuroimaging scans and completing cTBS or sham cTBS, participants were then escorted back to the sleep laboratory to have dinner and underwent polysomnographic (PSG) electrode hook-up. Participants also completed a brief cognitive testing block before bed consisting of RBANS story recall, RBANS digit span, RBANS Symbol Digit Test, and CVLT3 word list recall. After PSG electrode hook-up, participants slept undisturbed in a light- and temperature-controlled private bedroom while continuously monitored by a trained technician with a Nihon Kohden JE-921 PSG recording system using standard 10-20 electrode placement. Data from PSG were scored using Polysmith software by a trained and certified sleep technician who was blind to participant condition and status. The overnight metrics of sleep onset latency (SOL), latency to N1, N2, N3, and REM, total sleep time (TST), sleep efficiency (SE), wake after sleep onset (WASO), and number of awakenings and arousals, as well as time and percentage of time spent in each sleep stage.

The following morning, participants were awakened and had breakfast, followed by an approximately two-hour cognitive assessment battery consisting of the 10 minute Psychomotor Vigilance Testing (PVT) and Karolinska Sleepiness Scale (KSS) approximately once every hour as well as the Visual Mood Scale, State-Trait Inventory – State only (STAI-S), Beck Depression Inventory (BDI-II), California Verbal Learning Task 3 (CVLT3) – recall the list, Shoot/No-Shoot

Task, Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Digit Span, RBANS story recall, and RBANS Symbol Digit Test. Participants were then dismissed from the lab.

Neuroimaging Methods: Scans were collected on a Skyra 3T scanner (Siemens, Erlangen, Germany) using a 32-channel head coil. Participants will complete a series of scans that include structural (MPRAGE), functional (10-minute eyes open) resting state, and proton magnetic resonance spectroscopy (^1H MRS) neurochemistry scans, with voxels placed in 1) the anterior cingulate gyrus, a cortical region involved in attentional control, and 2) posterior cingulate/precuneus. fMRI data were pre-processed with standard neuroimaging packages, including SPM12, FSL, and the functional connectivity toolbox (CONN; focusing in DMN within-network connectivity) following standard published pipelines.

Continuous theta burst stimulation protocol: Our goal was to explore the effects of cTBS specifically on the activation and connectivity of the DMN to reduce self-focused cognition and rumination prior to bedtime. The aim was to modulate the DMN by simply stimulating a region of the left inferior parietal lobule (IPL) that is an easily accessible surface node of the DMN (see **Figure 8**). Based on the Yeo-Buckner probability atlas, we selected a stimulation point with centroid MNI coordinates located at $x = -48, y = -61.5, z = 32.5$, which corresponded to the centroid of the left lateral parietal node of the DMN.

rTMS Stimulation Location: Lateral Node of DMN

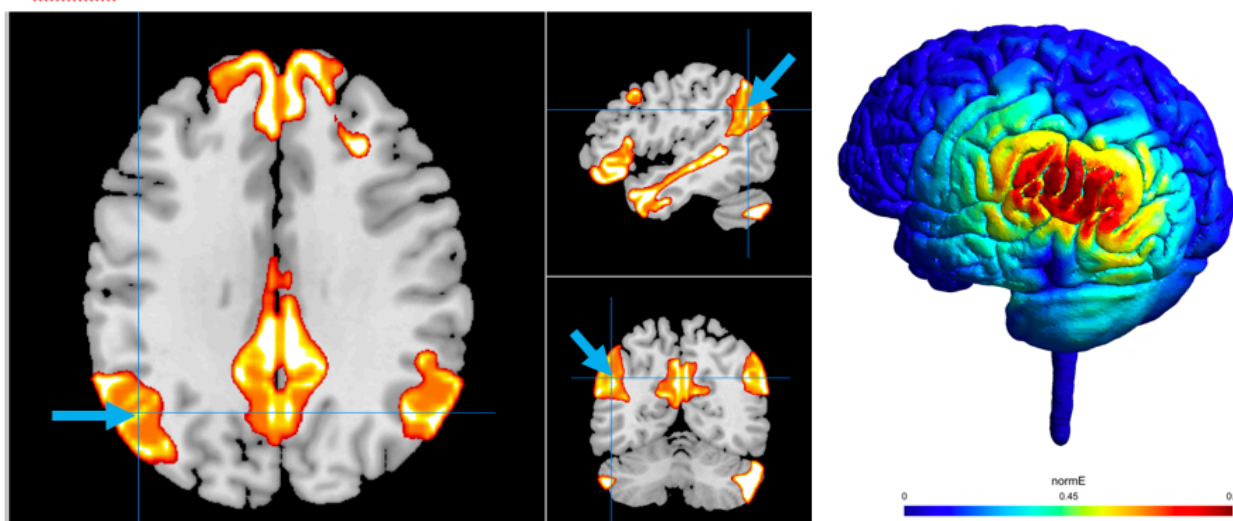


Figure 8. Location of rTMS stimulation. We used rTMS to stimulate the left inferior parietal region which is an easily accessible node of the default mode network. The left image shows the node of stimulation. The right image shows probability of stimulating the DMN at the specific stereotaxic coordinates we used.

Following the first functional magnetic resonance imaging (fMRI) session of the night, participants underwent rTMS using a 40 second cTBS stimulation train applied over an easily accessible node of the DMN located at the left inferior parietal lobe. In this project, we used the non-invasive continuous theta burst stimulation (cTBS) paradigm as the treatment protocol. The cTBS (600 stimuli/per session) suppresses neural activity and the effect of one session of cTBS (40 seconds) can last up to 40 minutes. A MagVenture MagPro X100 stimulator (MagVenture Inc. Denmark)

connected with a figure-of-eight magnetic coil with active cooling will be used for the cTBS protocol. cTBS will be administered by trained research personnel. Each individual was expected to have a different sensitivity to the magnetic fields generated by the cTBS, and the stimulation intensity was therefore adjusted based on each individual's resting motor threshold (RMT). The RMT was defined as the lowest intensity required to elicit at least five motor-evoked potentials of 200 μ V peak-to-peak amplitude of the right abductor pollicis brevis (APB) muscle measured with an electromyography machine in 10 consecutive stimulations when the single-pulse TMS was delivered to the hotspot of the left primary motor cortex. Participants were instructed to voluntarily contract the right APB muscle with ~20% of their maximum muscle contraction during the measurement of RMT. Real-time motor-evoked potential of muscle contraction was provided to ensure consistent force production. Once the RMT was identified, the stimulation intensity for TBS was set to 70% of each participant's RMT. For primary stimulation we located a pre-determined surface stimulation site, by focusing stimulation on a surface node in the inferior parietal lobe—following similar approaches used by others (Eldaief et al., 2011; Vidal-Piñeiro et al., 2015), localized by co-registering the participant's head, structural T1-weighted MRI image, and TMS coil in the same space using a TMS 3D Neuronavigation System. Once co-registration was complete, the Neuronavigation system provided real-time feedback of the coil location and record the coil position and orientation relative to the head. The cTBS was applied using a figure-of-eight coil with an active cooling system connected to the MagPro magnetic stimulator (MagVenture Cool-B65). For the sham condition, a sham coil resembling a regular TMS coil equipped with a magnetic shield that attenuated the magnetic field was used. **Figure 9** shows the stimulation system that was used.

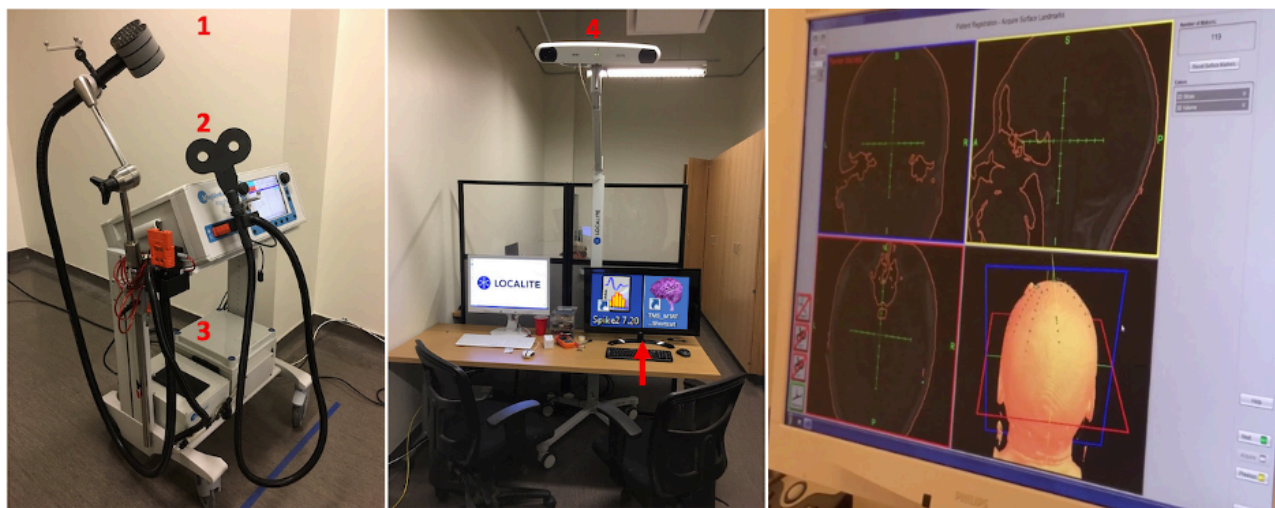


Figure 9. TMS stimulation system. Left: 1) the cTBS was administered with a MagVenture Cool-B65 stimulator that included an active and sham side; 2) the resting motor threshold was determined using a MagPro X100 stimulator with figure 8 coil; 3) the TMS system was maintained at a constant temperature using an active cooling system. Middle: the stimulation was directed by a computerized system that detected the orientation of the head in space using a 4) antenna camera and correlate it with the individual's co-registered MRI scan. Right: An image showing the Neuronavigation system that was used to administer the TMS stimulation to the precise DMN locations.

Data Management

The study staff utilized University of Arizona Health Sciences REDCap system, a HIPAA compliant digital storage database to compile the final dataset for the study.

Statistical Analysis

Sleep data: Sleep data collected by polysomnography (PSG) during overnight visits was sent to a certified sleep technologist who scored the data according to the standard Rechtschaffen and Kales scoring approach. The technician was blind to participant stimulation condition. Standard metrics of sleep onset latency (SOL), latency to N1, N2, N3, and REM, total sleep time (TST), sleep efficiency (SE), wake after sleep onset (WASO), number of awakenings, number of arousals, and percentage of time spent in each stage were recorded. All variables were then analyzed in IBM SPSS for statistical analysis.

Behavioral data: neuropsychological assessments and self-report questionnaires were imported into IBM SPSS for statistical analysis.

Neuroimaging data: Multimodal imaging data included resting state functional connectivity (FC). Imaging data was analyzed using statistical parametric mapping (SPM12) and the functional connectivity toolbox (CONN) version 17f.

Specific Objectives

The stated objective of this proposal was to assess the effectiveness of continuous theta burst (cTBS) transcranial magnetic stimulation (TMS) on the DMN and improving sleep metrics and post-sleep cognitive performance.

This objective was accomplished, as described in detail in the following section, Significant Results/Key Outcomes.

Significant Results/Key Outcomes:

Overview:

Specific Aim: Determine the effects of cTBS targeted to the DMN on sleep quality, brain neurochemistry, functional connectivity, and next-day cognitive performance. Our *working hypothesis* was that relative to sham treatment, cTBS will suppress neural activity within the DMN, leading to improvements in polysomnographically (PSG) measured sleep parameters, and this would be associated with neurochemistry changes and functional connectivity in the DMN, and would improve next day cognitive performance.

In the following sections, we will present summary data regarding the effects of cTBS on polysomnographically measured sleep quality, associated changes in functional connectivity, and effects on neurocognitive performance. We will first present the primary outcome and study data related to our Specific Aims and hypotheses. Then, in a subsequent section, we will present supplementary analyses of interest based on outcome measures collected. During the study visits, we collected the following primary measures:

Neuroimaging on 3T scanner

- Resting State Function Connectivity (FC)

Measures of Attention

- Psychomotor Vigilance Test (PVT)

Measures of Information Processing Speed

- Go/No Go (GNG)/Shoot-No-Shoot (SNS)

Measures of Learning and Memory

- California Verbal Learning Test (CVLT)
- Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)

Sample Characteristics

Basic demographic characteristics for the groups are reported in **Tables 1 and 2**.

	Age (yrs)	Height (in)	Weight (lbs)	IQ
N	20	20	20	20
Mean	26.90	66.03	160.95	107.30
SD	6.56	4.15	63.10	11.85

Table 1. Demographic characteristics

	Female	Male
N	12	8
Age	23.75 ± 4.29	31.63 ± 6.74
Height	64.13 ± 3.57	68.88 ± 3.36
Weight	156.58 ± 49.31	167.50 ± 33.78
IQ	106.33 ± 8.09	108.75 ± 16.55

Table 2. Demographic characteristics by sex.

In addition to demographic information, all participants completed psychological questionnaires during their enrollment visit to assess depression, anxiety, and perceived stress. Independent t-test analyses indicated there were no significant differences between males and females baseline psychological characteristics ($p > .05$). Summary statistics for psychological characteristics are presented in **Tables 3 and 4**.

	Baseline Depression Score (BDI)	Baseline Trait Anxiety (STAI-T)	Baseline Perceived Stress (PSQ)
N	20	20	20
Mean	17.80	56.25	69.50
SD	9.70	22.65	11.07

Table 3. Psychological characteristics

	Female	Male
N	12	8
BDI	19.42 ± 9.42	15.38 ± 10.24
STAI-T	93.25 ± 20.03	75.75 ± 23.49
PSQ	72.92 ± 23.49	64.38 ± 5.805

Table 4. Psychological Characteristics by sex.

In accordance with the specific objectives of the study, we collected multiple sleep variables during participant's enrollment visit. We administered the Pittsburg Sleep Quality Index (PSQI), a standardized measure of sleep quality, the Epworth Sleepiness Scale (ESS), the most widely used scale of excessive daytime sleepiness, the Insomnia Severity Index, a measure of both daytime and nighttime severity of insomnia, Glasgow Content of Thoughts Inventory (GCTI), a measurement of intrusive cognitions prior to sleep, the Functional Outcomes of Sleep Questionnaire (FOSQ), an assessment of the functional impact of sleepiness, and the Horne-Ostberg Morning-Eveningness Questionnaire (MEQ), measuring individual circadian rhythm. Summary statistics for sleep characteristics are included in **Tables 5 and 6**.

Based on the GCTI, we found significant between-group differences between males and females in reported cognitions and intrusiveness of thoughts prior to sleep ($t(18) = 2.125, p = .048$). Females reported significantly higher frequency on intrusiveness of thoughts prior to sleep ($M = 61.17$; $SD = 9.29$) than males ($M = 50.88$; $SD = 12.40$) at baseline. There were no other significant differences between males and females on ISI, PSQI, ESS, FOSQ, or MEQ ($p > .05$).

	Baseline GCTI	Baseline ISI	Baseline PSQI	Baseline ESS	Baseline FOSQ	Baseline MEQ
N	20	20	20	20	20	20
Mean	57.05	17.30	11.55	10.60	15.33	46.00
Standard Deviation	1.50	3.87	2.52	3.94	2.34	12.63

Table 5. Sleep characteristics

	Female	Male
N	12	8
GCTI*	61.17 ± 9.29	50.88 ± 12.42
ISI	18.25 ± 2.99	15.88 ± 4.76
PSQI	12.25 ± 2.01	10.50 ± 2.98
ESS	11.25 ± 3.62	9.63 ± 4.44
FOSQ	15.15 ± 2.09	15.60 ± 2.81
MEQ	48.08 ± 12.37	42.88 ± 13.20
* Indicates significance of $p < .05$		

Table 6. Sleep characteristics by sex.

Sleep Outcomes:

As described above, after completion of ACTIVE or SHAM treatment, participants retired to their own private bedroom from 23:00 until 07:00 the following morning. Participants were monitored throughout via PSG, which was scored by a trained and certified sleep technologist who was blind to participant condition and the hypotheses of the study. Due to a technical malfunction, one participant was inadvertently awakened an hour early (i.e., 06:00). Therefore, to equate data for all 20 participants, we constrained the data analysis for all participants from lights out at 23:00 until 06:00 for all participants (i.e., 7 hours). Data were analyzed using a repeated measures (SHAM vs ACTIVE) analysis of variance (ANOVA), controlling for participants age and full-scale IQ, with each sleep variable as a separate dependent variable.

Total Sleep Time (TST). As shown in **Figure 10**, ACTIVE cTBS treatment led to a significant increase in mean TST relative to SHAM treatment, $F(1,17) = 6.65$, $p = .020$, $\eta_p^2 = .281$. The mean TST for SHAM was 5:46:06 ($SD = 0:53:43$) and 6:02:06 ($SD = 0:43:12$) for ACTIVE cTBS. As mentioned above, this was constrained to only the *first 7 hours* of the sleep opportunity. Overall, ACTIVE treatment was associated with 15:25 ($SE = 9:27$) more minutes of sleep than SHAM. Moreover, the effect size was extremely large, suggesting that this effect was robust and likely to be associated with meaningful improvement in sleep. Prior research suggests that most effect sizes for pharmacologic and behavioral treatments for insomnia are in the “medium” range, suggesting that this novel TMS approach may meet or exceed the effect sizes of currently available treatments.

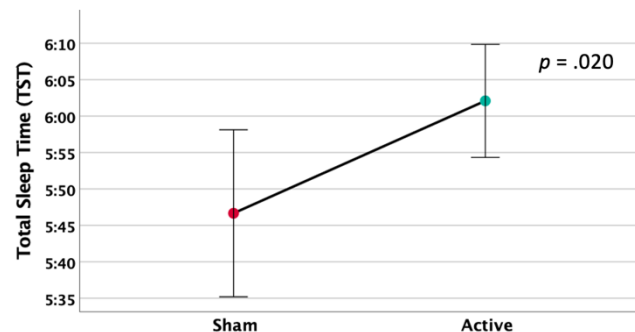


Figure 10. Mean total sleep time (TST) difference between sham and active cTBS conditions (error bars = 1SE).

N1 Latency. As shown in **Figure 11**, ACTIVE cTBS treatment did not influence mean N1 Latency relative to SHAM treatment, $F(1,17) = 0.335$, $p = .571$, $\eta_p^2 = .019$. The mean N1 Latency for SHAM was 32:42 min ($SD = 35:09$) and 53:54 ($SD = 2:05:05$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 21:11 ($SE = 28:32$) minutes longer to fall into Stage 1 sleep than SHAM. However, the effect size was small, suggesting that this difference was likely inconsequential.

N2 Latency. As shown in **Figure 12**, ACTIVE cTBS treatment did not influence mean N2 Latency relative to SHAM treatment, $F(1,17) = 0.300$, $p = .591$, $\eta_p^2 = .017$. The mean N2 Latency for SHAM was 39:51 min ($SD = 35:25$) and 32:06 ($SD = 0:31:04$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 7:45 ($SE = 7:40$) minutes less to enter Stage 2 sleep than SHAM. However, the effect size was small, suggesting that this difference was likely inconsequential.

N3 Latency. As shown in **Figure 13**, ACTIVE cTBS treatment was associated with significantly shorter mean N3 Latency relative to SHAM treatment, $F(1,17) = 5.033$, $p = .038$, $\eta_p^2 = .228$. The mean N3 Latency for SHAM was 1:12:16 hrs ($SD = 1:04:59$) and 0:57:12 ($SD = 0:59:50$) hrs for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 15:04 ($SE = 09:15$) minutes less time to enter Stage 3 sleep than SHAM. Moreover, the effect size was extremely large, suggesting that this effect was robust and likely to be associated with meaningful improvement in N3 latency.

REM Latency. As shown in **Figure 14**, ACTIVE cTBS treatment did not influence mean REM Latency relative to SHAM treatment, $F(1,17) = 0.434$, $p = .591$, $\eta_p^2 = .025$. The mean REM Latency for SHAM was 1:40:10 hrs ($SD = 0:53:34$) and 1:32:40 hrs ($SD = 0:58:10$) for ACTIVE cTBS. Overall,

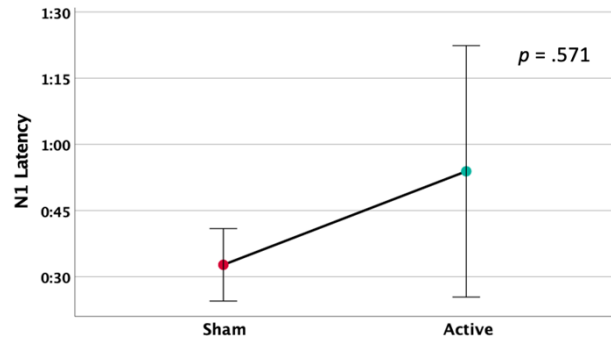


Figure 11. Mean latency to stage N1 difference between sham and active cTBS conditions (error bars = 1 SE).

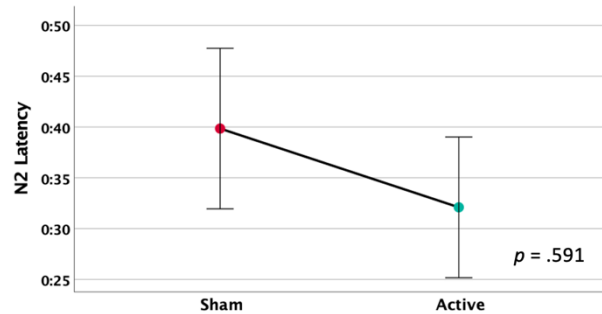


Figure 12. Mean latency to stage N2 difference between sham and active cTBS conditions (error bars = 1 SE).

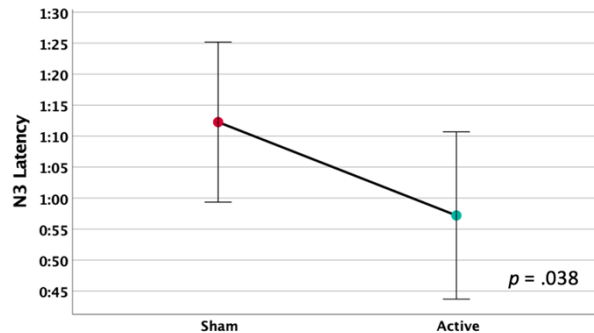


Figure 13. Mean latency to stage N3 difference between sham and active cTBS conditions (error bars = 1 SE).

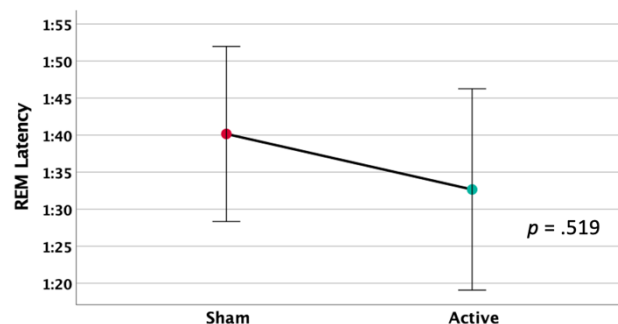


Figure 14. Mean latency to rapid eye movement (REM) sleep difference between sham and active cTBS conditions (error bars = 1 SE).

ACTIVE treatment was associated with 7:30 ($SE = 13:19$) fewer minutes to enter REM sleep than SHAM. However, the effect size was small, suggesting that this difference was likely inconsequential.

Sleep Onset Latency. As shown in **Figure 15**, ACTIVE cTBS treatment did not influence mean Sleep Onset Latency relative to SHAM treatment, $F(1,17) = 1.303$, $p = .269$, $\eta_p^2 = .071$. The mean Sleep Onset Latency for SHAM was 0:32:42 hrs ($SD = 0:35:09$) and 0:24:12 hrs ($SD = 0:29:51$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 8:30 ($SE = 07:18$) fewer minutes to initiate sleep than SHAM. Overall, the effect size was medium, suggesting that this difference could prove meaningful with a larger sample size.

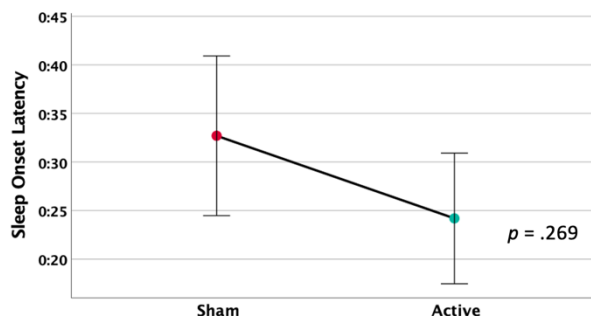


Figure 15. Mean sleep onset latency difference between sham and active cTBS conditions (error bars = 1SE).

Persistent Sleep Onset Latency. As shown in **Figure 16**, ACTIVE cTBS treatment did not influence mean Latency to enter Persistent Sleep relative to SHAM treatment, $F(1,17) = 0.186$, $p = .672$, $\eta_p^2 = .011$. The mean Persistent Sleep Onset Latency for SHAM was 0:40:53 hrs ($SD = 0:36:13$) and 0:31:39 hrs ($SD = 0:31:00$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 9:14 ($SE = 7:44$) fewer minutes to enter persistent sleep than SHAM. However, the effect size was small, suggesting that this difference was likely inconsequential.

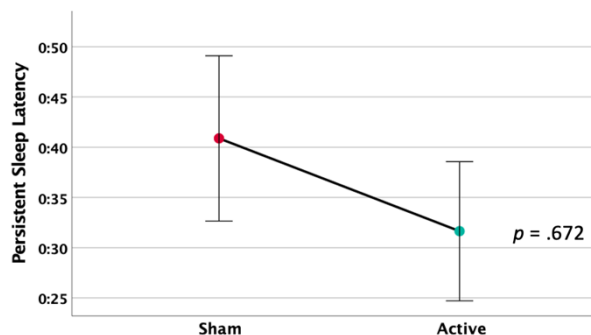


Figure 16. Mean latency to persistent sleep difference between sham and active cTBS conditions (error bars = 1SE).

Sleep Efficiency (SE). As shown in **Figure 17**, ACTIVE cTBS treatment led to a significant increase in mean SE relative to SHAM treatment, $F(1,17) = 6.587$, $p = .020$, $\eta_p^2 = .279$. The mean SE for SHAM was 82.85% ($SD = 12.45\%$) and 86.16% ($SD = 10.38\%$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with an increase of 3.31% ($SE = 2.13\%$) in SE over SHAM. Moreover, the effect size was extremely large, suggesting that this effect was robust and likely to be associated with meaningful improvement in sleep. As mentioned above, this very large effect size exceeds that reported for most currently available pharmacologic and behavioral treatments that are considered the clinical standard of care for insomnia.

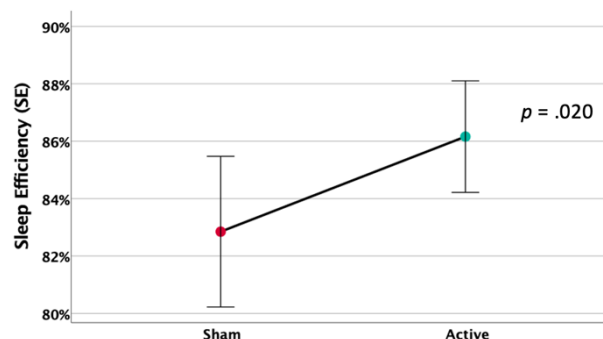


Figure 17. Mean sleep efficiency (SE) difference between sham and active cTBS conditions (error bars = 1SE).

Wake Duration. As shown in **Figure 18**, ACTIVE cTBS treatment did not influence mean minutes awake relative to SHAM treatment, $F(1,17) = 2.347$, $p = .144$, $\eta_p^2 = .121$. The mean duration of wake after sleep onset for SHAM was 38.18 min ($SD = 38.02$) and 32.35 min ($SD = 32.48$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 5.83 min ($SE = 8.04$) less time awake after sleep onset than SHAM. Overall, the effect size was medium to large, suggesting that this difference, while not currently statistically significant, would likely reach significance with a larger sample size.

N1 Duration. As shown in **Figure 19**, ACTIVE cTBS treatment did not influence mean duration of N1 sleep relative to SHAM treatment, $F(1,17) = 0.071$, $p = .793$, $\eta_p^2 = .004$. The mean N1 duration for SHAM was 23.38 min ($SD = 14.64$ min) and 26.40 ($SD = 13.34$ min) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 3.02 ($SE = 2.43$) more minutes of N1 sleep than SHAM. However, the effect size was extremely small, suggesting that this difference was likely inconsequential.

N2 Duration. As shown in **Figure 20**, ACTIVE cTBS treatment did not influence mean duration of N2 sleep relative to SHAM treatment, $F(1,17) = 2.52$, $p = .131$, $\eta_p^2 = .129$. The mean N2 duration for SHAM was 201.93 min ($SD = 25.79$ min) and 207.90 ($SD = 28.12$ min) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 5.98 ($SE = 6.11$) more minutes of N2 sleep than SHAM. Overall, the effect size was medium to large, suggesting that this difference, while not currently statistically significant, would likely reach significance with a larger sample size.

N3 Duration. As shown in **Figure 21**, ACTIVE cTBS treatment did not influence mean duration of N3 sleep relative to SHAM treatment, $F(1,17) = 0.002$, $p = .968$, $\eta_p^2 < .001$. The mean N3 duration for SHAM was 68.53 min ($SD = 33.68$ min) and 63.03 ($SD = 25.74$ min) for

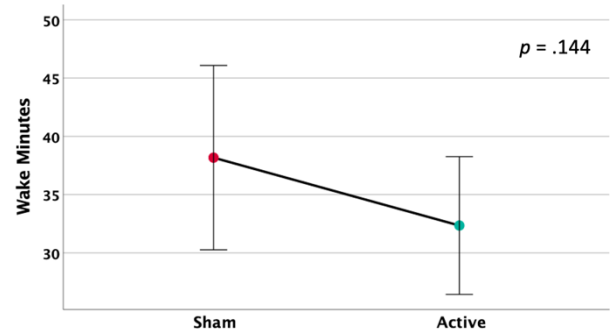


Figure 18. Mean wake duration (minutes) difference between sham and active cTBS conditions (error bars = 1SE).

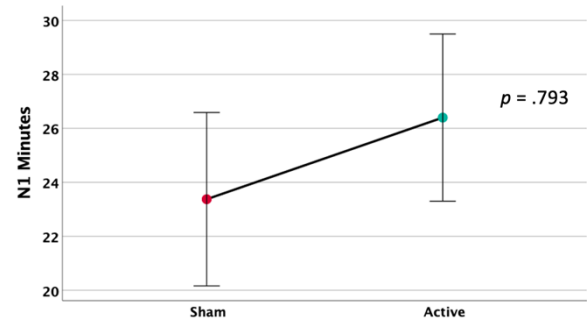


Figure 19. Mean duration of stage N1 (minutes) difference between sham and active cTBS conditions (error bars = 1SE).

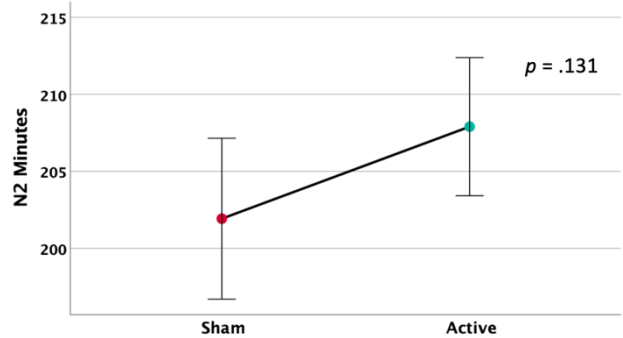


Figure 20. Mean duration of stage N2 (minutes) difference between sham and active cTBS conditions (error bars = 1SE).

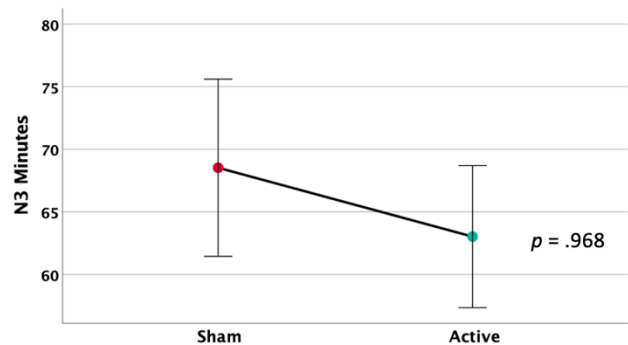


Figure 21. Mean duration of stage N3 (minutes) difference between sham and active cTBS conditions (error bars = 1SE).

ACTIVE cTBS. Overall, ACTIVE treatment was associated with 5.5 min ($SE = 4.10$) less N3 sleep than SHAM. However, the effect size was extremely small, suggesting that this difference was likely inconsequential.

REM Duration. As shown in **Figure 22**, ACTIVE cTBS treatment led to a *marginally significant* increase in mean minutes of REM sleep relative to SHAM treatment, $F(1,17) = 4.13$, $p = .058$, $\eta_p^2 = .195$. The mean minutes of REM for SHAM was 52.85 min ($SD = 23.67$) and 64.78 ($SD = 31.99$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with an increase of 11.93 min ($SE = 7.24$) of REM over SHAM. Moreover, the effect size was large, suggesting that this effect was robust and likely to be associated with a statistically significant improvement in REM with an adequately powered sample.

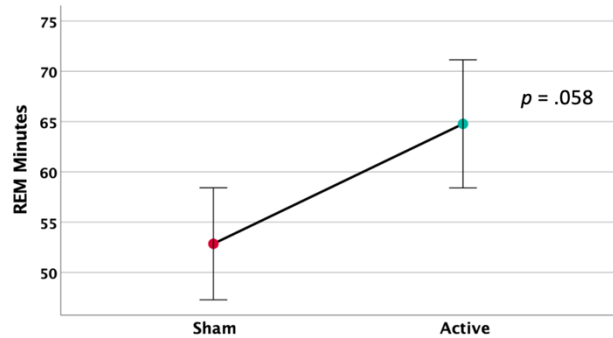


Figure 22. Mean duration of rapid eye movement (REM) sleep difference between sham and active cTBS conditions (error bars = 1 SE).

Percent Wake. As shown in **Figure 23**, ACTIVE cTBS treatment did not influence mean percent time spent awake relative to SHAM treatment, $F(1,17) = 2.33$, $p = .145$, $\eta_p^2 = .121$. The mean percent of time in bed spent in wake after sleep onset for SHAM was 10.02% ($SD = 9.68\%$) and 8.19% ($SD = 8.04\%$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with a decrease of 1.84% ($SE = 1.93\%$) in wake time than SHAM. Overall, the effect size was moderately large, suggesting that this difference, while not currently statistically significant, would likely reach significance with a larger sample size.

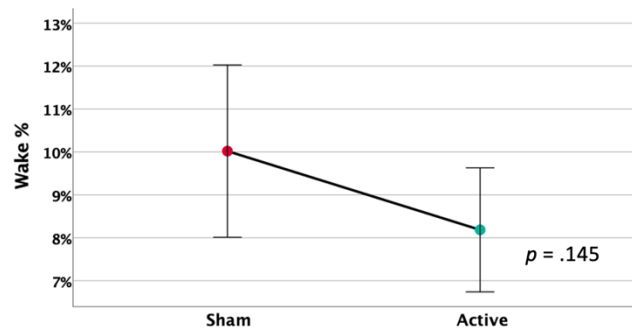


Figure 23. Mean wake time (percent) difference between sham and active cTBS conditions (error bars = 1 SE).

Percent N1. As shown in **Figure 24**, ACTIVE cTBS treatment did not influence mean percent duration of N1 sleep relative to SHAM treatment, $F(1,17) = 0.676$, $p = .422$, $\eta_p^2 = .038$. The mean percent time in N1 for SHAM was 7.12% ($SD = 5.0\%$) and 7.47% ($SD = 4.20\%$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 0.35% ($SE = 0.82\%$) more time in N1 sleep than SHAM. However, the effect size was small, suggesting that this difference was likely inconsequential.

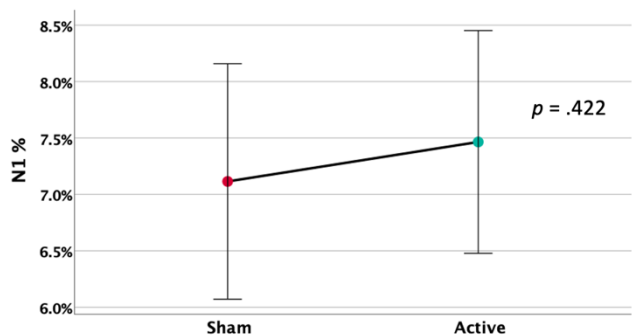


Figure 24. Mean stage N1 time (percent) difference between sham and active cTBS conditions (error bars = 1 SE).

Percent N2. As shown in **Figure 25**, ACTIVE cTBS treatment did not influence mean percent duration of N2 sleep relative to SHAM treatment, $F(1,17) = 0.347$, $p = .563$, $\eta_p^2 = .020$. The mean percent N2 duration for SHAM was 59.06% ($SD = 8.32\%$) and 57.70% ($SD = 6.61\%$ min) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 1.36% ($SE = 1.74\%$) less time in N2 sleep than SHAM. Overall, the effect size was small, suggesting that this difference was likely inconsequential.

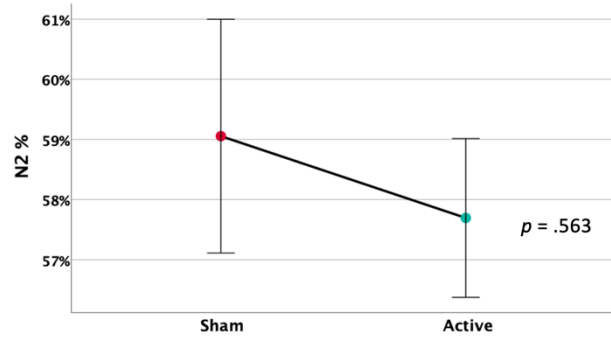


Figure 25. Mean stage N2 time (percent) difference between sham and active cTBS conditions (error bars = 1SE).

Percent N3. As shown in **Figure 26**, ACTIVE cTBS treatment did not influence mean percent duration of N3 sleep relative to SHAM treatment, $F(1,17) = 0.399$, $p = .536$, $\eta_p^2 = .023$. The mean percent time in N3 for SHAM was 18.98% ($SD = 8.01\%$) and 17.17% ($SD = 6.45\%$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with 1.82% ($SE = 1.08\%$) less N3 sleep than SHAM. However, the effect size was also small, suggesting that this difference was likely inconsequential.

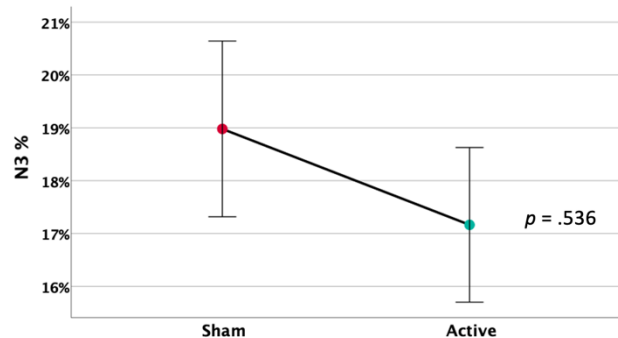


Figure 26. Mean stage N3 time (percent) difference between sham and active cTBS conditions (error bars = 1SE).

Percent REM. As shown in **Figure 27**, ACTIVE cTBS treatment led to a nonsignificant increase in mean percent duration in REM relative to SHAM treatment, $F(1,17) = 2.08$, $p = .167$, $\eta_p^2 = .109$. The mean percent time in REM for SHAM was 14.85% ($SD = 5.03\%$) and 17.66% ($SD = 7.70\%$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with an increase of 2.81% ($SE = 1.73\%$) of REM over SHAM. Moreover, the effect size was in the medium range, suggesting that this effect might emerge as significant with a larger sample size.

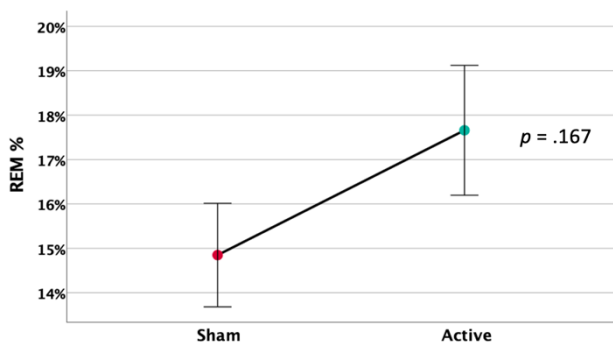


Figure 27. Mean rapid eye movement (REM) time (percent) difference between sham and active cTBS conditions (error bars = 1SE).

Total Awakenings. As shown in **Figure 28**, ACTIVE cTBS treatment had no significant effect on mean number of awakenings through the night relative to SHAM treatment, $F(1,17) = 0.30, p = .591, \eta_p^2 = .017$. The mean number of awakenings for SHAM was 3.40 ($SD = 3.00$) and 3.35 ($SD = 2.25$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with decrease of 0.05 awakenings ($SE = 0.69$) than SHAM. However, the effect size was also small, suggesting that this difference was likely inconsequential.

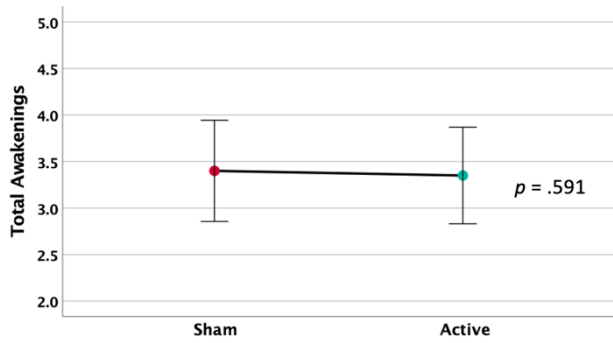


Figure 28. Mean total number of awakenings difference between sham and active cTBS conditions (error bars = 1 SE).

Latency to First Awakening after Sleep Onset. As shown in **Figure 29**, ACTIVE cTBS treatment did not influence mean latency to first awakening after the onset of sleep relative to SHAM treatment, $F(1,17) = 2.35, p = .144, \eta_p^2 = .121$. The latency to first awakening for SHAM was 38.18 min ($SD = 38.02$) and 32.35 ($SD = 32.48$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with a decrease of 5.83 min ($SE = 8.04$) in latency to first awakening than SHAM. Overall, the effect size was medium to large, suggesting that this difference, while not currently statistically significant, would likely reach conventional levels of statistical significance with a larger sample size.

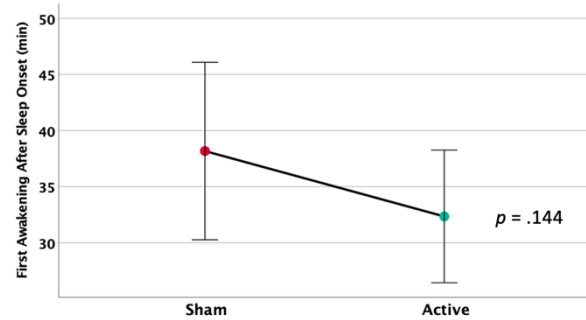


Figure 29. Mean latency to first awakening after sleep onset (min) difference between sham and active cTBS conditions (error bars = 1 SE).

Latency to First Awakening after Persistent Sleep. As shown in **Figure 30**, ACTIVE cTBS treatment was associated with a nonsignificant trend toward shorter mean latency to first awakening following a persistent period of sleep relative to SHAM treatment, $F(1,17) = 4.12, p = .058, \eta_p^2 = .195$. The latency to first awakening after persistent sleep for SHAM was 32.75 min ($SD = 34.47$) and 26.93 min ($SD = 31.02$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with a decrease of 5.83 min ($SE = 8.41$) in latency to first awakening after persistent sleep than SHAM. Overall, the effect size was large, suggesting that this difference, while not currently statistically significant, would likely reach significance with a larger sample size.

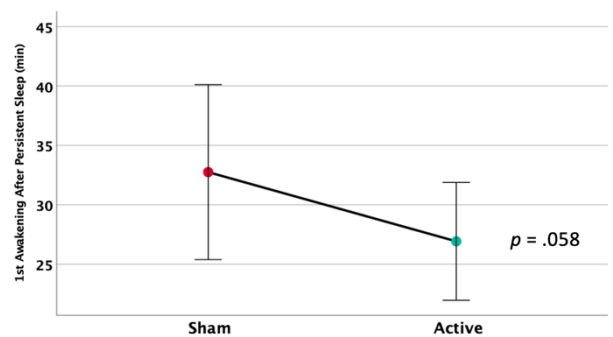


Figure 30. Mean latency to first awakening after persistent sleep (min) between sham and active cTBS conditions (error bars = 1 SE).

Spontaneous Arousals. As shown in **Figure 31**, ACTIVE cTBS treatment was associated with a nonsignificant trend toward fewer spontaneous arousals relative to SHAM treatment, $F(1,17) = 3.40$, $p = .083$, $\eta_p^2 = .167$. The number of spontaneous arousals for SHAM was 41.90 ($SD = 22.42$) and 40.90 ($SD = 26.17$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with a mean decrease of 1.0 arousal ($SE = 5.55$) than SHAM. Overall, the effect size was large, suggesting that this difference, while not currently statistically significant, would likely reach significance with a larger sample size.

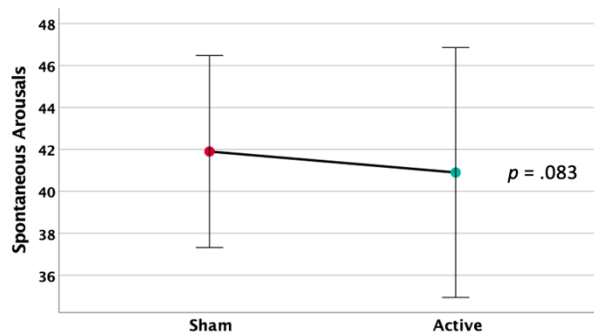


Figure 31. Mean number of spontaneous arousals between sham and active cTBS conditions (error bars = 1 SE).

Arousal Index. As shown in **Figure 32**, ACTIVE cTBS treatment was associated with a significant decline in the Arousal Index relative to SHAM treatment, $F(1,17) = 4.65$, $p = .046$, $\eta_p^2 = .215$. The Arousal Index for SHAM was 7.53 ($SD = 4.29$) and 7.05 ($SD = 5.03$) for ACTIVE cTBS. Overall, ACTIVE treatment was associated with a mean decrease of 0.48 points ($SE = 1.09$) in the Arousal Index than SHAM. Moreover, the effect size was extremely large, suggesting that this effect was robust and likely to be associated with meaningful improvement in sleep.

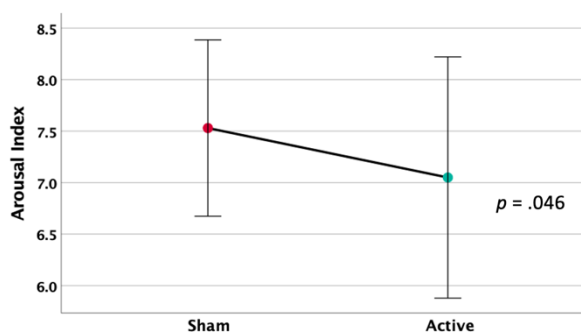


Figure 32. Mean difference in arousal index between sham and active cTBS conditions (error bars = 1 SE).

Sleep Outcomes: Summary and Conclusions. *These findings suggest that a single 40-second cTBS stimulation train to the left lateral node of the DMN led to a significant improvement in several sleep outcomes as measured by PSG. In particular, relative to SHAM, the ACTIVE cTBS condition was associated with significant increases in Total Sleep Time (TST), reduced latency to N3 deep sleep, improved Sleep Efficiency (SE), and reduced Arousal Index, and trend-level improvements in Rapid Eye Movement (REM) duration, and fewer spontaneous arousals. The effect sizes of many of the findings exceed those of the current clinical standard of practice for treating insomnia with pharmacologic or behavioral treatments. Conclusion: A single 40-second cTBS stimulation improved multiple objective sleep outcomes compared to sham.*

Neuroimaging Outcomes:

Multimodal neuroimaging data were collected to examine structural integrity and functional connectivity in the brain before and after treatment with Active TMS (cTBS) or Sham stimulation.

Neuroimaging Data Collection.

Neuroimaging data were collected using a 3T Siemens MAGNETOM Skyra using a 32-channel head coil. Head movement was restricted using foam cushions during all image acquisition. We collected a high-resolution anatomical T1-weighted (T1w) MPRAGE (TR/TE/flip angle = 2100 msec., 2.33 msec., 12°) that consisted of 176 slices (256 x 256 matrix) with a slice thickness of 1mm and voxel size of 1mm x 1mm x 1mm and a distance factor of 50%. Resting-state functional images (TR/TE/flip angle = 2000 msec., 36 msec.) were collected with 60 slices (240 x 240 matrix) and a voxel size of 2.0mm x 2.0mm x 2.0mm (distance factor 10%), in an interleaved excitation order, with anterior-posterior phase encoding. During the collection of the resting state functional data, participants were instructed to remain awake but keep their eyes open and let their “mind wander”.

Resting State Functional Connectivity (rsFC) Preprocessing and Analyses.

Preprocessing. Data from all 20 participants were preprocessed using the default pipeline in the CONN Toolbox (version 17.f). Functional resting state images were realigned and unwarped to correct for scan-to-scan motion, re-centered (to coordinates of $x = 0$, $y = 0$, $z = 0$). Essentially, the scans were coregistered and resampled to the first scan from the first session by employing a b-spline interpolation. Data were then slice time corrected based on the Siemens interleaved sequence using the standard SPM12 procedure, detection and scrubbing of outlier scans based on global signal intensity and movement, segmentation of functional images according to gray matter, white matter, and cerebrospinal fluid, and normalization to the standard template of the Montreal Neurologic Institute (MNI), re-centering of the structural magnetization prepared rapid acquisition gradient echo (MPRAGE) scan (to coordinates of 0, 0, 0), skull stripping, segmentation and normalization of the structural images according to gray matter, white matter, and cerebrospinal fluid, and normalization to MNI space, and gaussian spatial convolution (8mm full width and half maximum) of the functional images (i.e., smoothing).

Denoising. After preprocessing, the data were denoised using the

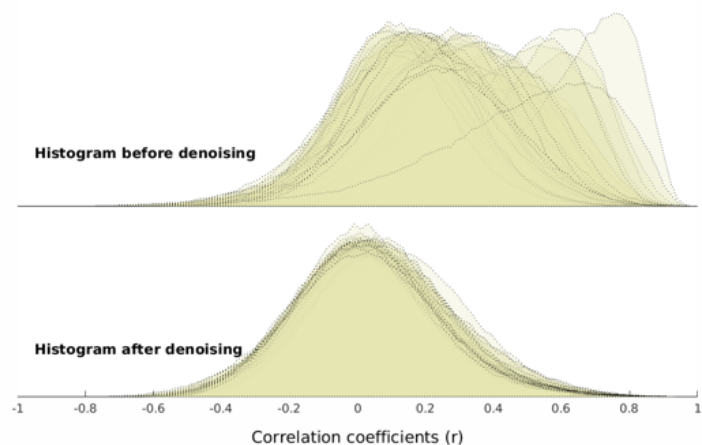


Figure 33. Outcomes of denoising step in CONN Toolbox for functional connectivity data.

standard pipelines in the CONN (v17.f) toolbox, including linear regression to remove confounding effects that could influence the BOLD signal, including noise components from white matter, cerebrospinal fluid, realignment parameters and other outlier scans. As shown in **Figure 33** (the histogram QA plots), the denoising approach was successful (i.e., histograms are more closely centered around zero after denoising).

First-Level Analyses. Once the data were denoised, first level whole brain connectivity analyses were undertaken in CONN for each subject at each of the four sessions (i.e., Active Pre-Stimulation; Active Post-Stimulation; Sham Pre-Stimulation; Sham Post-Stimulation). As shown in an example subject in **Figure 34**, this resulted in a functional connectivity map for each participant at each session, indicating the magnitude and direction of intrinsic correlation between each seed region (e.g., Lateral Parietal Cortex of the DMN) and all other voxels in the brain.

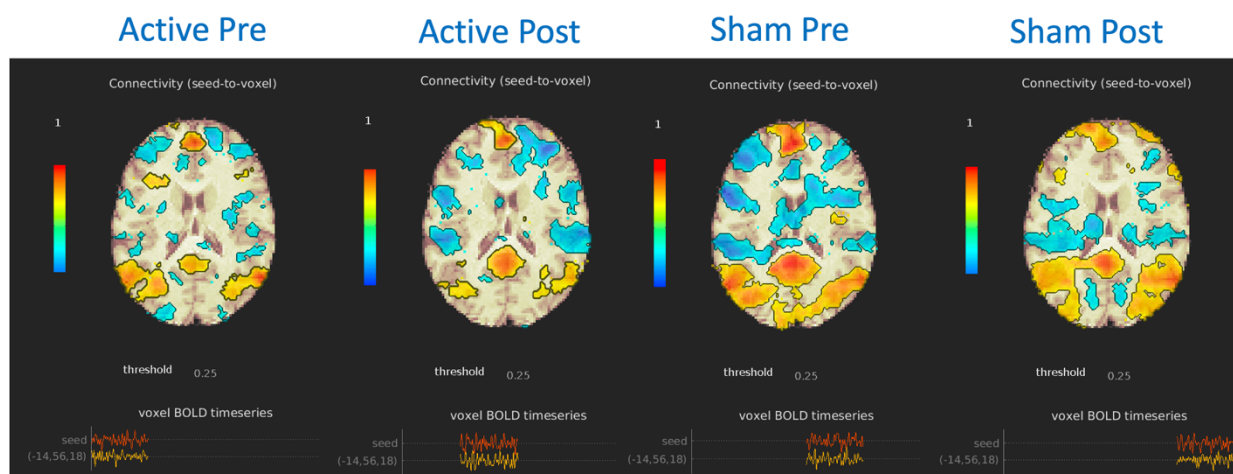


Figure 34. Example of the results from first level analysis. The data show representative connectivity maps for a single individual at each of the four scanning sessions, including Pre Active cTBS (left), Post Active cTBS (left middle), Pre Sham (right middle), and Post Sham (right).

Second-Level Analyses. The First-Level connectivity maps were then combined in subsequent Second-Level Analyses in CONN to explore the effects of cTBS stimulation on brain connectivity. The analyses followed several stages: 1) Independent Components Analysis (ICA), 2) Seed-to Voxel Analyses, and 3) Region of interest (ROI)-to-ROI Analyses.

1) Group ICA. Using CONN (v17.f), a standard group-ICA was conducted on the 80 connectivity maps ($n = 20 \times 4$ sessions), extracting 20 components and dimensionality reduction = 64. As shown in **Figure 35**, the 20 independent components accounted well for the data and were spatially similar to those found in most other studies. Inspection of the ICA component maps revealed several components that were similar in spatial configuration to the classic DMN, including ICA 2, ICA 5, ICA 6, and ICA 14. However, ICA 2 did not include the medial prefrontal cortex, ICA 5 did not include the posterior cingulate and lateral parietal regions, and ICA 14 did not include the medial prefrontal cortex and lateral parietal regions. Therefore, ICA 6 appeared to be closest in spatial configuration to the classic DMN, as it included medial prefrontal cortex (MPFC), posterior cingulate cortex (PCC), and the left parietal cortex (LPC) and right lateral parietal cortex (RPC) regions. These areas can be seen clearly in **Figure 36**.

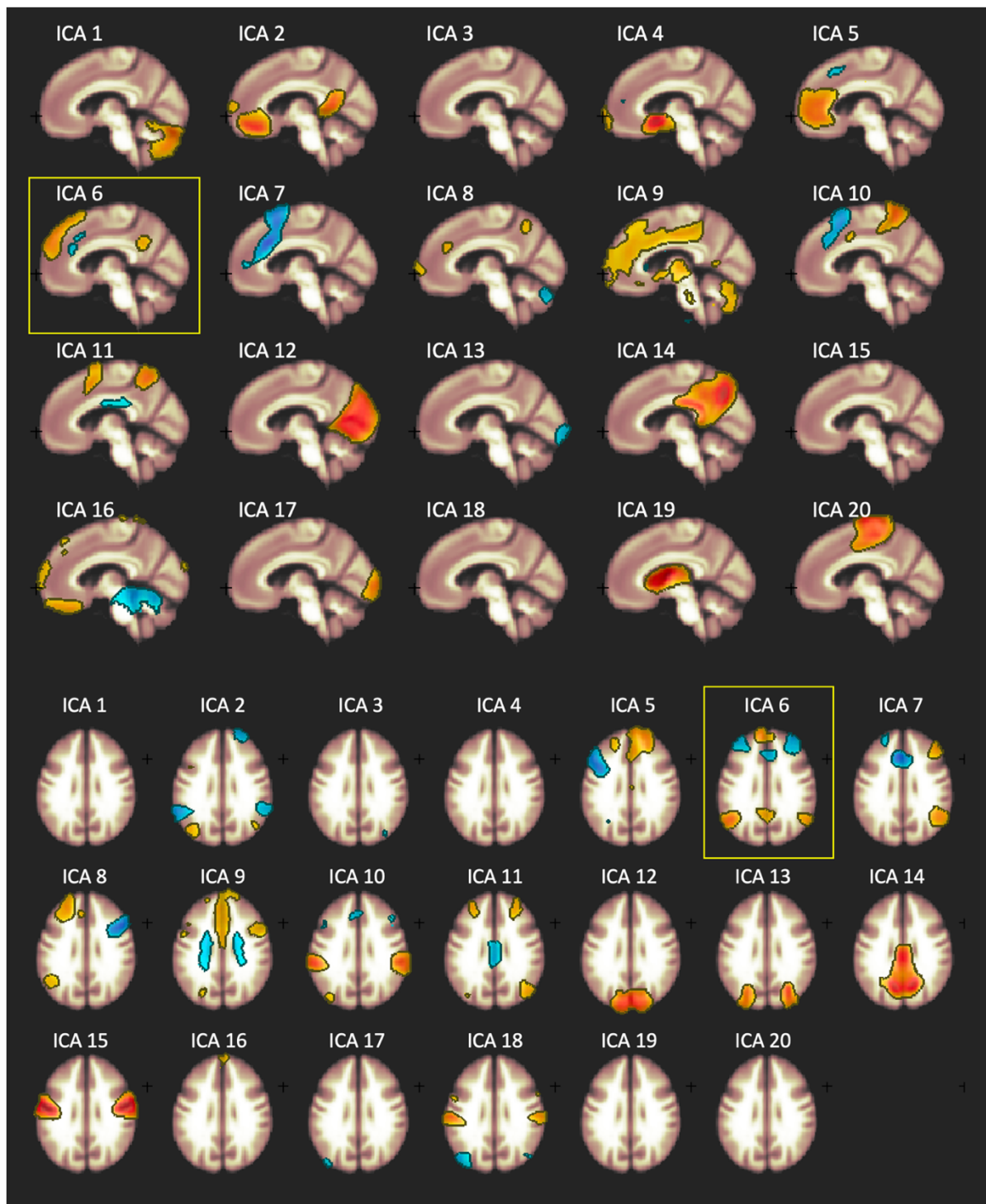


Figure 35. Results of the group independent components analysis (ICA). A total of 20 independent components were extracted. ICA #6 (yellow square) appeared to most closely match the spatial features corresponding to the traditional default mode network (DMN) by including anterior medial prefrontal cortex, posterior cingulate cortex, and lateral inferior parietal cortex regions. Sagittal views are displayed in the top half of the figure and axial views in the bottom half. Images are in neurologic space (i.e., left = left).

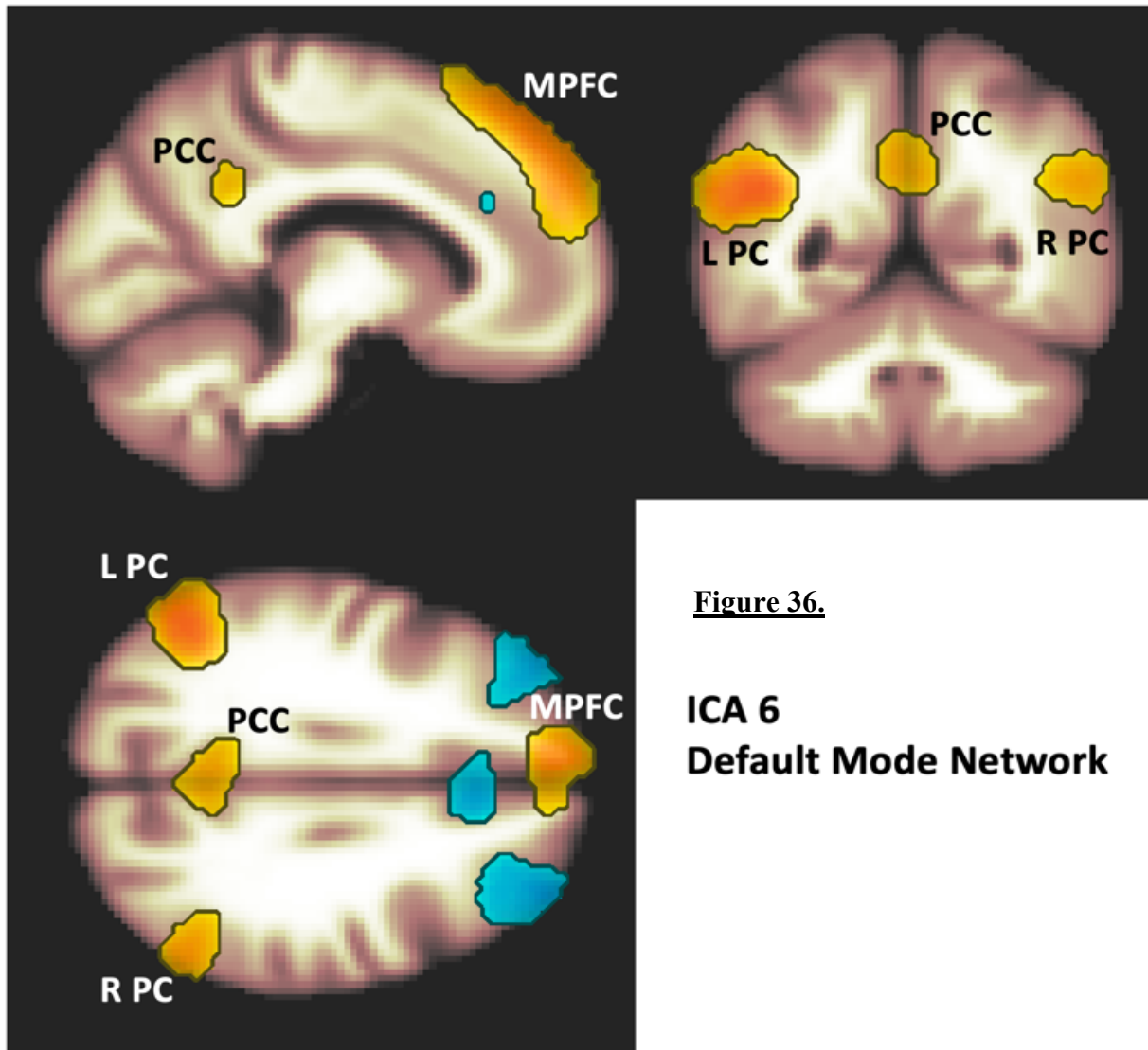


Figure 36.

ICA 6 Default Mode Network

This intrinsic default mode network (ICA 6) will henceforth be referred to as the *ICA-DMN* for all subsequent analyses. To facilitate within network connectivity analyses, the cluster regions comprising the ICA-DMN were further extracted using the ICA parcellation feature of the CONN Toolbox. These regions are listed in **Table 7**, as identified by their MNI coordinates representing the spatial centroids of each cluster.

WITHIN NETWORK Connectivity. The goal of this analysis was to examine the effect of ACTIVE versus SHAM stimulation on the strength of connectivity WITHIN the previously described regions of the ICA-DMN. To accomplish this, we utilized the ROI-to-ROI analysis module in the CONN analysis package. First, because the site of stimulation was located over the left angular gyrus, we included the standard angular gyrus ROI and all 19 ICA-DMN regions of interest (ROIs) outlined regions comprising the ICA-DMN identified in **Table 7** below. The contrast was set so that positive values corresponded to increased connectivity with the ACTIVE stimulation compared to the SHAM stimulation. Specifically, the contrast was $[-1 \ 1 \ 1 \ -1]$ in the design matrix, corresponding to [Active Pre Tx, Active Post Tx, Sham Pre-Tx, Sham

Post-Tx]. For an initial exploration of our hypothesis, positive and negative connectivity maps were each evaluated individually at an uncorrected $p < .05$, although the **Figure 37** below shows them overlaid together for ease of visualization. These regions were examined simply to identify potential connectivity patterns associated with the site of stimulation, not as a formal hypothesis test.

Table 7. Network Components Derived from ICA-DMN			
Network Component	X	Y	Z
R Middle Frontal Gyrus	31	47	8
L Middle Temporal Gyrus	-52	-5	-25
L Superior Medial Prefrontal Gyrus	-3	47	39
L Middle Frontal Gyrus	-34	47	17
R Inferior Temporal Gyrus	49	8	-34
L Angular Gyrus (~STIMULATION SITE)	-49	-57	26
R Middle Cingulate Gyrus	3	28	31
R Insula	34	19	-1
L Middle Orbital Frontal Gyrus	-22	38	-17
L Posterior Cingulate Gyrus	-1	-52	31
R Angular Gyrus	52	-57	27
L Insula	-32	18	1
L Middle Frontal Gyrus	-41	12	49
L Inferior Frontal Gyrus	-47	31	-11
L Inferior Frontal Trigone	-52	22	9
R Cerebellar Crus 2	26	-77	-36
L Cerebellar Crus 2	-38	-61	-44
L Superior Temporal Gyrus	-59	-28	11
R Inferior Parietal Cortex	50	-40	50

As shown in **Figure 37**, the activation at the stimulation point (i.e., angular gyrus ROI—Pink ROI) was positively correlated (i.e., positively functionally connected) with a network of left lateralized regions including the middle temporal gyrus, inferior frontal trigone, middle frontal gyrus, inferior frontal gyrus, and superior medial prefrontal gyrus, while a second right lateralized network also showed positive connectivity among the posterior cingulate cortex, inferior temporal gyrus, and the middle frontal gyrus and inferior parietal cortex. The warm colors show positive connectivity (i.e., as the DMN is suppressed, these warm colored regions also change in unison to show decreased activation, and vice versa). In contrast, the cool (blue) connections reflect inverse correlation between activation in connected regions. Together, these data suggest that suppression of the left angular gyrus node of the DMN with cTBS TMS (which is inhibitory), was associated with corresponding decreases in activation of regions involved in language processing, controlled thought, emotional processing, and other DMN regions involved in inward directed cognition.

Within Network Connectivity (Active > Sham) of ICA-DMN and TMS Stimulation Site

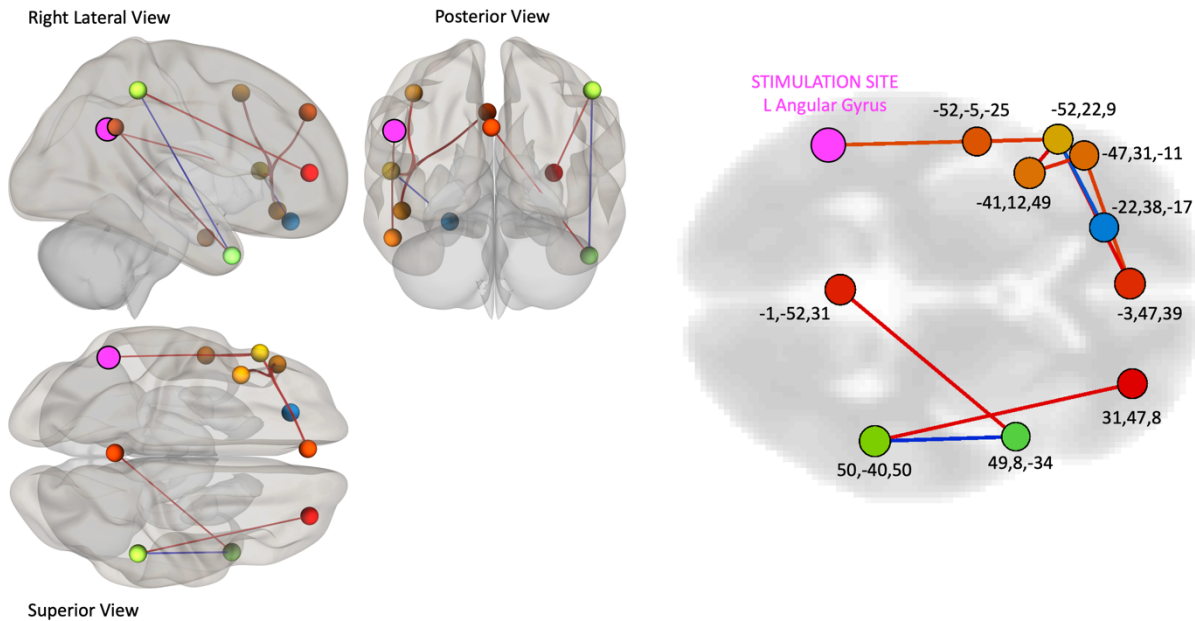


Figure 37. Initial exploration of connectivity associated with the site of stimulation in the Left Angular Gyrus. This exploratory map was thresholded at a liberal $p < .05$ (uncorrected) in order to identify potential patterns of connectivity for future work. Overall, this analysis shows that initial exposure to cTBS at the stimulation site is associated with increased positive connectivity among most of the connected nodes. This pattern suggests that these regions move in unison more after ACTIVE cTBS stimulation than following SHAM. Thus, suppression of the stimulation site would be expected to result in corresponding decreases in other connected regions, as these predominantly fluctuate in unison. Many of these regions are involved in language and auditory processing, consistent with our initial hypothesis that increased DMN activation would be associated with internal “chatter” that would be suppressed via cTBS (which is inhibitory) to this network.

Next, we formally examined the strength of WITHIN NETWORK functional connectivity originating from the site of stimulation (i.e., approximately $x = -48$, $y = -61.5$, $z = 32.5$) separately before and after the stimulation/sham procedure. As one of the 19 ROIs included the stimulation site, we simply ran this analysis on the ROIs comprising the ICA-DMN as they correlated with the cluster representing the stimulation site. These single condition contrasts were evaluated at a False Discovery Rate (FDR, seed-level) corrected $p < .05$. As shown in **Figure 38**, the area proximal to the stimulation site (i.e., left angular gyrus) demonstrated significant rsFC with a number of network regions before and after stimulation and sham conditions.

It was also of interest to examine whether the ACTIVE and SHAM conditions produced different patterns of changes of WITHIN NETWORK connectivity for the ICA-DMN. For each condition (ACTIVE or SHAM), the connectivity maps were contrasted using a paired t -test procedure across all 19 ICA-DMN regions of interest (ROIs) outlined in **Table 7**. Due to the small sample size, we implemented a liberal threshold of $p < .10$ (FDR corrected, seed-level). As evident in **Figure 39**, the ACTIVE cTBS condition was associated with significant changes in *within-network* connectivity, including increased strength of correlated (warm colors) and anticorrelated (cool colors) connectivity. In contrast, the SHAM condition did not show any significant changes in connectivity from before to after the stimulation session. These findings suggest that the active cTBS condition was associated with significant increases of positive and negative WITHIN

NETWORK connectivity of the ICA-DMN, whereas the sham treatment did not lead to a significant change.

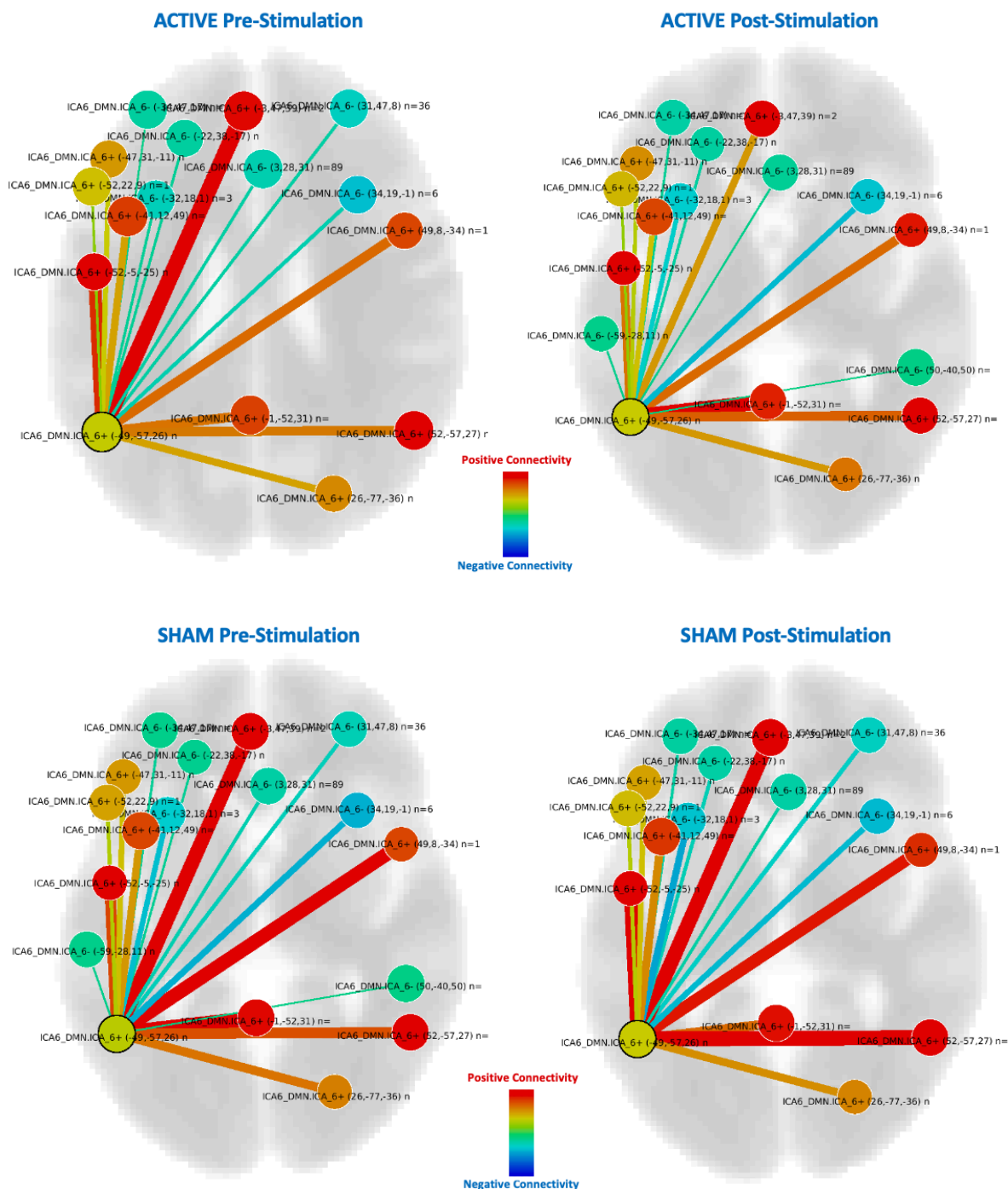


Figure 38. Direct connectivity patterns from the site of stimulation. The figure shows the strength of positive and negative connectivity before and after the TMS stimulation sessions. Warm colors represent positive connectivity and cool colors represent inverse (anticorrelated connectivity).

Changes in Within-Network Connectivity

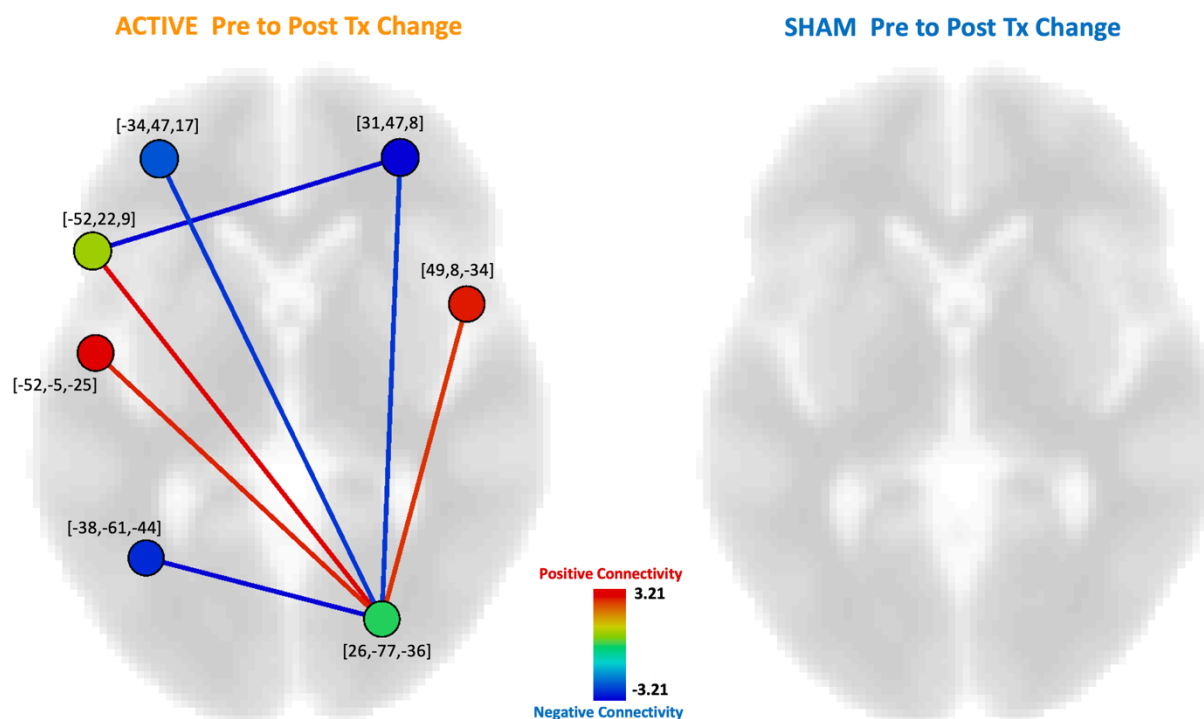
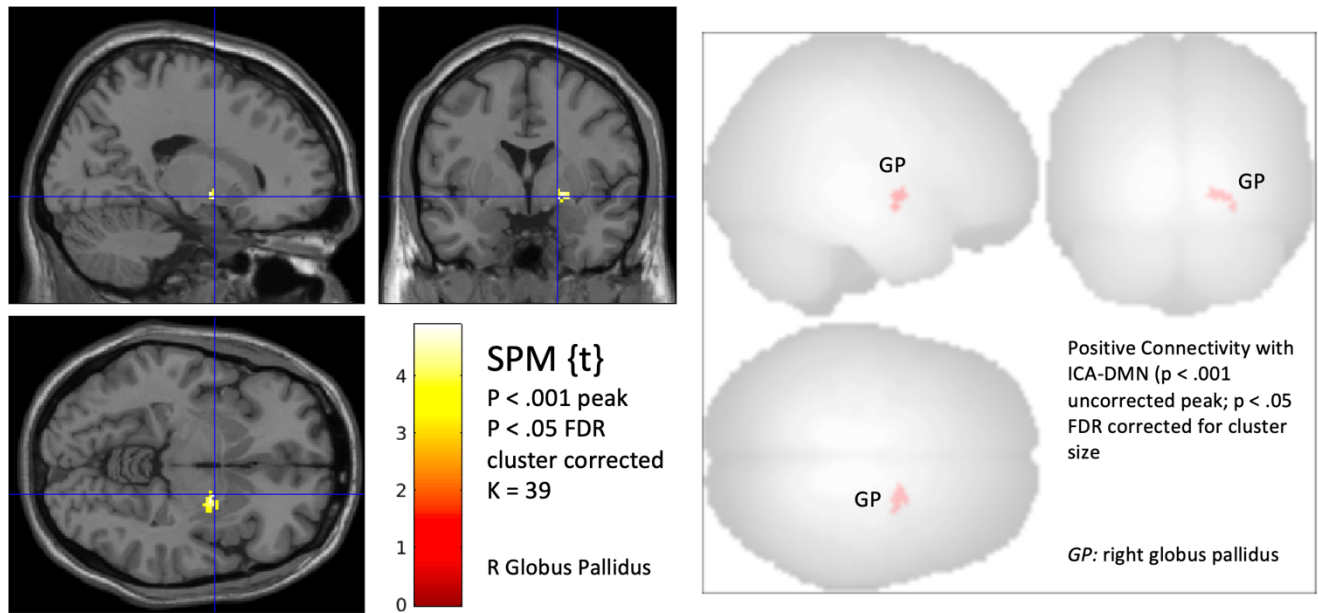


Figure 39. Significant changes in within-network connectivity for the ACTIVE cTBS condition (left) and SHAM condition (right). Data are corrected for multiple comparisons at False Discovery Rate (FDR) $p < .05$. Overall, the ACTIVE condition led to significant changes in within-network connectivity, while no significant changes emerged following SHAM.

2) Seed to Voxel Analyses. Once the ICA-DMN had been identified, we then examined seed to voxel connectivity throughout the brain, where the seed was the ICA-DMN in its entirety. This involved conducting a contrast that tested changes in connectivity between the ICA-DMN and all other voxels in the brain. The contrast was set so that positive values corresponded to increased connectivity with the ACTIVE stimulation compared to the SHAM stimulation. Specifically, the contrast was $[-1 \ 1 \ 1 \ -1]$ in the design matrix, corresponding to [Active Pre Tx, Active Post Tx, Sham Pre-Tx, Sham Post-Tx] respectively.

Increased Positive Connectivity with Active Treatment: This analysis revealed a significant cluster in the right globus pallidus that demonstrated significant ($p < .001$ uncorrected peak, $p < .05$ FDR corrected for cluster size) positive connectivity with the ICA-DMN (see **Figure 40**) following ACTIVE treatment compared to SHAM (MNI: $x = 18, y = 0, -z = 6$; $k = 39$ voxels). **Figure 41** shows the parameter estimates of connectivity for each condition. This suggests that following treatment, as the DMN was suppressed, this region of the right globus pallidus was also significantly suppressed, but as DMN activation increased, this area increased in activation accordingly. Thus, DMN and GP became more tightly coupled following ACTIVE than SHAM treatment.



Statistics: *p*-values adjusted for search volume

cluster-level				peak-level					mm mm mm		
$p_{\text{FWE-corr}}$	$q_{\text{FDR-corr}}$	k_E	p_{uncorr}	$p_{\text{FWE-corr}}$	$q_{\text{FDR-corr}}$	T	$(Z_{\equiv})$	p_{uncorr}			
0.079	0.044	39	0.001	1.000	0.902	4.88	3.88	0.000	18	0	-6
				1.000	0.902	4.46	3.64	0.000	30	-4	-14

Figure 40. Regions showing significant positive connectivity from the default mode network (DMN) that increased with ACTIVE cTBS relative to SHAM. The figure shows that active cTBS was associated with increased positive connectivity between the ICA-DMN and the globus pallidus, FDR corrected $p < .05$. The lower table shows the MNI coordinates of this connected region and the associated statistics.

We further examined the correlation between ICA-DMN-to-GP connectivity by extracting the first eigenvariate of connectivity values from the preceding analysis and correlating those with various PSG metrics separately for the nights following ACTIVE and SHAM treatments. **Table 8** displays these correlations. Overall, greater increases in this positive coupling following active treatment was associated with shorter TST, longer latency to enter N1 sleep, longer latency to enter REM, reduced sleep efficiency, increased wake duration, more awakenings and arousals. Given that this pattern was associated with tighter coupling between DMN and GP, we take this as consistent with our hypothesis that *suppression* of the DMN by cTBS contributes to improvements in these outcomes.

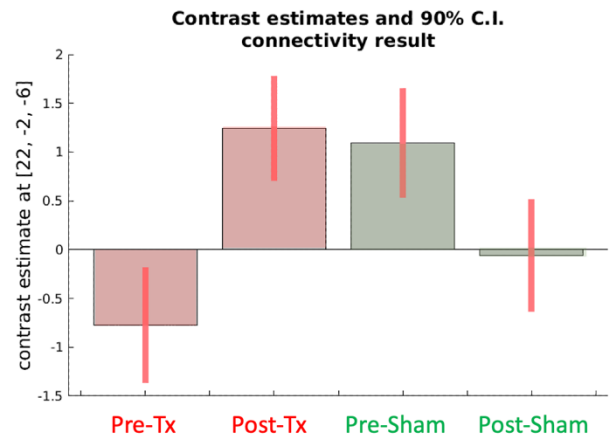


Figure 41. Parameter estimates for the connectivity between the ICA-DMN and the right globus pallidus (GP) at each of the four MRI scan sessions. As shown in the figure, active treatment was associated with an increase in DMN to GP connectivity, while sham was not.

To further explore the downstream connectivity of the right globus pallidus (GP), we conducted an ROI-to-ROI connectivity analysis using the right GP as a seed region and examining its other connected regions according to the cerebrum map of the default Automated Anatomical Labeling (AAL) Atlas implemented in the CONN Toolbox. This analysis was conducted at corrected $p < .05$ (FDR seed level correction) based on the primary contrast described above (i.e., -1 1 1 -1 [Active Pre Tx, Active Post Tx, Sham Pre-Tx, Sham Post-Tx]). As shown in **Figure 42**, the active cTBS condition was associated with a significant increase in positive functional connectivity between the right GP and multiple brain regions including: right supplementary motor area (SMA), anterior cingulate cortex (AC), right planum polare (PP), right lingual gyrus (LG), left temporal pole (TP), left insular cortex (IC), and left Heschl's gyrus (HG). These regions are involved in motor planning, language, visual, and emotion processing. Because the GP was significantly positively connected with ICA-DMN, the observed downstream positive connectivity suggests that these regions would also be expected to be modulated in unison with DMN suppression or activation (i.e., suppression of DMN by cTBS would be expected to be associated with reductions

Right Globus Pallidus		
PSG Measure	Active Tx	Sham Tx
Time in Bed (TIB)	-.012	.091
Total Sleep Time (TST)	-.462*	-.367†
N1 Latency	.520**	-.051
N2 Latency	.199	.026
N3 Latency	-.073	.034
REM Latency	.648**	.306†
Sleep Onset Latency	.113	.051
Persistent Sleep Latency	.266	.009
Sleep Efficiency	-.455*	-.390*
Wake Duration	.462*	.573**
N1 Duration	.095	.254
N2 Duration	-.154	-.401*
N3 Duration	-.236	-.308
REM Duration	-.338†	-.114
Wake %	.472*	.568**
N1 %	.195	.318†
N2 %	.307†	.028
N3 %	-.119	-.230
REM %	-.270	.003
# Awakenings	.429*	.381*
Wake After Sleep Onset	.462*	.573**
Wake After Persistent Sleep	.360†	.567**
# Arousals	.430*	.141
Arousal Index	.435*	.228

All tests one-tailed; † $p < .10$, * $p < .05$, ** $p < .01$

Table 8. Correlation between connectivity values and polysomnography sleep outcomes.

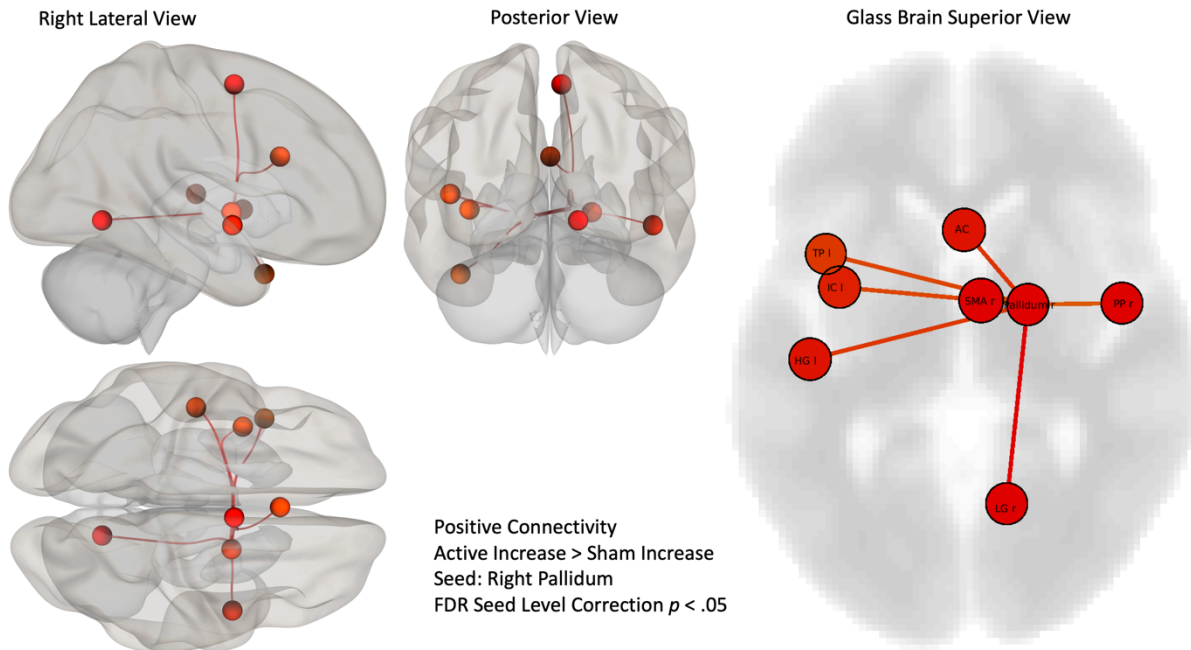


Figure 42. Increased positive connectivity following active cTBS versus sham was evident between the globus pallidus and multiple other regions of the brain (see text above).

in activation in these regions, potentially reducing self-referential internalized dialogue, motor planning, emotional arousal, visual imagery).

Increased Negative (Inverse/Anticorrelated) Connectivity with Active Treatment: This analysis yielded two clusters ($p < .001$ uncorrected peak, $p < .05$ FDR corrected for cluster size) where increased ICA-DMN activation was inversely correlated with cortical activation (see **Figure 43**). The first was in the supplementary motor cortex (SMA; MNI: 4, -2, 58; $k = 130$ voxels), and the second was the right parietal operculum (MNI: 56, -26, 20; $k = 55$). These regions were anticorrelated with the ICA-DMN, suggesting that suppression of DMN by the ACTIVE cTBS treatment was associated with increased activation in each of these two areas compared to SHAM treatment. Graphical representation of these two regions and the associated statistical results are presented in **Figure 44**.

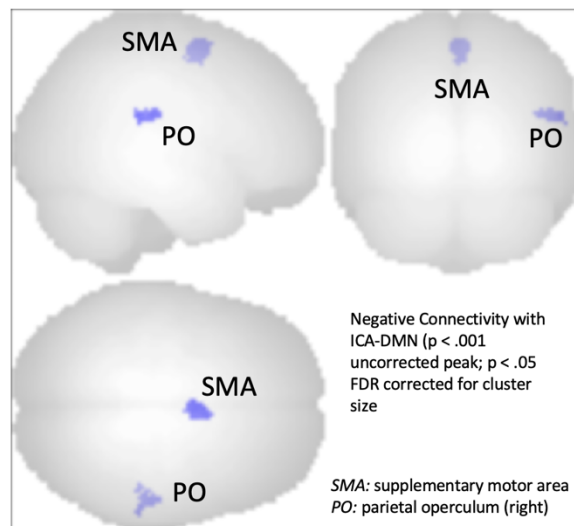
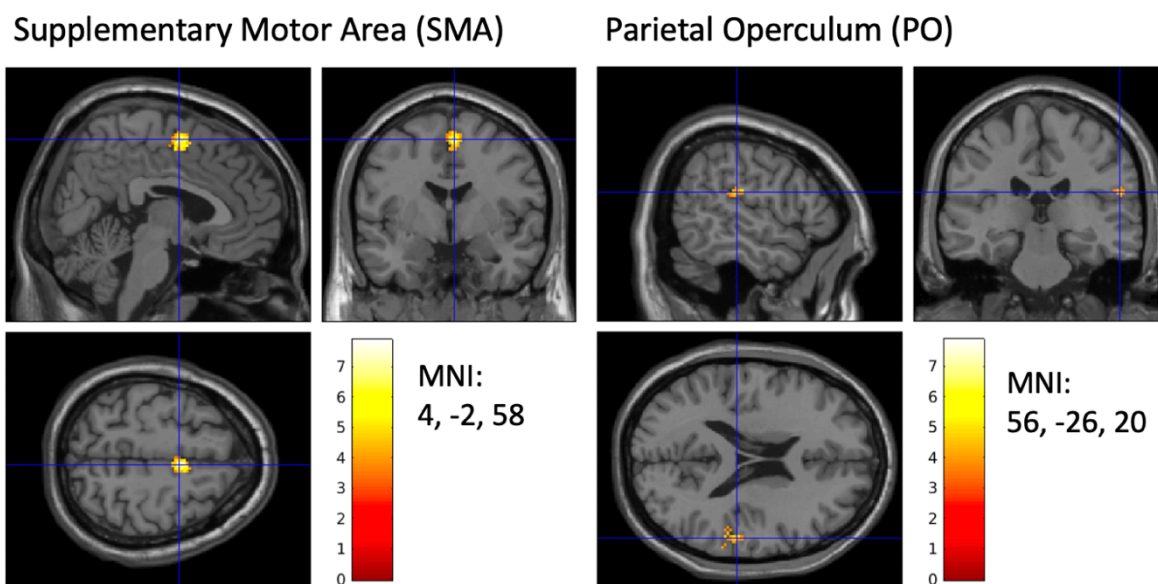


Figure 43. Regions showing negative (inverse or anticorrelated) connectivity with the ICA-DMN. These include anticorrelated activity in the supplementary motor area (SMA) and parietal operculum (PO).



Statistics: p -values adjusted for search volume

set-level		cluster-level				peak-level					mm mm mm		
p	C	$p_{\text{FWE-corr}}$	$q_{\text{FDR-corr}}$	k_E	p_{uncorr}	$p_{\text{FWE-corr}}$	$q_{\text{FDR-corr}}$	T	$(Z_{\equiv})$	p_{uncorr}			
0.000	2	0.000	0.000	130	0.000	0.026	0.107	7.86	5.19	0.000	4	-2	58
		0.014	0.006	55	0.000	0.941	0.867	5.74	4.32	0.000	56	-26	20
						1.000	0.963	4.37	3.59	0.000	60	-34	22
						1.000	0.963	4.05	3.40	0.000	46	-34	22

Figure 44. Regions showing significant negative (inverse) connectivity from the default mode network (DMN) that increased with ACTIVE cTBS relative to SHAM. The figure shows that active cTBS was associated with increased negative connectivity between the ICA-DMN and the supplementary motor area (SMA) and parietal operculum (PO), FDR corrected $p < .05$. The lower table shows the MNI coordinates of these connected regions and their associated statistics.

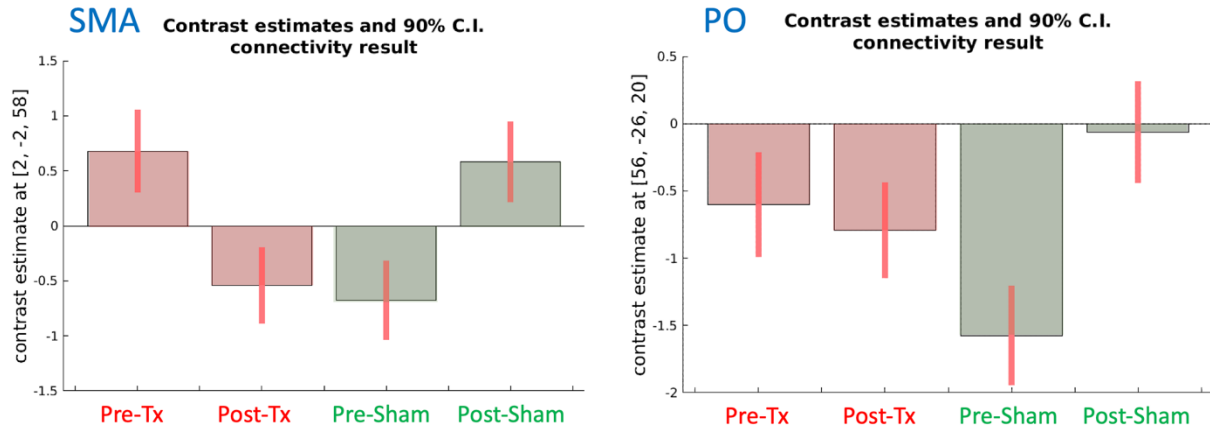


Figure 41. Parameter estimates for the connectivity between the ICA-DMN and the supplementary motor area (SMA) and parietal operculum (PO) at each of the four MRI scan sessions.

We further examined the correlation between ICA-DMN-to-SMA and ICA-DMN-to-PO connectivity by extracting the first eigenvariate of connectivity values from the preceding analysis and correlating those with various PSG metrics separately for the nights following ACTIVE and SHAM treatments. **Table 9** displays these correlations. Overall, increased anticorrelation between DMN and the SMA following active treatment was associated with shorter latency to enter N1 sleep, greater sleep efficiency, reduced wake duration, increased stage N3 duration, fewer awakenings, and less time spent awake after sleep onset or persistent sleep. Given that this pattern was associated with greater anticorrelation between DMN and SMA, we take this as consistent with our hypothesis that *suppression* of the DMN by cTBS contributes to increased activation in SMAN and corresponding improvements in these outcomes. Secondly, we also examined the ICA-DMN-to-PO connectivity strength with outcomes. This association was much weaker and inconsistent overall and appeared driven primarily by changes in the SMAM group. Since SHAM did not involve any actual stimulation, it is possible that changes were due to expectation, or perhaps due to increasing fatigue through the evening hours, which was not offset by any active stimulation. These remain speculative and open to future investigation. Nonetheless, we did find that greater increases in anticorrelation between ICA-DMN and PO were associated with reduced sleep efficiency and

PSG Measure	Suppl. Motor Area		Right Parietal Occipital Operculum	
	Active Tx	Sham Tx	Active Tx	Sham Tx
Time in Bed (TIB)	-.027	.185	.148	.046
Total Sleep Time (TST)	.377†	.481*	-.373†	-.339†
N1 Latency	-.615**	-.274	.118	.249
N2 Latency	-.189	-.338†	.344†	.266
N3 Latency	-.222	-.272	.158	.233
REM Latency	-.361†	-.411*	.010	.061
Sleep Onset Latency	-.069	-.274	.377†	.249
Persistent Sleep Latency	-.250	-.313†	.331	.280
Sleep Efficiency	.380*	.468*	-.391*	-.350†
Wake Duration	-.510*	-.355	.107	.265
N1 Duration	-.281	.070	.088	.120
N2 Duration	.061	.224	-.010	.061
N3 Duration	.527**	.374†	-.148	-.425*
REM Duration	.149	.273	-.413*	-.305†
Wake %	-.526**	-.396*	.127	.269
N1 %	-.366†	-.013	.128	.203
N2 %	-.341†	-.355†	.350†	.366
N3 %	.490*	.297	-.011	-.344†
REM %	.081	.127	-.362†	-.254
# Awakenings	-.565**	-.092	.016	.174
Wake After Sleep Onset	-.510*	-.355†	.107	.265
Wake After Persistent Sleep	-.403*	-.339†	.137	.276
# Arousals	-.282	-.003	-.169	-.073
Arousal Index	-.348†	-.135	-.077	.047

All tests one-tailed; †p < .10, *p < .05, **p < .01

Table 9. Correlation between connectivity values and polysomography sleep outcomes for the negatively connected regions.

shorter REM duration, perhaps pointing toward individual differences in responses to this treatment approach.

Neuroimaging Outcomes: Summary and Conclusions. *These findings suggest that a brief cTBS stimulation to the left lateral node of the DMN produced significant alterations in within-network connectivity of the DMN, including decreased activation of regions involved in language processing, controlled thought, emotional processing, and inward directed cognition. Furthermore, DMN activation was positively connected with the right GP and inversely connected with the SMA and PO, which each significantly predicted sleep related outcomes on PSG. Overall, these findings suggest that cTBS to the left lateral DMN significantly influenced brain connectivity, which in turn, was associated with several objective metrics of improved sleep on PSG.*

Cognitive Performance Outcomes:

While the primary objectives of the project were to determine the effects of cTBS to the left lateral node of the DMN on sleep and functional brain connectivity, we also sought to document potential effects on cognitive performance. Given that the stimulation train was only 40 seconds in duration, we did not expect to identify meaningful changes in cognition. Our primary goal was to ensure that there were no iatrogenic effects of the rTMS procedure on subsequent cognitive function. Nonetheless, we also expected that if sleep was improved, there might be associated improvements in simple alertness, attention, and vigilance.

Impact of cTBS on Vigilance, Attention, and Processing Speed

Psychomotor Vigilance Task (PVT). We used the Psychomotor Vigilance Test (PVT) to measure sustained vigilance and attention of participants. Participants completed three 10-minute PVT sessions prior to TMS at 15:45, 16:45, and 17:45 on the evening of the lab stay. Three additional PVT administrations were given the following morning after the TMS/SHAM administration and a night of PSG monitored sleep. These morning administrations were given at 07:30, 08:30, and 09:30. We predicted that vigilance and sustained attention would not significantly differ between participants active cTBS session and sham cTBS session. The PVT includes metrics of simple reaction time (RT) and speed ($1/RT \times 1000$). We report outcomes of both of these below.

Reaction Time

Reaction time on PVT is the time in milliseconds it takes for a participant to respond to a presented stimulus. The greater the reaction time the longer it took the participant to respond.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reaction time ($F(1,17) = 1.221, p = .284, \eta^2 = .067$). There was no significant effect of administration on reaction time ($F(5,85) = 1.796, p = .191, \eta^2 = .096$). Additionally there was no interaction of condition on administration ($F(5,85) = .868, p = .433, \eta^2 = .049$). Post hoc analyses

revealed there was no significant differences for any main or interaction effect ($p>.05$). See **Figure 45**.

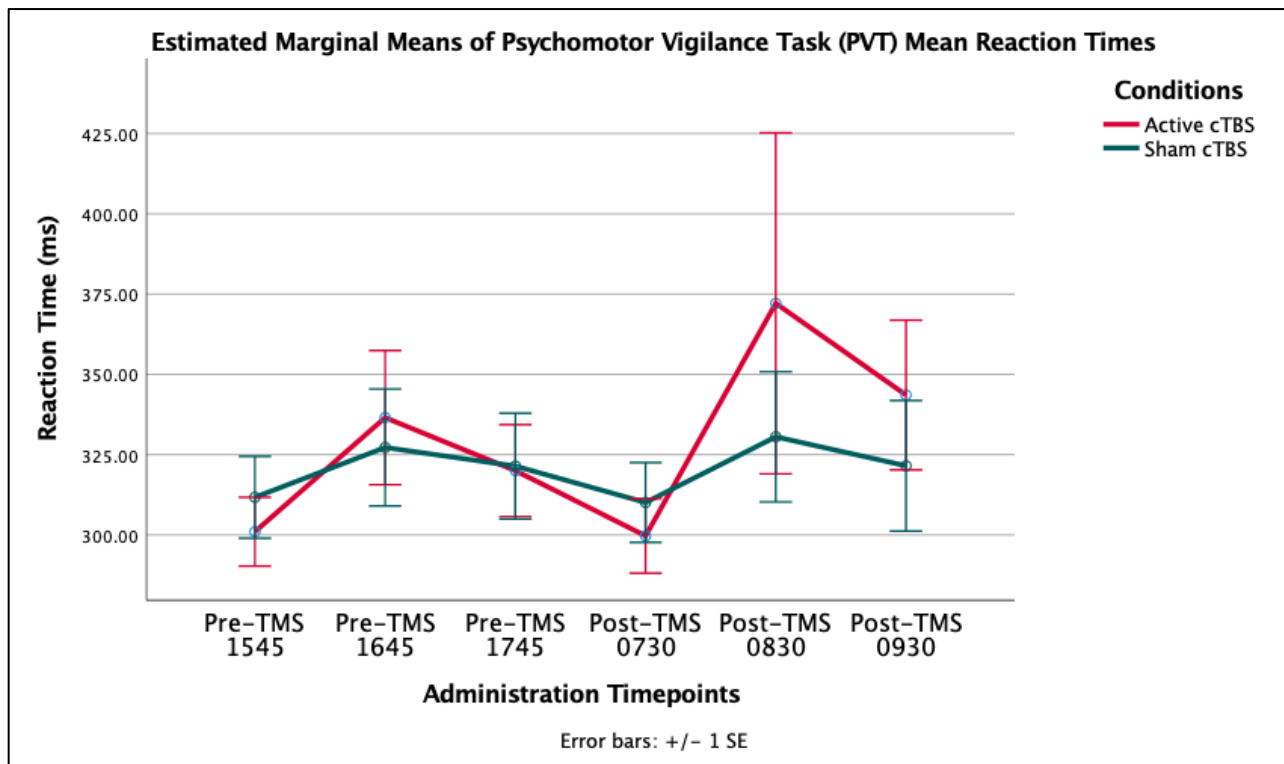


Figure 45. Mean reaction time at each administration of the psychomotor vigilance test. The first three administrations occurred in the evening prior to the TMS procedure and the last three occurred the next morning following laboratory sleep.

Speed

Speed on the PVT is the reciprocal of reaction time. Speed is calculated by taking $1/\text{Reaction Time}$ for each participant. Higher scores indicate greater speed during the PVT.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on speed ($F(1,17) = .196, p = .663, \eta^2 = .011$). There was no significant effect of administration on reaction time ($F(5,85) = 2.331, p = .093, \eta^2 = .121$). Additionally there was no interaction of condition on administration ($F(5,85) = .902, p = .452, \eta^2 = .050$). Post hoc analyses revealed there was no significant differences for any main or interaction effect ($p>.05$). See **Figure 46**.

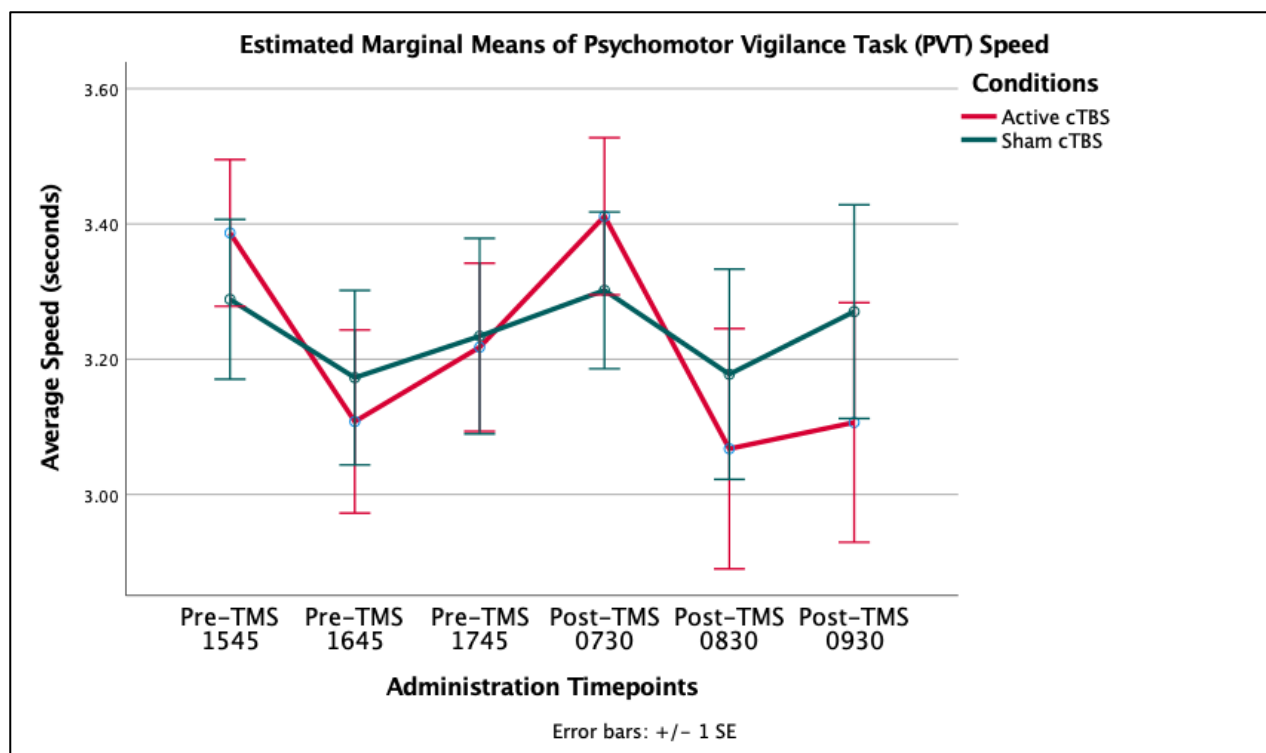


Figure 46. Speed at each administration of the psychomotor vigilance test. The first three administrations occurred in the evening prior to the TMS procedure and the last three occurred the next morning following laboratory sleep.

Shoot-No-Shoot (SNS) Task. A secondary aim the study is to determine whether administration of TMS impacted next day cognitive performance. We utilized a variant of a Go-No-Go (GNG) task created by our team called the Shoot-No-Shoot (SNS) Task to measure attention and cognitive flexibility changes associated with treatment. This task is designed to measure the ability to withhold a response (i.e., don't shoot) to friendly forces but to engage (i.e., shoot) when confronted with enemy forces, and has been designed to be face valid and relevant to military decisions. Participants were asked to decide whether or not to press a response button to on the keyboard depending on 1) the context scene (urban or rural) and 2) the color of the soldier's uniform in the image (tan or green). At the beginning of the task, participants were shown images of an urban scene or a rural scene, with a combatant wearing either a tan or green uniform. Participants were given instructions that indicate which uniforms and contexts would be "shoot" conditions and which images will be "no-shoot" conditions. Moreover, we were interested in cognitive flexibility, so we also built in a contingency reversal halfway through the task. This contingency reversal was not explicitly stated to the participant, so they were required to learn the contingency switch based on feedback from the task. Within the SNS task four main variables were calculated to measure a participant's response inhibition, attention, and sensitivity during the task; Correct Rejection Rate, Hit Rate, False Alarm Rate, and d Prime.

Correct Rejection Rate

Correct Rejection (CR) Rate is calculated by the number of times a participant correctly inhibits a response also known as "no shoot". Higher scores indicate more correct responses across trials [Range 0.0-1.0].

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on correct rejection rate ($F(1,16) = .173, p = .683, \eta^2 = .011$). There was no significant effect of administration (pre vs. postTMS) on correct rejection rate ($F(1,16) = 1.720, p = .208, \eta^2 = .097$). There was no significant effect of reversal (pre vs. post reversal) on correct rejection rate ($F(1,16) = 2.293, p = .149, \eta^2 = .125$). There were no significant interaction effects of condition, reversal, or administration on correct rejection rate during SNS ($p > .05$). This suggests that the rTMS procedure had no meaningful effect on the ability to perform this task. However, the interaction did demonstrate a moderately large effect size, suggesting that with a larger sample that the one used here, these findings would have a strong likelihood of demonstrating a statistically significant difference. This is displayed in **Figures 47 and 48**.

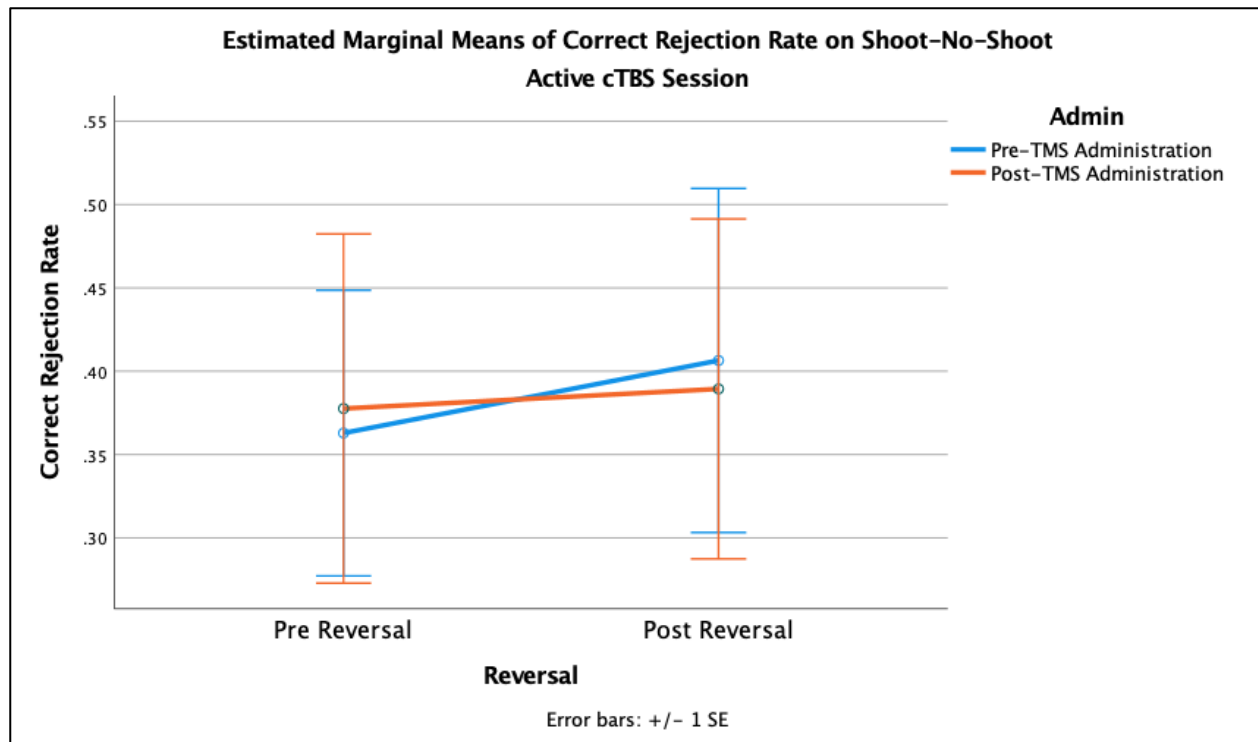


Figure 47. Average correct rejection rate during SNS task during participant's active cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

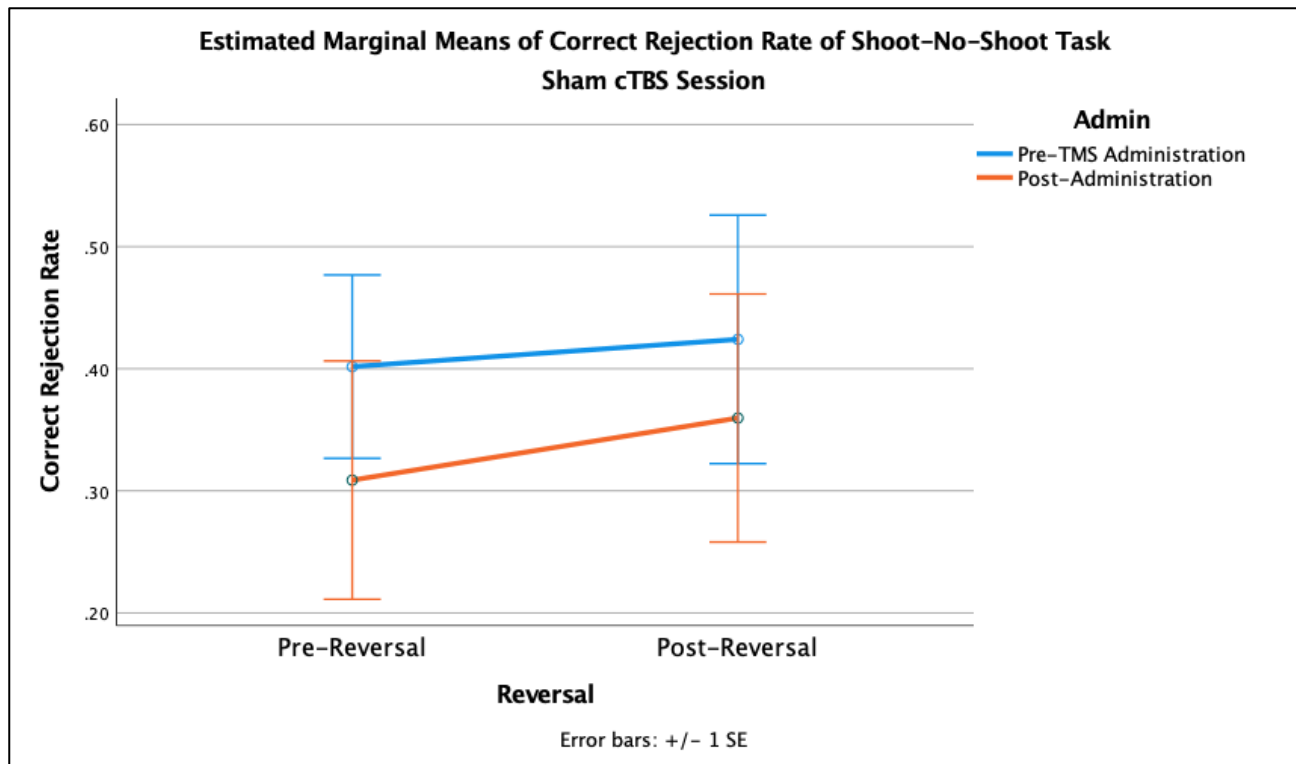


Figure 48. Average correct rejection rate during SNS task during participant’s sham cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

Hit Rate

Hit Rate (HR) is calculated by the number of times a participant correctly produces a response also known as “shoot”. Higher scores indicate more correct responses across trials [Range 0.0-1.0].

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on hit rate ($F(1,16) = .007, p = .936, \eta^2 = .000$). There was no significant effect of administration (pre vs. post TMS) on hit rate ($F(1,16) = 1.131, p = .303, \eta^2 = .066$). There was no significant effect of reversal (pre vs. post reversal) on hit rate ($F(1,16) = 3.057, p = .100, \eta^2 = .160$). There were no significant interaction effects of condition, reversal, or administration on correct rejection rate during SNS ($p > .05$). Post hoc pairwise comparisons demonstrated no significant differences in hit rate between participants active cTBS session and sham cTBS session on administration or reversal ($p > .05$). However, given the small sample size, the large effect size of the interaction should not be overlooked, as this points to a robust outcome that may emerge as reliable with a larger sample size. See **Figure 49 and 50**.

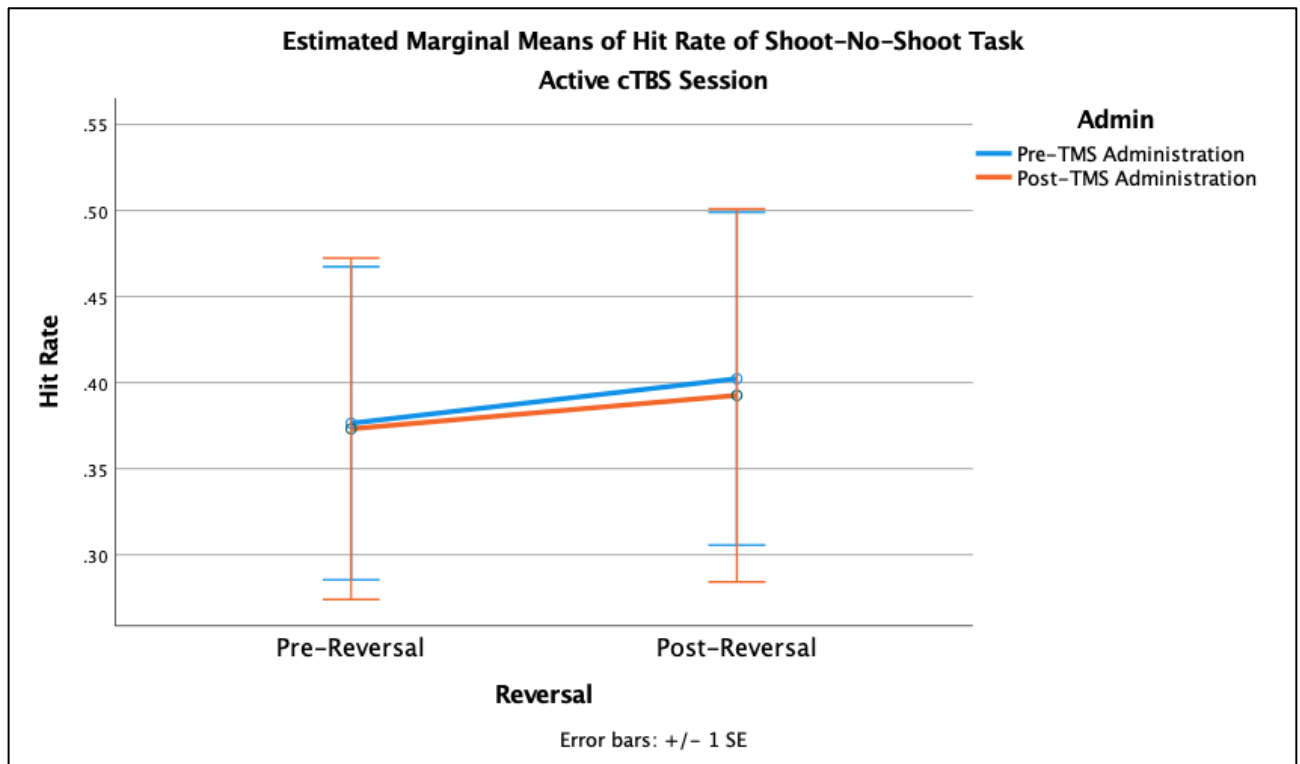


Figure 49. Average hit rate during SNS task during participant's active cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

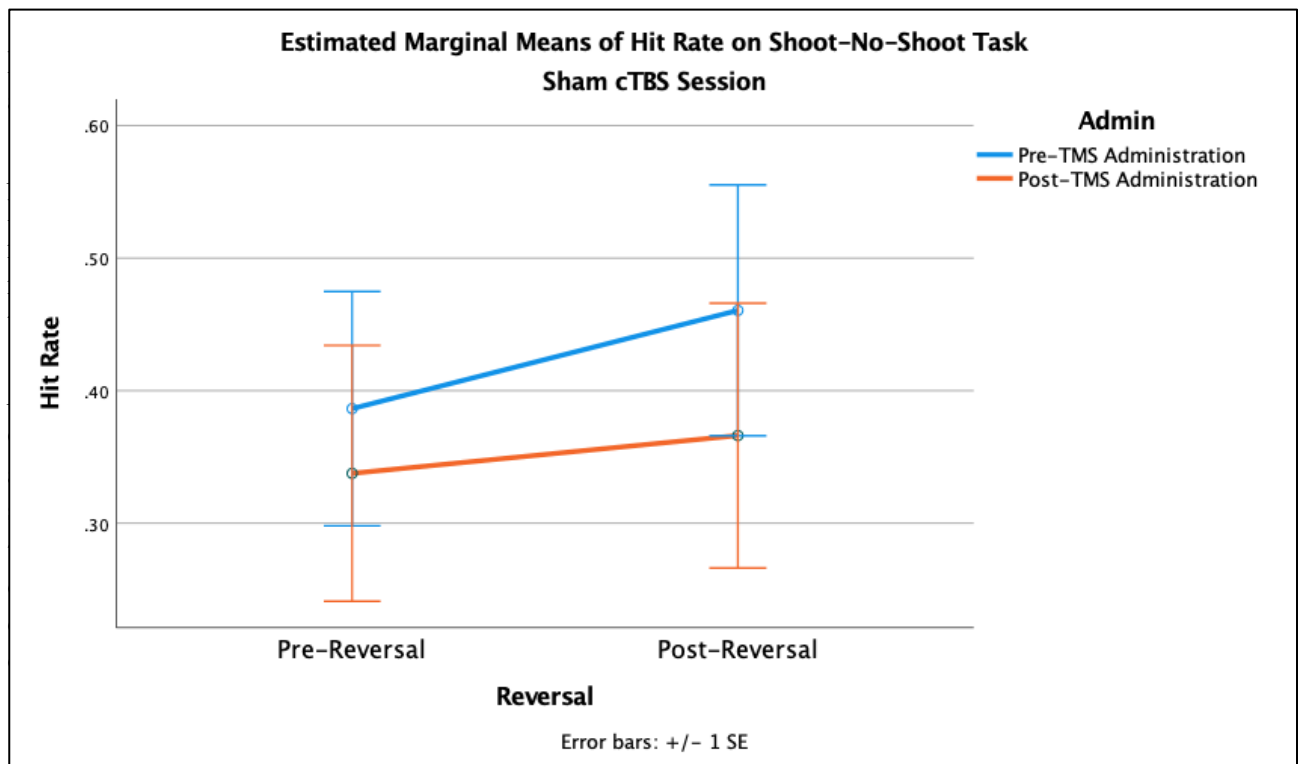


Figure 50. Average hit rate during SNS task during participant's sham cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

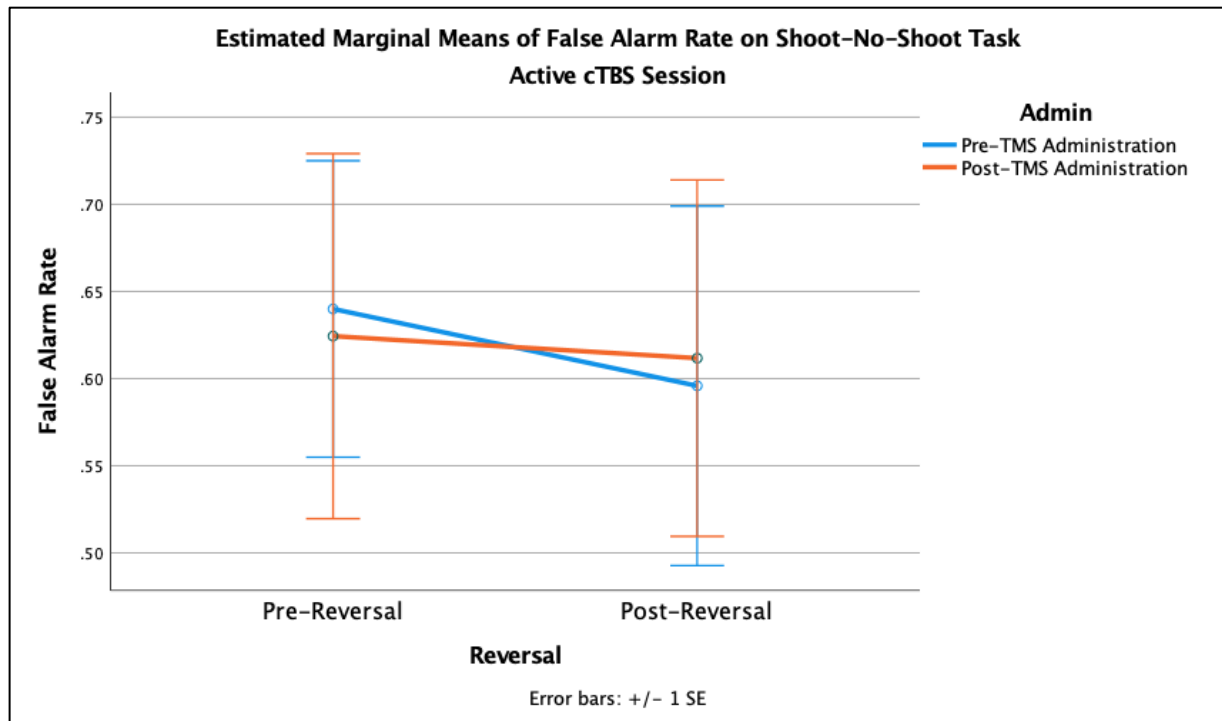


Figure 51. Average false alarm rate during SNS task during participant's active cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

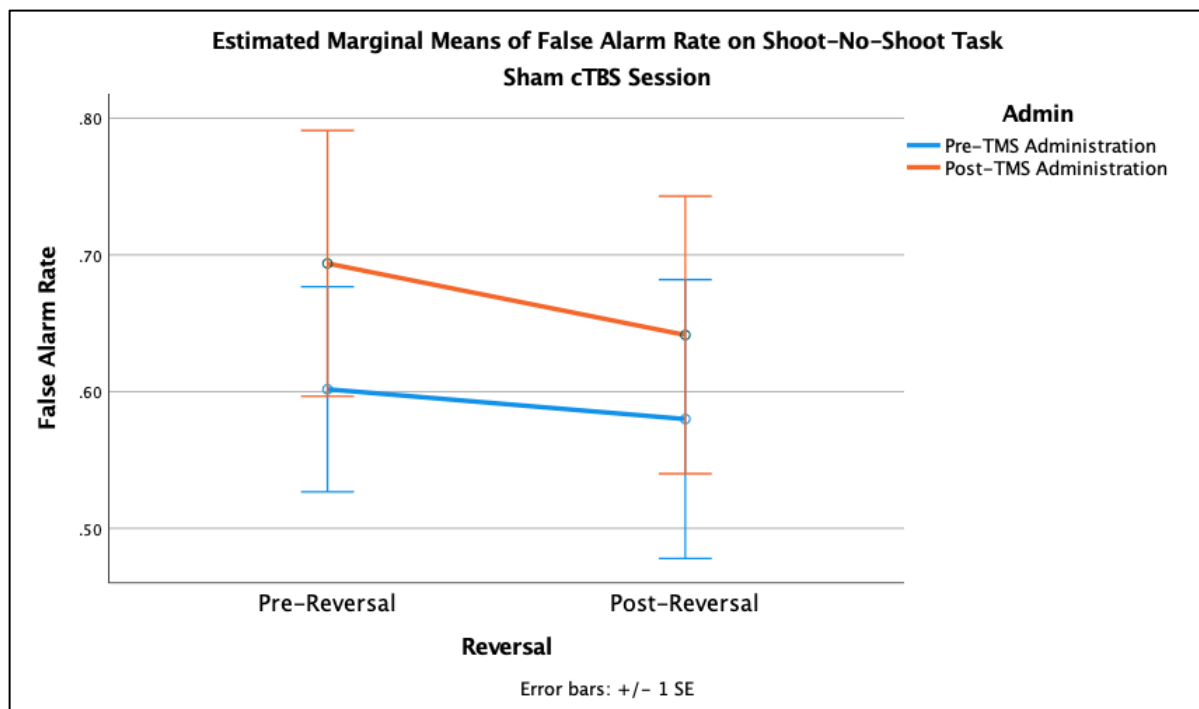


Figure 52. Average false alarm rate during SNS task during participant's sham cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

Discriminability Index (d')

According to signal detection theory, d' is the measure of an individual's ability to detect and discriminate a signal from the noise; specifically, d' is a measure of sensitivity and discriminability. It is the standardized difference between the mean signal present and signal absent distributions. Thus d' is the standardized z-score of the individual's hit rate and false alarm rate. Negative d' values indicate a false-alarm rate greater than the hit rate. The closer the d' score is to 0 the more likely the participant's pattern of response was not related to whether or not the signal was actually present.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on sensitivity to signal ($F(1,16) = .022, p = .884, \eta^2 = .001$). There was no significant effect of administration (pre vs. post TMS) on sensitivity to signal ($F(1,16) = 2.165, p = .161, \eta^2 = .119$). There was a significant effect of reversal (pre vs. post reversal) on sensitivity ($F(1,16) = 4.531, p = .049, \eta^2 = .221$). There were no significant interaction effects of condition, reversal, or administration on d' during SNS ($p > .05$). Post hoc pairwise comparisons demonstrated higher d' scores post-reversal ($M = -.778; SD = 2.972$) compared to pre-reversal ($M = -1.099; SD = 2.602$) ($p = .049$). These results indicate that while d' did increase post reversal participants likely had a higher hit rate than false alarm rate during post reversal trials. However, in doing so their overall sensitivity to stimuli was less likely due to signals being present and was not related to the rTMS procedure. See **Figures 53 and 54**.

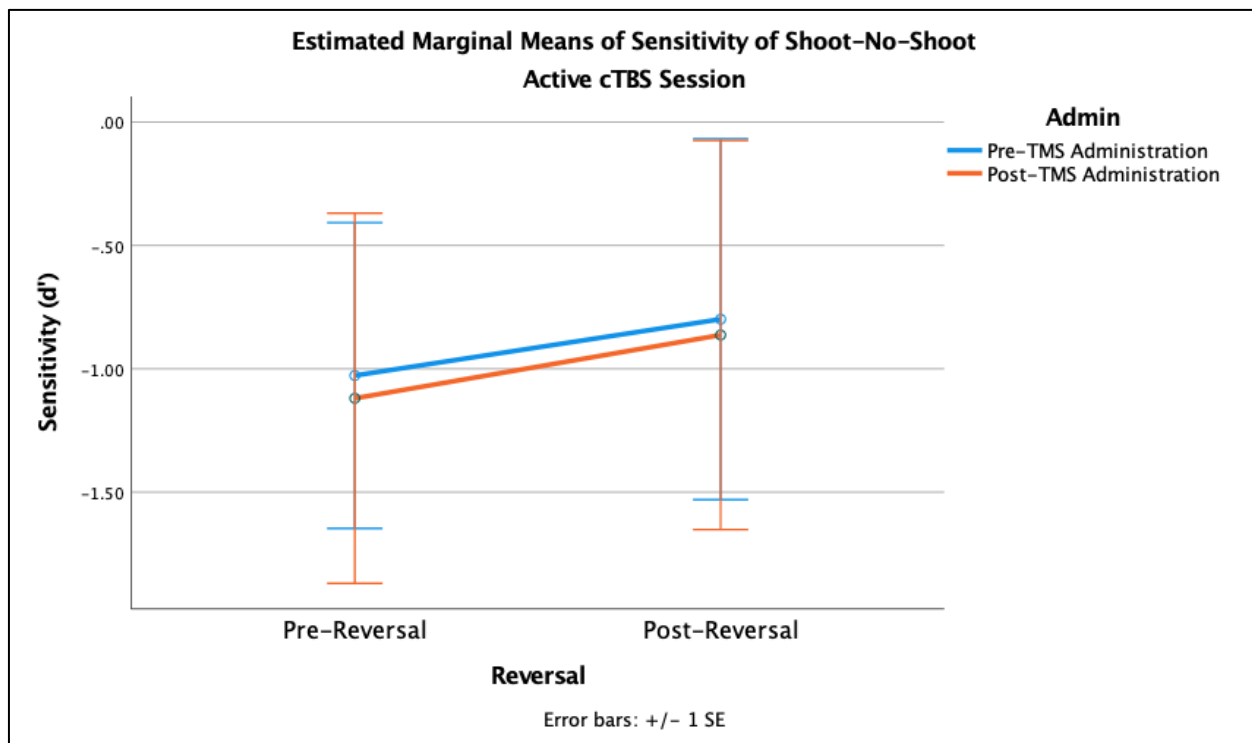


Figure 53. Sensitivity (d') during SNS task during participant's active cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

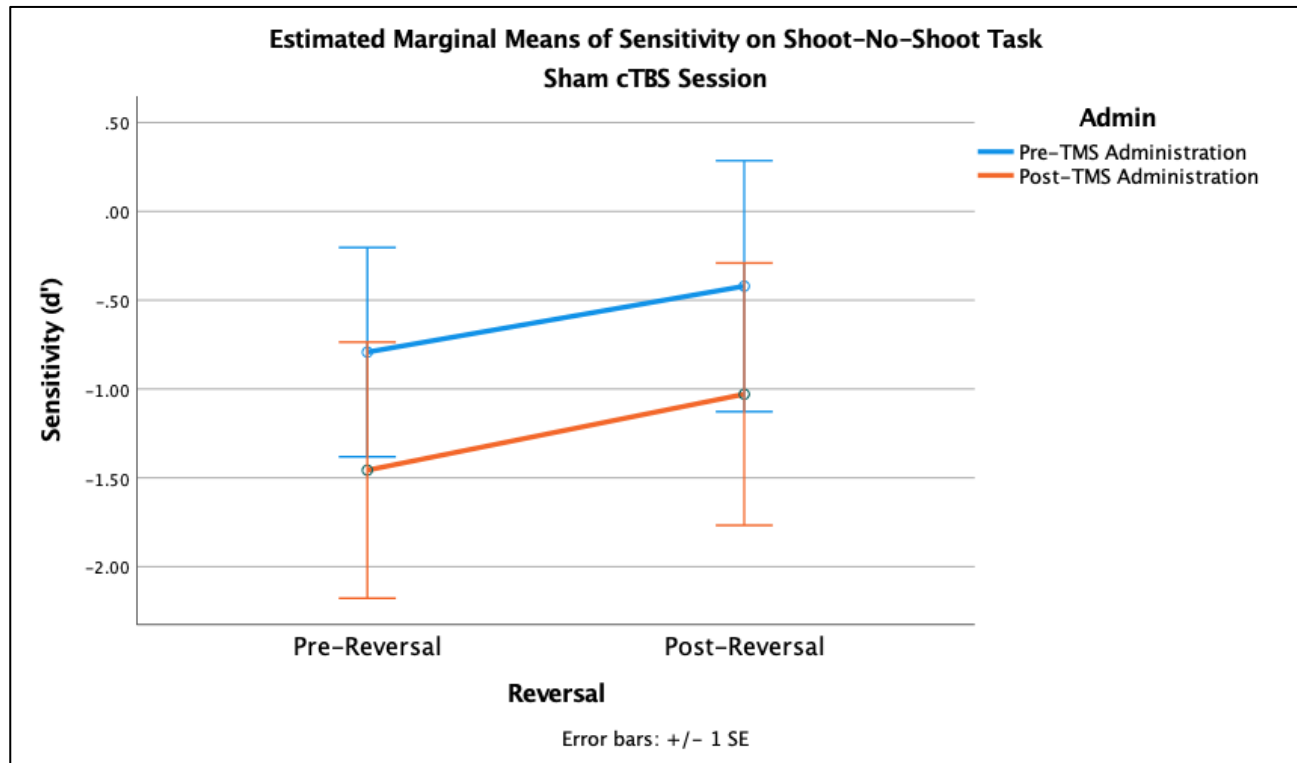


Figure 54. Sensitivity (d') during SNS task during participant's sham cTBS session compared on administration (pre vs. post TMS administration) and task reversal (pre vs. post reversal).

Processing Speed and Attention. We hypothesized that neurocognitive improvements due to cTBS would be mediated by polysomnographic (PSG) parameters of slow wave sleep, due to prior findings suggesting that slow wave sleep plays a role in learning. The symbol coding (simple attention and processing speed) and digit span (simple attention) subtests of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) were administered before the ACTIVE and SHAM cTBS procedures and again upon awakening the following morning.

Results: Improvements in attention and processing speed were observed after a night of sleep following both active TMS (cTBS; $B = 11.05$, $p < .001$) and sham TMS conditions ($B = 8.10$, $p = .002$) the prior day. However, in the cTBS condition only, these improvements in attention were mediated by latency to slow wave sleep (N3), such that shorter latencies were related to greater improvements on a simple attention task (RBANS digit span; $B = -0.75$, $p < .001$). This is particularly relevant given the findings discussed earlier showing that the ACTIVE cTBS condition led to a reduction in latency to N3 sleep. Effects of N3 latency on improvements in processing speed and simple attention (RBANS coding) trended toward significance in both the cTBS ($p = .093$) and sham ($p = .077$) conditions. This effect of night to morning improvement in attention and processing speed was also found in the sham condition for the coding task ($B = 60.81$, $p < .001$), but not for digit span. No effects of slow wave sleep duration on RBANS coding or digit span were observed in either condition. Neurocognitive improvements in simple attention

performance in response to cTBS may be, in part, due to slow wave sleep parameters. Moreover, results suggest that simple attention may have been more sensitive to the effects of cTBS, whereas processing speed may have been a factor of lower slow wave sleep onset latency.

Attention and Vigilance Outcomes: Summary and Conclusions. Overall, performance on the PVT and SNS were similar before and after the ACTIVE and SHAM cTBS procedures. These findings suggest the cTBS stimulation of the left lateral DMN node did not significantly alter attention and vigilance, suggesting that the intervention can be used without concern for adverse outcomes on these cognitive domains. There was also some evidence that processing speed and attention may have been mediated by the effect of cTBS on latency to N3. **Conclusions:** The cTBS procedure used here did not significantly alter attention and vigilance directly, but improvements to processing speed were significantly mediated by cTBS induced reductions in latency to N3 deep sleep.

Impact of cTBS on Learning and Memory

California Verbal Learning Test (CVLT). The CVLT is a popular clinical and research test that measures key constructs such as repetition learning, serial position effects, semantic organization, intrusions, and proactive interference. For the present study, we examined the effects of active cTBS on repetition learning. This is indicated by total recall performance on the CVLT. Participants are read a list five times during their first administration and are asked to recall as many words from the list as possible on each subsequent trial. The CVLT is split into three separate administrations. The first administration assesses immediate recall performance on five subsequent trials, performance on an intrusion task (recall of a second list), and short delay free recall. The second administration assesses both free and cued recall performance after a short delay. The third administration assesses free, cued, and recognition recall after a long delay. We assessed delayed memory performance immediately after learning, again after the TMS (ACTIVE or SHAM) procedure, and the following morning.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on recall performance ($F(1,18) = 3.654, p = .072, \eta^2 = .169$). There was an expected significant effect of trial on recall performance ($F(10,180) = 69.120, p < .001, \eta^2 = .793$). This finding is a result of immediate recall trials where this effect is an expected outcome of repeated learning. Importantly, there was no significant interaction effect of condition on trials ($F(10,180) = 0.701, p = .625, \eta^2 = .037$). Post hoc pairwise comparisons revealed that participants performed worse on short delay free recall during their active cTBS session ($M = 12.632; SD = 2.910$) than during their sham cTBS session ($M = 13.42; SD = 2.545$) ($p = .048$). Importantly, however, this trial was performed prior to the administration of TMS, and likely represents a false difference. Analyses demonstrate that there are no significant differences in learning when receiving active cTBS compared to sham cTBS post-TMS administration. This is an important finding, as it suggests that the cTBS procedure does not adversely affect memory capacities. See **Figure 55**.

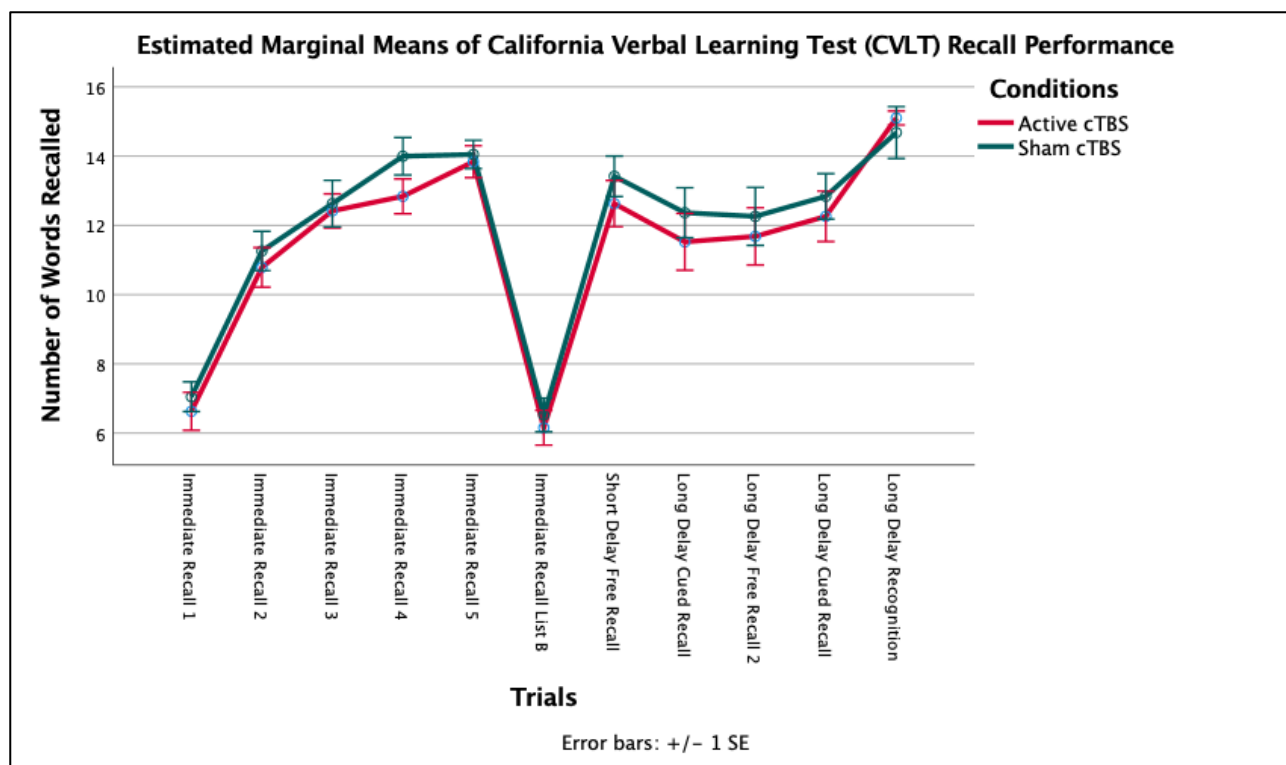


Figure 55. Total recall performance compared across both condition (active cTBS vs. sham cTBS) and trials.

Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). A primary aim of the study is to determine whether administration of TMS impacted next day cognitive performance. We used the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). RBANS is a well validated neuropsychological assessment that assesses five primary cognitive domains; immediate memory, visuospatial/constructional, language, attention, and delayed memory. For the present study we conducted story memory, digit span, and coding subtests. Story memory subtest measures immediate and delayed memory cognitive domains. Both digit span and coding test the cognitive domain of attention.

Story Recall

Story memory is measured by the RBANS Story Recall subtest. It measures both immediate and delayed recall memory performance. Participants are asked to recall as many details from a story that is read to them. Participants are read a story once and then asked to immediately recall as many details from the story as possible during Administration 1. Participants are then immediately read the story again then asked to recall as many details from the story for administration 2. Higher scores on administrations 1 and 2 indicate better immediate recall [Range 0-24]. Administration 1 and 2 occurred around 16:00 in the evening, prior to the rTMS procedure. During administrations 3 and 4, participants were asked to recall as many details from earlier administrations without being read the list again. Administration 3 occurred after rTMS at approximately 21:30 that same evening and Administration 4 occurred the following morning at approximately 08:00. Higher

scores on administrations 3 and 4 indicate higher delayed recall performance [Range 0-12]. Administrations 2 and 3 consists of one trial. Higher scores on administrations 2 and 3 indicate higher delayed recall performance.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on recall performance ($F(1,19) = .093, p = .764, \eta^2 = .005$). There was a significant effect of administration (Administration 1, 2, 3,4) on recall performance ($F(3,17) = 49.846, p < .001, \eta^2 = .898$). There was no significant interaction effect of condition on administration ($F(3,17) = 0.675, p = .579, \eta^2 = .107$). Post hoc analyses revealed that participants performed significantly better on all subsequent administrations after Administration 1 ($p < .01$) during both overnight visits indicating rehearsal effects. See **Figure 56**.

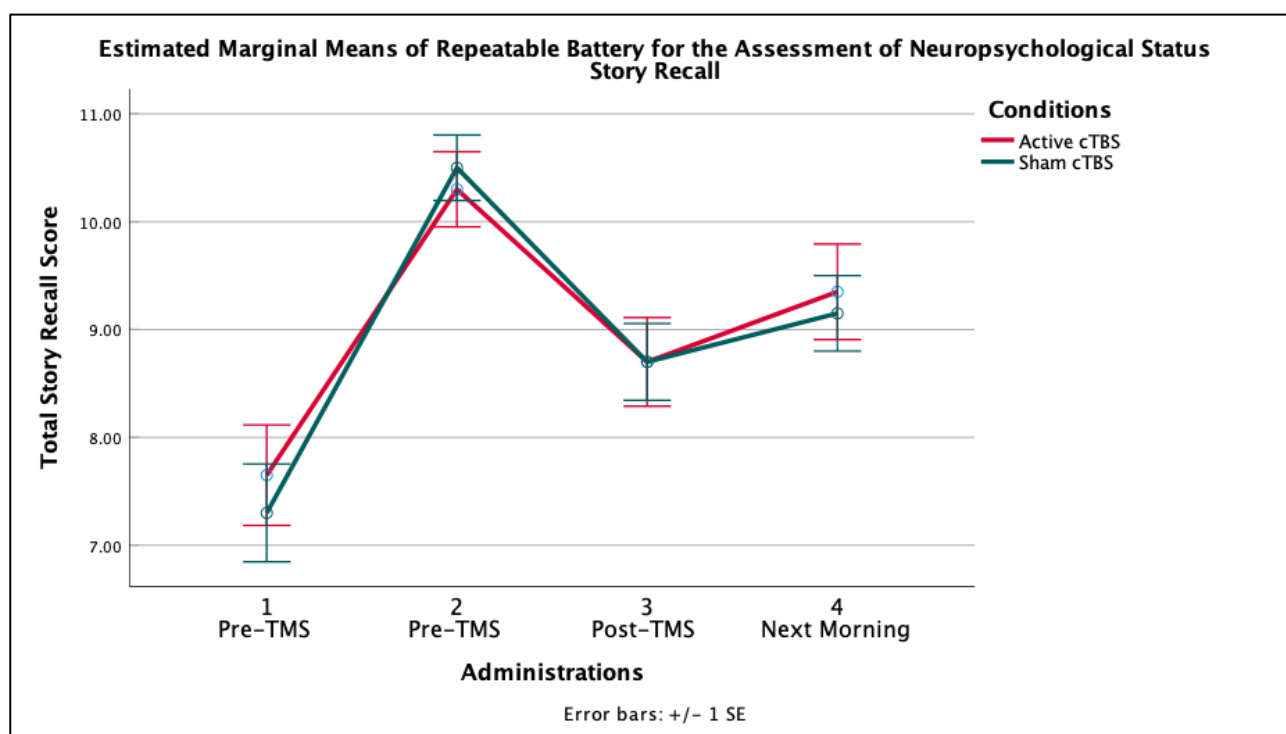


Figure 56. Total story recall performance compared across both condition (active cTBS vs. sham cTBS) and trials.

Digit Span

The cognitive domain of attention and working memory is measured by the Digit Span subtest on the RBANS. Participants are read a string of numbers for each trial and are asked to repeat the numbers in order back to the administrator. Higher scores indicate greater attention and working memory performance [Range 0-16].

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on digit span performance ($F(1,19) = .039, p = .845, \eta^2 = .002$). There was no significant effect of administration (pre-TMS, post-TMS, and next morning) on digit span performance

($F(2,38) = .582, p = .564, \eta^2 = .030$). There was no significant interaction effect of condition on administration ($F(2,38) = 0.74, p = .929, \eta^2 = .004$). Post hoc analyses revealed there were no significant differences for any main or interaction effect ($p > .05$). See **Figure 57**.

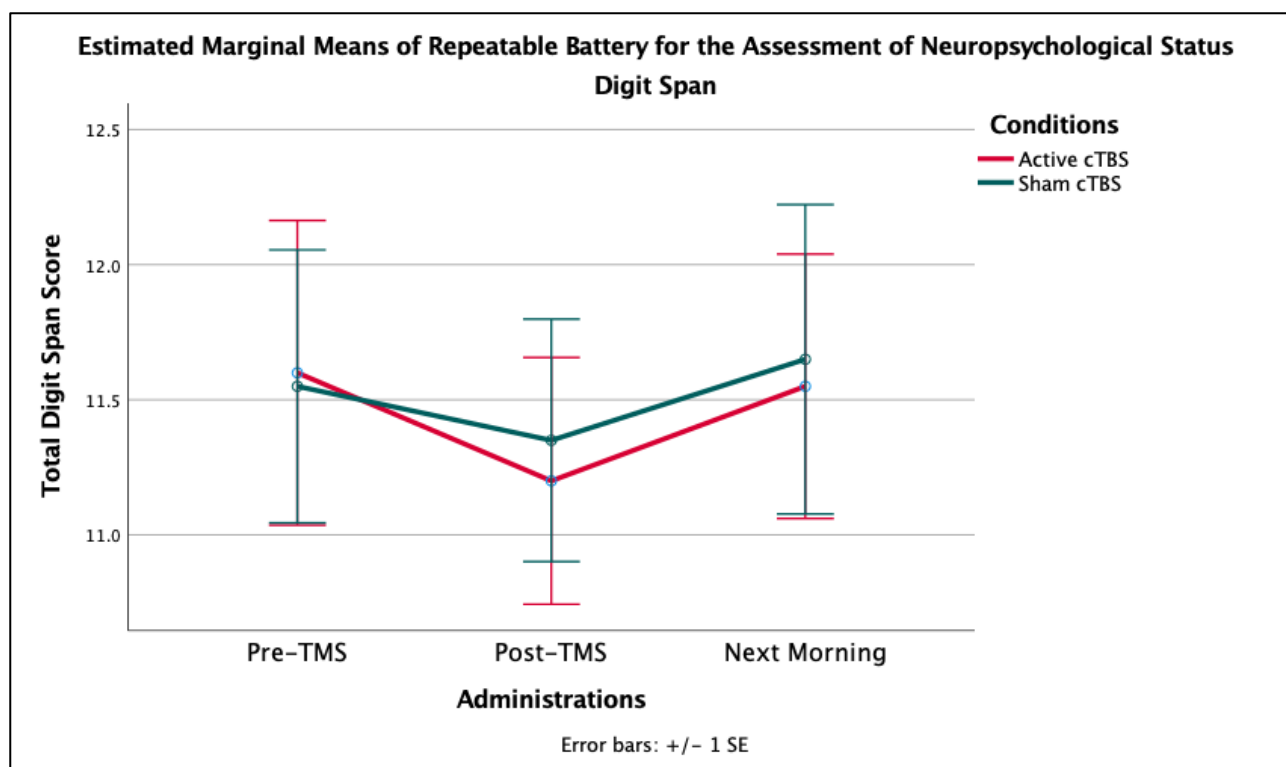


Figure 57. Total digit span performance scores compared across both condition (active cTBS vs. sham cTBS) and administration (pre-TMS, post-TMS, next morning).

Figure. Total digit span performance scores compared across both condition (active cTBS vs. sham cTBS) and administration (pre-TMS, post-TMS, next morning).

Coding

The cognitive domain of attention is also measured by the Coding subtest on the RBANS. Participants are given an associated key with symbols. Each symbol has a corresponding number. Participants are given 90 seconds to fill in the number that goes with each symbol. Higher scores indicate greater attention and performance [Range 0-89].

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on coding performance ($F(1,19) = 2.635, p = .121, \eta^2 = .122$). There was a significant effect of administration (pre-TMS, post-TMS, and next morning) on coding performance ($F(2,38) = 15.271, p < .001, \eta^2 = .446$). There was no significant interaction effect of condition on administration ($F(2,38) = 1.267, p = .293, \eta^2 = .063$).

Main Effects

Post hoc analyses revealed participants scored significantly higher on the coding subtest the next morning ($M=65.775$; $SD= 14.508$) compared to their pre-TMS administration ($M=56.200$; $SD=7.231$) ($p=.002$). Participants also performed significantly better on the coding subtest post-TMS administration ($M=62.200$; $SD= 10.318$) compared to their pre-TMS administration ($M=56.200$; $SD=7.231$) ($p<.001$).

Interaction of Condition and Administration

Post-hoc analyses also showed that participants performed significantly better with each administration during their active cTBS session. Participants performed significantly higher on the coding subtest the morning after receiving ACTIVE rTMS ($M = 67.950$; $SD = 15.659$) compared to their immediate post-TMS administration ($M = 62.850$, $SD = 11.348$) ($p = .040$) and their pre-TMS administration ($M = 56.900$; $SD = 8.315$) ($p = .002$), suggesting some benefit to consolidation during the night of sleep. We also found that during their active cTBS session, participants performed significantly better on their post-TMS administration ($M = 62.850$, $SD = 11.348$) compared to their pre-TMS administration ($M = 56.900$; $SD = 8.315$) ($p = .007$), suggesting that learning was not disrupted by the TMS procedure. During participants SHAM cTBS session, participants did perform significantly better on the coding subtest the following morning ($M = 63.60$; $SD = 15.045$) compared to their pre-TMS administration ($M = 55.500$; $SD = 8.829$) ($p = .009$). Additionally, participants did significantly better on the coding subtest after they were administered SHAM TMS ($M = 61.550$; $SD = 10.045$) compared to before they were administered TMS ($M = 55.500$; $SD = 8.829$) during their SHAM cTBS session ($p = .008$). However, unlike during participants ACTIVE cTBS session, participants did not significantly perform better the next morning ($M = 63.60$; $SD = 15.045$) compared to their performance post-TMS administration ($M = 61.550$; $SD = 10.045$) during their sham cTBS session ($p = .703$). This may suggest that with the increased sleep experienced by participants during their active cTBS session may have helped their attention.

Additionally, while not statistically significant, our analyses suggest a trend pattern where participants performed better on the coding subtest the next morning during their ACTIVE cTBS session ($M = 67.50$; $SD = 15.659$) compared to their next morning coding performance during their SHAM cTBS session ($M = 63.60$; $SD = 15.045$) ($p= .069$; see **Figure 58**)

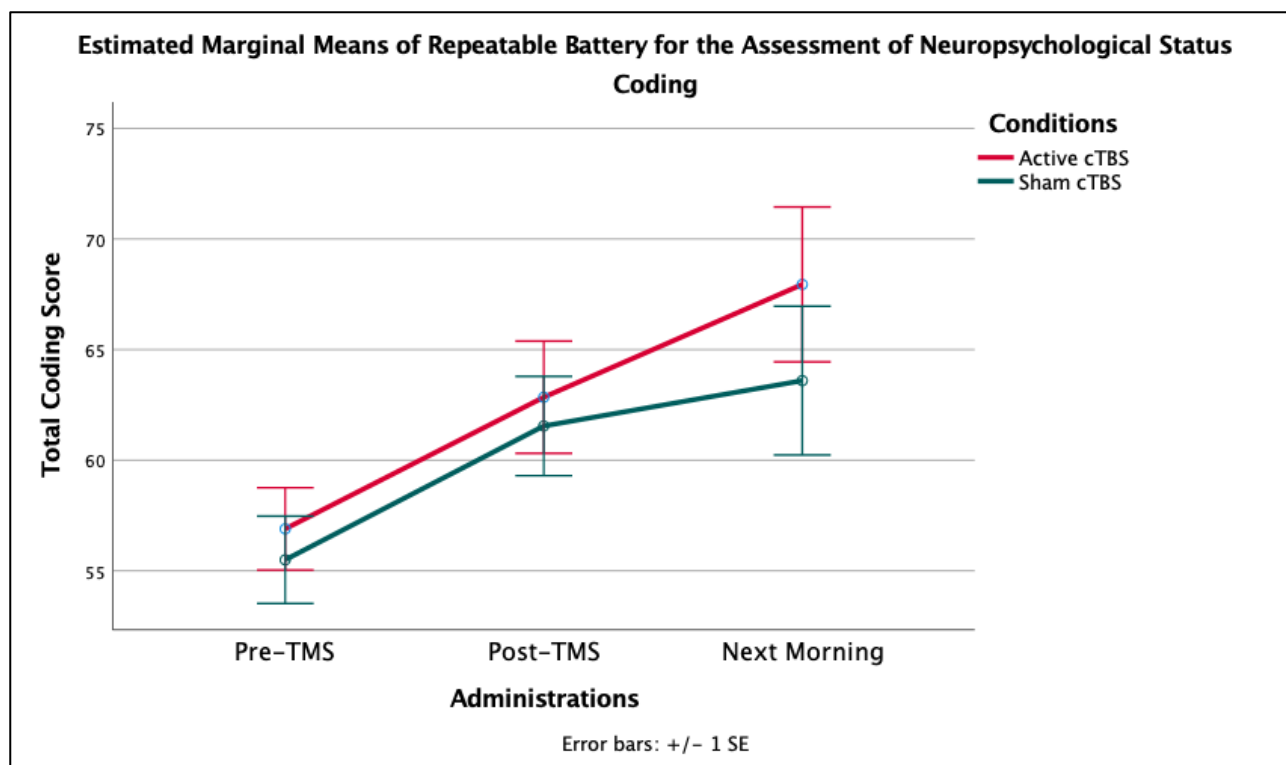


Figure 58. Total coding performance scores compared across both condition (active cTBS vs. sham cTBS) and administration (pre-TMS, post-TMS, next morning).

Memory Outcomes: Summary and Conclusions. The ACTIVE cTBS procedure had no apparent effect on verbal working memory, short-term verbal memory, or long-term retention of verbal memory. There was trend level evidence that ACTIVE cTBS may facilitate retention of incidental visual memory on the coding subtest via improvements in sleep. Conclusions: These findings suggest that there appears to be no adverse effects of the cTBS stimulation to the left lateral node of the DMN and it may improve incidental visual memory.

Secondary Analyses:

In addition to the primary analyses described above, we undertook additional analyses to further explore potential effects of rTMS on mood and symptoms that could be problematic. These are described in the subsequent sections.

Impact of TMS on Mood

Depression

A secondary aim the study is to determine whether administration of TMS impacted mood scores. We used the Beck Depression Inventory (BDI) to measure reports of attitudes and symptoms related to depression in participants. Higher scores indicate more severe levels of depression [Range: 0-63]. We predicted that total depression scores would not significantly differ between participants active cTBS session and sham cTBS session.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported depression ($F(1,14) = 1.625, p = .223, \eta^2 = .104$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported depression ($F(1,14) = 1.561, p = .232, \eta^2 = .100$). There was no significant interaction effect of condition on administration ($F(1,14) = 2.944, p = .18, \eta^2 = .174$), although the effect size was large. Post hoc pairwise comparison revealed no significant differences in mean depression scores between their

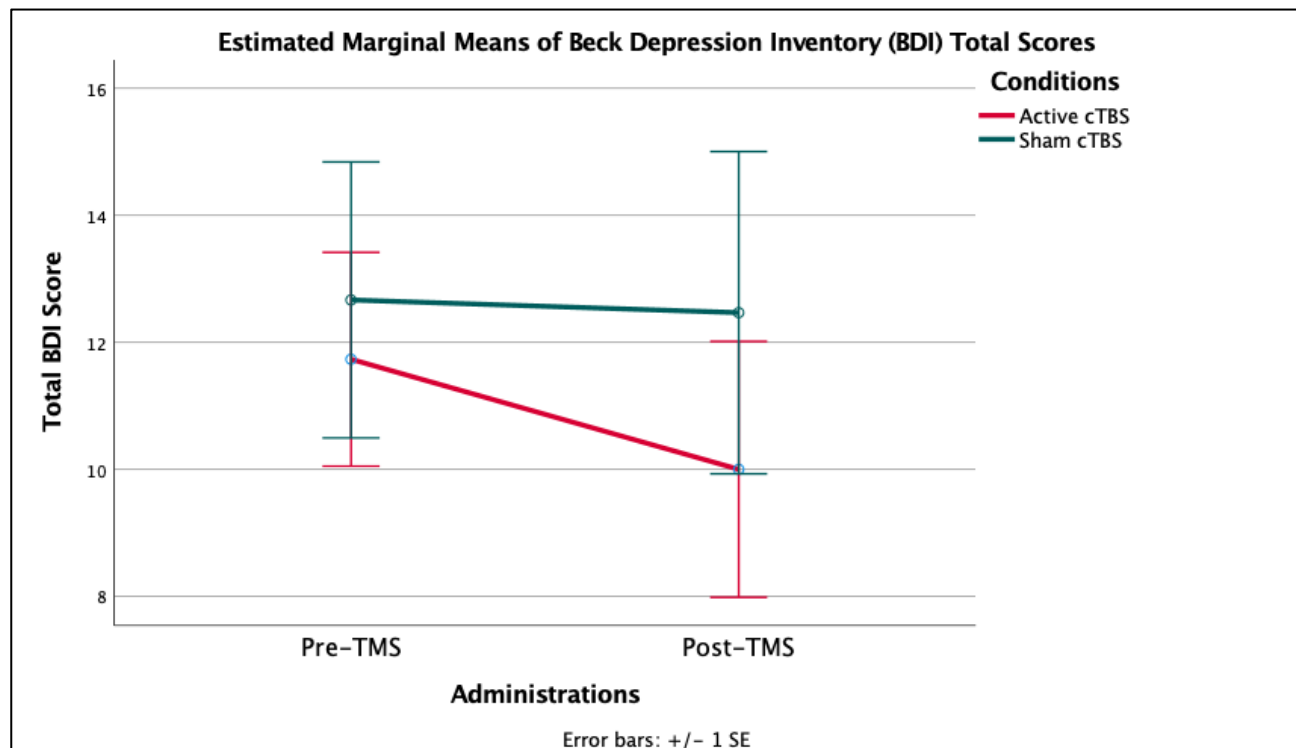


Figure 59. Total depressive scores (BDI) compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

pre ($M = 11.730$; $SD = 6.519$) and post ($M = 10.000$; $SD = 7.801$) sessions during their active cTBS session ($p = .125$) and their pre ($M = 12.670$; $SD = 8.415$) and post ($M = 12.470$; $SD = 9.826$) TMS session sham cTBS session ($p = .774$). See **Figure 59**.

Summary: Overall, we found that there was no significant effect of active cTBS on reported depression compared to sham cTBS. While there was no significant difference in BDI scores, our findings suggest a downward trend in reported depressive attitudes and symptoms after receiving active cTBS. While TMS has been utilized as a treatment for depression in previous studies, our stimulation site (i.e., left inferior parietal) differs spatially from the typical location for depression treatment (i.e., left dorsolateral prefrontal cortex). The present non-hypothesized findings with a large effect size suggest that there may be a positive secondary effect on depression induced by targeting the DMN with cTBS.

Anxiety

A secondary aim the study is to determine whether administration of TMS impacted mood scores. We used the State Trait Anxiety Inventory (STAI) to measure individual state anxiety. Higher scores indicate higher levels of anxiety [Range: 20-80]. We predicted that total anxiety scores would not significantly differ between participants active cTBS session and sham cTBS session.

Results: There was no significant effect of condition (active vs. sham cTBS) on reported anxiety level ($F(1,19) = 1.244$, $p = .279$, $\eta^2 = .061$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported anxiety ($F(1,19) = 1.324$, $p = .264$, $\eta^2 =$

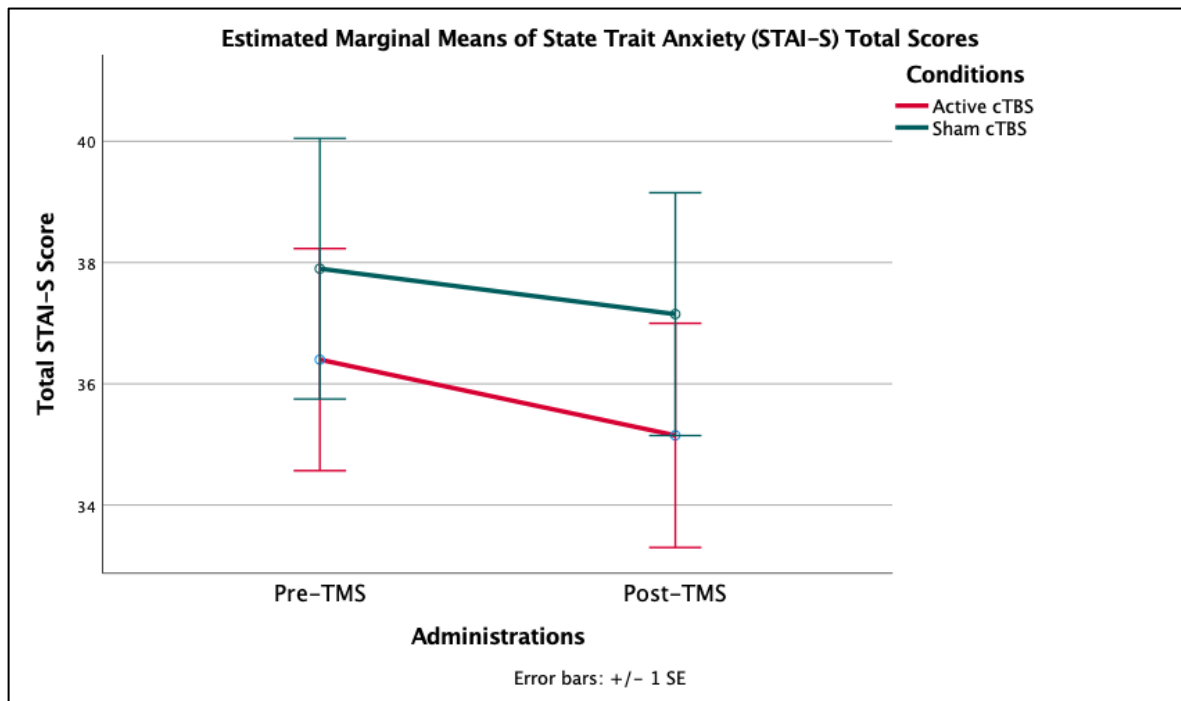


Figure 60. Total state anxiety scores compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration). There was significantly reduced reported anxiety post-TMS administration during participant's active TMS session ($p=.033$).

.065). There was additionally no significant interaction effect of condition on administration on participants anxiety ($F(1,19) = 1.250, p = .790, \eta^2 = .004$). Post hoc pairwise comparison revealed there was a significant difference in mean anxiety scores between their pre ($M = 36.400$; $SD = 8.191$) and post ($M = 35.150$; $SD = 8.267$) administrations during participant's ACTIVE cTBS session ($p = .033$). There was no significant difference between pre ($M = 37.900$; $SD = 9.613$) and post ($M = 37.150$; $SD = 8.958$) TMS administration during participant's SHAM session ($p = .667$). See **Figure 60**.

Visual Analogue Mood Scale

A secondary aim the study is to determine whether administration of TMS impacted mood scores. We used the Visual Analogue Mood Scale (VAMS) to measure levels of eight specific mood states: Afraid, Confused, Sad, Angry, Energetic, Tired, Happy, and Tense. Participants were asked to mark their current level of each of these mood states during each administration. Higher scores indicate more intense feelings of that mood state [Range: 0-100]. Participants completed the VAMS at approximately 16:00, prior to the TMS session, and again the next morning at 08:00. We predicted that total depression scores would not significantly differ between participants active cTBS session and sham cTBS session across all mood states.

Afraid

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported feelings of fear ($F(1,19) = 279, p = .604, \eta^2 = .014$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported feelings of fear ($F(1,19) = .031, p = .862, \eta^2 = .002$). There was no significant interaction effect of condition on

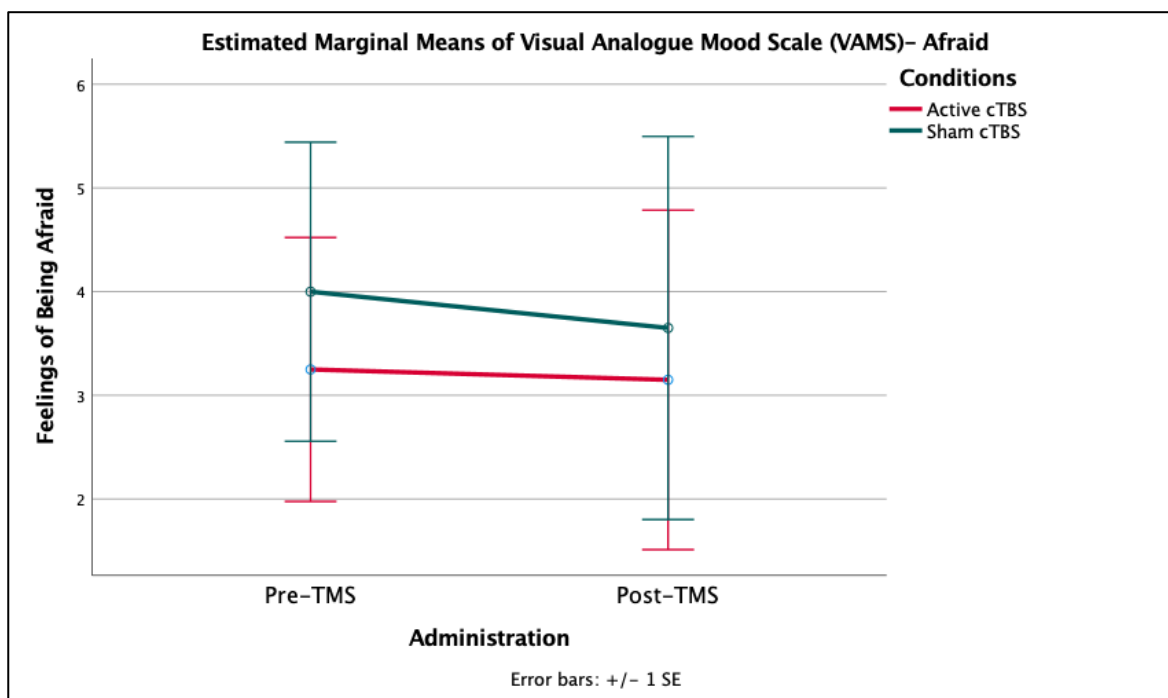


Figure 61. Total rating of fear on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

administration ($F(1,19) = .007, p = .933, \eta^2 = .000$). Post hoc pairwise comparison revealed no significant differences in average level of fear for any main or interaction effect ($p > .05$). See **Figure 61**.

Confused

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported feelings of confusion ($F(1,19) = .505, p = .486, \eta^2 = .026$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported feelings of confusion ($F(1,19) = 11.375, p = .255, \eta^2 = .067$). There was no significant interaction effect of condition on administration ($F(1,19) = .817, p = .377, \eta^2 = .041$). Post hoc pairwise comparison revealed no significant differences in average feelings of confusion between their pre ($M = 3.100$; $SD = 6.155$) and post ($M = 3.000$; $SD = 6.341$) sessions during their active cTBS session ($p = .906$) and their pre ($M = 3.000$; $SD = 4.519$) and post ($M = 1.850$; $SD = 2.519$) TMS session sham cTBS session ($p = .135$). See **Figure 62**.

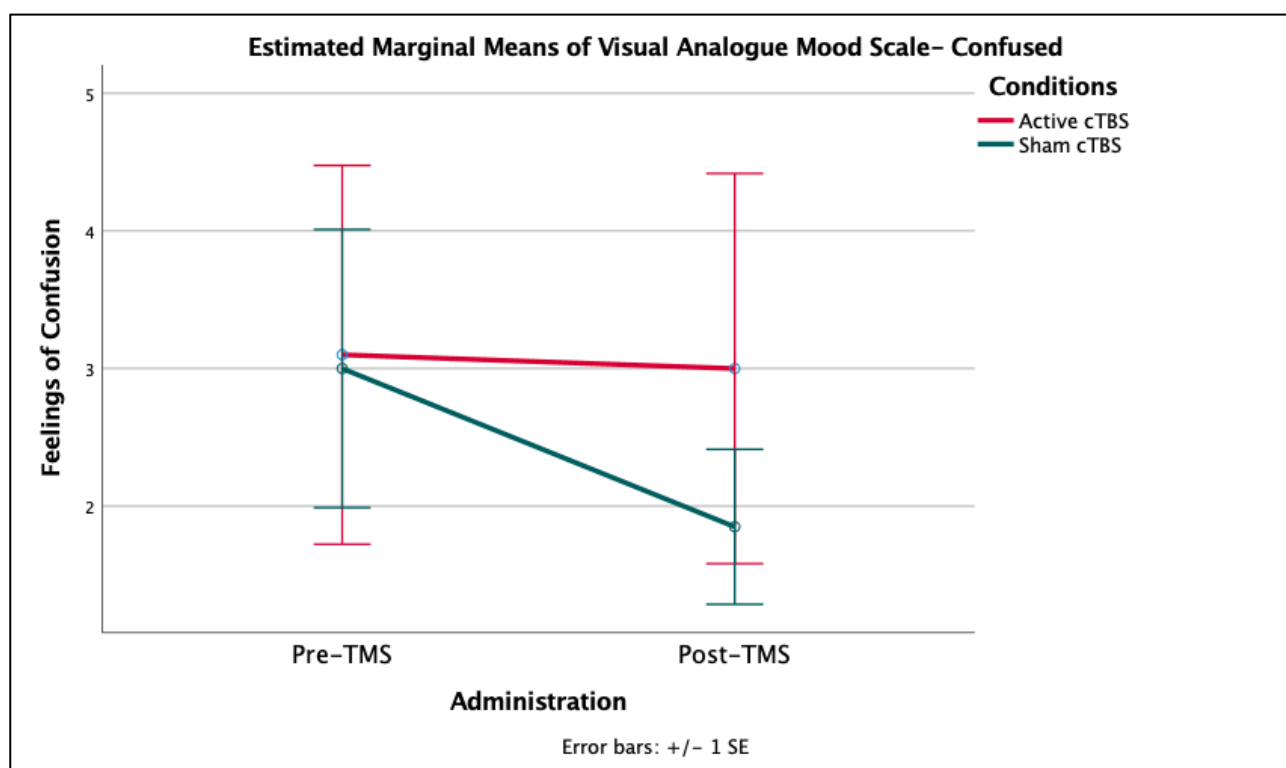


Figure 62. Total rating of confusion on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Sadness

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported depression ($F(1,19) = .000$, $p = .985$, $\eta^2 = .000$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported depression ($F(1,19) = .085$, $p = .774$, $\eta^2 = .004$). There was no significant interaction effect of condition on administration ($F(1,19) = .051$, $p = .824$, $\eta^2 = .003$). Post hoc pairwise comparison revealed no significant differences in feelings of sadness on any main or interaction effect ($p > .05$).

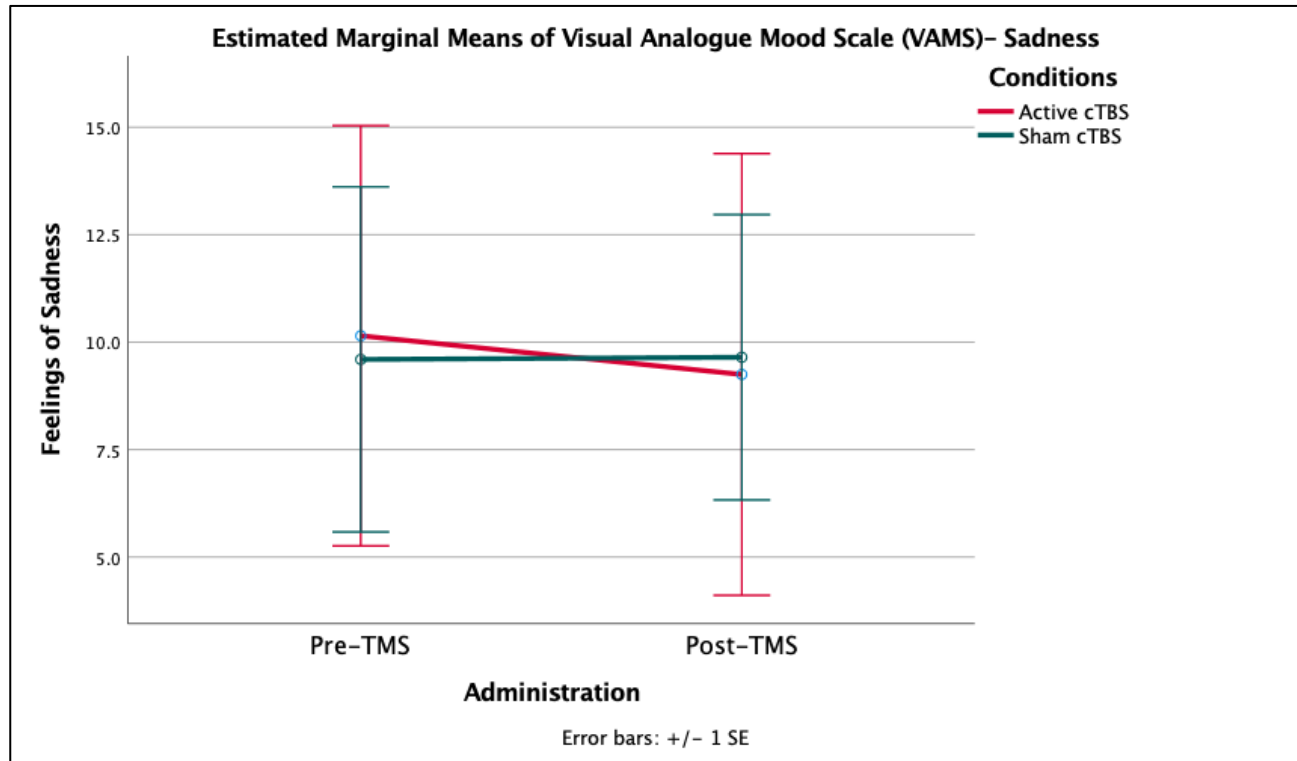


Figure 63. Total rating of sadness on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Angry

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported feelings of anger ($F(1,19) = 3.094, p = .095, \eta^2 = .140$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported feelings of anger ($F(1,19) = .408, p = .531, \eta^2 = .021$). There was no significant interaction effect of condition on administration ($F(1,19) = .086, p = .772, \eta^2 = .005$). Post hoc pairwise comparison revealed no significant differences in average feelings of anger for any main or interaction effects ($p > .05$). See **Figure 64**.

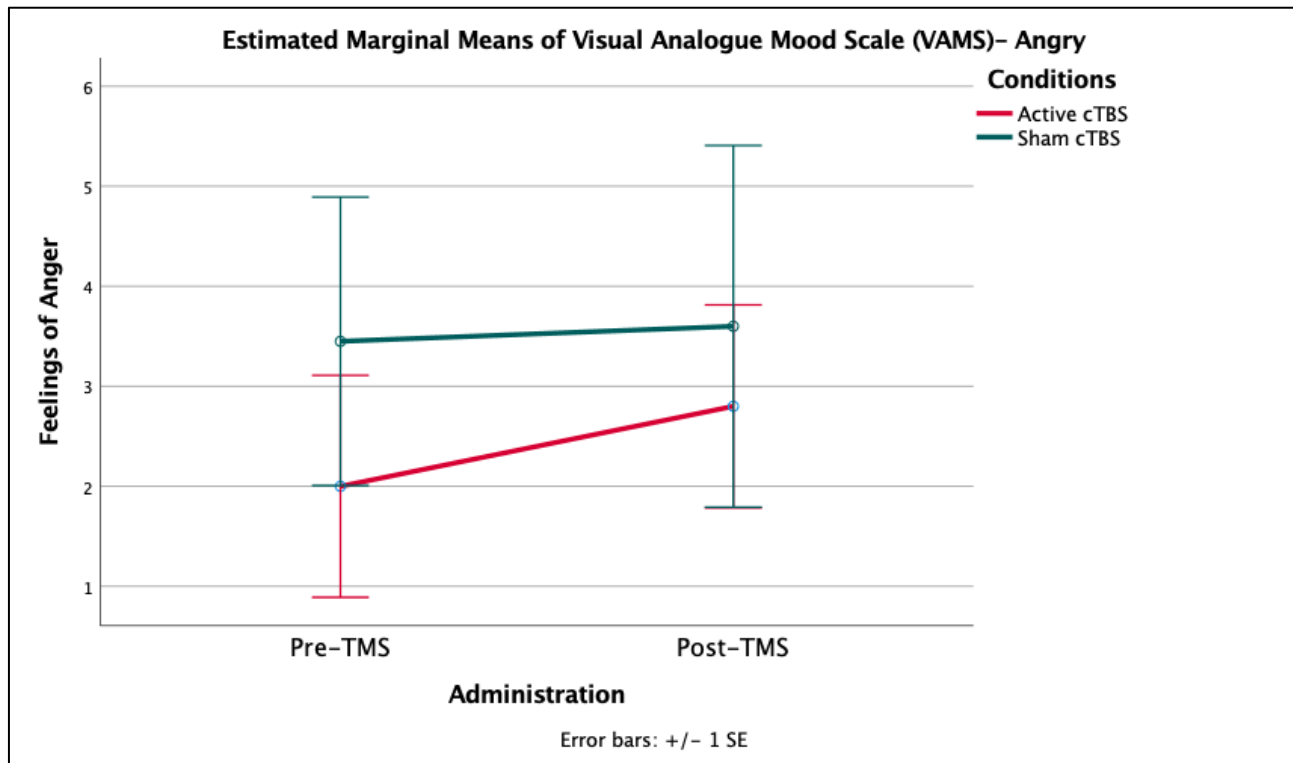


Figure 64. Total feelings of anger on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Energetic

Results: In our preliminary analyses, there was a significant effect of condition (active vs. sham cTBS) on reported energy levels ($F(1,19) = 5.036, p = .036, \eta^2 = .211$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported energy levels ($F(1,19) = .477, p = .498, \eta^2 = .025$). There was no significant interaction effect of condition on administration ($F(1,19) = .796, p = .383, \eta^2 = .040$). Post hoc pairwise comparison revealed that average levels of energy were significantly higher during participants ACTIVE cTBS session ($M = 33.075$; $SD = 24.870$) compared to their sham cTBS session ($M = 25.400$; $SE = 23.801$) ($p = .036$). While not statistically significant, participants reported higher energy levels pre-TMS administration during their ACTIVE cTBS session ($M = 35.450$; $SD = 27.841$) compared to their sham cTBS session ($M = 25.300$; $SD = 23.713$) ($p = .074$). Additionally, while not significant, posthoc comparisons suggest that participants reported higher levels of energy after TMS administration during their active cTBS session ($M = 30.700$; $SD = 26.672$) compared to their sham cTBS session ($M = 25.500$; $SD = 26.301$) ($p = .113$). See **Figure 65**.

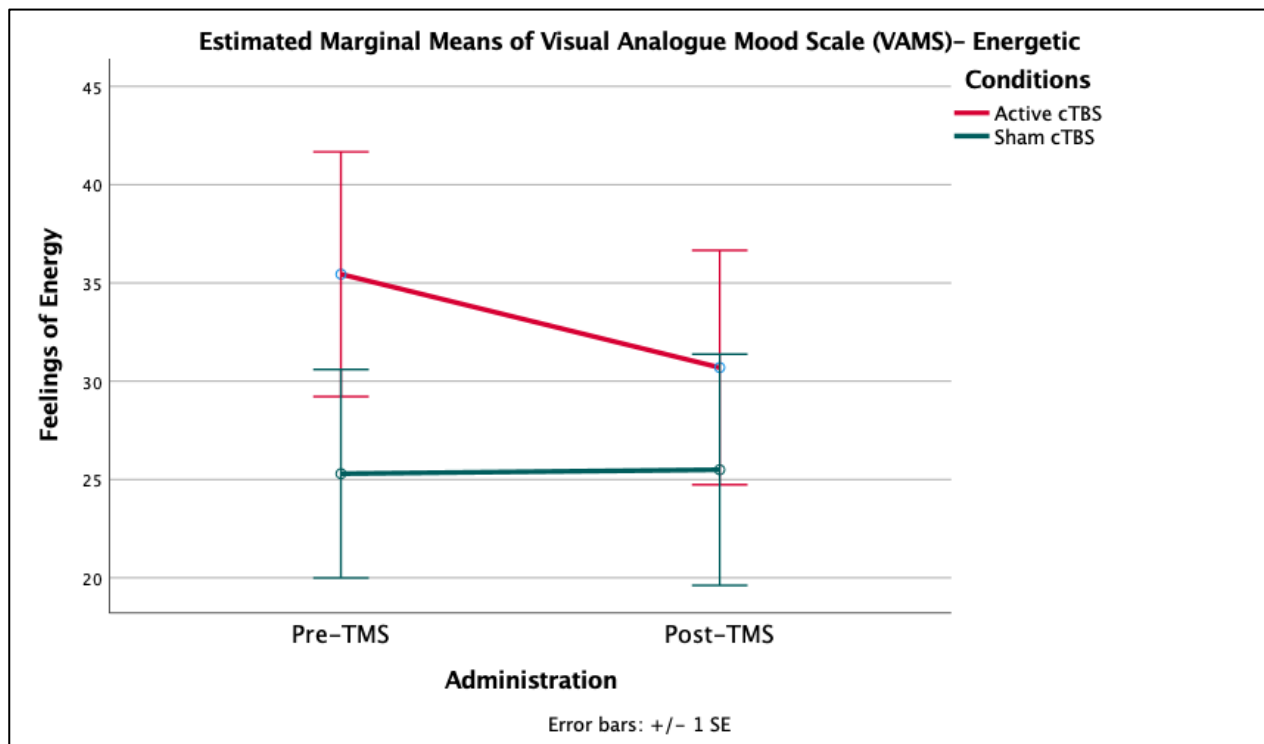


Figure 65. Total feelings of anger on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration). There was a significant main effect of condition on reported energy levels ($p=.036$). Participants reported higher levels of energy during their active cTBS session compared to their sham cTBS session ($p=.036$).

Tired

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported tiredness ($F(1,19) = .195$, $p = .664$, $\eta^2 = .010$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported depression ($F(1,19) = 2.397$, $p = .138$, $\eta^2 = .112$). There was no significant interaction effect of condition on administration ($F(1,19) = .358$, $p = .557$, $\eta^2 = .018$). Post hoc pairwise comparison revealed no significant differences in average reported tiredness for any main effect or interaction effect ($p > .05$). See **Figure 66**.

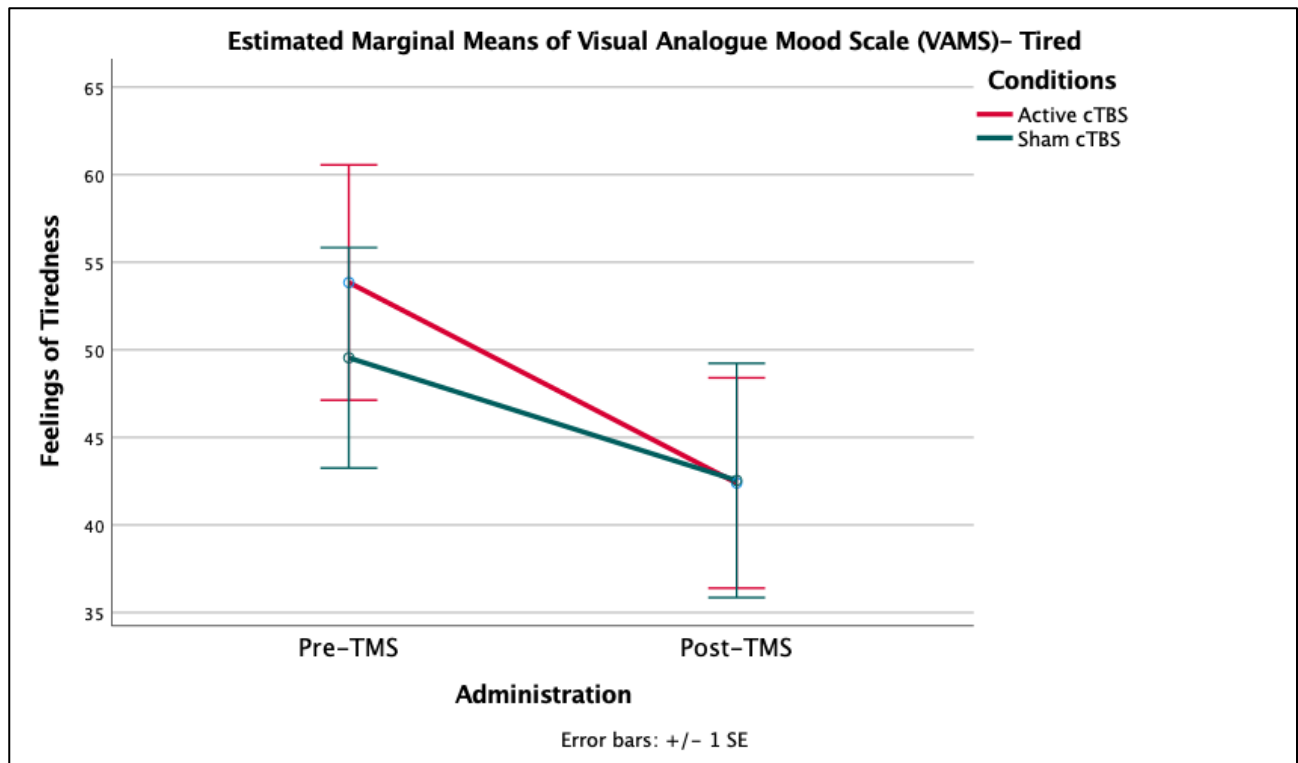


Figure 66. Total feelings of tiredness on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Happy

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported levels of happiness ($F(1,19) = .485, p = .495, \eta^2 = .025$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported depression ($F(1,19) = 2.254, p = .150, \eta^2 = .106$). There was no significant interaction effect of condition on administration ($F(1,19) = .049, p = .827, \eta^2 = .003$). Post hoc pairwise comparison revealed no significant differences in average feelings of happiness for any main or interaction effect ($p > .05$). See **Figure 67**.

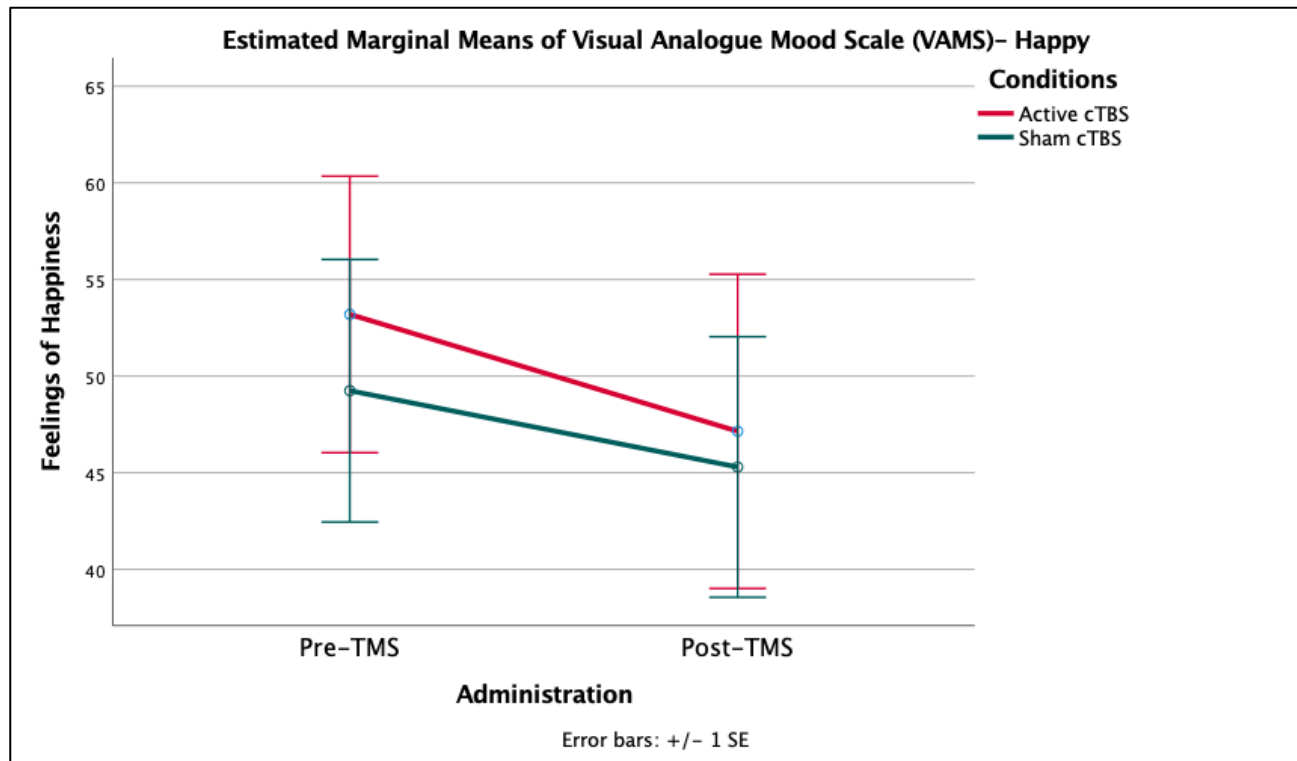


Figure 67. Total feelings of happiness on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Tense

Results: There was no significant effect of condition (active vs. sham cTBS) on reported feelings of being tense ($F(1,19) = .031, p = .863, \eta^2 = .002$). There was additionally no significant effect of administration (Pre-TMS vs. Post-TMS) on reported feelings of being tense ($F(1,19) = 2.788, p = .111, \eta^2 = .128$). There was no significant interaction effect of condition on administration ($F(1,19) = .041, p = .842, \eta^2 = .002$). Post hoc pairwise comparison revealed no significant differences in feeling tense for any main or interaction effect ($p > .05$). See **Figure 68**.

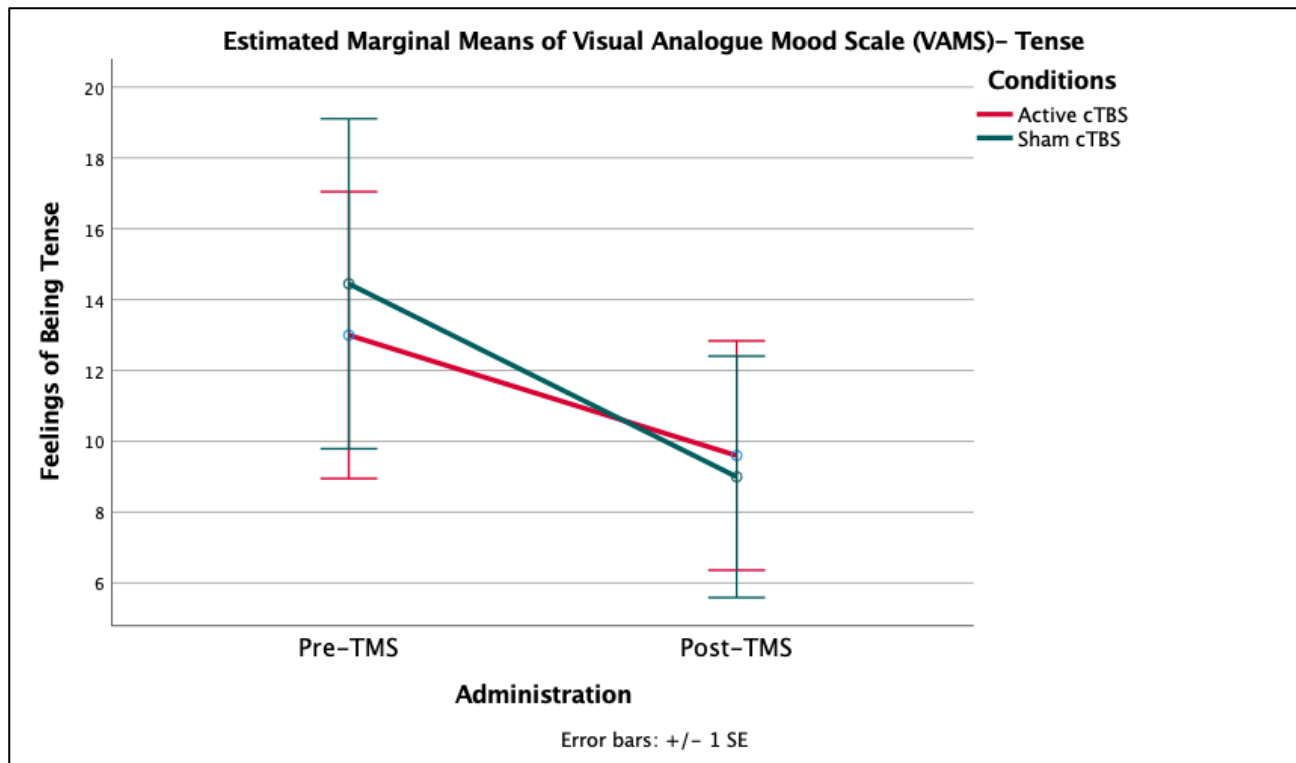


Figure 68. Total feelings of being tense on VAMS compared across both condition (active cTBS vs. sham cTBS) and administration (pre vs. post TMS administration).

Mood Outcomes: Summary and Conclusions. The administration of cTBS had no apparent effect on most mood measures. There was some evidence of a decline in depression scores with ACTIVE cTBS compared to SHAM, but overall, most mood variables were not affected by the procedure. **Conclusions:** The cTBS procedure used here did not meaningfully alter mood.

Impact of TMS on Additional Sleep Variables

Karolinska Sleepiness Scale

A secondary objective the study was to determine whether administration of cTBS impacted subjective sleepiness. We used the Karolinska Sleepiness Scale (KSS) to measure subjective sleepiness levels by the participants throughout the study. Higher scores on the KSS indicate greater levels of self-reported sleepiness [Range: 0-9]. We predicted that total sleepiness scores would significantly differ between participants during the ACTIVE cTBS and SHAM session after TMS administration and overnight sleep. We predicted that participants would report less sleepiness the morning after their ACTIVE cTBS session than their SHAM session.

Results: In our preliminary analyses, there was no significant effect of condition (active vs. sham cTBS) on reported subjective sleepiness ($F(1,19) = .124, p = .728, \eta^2 = .006$). There was no significant effect of session on reported sleepiness levels ($F(5,95) = 2.655, p = .057, \eta^2 = .123$), although there was a trend toward decreased sleepiness overall following a night of sleep. There was no significant interaction effect of condition and session on participants subjective sleepiness ($F(5,95) = .493, p = .665, \eta^2 = .025$). Post hoc pairwise comparison revealed there were no significant differences in mean reported sleepiness for any main or interaction effect ($p > .05$). See **Figure 69**.

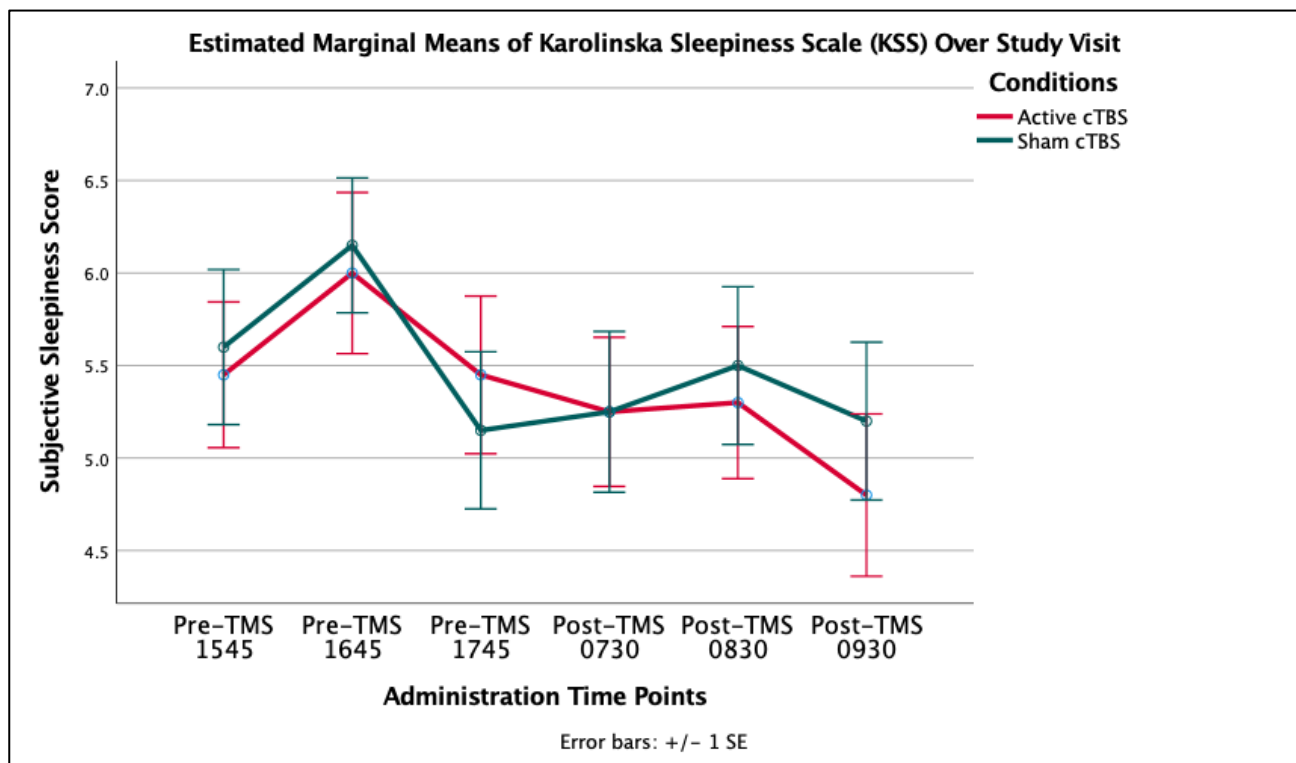


Figure 69. Total subjective sleepiness scores compared across both condition (active cTBS vs. sham cTBS) and administration.

Glasgow Content of Thoughts Inventory

A secondary aim the study is to determine whether a single rTMS cTBS stimulation would impact intrusive worry about sleep during the overnight PSG sleep session. We used the Glasgow Content of Thoughts Inventory (GCTI) to evaluate the content, character, and intrusiveness of cognitions in adults in the moments prior to sleep onset. Higher scores on the GCTI indicate higher frequency of intrusive cognitions prior to sleep [Range: 25-100]. Participants completed the GCTI at approximately 15:45 each afternoon before the in-lab overnight sleep session, and again at 07:45 the next morning, with specific reference to cognitions occurring during the prior night of sleep in the lab. We predicted that GCTI scores would not significantly differ between participants active cTBS session and sham cTBS session after TMS administration and overnight sleep.

Results: There was no significant effect of condition (active vs. sham cTBS) on reported intrusiveness of cognitions ($F(1,19) = .793, p = .384, \eta^2 = .040$). There was a significant effect of session on reported cognitions regarding sleep ($F(1,19) = 5.925, p = .025, \eta^2 = .238$). There was no significant interaction effect of condition and administration on GCTI scores ($F(1,19) = .501, p = .488, \eta^2 = .026$). Post hoc pairwise comparison revealed that participants reported higher GCTI scores post-TMS administration ($M = 50.900$; $SD = 10.510$) compared to pre-TMS administration ($M = 48.475$; $SD = 10.742$) ($p = .025$). Post hoc pairwise comparison revealed there were no significant differences in mean reported intrusiveness and frequency of cognitions during their active vs. sham cTBS sessions at any administration ($p > .05$). Post hoc pairwise comparison also revealed there were no significant differences in mean reported intrusiveness and frequency of

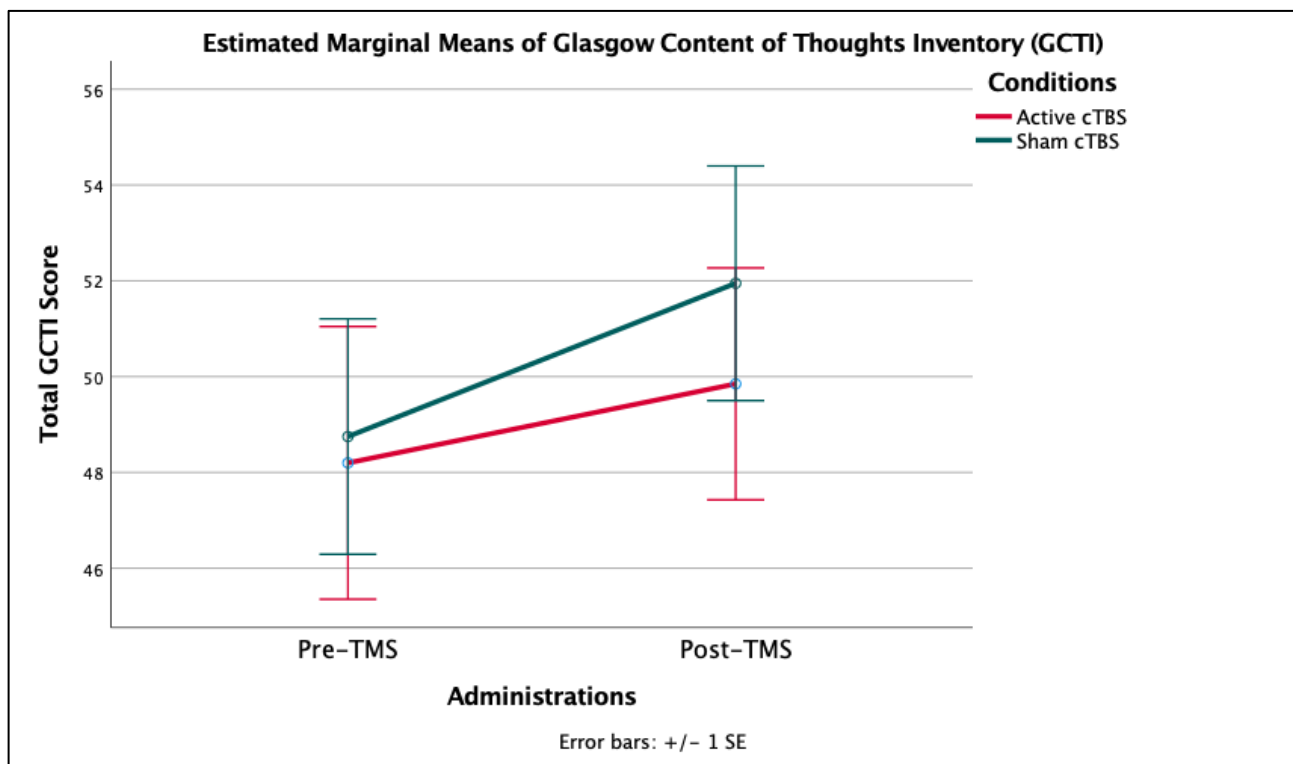


Figure 70. Total GCTI scores compared across both condition (active cTBS vs. sham cTBS) and administration (pre-TMS vs. post-TMS).

cognitions of participants within each participant active cTBS session or sham cTBS session ($p > .05$). See **Figure 70**.

Additionally, the GCTI also includes a specific scale that assesses intrusive cognitions related to sleep and wakefulness. We further examined these specific cognitions at the same time points. There was a medium effect size ($\eta_p^2 = .087$) but no significant difference ($p > .05$) in average sleep worry intrusion scores between participants sham cTBS ($M=19.100$, $SD=5.349$) and active cTBS ($M=18.200$, $SD=4.502$) Post-TMS sessions. However, there was a significant interaction between sex, cTBS/SHAM condition, and administration ($F(1,18) = 4.697$; $p = .044$; $\eta_p^2 = .207$). There was no significant effect of cTBS condition on reported intrusive thinking post-TMS administration ($F(1,7) = .628$; $\eta_p^2 = .082$; $p = .454$) for males. However, there was a significant interaction of cTBS condition on intrusive thoughts post-TMS administration for females ($F(1,11) = 5.894$; $\eta_p^2 = .349$; $p = .034$). Post-hoc pairwise comparison revealed that females reported significantly greater intrusive thinking about sleep issues post-SHAM administration ($M=20.167$, $SD=5.68$) compared to pre-SHAM administration ($M=17.5$, $SD=5.73$; $p = .042$). This was not present post-TMS administration during active cTBS ($p > .05$). This suggests that there was a decrease in intrusive thoughts relating to sleep and wakefulness in females, but not males, following active cTBS. Interestingly, we also observed an increase in intrusive thoughts only for the SHAM condition, suggesting that participants may have developed expectations of improvement and been sensitized to these cognitions when sleep was not improved. These findings are encouraging suggesting that cTBS may improve sleep-related worries, although preliminary data suggest this may differ between males and females.

Subjective Sleepiness and Intrusive Thoughts Outcomes: Summary and Conclusions. The administration of cTBS had no apparent effect on subjective sleepiness or intrusive cognitions following a night of post-treatment sleep. There was some preliminary evidence that ACTIVE cTBS was associated with lower post-treatment worry about sleep issues compared to SHAM, but only among females. Conclusions: The cTBS procedure used here did not meaningfully alter subjective sleepiness or intrusive thoughts.

Post-TMS Administration Side Effects

A secondary objective the study is to determine whether administration of active cTBS produced any significant side effects. To assess this, we developed a post-TMS assessment questionnaire to evaluate negative impact of stimulation on somatic, mood, and cognitive symptoms after TMS administration. Each symptom was simply rated as present [1] or absent [0]. Higher scores on the post-TMS symptom questionnaire indicate presence of symptoms after TMS administration [Range: 0-1 per item]. We predicted that active cTBS would not produce significantly more side effects during participant's ACTIVE cTBS and sham cTBS sessions.

Results: McNemar's test analyses indicated there was no significant difference in the proportion of reported side effects during active cTBS and sham cTBS post-TMS administration to include loss of consciousness, headache, neck pain, scalp pain, jaw pain, toothache, changes in hearing, trouble thinking, mood change, other changes, and thoughts of suicide ($p = 1.00$). The number of participants (out of $n = 20$) endorsing each symptom during the ACTIVE and SHAM conditions is presented in **Figure 71**. As seen in the figure, headache was the most common symptom reported, but did not differ between ACTIVE ($n = 2$) and SHAM ($n = 2$) conditions. Neck pain

was reported by one participant following the ACTIVE stimulation and two participants following the SHAM stimulation. Also, there was one report of jaw pain, trouble thinking, and mood change following the ACTIVE condition.

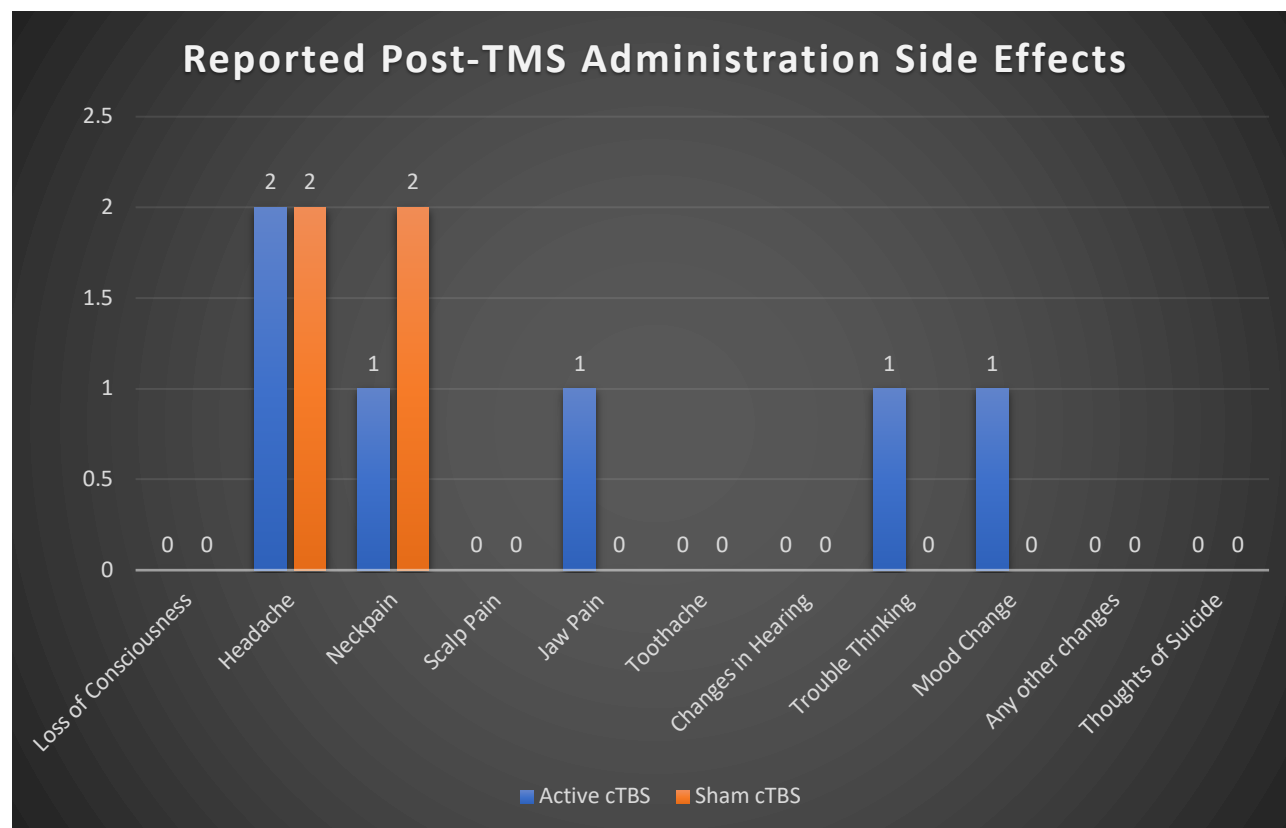


Figure 70. Self-reported side effects after cTBS TMS administration experienced by participants. There were no significant differences in reported side effects between active cTBS and sham conditions.

Symptom Complaint Outcomes: Summary and Conclusions. Side effect complaints were rare and did not differ significantly between ACTIVE and SHAM conditions. Conclusions: The ACTIVE cTBS procedure used here did not induce significant adverse side effects relative to SHAM.

Other Achievements:

What opportunities for training and professional development has the project provided?

Although not a primary research goal of the study, this project provided training and professional development for students, staff, and researchers involved in the project. Training and professional development opportunities associated with this project are listed below in reverse chronological order.

10 members of our lab submitted and had abstracts accepted for the annual SLEEP Conference, June 2023

7 members of our lab presented research findings at the remote International Neuropsychological Society, February 2-5, 2023.

4 undergraduate students were supervised for their Senior Honors Thesis' in our lab.

7 undergraduate students were supervised for their research credit in our lab.

1 graduate student was supervised for his Master's Thesis in our lab.

1 postdoctoral fellow was supervised in our lab.

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.

All members of our lab receive regular one-on-one instruction and supervision in the administration and scoring of neuro-psychological assessments, psycho-diagnostic testing, electrode placement, and patient interviewing to ensure best data collection practices.

Over 20 members of our lab have undergone basic training modules in ethical conduct, statistical analysis, and PSG application. All paid lab staff members have been certified in CPR and basic life support and first aid.

How were the results disseminated to communities of interest?

Findings have been submitted in abstract form to multiple scientific conferences, including the Annual Meeting of the International Neuropsychological Society, the Society for Brain Mapping

and Therapeutics, the Associated Professional Sleep Societies (SLEEP) Meeting, and the Military Health Systems Research Symposium (MHSRS).

Additionally, the findings were discussed at a local educational event for children interested in neuroscience in Tucson, known as “The Brain Bus.” This effort was led by one of the study team members, Kimberly Henderson-Arredondo.

Manuscripts describing the outcomes of this project are currently being prepared and should be submitted for publication in the coming months.

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

If this is the final report, state “Nothing to Report.”

Nothing to Report. This is the final report.

4. IMPACT:

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

Although the funding period for this Discovery Award has just concluded, the impacts of the research on the field of sleep and insomnia are just beginning to be realized. These include:

- 1) We propose a novel model of insomnia and its treatment. This is the first study of its type to explore the role of the DMN on brain function and sleep outcomes in insomnia and to modulate these outcomes with continuous theta burst suppression. Prior insomnia research has focused nearly entirely on using TMS to stimulate the dorsolateral prefrontal cortex. Our approach is unique and is based on an entirely different hypothesis about the mechanisms underlying insomnia. We propose that one mechanism of insomnia is excessive DMN activation/connectivity, which could sustain self-directed cognition and “self-talk” at a level that makes it difficult for sleep onset to occur. If successful, this model of DMN over-activation could provide a novel approach for understanding some forms of insomnia and could lead to further research and significant advancements in theory and treatment.
- 2) Our cTBS approach successfully modulates the brain systems hypothesized to contribute to insomnia. Our findings showed that a single 40-second cTBS train to the left lateral node of the DMN was effective at altering within-network connectivity. This will likely impact the field by showing that a pulse of cTBS to an easily accessible node of the DMN can propagate throughout the entire DMN.

- 3) Our findings suggest that extremely brief DMN stimulation with cTBS appears to produce significant improvements in objectively measured sleep, including Total Sleep Time, shorter latency to N3 deep sleep, improved Sleep Efficiency, and reduced Arousal Index, as well as trend level improvements in Rapid Eye Movement and total number of arousals. With further research, this approach has the potential to yield an alternative method for improving sleep in people with insomnia. Importantly, for this small pilot sample, many of the effect sizes are in the large range, and are larger than those reported for pharmacologic (e.g., eszopiclone)(Krystal et al., 2012) and psychological treatments for insomnia (Dautovich et al., 2010; van Straten et al., 2018), which bodes well for the viability of these findings for larger trials with sufficiently powered statistical analyses.
- 4) Our findings also showed that stimulation of the DMN with cTBS produced downstream effects on additional connected regions, including the right globus pallidus, supplementary motor cortex, and right parietal operculum. Importantly, modulation of these regions showed significant associations with subsequent sleep outcomes on PSG. These findings provide further understanding of the potential neural mechanisms underlying insomnia and sleep quality.

What was the impact on other disciplines?

While these findings are most likely to impact current neurobiological theories of insomnia and potentially lead to methods for treating insomnia, it is likely that the outcomes will also have broader impact on related fields. These include:

- 1) Potential impact on countermeasures to sleep loss. Although we focused on development of a method for enhancing sleep, the findings that emerge from this preliminary study could also be utilized to improve non-pharmacologic methods for enhancing alertness and cognition. While improved sleep would be important in these areas, it is quite conceivable that reverse modulation of these same regions could facilitate resilience against sleep loss during periods requiring sustained wakefulness.

What was the impact on technology transfer?

Our team is currently working with TechLaunch Arizona to submit an invention disclosure for this approach. We foresee this novel approach to insomnia as having long-term impact on technology transfer and could eventually lead to a patentable approach to using cTBS as an intervention for insomnia. We have applied for an Expansion Award in August 2022 to allow us to further expand

this approach into a viable treatment option for the military. Such an award would allow us to determine the effect of multiple cTBS administrations over a 2-week period on PSG sleep and to identify the optimal DMN node of stimulation to obtain maximal benefits. We are awaiting notice on the status of that application.

What was the impact on society beyond science and technology?

As this study has just concluded, the larger impact on society remains to be seen. However, insomnia is one of the most prevalent health issues in the world and is associated with significant impairments in health and wellbeing among millions of people. Moreover, sleep problems affect approximately 85% of military personnel, with approximately 25% having a primary complaint of insomnia. Our approach is novel and, with appropriate follow-on research and development, has the potential to significantly improve insomnia as well or better than current pharmacologic and behavioral treatments that are considered to be the clinical standard of care. If follow-on work is successful, treatments emerging from this work could have a substantial and meaningful impact on sleep and health.

5. CHANGES/PROBLEMS:

Changes in approach and reasons for change

Nothing to Report.

Actual or anticipated problems or delays and actions or plans to resolve them

The COVID-19 pandemic emerged just before this project received funding. The study got underway during a period of university shutdown and eventual implementation of COVID precautions for research. Eventually, due to funding shortfalls, most of the laboratory team was also dismissed from employment. Consequently, the project had to be carried out with a severely limited staff.

Changes that had a significant impact on expenditures

Nothing to Report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

Due to the COVID-19 pandemic, increased human protections were implemented, including the mandatory use of face masks in all participant areas, barrier protection during cognitive testing, and enhanced disinfection protocols for the sleep and MRI facilities.

Significant changes in use or care of vertebrate animals

Not Applicable.

Significant changes in use of biohazards and/or select agents

Nothing to Report.

6. PRODUCTS:**Publications, conference papers, and presentations****Journal publications.**

Nothing to Report. The project just concluded and manuscripts are currently in preparation.

Books or other non-periodical, one-time publications.

Nothing to Report.

Other publications, conference papers and presentations. /

Killgore, WDS, Jankowski, S, Henderson-Arredondo, K, Trapani, C, Elledge, H, Lucas,

DA, Le, A, Suckow, EJ, Hildebrand, L, Persich, M, Zahorecz, Salazar, C, Watson, T, Wellman, C, Reign, D, Chen, YC, Chou, YH, & Dailey, NS. Continuous theta burst stimulation (cTBS) over the inferior parietal cortex decreases default mode connectivity and improves overnight sleep in people with insomnia. Abstract accepted for presentation at the 51st North American Meeting of the International Neuropsychological Society, San Diego, CA, February 1-4, 2023.

Killgore, WDS. Transcranial Magnetic Stimulation of the default mode network to improve sleep: A preliminary Trial. Abstract accepted for presentation at the Military Medicine and Veteran Health Track, Society for Brain Mapping and Therapeutics 2023, San Diego, CA, February 16-19, 2023.

Killgore, WDS, Jankowski, S, Henderson-Arredondo, K, Hildebrand, L, Trapani, C, Lucas, DA, Suckow, EJ, Desai, S, Reich-Fuehrer, Franca, G, Reign, D, Huskey, A, Chen, YC, Chou, YH, & Dailey, NS. Improving sleep with continuous theta burst transcranial magnetic stimulation (TMS) of the default mode network. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Killgore, WDS, Jankowski, S, Henderson-Arredondo, K, Hildebrand, L, Elledge, H, Lucas, D, & Dailey, NS. Functional connectivity of brain networks predicts polysomnographically measured sleep. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Desai, S, Hildebrand, L, Reich-Fuehrer, M, Grandner, MA, & **Killgore, WDS.** Sex differences in the effects of TMS on depression. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Reich-Fuehrer, M, Hildebrand, L, Jankowski, S, Henderson-Arredondo, K, Trapani, C, Franca, G, Desai, S, Patel, SI, Chen, YC, Chou, YH, Dailey, NS, & **Killgore, WDS.** Effects of transcranial magnetic stimulation (TMS) on treatment of intrusive thinking in insomniac populations. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Franca, G, Hildebrand, L, Jankowski, S, Henderson-Arredondo, K, Trapani, C, Patel, SI, Chen, YC, Chou, YH, Dailey, NS, & **Killgore, WDS.** A preliminary study of the effects of continuous theta burst stimulation of the default mode network on subjective sleepiness before and after a night of sleep. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Hildebrand, L, Jankowski, S, Henderson-Arredondo, K, Trapani, C, Patel, SI, Chen, YC, Chou, YH, Dailey, NS, & **Killgore, WDS**. Continuous theta burst transcranial magnetic stimulation for insomnia and its effects on verbal recall performance. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Hildebrand, L, Jankowski, S, Henderson-Arredondo, K, Trapani, C, Patel, SI, Chen, YC, Chou, YH, Dailey, NS, & **Killgore, WDS**. Continuous theta burst transcranial magnetic stimulation and signal detection performance on a military go/no-go task. Abstract submitted for presentation at the 2023 Annual SLEEP Conference, Indianapolis, IN, June 3-7, 2023.

Website(s) or other Internet site(s)

Nothing to Report.

Technologies or techniques

The stimulation site and technique used in this project represents a unique approach. The present approach utilized a specific stimulation site in the left inferior parietal cortex using cTBS [MNI coordinates: $x = -48$, $y = -61.5$, $z = 32.5$]. This stimulation site is displayed in **Figure 72**, which shows the DMN as reflected in the Yeo-Buckner Atlas.

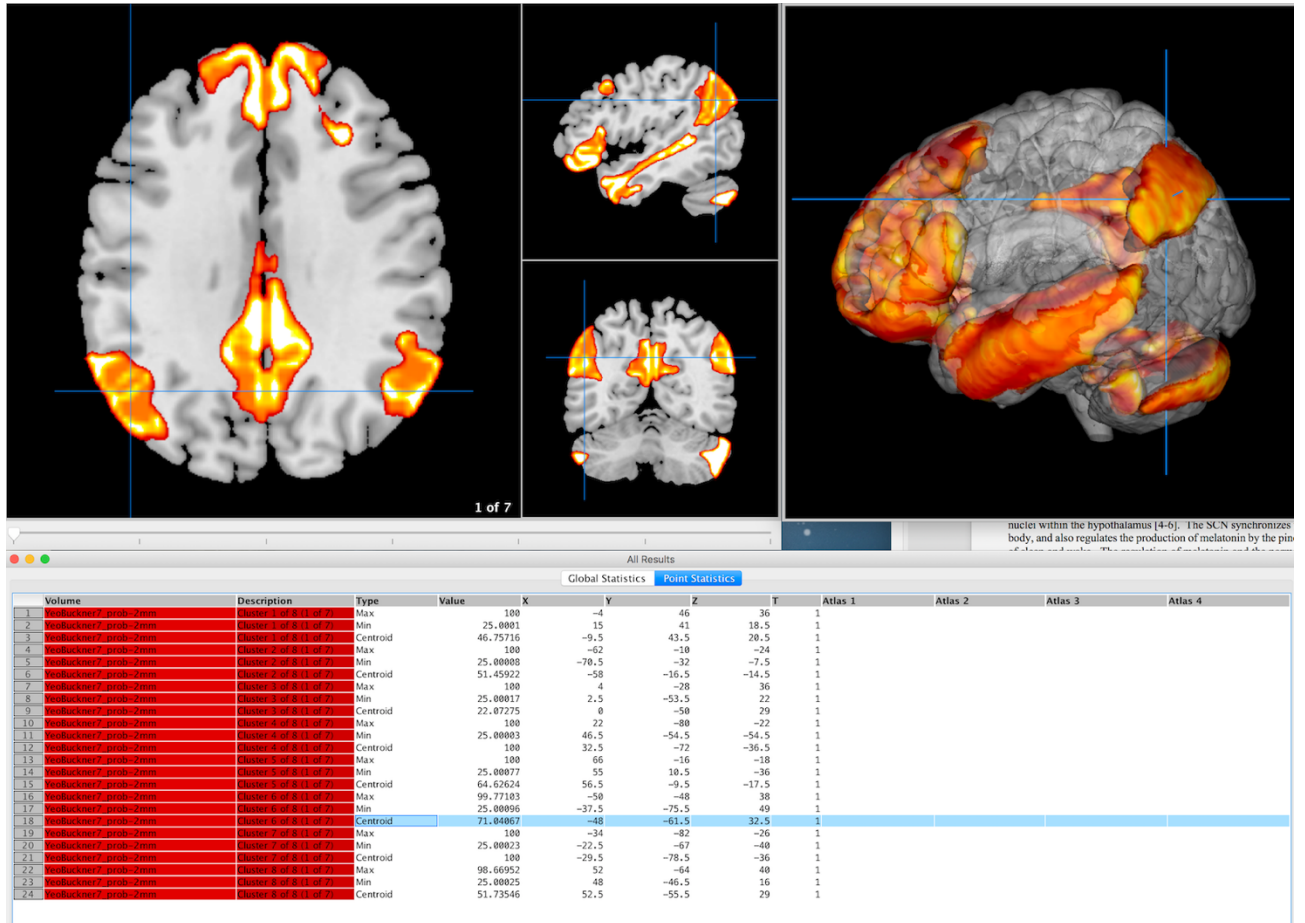


Figure 71. 3D map showing the location of the default mode network extracted from the Yeo-Buckner atlas. The atlas was downloaded into the visualization software Mango and the centroid coordinates were extracted for each cluster area. We selected the centroid of the left inferior parietal cluster for stimulation in this project

For the active condition, we used a single non-invasive continuous theta burst stimulation (cTBS) paradigm as the treatment protocol. The cTBS (600 stimuli/per session) suppresses neural activity (40 seconds). A MagVenture MagPro X100 stimulator (MagVenture Inc. Denmark) connected with a figure-of-eight magnetic coil with active cooling will be used for the TBS protocol. Each individual is expected to have a different sensitivity to the magnetic fields generated by the cTBS, and the stimulation intensity was adjusted based on each individual's resting motor threshold (RMT). The RMT was defined as the lowest intensity required to elicit at least five motor-evoked potentials of 50 μ V peak-to-peak amplitude of the right abductor pollicis brevis (APB) muscle measured with an electromyography machine in 10 consecutive stimulations when the single-pulse TMS is delivered to the hand-knob of the left-hemisphere primary motor cortex. Once the RMT was identified, the stimulation intensity for cTBS was set to 70% of each participant's RMT. We located a pre-determined surface stimulation site, by focusing stimulation on a surface node in the IPL or the dmPFC localized by co-registering the participant's head, structural T1-weighted MRI image, and TMS coil in the same space using a TMS 3D Neuronavigation System. Once co-registration was complete, the Neuronavigation system provided real-time feedback of the coil location and record the

coil position and orientation relative to the head. The cTBS will be applied using a figure-of-eight coil with an active cooling system connected to the MagPro magnetic stimulator (MagVenture Cool-B65). The coil includes two sides, one that is active and one that is sham. Therefore, for the sham condition, the non-active side of the same coil was used. Thus, the procedure and stimulation protocol were exactly the same, but stimulation was not administered to the participant on sham/placebo trials. Blinding was ensured by a coding system placed on the stimulation coil prior to the session that tells the technician which side of the coil to use for each administration.

Inventions, patent applications, and/or licenses

Nothing has been submitted at the time of this report. We do plan to submit an invention disclosure in the coming weeks.

Other Products

Nothing to Report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name: Dr. William “Scott” Killgore

Project Role: Principal investigator

Nearest person month worked: 15

Contribution to project: Dr. Killgore oversaw all study activities, including MRI parameter development, IRB amendments, and data collection.

Name: Dr. Ying-Hui Chou
Project Role: Co-Investigator
Nearest person month worked: 15
Contribution to the project: Dr. Chou oversaw all TMS activities including staff training, protocol development, and administration.

Name: Dr. Natalie Dailey
Project Role: Research Scientist
Nearest person month worked: 12
Contribution to project: Dr. Dailey assisted with research personnel training efforts, MRI data collection and preprocessing.

Name: Samantha Jankowski
Project Role: Research Technician
Nearest person month worked: 12
Contribution to project: Ms. Jankowski coordinated research personnel training, developed materials for IRB amendments, conducted phone screenings, ran enrollment visits, and assisted with data collection during overnight visits.

Name: Kimberly Henderson-Arredondo
Project Role: Research Technician
Nearest person month worked: 5
Contribution to project: Ms. Henderson trained on all study procedures, helped to develop materials for IRB amendments, conducted phone screenings, assisted with recruitment activities, ran enrollment visits, and assisted with data collection during overnight visits.

Name: Dr. Michelle Persich
Project Role: Postdoctoral Fellow
Nearest person month worked: 5
Contribution to project: Dr. Persich assisted with data collection during overnight visits and developed materials for IRB amendments.

Name: Christopher Trapani
Project Role: TMS Technician
Nearest person month worked: 5
Contribution to project: Ms. Trapani assisted with TMS training and administration of TMS during overnight visits.

Name: Camryn Wellman
Project Role: Student Research Technician
Nearest person month worked: 5
Contribution to project: Ms. Wellman assisted with recruitment activities, ran enrollment visits, and developed materials for IRB amendments.

Name: Daniel Lucas
Project Role: Student Research Technician

Nearest person month worked: 7

Contribution to project: Mr. Lucas assisted with recruitment activities and data collection during overnight visits.

Name: Shivani Desai

Project Role: Research Assistant

Nearest person month worked: 4

Contribution to project: Ms. Desai assisted with recruitment activities and data collection during overnight visits.

Name: Emmett Suckow

Project Role: Research Assistant

Nearest person month worked: 4

Contribution to project: Mr. Suckow assisted with recruitment activities and data collection during overnight visits.

Name: Andrew Le

Project Role: Research Assistant

Nearest person month worked: 3

Contribution to project: Mr. Le assisted with data collection for overnight visits.

Name: Lindsey Hildebrand

Project Role: Research Assistant

Nearest person month worked: 4

Contribution to project: Ms. Hildebrand assisted with recruitment activities, ran enrollment visits, performed data collection during overnight visits, and developed materials for IRB closure report.

Name: Deva Reign

Project Role: Research Assistant

Nearest person month worked: 3

Contribution to project: Mr. Reign assisted with data collection during overnight visits.

Name: Brianna Zahorecz

Project Role: Research Assistant

Nearest person month worked: 3

Contribution to project: Ms. Zahorecz assisted with data collection for enrollment visits and overnight visits.

Name: Tyler Watson

Project Role: Research Assistant

Nearest person month worked: 3

Contribution to project: Mr. Watson assisted with data collection for enrollment visits and overnight visits.

Name: Cohelly Salazar

Project Role: Research Assistant

Nearest person month worked: 3

Contribution to project: Ms. Salazar assisted with data collection for enrollment visits and overnight visits.

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

Since the last reporting period, the PI has received 2 pending awards:

W81XWH-22-10862

A Head-to-Head Comparison of the 2B-Alert Caffeine Optimization Algorithm versus Standard Caffeine Dosing on Performance During Sleep Deprivation

W81XWH-22-10990

Regulating Mood and Suicidal Ideation with Morning Light Exposure Treatment

What other organizations were involved as partners?

Nothing to Report.

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS:

QUAD CHARTS:

9. APPENDICES:

	Page
References.....	83
Questionnaires & Examples of Computer-Administered Tasks.....	85
Publications.....	143
William D.”Scott” Killgore, Ph.D Curriculum Vitae.....	156

References

- Dautovich, N. D., McNamara, J., Williams, J. M., Cross, N. J., & McCrae, C. S. (2010). Tackling sleeplessness: Psychological treatment options for insomnia. *Nat Sci Sleep*, 2, 23-37. <https://www.ncbi.nlm.nih.gov/pubmed/23616696>
- Krystal, A. D., McCall, W. V., Fava, M., Joffe, H., Soares, C. N., Huang, H., Grinell, T., Zummo, J., Spalding, W., & Marshall, R. (2012). Eszopiclone Treatment for Insomnia. *The Primary Care Companion For CNS Disorders*. <https://doi.org/10.4088/PCC.11m01296>
- Mysliwiec, V., McGraw, L., Pierce, R., Smith, P., Trapp, B., & Roth, B. J. (2013). Sleep disorders and associated medical comorbidities in active duty military personnel. *Sleep*, 36(2), 167-174. <https://doi.org/10.5665/sleep.2364>
- Raichle, M. E., MacLeod, A. M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. *Proceedings of the National Academy of Sciences of the United States of America*, 98(2), 676-682. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=11209064
- van Straten, A., van der Zweerde, T., Kleiboer, A., Cuijpers, P., Morin, C. M., & Lancee, J. (2018). Cognitive and behavioral therapies in the treatment of insomnia: A meta-analysis. *Sleep medicine reviews*, 38, 3-16. <https://doi.org/10.1016/j.smr.2017.02.001>

Transcranial Magnetic Stimulation of the Default Mode Network to Improve Sleep

W81XWH2010173 (PR192753)



PI: Dr. William D. "Scott" Killgore

Org: University of Arizona

Award Amount: \$306,995

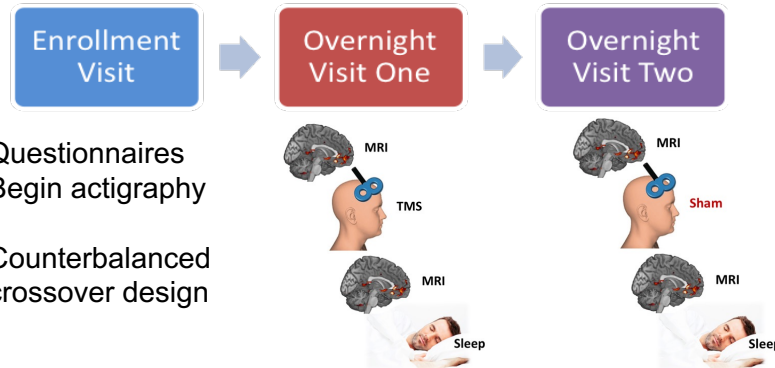
Study/Product Aim(s)

Specific aim: Determine the effects of cTBS targeted to the DMN on sleep quality, brain neurochemistry, functional connectivity, and next-day cognitive performance.

- **Major Task 1:** Obtain IRB/HRPO Approval, Hire Staff, and Procure Equipment
- **Major Task 2:** Collect data using randomized counterbalanced crossover design
- **Major Task 3:** Analyze data and disseminate results

Approach

The present study will investigate the efficacy of a non-pharmacological method of alleviating insomnia by administering either continuous theta burst (cTBS) transcranial magnetic stimulation (TMS) or sham stimulation, in a counterbalanced crossover design, to 20 volunteers (aged 19-39; 8 males, 12 females) with self-reported sleep problems.



Accomplishments: Study successfully completed, data analyzed, abstracts submitted, and final report completed.

Outcomes: cTBS significantly improves total sleep time, sleep efficiency, latency to N3, and reduces arousal index. Sleep improvements were associated with changes in DMN brain connectivity, without adverse physical or cognitive side effects

Timeline and Cost

Activities	CY	20	21	22	
Obtain IRB/HRPO approval, train study staff and procure equipment					
Collect data					
Analyze data and disseminate results					
Estimated Budget (\$K)		\$51K	\$154K	\$102K	

Goals/Milestones

CY20 Goal – Regulatory approvals

- ☑ Obtain IRB and HRPO approvals

CY21 Goals – Study startup and data collection

- ☑ Train study staff
- ☑ Procure equipment
- ☑ Collect active/sham data for $n = 20$ poor sleepers

CY22 Goal – Analyze data and disseminate results

- ☑ Perform statistical analyses
- ☑ Publish findings and submit final report

Comments/Challenges/Issues/Concerns

- Although COVID-19 impacted recruitment and staffing, we were able to complete enrollment and data collection by project deadline.

Budget Expenditure to Date

Expenditure: \$306,995

Updated: 29 DEC 2022

Disturbing Dream and Nightmare Severity Index

1. How often do you have disturbing dreams and/or nightmares: (Circle one, then follow the arrow)

→ Never → → Yearly → → Monthly → → Weekly →	STOP HERE: NO OTHER QUESTIONS NEED TO BE ANSWERED	
How many NIGHTS in a week do you have disturbing dreams and/or nightmares? 1 2 3 4 5 6 7	How many NIGHTS in a month do you have disturbing dreams and/or nightmares? 1 2 3	How many NIGHTS in a year do you have disturbing dreams and/or nightmares? 1 2 3 4 5 6 7 8 9 10 11
How many disturbing dreams and/or nightmares do you have in a week? _____	How many disturbing dreams and/or nightmares do you have in a month? _____	How many disturbing dreams and/or nightmares do you have in a year? _____
GO TO QUESTION #2		STOP HERE

2. Please estimate the NUMBER of months or years you have had disturbing dreams and/or nightmares:

_____ months _____ years

3. On average, do your nightmares wake you up? (Circle answer)

Never/Rarely Occasionally Sometimes Frequently Always

4. How would you rate the SEVERITY of your disturbing dreams and/or nightmare problem? (Circle answer)

No Problem Minimal Problem Mild Problem Moderate Problem Severe Problem Very Severe Problem Extremely Severe Problem

5. How would you rate the INTENSITY of your disturbing dreams and/or nightmares? (Circle answer)

Not Intense Minimal Intensity Mild Intensity Moderate Intensity Severe Intensity Very Severe Intensity Extremely Severe Intensity

Disturbing Dream and Nightmare Severity Index (cont.)

6. My disturbing dreams or nightmares cause me to lose sleep:

Not at All Slightly Moderately Very Much A Great Deal

7. My disturbing dreams or nightmares make it difficult to fall asleep:

Not at All Slightly Moderately Very Much A Great Deal

8. My disturbing dreams or nightmares interfere with the quality of my sleep:

Not at All Slightly Moderately Very Much A Great Deal

9. My disturbing dreams or nightmares make it difficult to sleep through the night:

Not at All Slightly Moderately Very Much A Great Deal

10. My disturbing dreams or nightmares interfere with my mood:

Not at All Slightly Moderately Very Much A Great Deal

11. My disturbing dreams or nightmares interfere with my mental health:

Not at All Slightly Moderately Very Much A Great Deal

12. My disturbing dreams or nightmares interfere with my physical health:

Not at All Slightly Moderately Very Much A Great Deal

13. My disturbing dreams or nightmares interfere with social or recreational activities:

Not at All Slightly Moderately Very Much A Great Deal

14. My disturbing dreams or nightmares interfere with my school or work performance:

Not at All Slightly Moderately Very Much A Great Deal

15. My disturbing dreams or nightmares interfere with my relationships:

Not at All Slightly Moderately Very Much A Great Deal

FOSQ

Study ID _____

Date _____

Some people have difficulty performing everyday activities when they feel tired or sleepy. The purpose of this questionnaire is to find out if you generally have difficulty carrying out certain activities because you are too sleepy or tired. In this questionnaire, when the words “sleepy” or “tired” are used, it means the feeling that you can’t keep your eyes open, your head is droopy, that you want to “nod off”, or that you feel the urge to take a nap. These words do not refer to the tired or fatigued feeling you may have after you have exercised.

Please circle one answer for each question. Please try to be as accurate as possible.

0 – I don’t do this activity for other reasons

1 – No difficulty

2 – Yes, a little difficulty

3 – Yes, Moderate difficulty

4 – Yes, Extreme difficulty

- | | | | | | |
|---|---|---|---|---|---|
| 1. Do you generally have difficulty concentrating on things you do because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 2. Do you generally have difficulty remembering things because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 3. Do you have difficulty finishing a meal because you become sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 4. Do you have difficulty working on a hobby (for example: sewing, collecting, gardening) because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 5. Do you have difficulty doing work around the house (for example: cleaning house, doing laundry, taking out the trash, repair work) because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 6. Do you have difficulty operating a motor vehicle for short distances (less than 100 miles) because you become sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 7. Do you have difficulty operating a motor vehicle for long distances (greater than 100 miles) because you become sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 8. Do you have difficulty getting things done because you are too sleepy or tired to drive or take public transportation? | 0 | 1 | 2 | 3 | 4 |
| 9. Do you have difficulty take care of financial affairs and doing paperwork (for example: writing checks, paying bills, keeping financial records, filling out tax forms, etc.) because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 10. Do you have difficulty performing employed or volunteer work because you are sleepy or tired? | 0 | 1 | 2 | 3 | 4 |
| 11. Do you have difficulty maintaining a telephone conversation because you become sleepy or tired? | 0 | 1 | 2 | 3 | 4 |

0 – I don’t do this activity for other reasons

- 1 – No difficulty**
2 – Yes, a little difficulty
3 – Yes, Moderate difficulty
4 – Yes, Extreme difficulty

	0	1	2	3	4
12. Do you have difficulty visiting with your family or friends in your home because you become sleepy or tired?	0	1	2	3	4
13. Do you have difficulty visiting with your family or friends in their homes because you become sleepy or tired?	0	1	2	3	4
14. Do you have difficulty doing things for your family or friends because you become sleepy or tired?	0	1	2	3	4
15. Has your relationship with family, friends or work colleagues been affected because you are sleepy or tired?	0	1	2	3	4
16. Do you have difficulty exercising or participating in a sporting activity because you are too sleepy or tired?	0	1	2	3	4
17. Do you have difficulty watching a movie or videotape because you become sleepy or tired?	0	1	2	3	4
18. Do you have difficulty enjoying the theater or a lecture because you become sleepy or tired?	0	1	2	3	4
19. Do you have difficulty enjoying a concert because you become sleepy or tired?	0	1	2	3	4
20. Do you have difficulty watching television because you are sleepy or tired?	0	1	2	3	4
21. Do you have difficulty participating in religious services, meetings or a group club because you are sleepy or tired?	0	1	2	3	4
22. Do you have difficulty being as active as you want to be in the evening because you are sleepy or tired?	0	1	2	3	4
23. Do you have difficulty being as active as you want to be in the morning because you are sleepy or tired?	0	1	2	3	4
24. Do you have difficulty being as active as you want to be in the afternoon because you are sleepy or tired?	0	1	2	3	4
25. Do you have difficulty keeping a pace with others your own age because you are sleepy or tired?	0	1	2	3	4
26. How would you rate yourself in your general level of activity?		1	2	3	4
		1= Very low; 2= Low; 3= Medium; 4= High			
27. Has your intimate or sexual relationship been affected because you are sleepy or tired?	0	1	2	3	4
28. Has your desire for intimacy or sex been affected because you are sleepy or tired?	0	1	2	3	4
29. Has your ability to become sexually aroused been affected because you are sleepy or tired?	0	1	2	3	4
30. Has your ability to have an orgasm been affected because you are sleepy or tired?	0	1	2	3	4

Session (1 or 2)_____ID#_____Date_____Time_____AM
PM

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 _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

9. 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 _____

Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired?

This refers to your usual way of life in recent times.

Even if you haven't 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

It is important that you answer each question as best you can.

Situation	Chance of Dozing (0-3)
Sitting and reading _____	_____
Watching TV _____	_____
Sitting, inactive in a public place (e.g. a theater or a meeting) _____	_____
As a passenger in a car for an hour without a break _____	_____
Lying down to rest in the afternoon when circumstances permit _____	_____
Sitting and talking to someone _____	_____
Sitting quietly after lunch without alcohol _____	_____
In a car, while stopped for a few minutes in traffic _____	_____

THANK YOU FOR YOUR COOPERATION

Insomnia Severity Index

Used with permission from Charles M. Morin, Ph.D., Université Laval

Thinking about your **CURRENT** (i.e., **LAST 2 WEEKS**) insomnia problem(s):

➤ **CIRCLE** the number that best describes your answer for each question.

	None	Mild	Moderate	Severe	Very severe
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problem waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.)?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Add the scores for all seven items.

Your Score: _____

Rating Scale:

0–7 = No clinically significant insomnia
15–21 = Clinical insomnia

8–14 = Sub-threshold insomnia
22–28 = Clinical insomnia

Subject ID: __

Date: _

The following questions concern your alcohol consumption. Place an X in one box that best describes your answer to each question.

Questions	0	1	2	3	4	
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week	
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more	
3. How often do you have six or more drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4. How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5. How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
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?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
9. Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year	
					Total	

GCTI

Here are some thoughts that people have when they can't sleep. Please indicate by placing a tick in the appropriate box how often over the past 7 nights the following thoughts have kept you awake.

		Never	Sometimes	Often	Always
1	Things in the future				
2	How tired/sleepy you feel				
3	Things that happened during the day				
4	How nervous/anxious you feel				
5	How mentally awake you feel				
6	Checking the time				
7	Trivial things				
8	How you can't stop your mind from racing				
9	How long you've been awake				
10	Your health				
11	Ways you can get to sleep				
12	Things you have to do tomorrow				
13	How hot/cold you feel				
14	Your work/responsibilities				
15	How frustrated/annoyed you feel				
16	How light/dark the room is				
17	Noises you hear				
18	Being awake all night				
19	Pictures of things in your mind				
20	The effects of not sleeping well				
21	Your personal life				
22	How thinking too much is the problem				
23	Things in your past				
24	How bad you are at sleeping				
25	Things to do to help you sleep				

Volunteer #:	Date: ____/____/_____ (DD/MON/YYYY)
---------------------	---

MORNINGNESS-EVENINGNESS QUESTIONNAIRE- PAGE 1 OF 2

INSTRUCTIONS TO VOLUNTEER: On this questionnaire, we ask you questions about your daily activities and attitudes. Please circle the answer that best describes you. When you finish this page, go on to the next page and complete the entire questionnaire.

					SCORE
1. Considering only your own "feeling best" rhythm, at what time would you get up if you were entirely free to plan your day?					
5:00 - 6:30 AM	6:30 - 7:45 AM	7:45 - 9:45 AM	9:45 - 11:00 AM	11:00 AM - 12:00 PM	
2. Considering only your own "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?					
8:00 - 9:00 PM	9:00 - 10:15 PM	10:15 PM - 12:30 AM	12:30 - 1:45 AM	1:45 - 3:00 AM	
3. If there is a specific time at which you have to get up in the morning, to what extent are you dependent on being woken up by an alarm clock?					
not at all dependent	slightly dependent	fairly dependent	very dependent	-----	
4. Assuming adequate environmental conditions, how easy do you find getting up in the mornings?					
not at all easy	not very easy	fairly easy	very easy	-----	
5. How alert do you feel during the first half hour after having awakened in the mornings?					
not at all alert	slightly alert	fairly alert	very alert	-----	
6. How is your appetite during the first half-hour after having woken in the mornings?					
very poor	fairly poor	fairly good	very good	-----	
7. During the first half-hour after having woken in the morning, how tired do you feel?					
very tired	fairly tired	fairly refreshed	very refreshed	-----	
8. When you have no commitments the next day, at what time do you go to bed compared to your usual bedtime?					
seldom or never later	less than one hour later	1-2 hours later	more than 2 hours later	-----	
9. You have decided to engage in some physical exercise. A friend suggests that you do this one hour twice a week and the best time for him is between 7:00-8:00 AM. Bearing in mind nothing else but your own "feeling best" rhythm how do you think you would perform?					
would be in good form	would be in reasonable form	would find it difficult	would find it very difficult	-----	
10. At what time in the evening do you feel tired, and as a result, in need of sleep?					
8:00 - 9:00 PM	9:00 - 10:15 PM	10:15 PM - 12:45 AM	12:45 - 2:00 AM	2:00 - 3:00 AM	

Total Score: _____ **Scorer Initials/Date:** _____ **QC Initials/Date:** _____

Volunteer #:	Date: ____/____/_____ (DD/MON/YYYY)
---------------------	---

MORNINGNESS-EVENINGNESS QUESTIONNAIRE- PAGE 2 OF 2

11. You wish to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day and considering only your own "feeling best" rhythm which ONE of the four testing times would you choose?						
8:00 - 10:00 AM	11:00 AM - 1:00 PM	3:00 - 5:00 PM	7:00 - 9:00 PM	----- -		
12. If you went to bed at 11:00 PM at what level of tiredness would you be?						
not at all tired	a little tired	fairly tired	very tired	----- -		
13. For some reason you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which ONE of the following events are you most likely to experience?						
will wake up at usual time and will NOT fall asleep	will wake up at usual time and will doze thereafter	will wake up at usual time but will fall asleep again	will NOT wake up until later than usual	----- -		
14. One night you have to remain awake between 4:00 - 6:00 AM in order to carry out a night watch. You have no commitments the next day. Which ONE of the following alternatives will suit you best?						
would NOT go to bed until watch was over	would take a nap before and sleep after	would take a good sleep before and nap after	would take ALL sleep before watch	----- -		
15. You have to do two hours of hard physical work. You are entirely free to plan your day and considering only your own "feeling best" rhythm which ONE of the following times would you choose?						
8:00 - 10:00 AM	11:00 AM - 1:00 PM	3:00 - 5:00 PM	7:00 - 9:00 PM	----- -		
16. You have decided to engage in hard physical exercise. A friend suggests that you do this for one hour twice a week and the best time for him is between 10:00 - 11:00 PM. Bearing in mind nothing else but your own "feeling best" rhythm how well do you think you would perform?						
would be in good form	would be in reasonable form	would find it difficult	would find it very difficult	----- -		
17. Suppose that you can choose your own work hours. Assume that you worked a FIVE-hour day (including breaks) and that your job was interesting and paid by results. During which time period would you want that five consecutive hours to END?						
12:00 - 4:00 AM	4:00 - 8:00 AM	8:00 - 9:00 AM	9:00 AM - 2:00 PM	2:00 - 5:00 PM	5:00 PM - 12:00 AM	
18. At what time of the day do you think that you reach your "feeling best" peak?						
12:00 - 5:00 AM	5:00 - 8:00 AM	8:00 - 10:00 AM	10:00 AM - 5:00 PM	5:00 - 10:00 PM	10:00 PM - 12:00 AM	
19. One hears about "morning" and "evening" types of people. Which ONE of these types do you consider yourself to be?						
definitely a "morning" person	rather more a "morning" than an "evening" type	rather more an "evening" than a "morning" type	definitely an "evening" type	----- -		

Caffeine Consumption Questionnaire

			Average number of ounces/doses/tablets per day	Average total per day
Beverages				
Coffee (6 oz.)	125mg	X	_____	_____
Decaf Coffee (6 oz.)	5 mg	X	_____	_____
Espresso (1 oz.)	50 mg	X	_____	_____
Tea (6 oz.) Green	35 mg	X	_____	_____
Tea (6 oz) Black	50 mg	X	_____	_____
Cocoa (6 oz.)	15 mg	X	_____	_____
Energy drinks (12 oz.)	*equivalent 200 mg	X	_____	_____
Caffeinated Soft Drinks (12 oz.)	40-60 mg	X	_____	_____
Chocolate candy bar	20 mg	X	_____	_____
Over-the-Counter Medications				
Anacin	32 mg	X	_____	_____
Appetite-control pills	100-200 mg	X	_____	_____
Dristan	16 mg	X	_____	_____
Excedrine	65 mg	X	_____	_____
Midol	132mg	X	_____	_____
NoDoz	200mg	X	_____	_____
Triaminicin	30 mg	X	_____	_____
Vanquish	33 mg	X	_____	_____
Vivarin	200 mg	X	_____	_____
Prescription Medications				
Cafergot	100 mg	X	_____	_____
Fiorinal	40 mg	X	_____	_____
TOTAL MG. CAFFEINE PER DAY				_____

*Caffeine content of energy drinks vary. They also include a number of stimulating herbs.

> 250 milligrams a day, if taken after noon, *may* interfere with deep sleep

® John Preston (2015)

PSQ

For each sentence, circle the number that describes how often it applies to you in general, *during the last year or two*. Work quickly, without bothering to check your answers, and be careful to describe your life *in the long run*.

- | | |
|---|---|
| 1. You feel rested | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 2. You feel that too many demands are being made on you | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 3. You are irritable or grouchy | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 4. You have too many things to do | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 5. You feel lonely or isolated | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 6. You find yourself in situations of conflict | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 7. You feel you're doing things you really like | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 8. You feel tired | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 9. You fear you may not manage to attain your goals | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 10. You feel calm | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u> |

- | | |
|--|---|
| | <u>O 4=usually</u> |
| 11. You have too many decisions to make | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 12. You feel frustrated | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 13. You are full of energy | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 14. You feel tense | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 15. Your problems seem to be piling up | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 16. You feel you're in a hurry | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 17. You feel safe and protected | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 18. You have many worries | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 19. You are under pressure from other people | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 20. You feel discouraged | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 21. You enjoy yourself | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |

- | | |
|---|---|
| 22. You are afraid for the future | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 23. You feel you're doing things because you have to, not because you want to | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 24. You feel criticized or judged | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 25. You are lighthearted | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 26. You feel mentally exhausted | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |
| 27. You have trouble relaxing | <u>O 1=almost</u>
<u>O 2=sometimes</u>
<u>O 3=often</u>
<u>O 4=usually</u> |

STAI

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then select 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.

STAI Form S

	Not at all (1)	Somewhat (2)	Moderately so (3)	Very much so (4)
1. I feel calm	☐	☐	☐	☐
2. I feel secure	☐	☐	☐	☐
3. I am tense	☐	☐	☐	☐
4. I feel strained	☐	☐	☐	☐
5. I feel at ease	☐	☐	☐	☐
6. I feel upset	☐	☐	☐	☐
7. I am presently worrying over possible misfortunes	☐	☐	☐	☐
8. I feel satisfied	☐	☐	☐	☐
9. I feel frightened	☐	☐	☐	☐
10. I feel comfortable	☐	☐	☐	☐
11. I feel self-confident	☐	☐	☐	☐
12. I feel nervous	☐	☐	☐	☐
13. I am jittery	☐	☐	☐	☐
14. I feel indecisive	☐	☐	☐	☐
15. I am relaxed	☐	☐	☐	☐
16. I feel content	☐	☐	☐	☐
17. I am worried	☐	☐	☐	☐
18. I feel confused	☐	☐	☐	☐
19. I feel steady	☐	☐	☐	☐
20. I feel pleasant	☐	☐	☐	☐

A number of statements which people have used to describe themselves are given below. Read each statement and then select the appropriate number to the right of the statement to indicate how you generally feel.

STAI Form T

	Almost never (1)	Sometimes (2)	Often (3)	Almost always (4)
21. I feel pleasant	☐	☐	☐	☐
22. I nervous and restless	☐	☐	☐	☐
23. I feel satisfied with myself	☐	☐	☐	☐
24. I wish I could be as happy as others seem to be	☐	☐	☐	☐
25. I feel like a failure	☐	☐	☐	☐
26. I feel rested	☐	☐	☐	☐
27. I am "calm, cool, and collected"	☐	☐	☐	☐
28. I feel that difficulties are piling up so that I cannot overcome them	☐	☐	☐	☐

29. I worry too much over something that really doesn't matter	☐	☐	☐	☐
30. I am happy	☐	☐	☐	☐
31. I have disturbing thoughts	☐	☐	☐	☐
32. I lack self-confidence	☐	☐	☐	☐
33. I feel secure	☐	☐	☐	☐
34. I make decisions easily	☐	☐	☐	☐
35. I feel inadequate	☐	☐	☐	☐
36. I am content	☐	☐	☐	☐
37. Some unimportant thought runs through my mind and bothers me	☐	☐	☐	☐
38. I take disappointments so keenly that I can't put them out of my mind	☐	☐	☐	☐
39. I am a steady person	☐	☐	☐	☐
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	☐	☐	☐	☐

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Participant #:_____

Date:_____

BDI - II

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).

1. Sadness

- 0 I do not feel sad.
- 1 I feel sad much of the time.
- 2 I am sad all the time
- 3 I am so sad or unhappy that I can't stand it.

2. Pessimism

- 0 I am not discouraged about my future.
- 1 I feel more discouraged about my future than I used to be.
- 2 I do not expect things to work out for me.
- 3 I feel that my future is hopeless and will only get worse.

3. Past Failure

- 0 I do not feel like a failure.
- 1 I have failed more than I should have.
- 2 As I look back, I see a lot of failures.
- 3 I feel I am a total failure as a person.

4. Loss of Pleasure

- 0 I get as much pleasure as I ever did from the things I enjoy.
- 1 I don't enjoy things as much as I used to.
- 2 I get very little pleasure from the things I used to enjoy.
- 3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

- 0 I don't feel particularly guilty.
- 1 I feel guilty over many things I have done or should have done.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

6. Punishment Feelings

- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

7. Self-Dislike

- 0 I feel the same about myself as ever.
- 1 I have lost confidence in myself.
- 2 I am disappointed in myself.
- 3 I dislike myself.

8. Self-Criticalness

- 0 I don't criticize or blame myself more than usual.
- 1 I am more critical of myself than I used to be.
- 2 I criticize myself for all of my faults.
- 3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

- 0 I don't have any thoughts of killing myself.
- 1 I have thoughts of killing myself, but I would not carry them out.
- 2 I would like to kill myself.
- 3 I would kill myself if I had the chance.

10. Crying

- 0 I don't cry any more than I used to.
- 1 I cry more than I used to
- 2 I cry over every little thing.
- 3 I feel like crying, but I can't.

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 don't feel I am worthless.
- 1 I do not 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.

GCTI

Here are some thoughts that people have when they can't sleep. Please indicate by placing a tick in the appropriate box how often in the last night the following thoughts have kept you awake.

		Never	Sometimes	Often	Always
1	Things in the future				
2	How tired/sleepy you feel				
3	Things that happened during the day				
4	How nervous/anxious you feel				
5	How mentally awake you feel				
6	Checking the time				
7	Trivial things				
8	How you can't stop your mind from racing				
9	How long you've been awake				
10	Your health				
11	Ways you can get to sleep				
12	Things you have to do tomorrow				
13	How hot/cold you feel				
14	Your work/responsibilities				
15	How frustrated/annoyed you feel				
16	How light/dark the room is				
17	Noises you hear				
18	Being awake all night				
19	Pictures of things in your mind				
20	The effects of not sleeping well				
21	Your personal life				
22	How thinking too much is the problem				
23	Things in your past				
24	How bad you are at sleeping				
25	Things to do to help you sleep				

7 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.

Item First String	String Score (0 or 2)	Second String	String Score (0 or 1)	Item Score (0-2)
1. 4-9		5-3		
2. 8-3-5		2-4-1		
3. 7-2-4-6		1-6-3-8		
4. 5-3-9-2-4		3-8-4-9-1		
5. 6-4-2-9-3-5		9-1-5-3-7-6		
6. 2-8-5-1-9-3-7		5-3-1-7-4-9-2		
7. 8-3-7-9-5-2-4-1		9-5-1-4-2-7-3-8		
8. 1-5-9-2-3-8-7-4-6		5-1-9-7-6-2-3-6-5		
Total Score Range=0-16				

C	A..	-	_J	'v	:)	+	J_	-
1	2	3	4	5	6	7	8	9

SAMPLE _____

[illegible][illegible][illegible][illegible][illegible][illegible][illegible]

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.

Story	Trial 1 Responses	Trial 1 Score (0 or 1)	Trial 2 Responses	Trial 2 Score (0 or 1)	Item Score (0-2)
1. On Tuesday ,					
2. May					
3. Fourth ,					
4. in Cleveland , Ohio,					
5. a alarm					
6. fire broke out.					
7. Two					
8. hotels					
9. and a restaurant					
10. were destroyed					
11. before the firefighters (firemen)					
12. were able to extinguish it (<i>put it out</i>).					
Total Score (Trial 1 + Trial 2) Range=0-24					

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.

Item First String	String Score (0 or 2)	Second String	String Score (0 or 1)	Item Score (0-2)
1. 9-4		3-5		
2. 5-3-8		1-4-2		
3. 6-4-2-7		8-3-6-1		
4. 4-2-9-3-5		1-9-4-8-3		
5. 5-3-9-2-4-6		6-3-7-5-1-9		
6. 6-3-9-5-1-8-2		2-9-4-7-1-3-5		
7. 4-2-6-9-1-7-3-8		8-3-7-9-1-4-2-5		
8. 3-1-7-8-2-9-5-4-6		2-1-9-5-4-7-3-8-6		
Total Score Range=0-16				

Story Memory

Trial 1

Say /*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 /*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.

Story	Trial 1 Responses	Trial 1 Score (0 or 1)	Trial 2 Responses	Trial 2 Score (0 or 1)	Item Score (0-2)
1. On Monday ,					
2. March					
3. Fifth ,					
4. in Miami , Florida,					
5. a tidal wave hit.					
6. Although 2 million dollars					
7. in damage was done					
8. to the waterfront ,					
9. only seven people					
10. were injured, (hurt)					
11. and nobody (no one)					
12. was killed .					
Total Score (Trial 1 + Trial 2) Range=0-24					

KSS

Please complete the survey below.

Thank you!

Please, indicate your sleepiness during the 5 minutes before this rating through selecting the appropriate description.

1)

- ☐ 1 Extremely Alert
- ☐ 2 Very Alert
- ☐ 3 Alert
- ☐ 4 Rather Alert
- ☐ 5 Neither alert nor sleepy
- ☐ 6 Some signs of sleepiness
- ☐ 7 Sleepy, but no effort to keep awake
- ☐ 8 Sleepy, some effort to keep awake
- ☐ 9 Very sleepy, great effort to keep awake, fighting sleep

Psychomotor Vigilance Task



Participants will be asked to press the space bar as fast as they can every time a red rectangle appears on the screen. In the red rectangle will be a timer that will count up until the participant presses the space bar. The participant will be able to see their reaction time on each trial before the screen goes blank in preparation for another rectangle to appear.

Shoot / No Shoot

This task is designed to measure the ability to withhold a response, and has been designed to have a military relevance. Participants will decide whether or not to press a response button on the keyboard depending on 1) the context scene (urban or rural) and 2) the color of the soldier's uniform in the image (tan or green). At the beginning of the task, participants will be shown images of an urban scene or a rural scene, with a soldier in either a tan or green uniform. Participants will be given instructions that indicate which images will be "shoot" images and which images will be "no-shoot" images. They will need to decide if the context is a "shoot" or "no-shoot" situation. They will be required to press a response button to "shoot" when the images depict 1) an urban scene with the soldier wearing a tan uniform and 2) a rural scene with the soldier wearing a green uniform. Participants will withhold a response ("no-shoot") when the images depict 1) an urban scene with the soldier wearing a green uniform and 2) a rural scene with the soldier wearing a tan uniform.



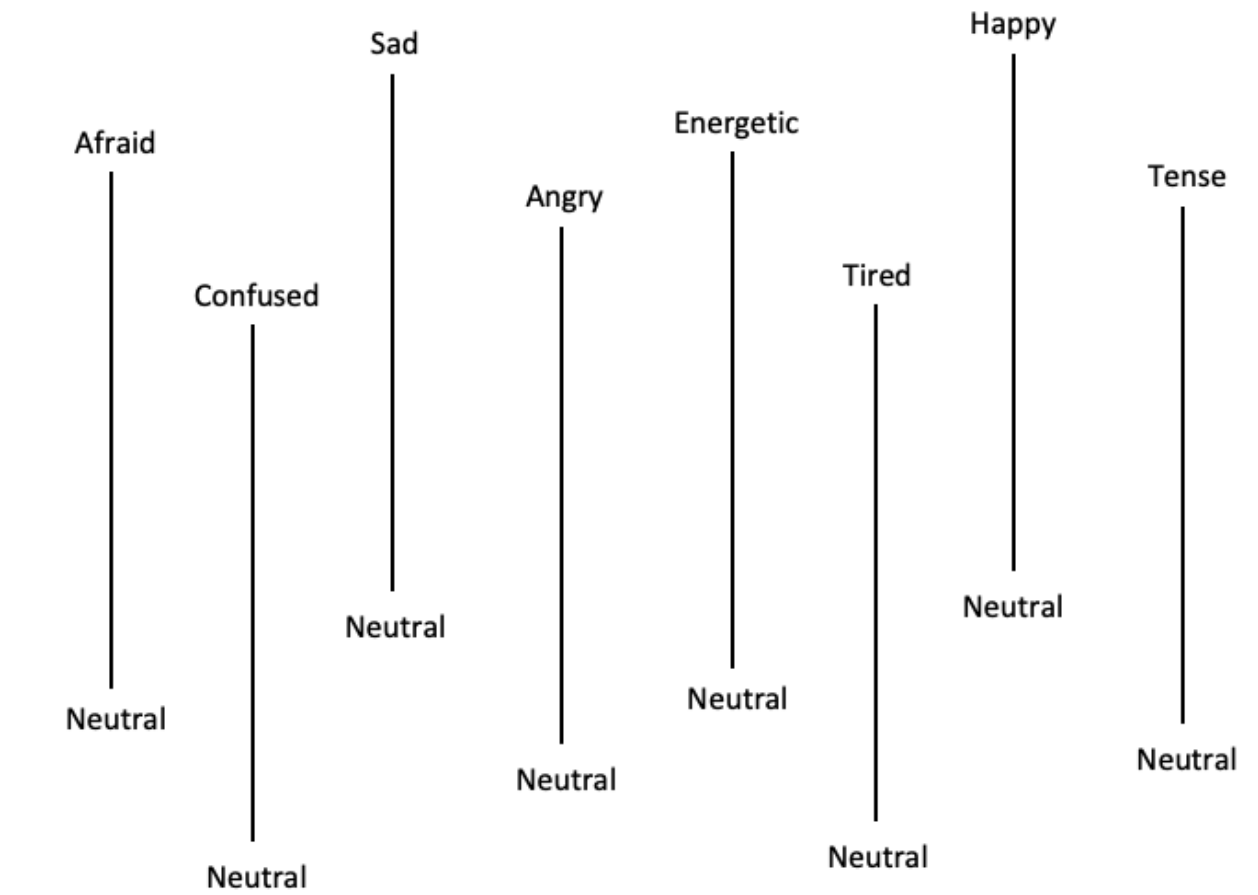
"No-Shoot"



"Shoot"

Visual Analog Mood Scales (VAMS)

Participants will complete visual analog mood scales (VAMS) for eight specific mood states: Afraid, Confused, Sad, Angry, Energetic, Tired, Happy, and Tense. For each scale, a neutral word is at the bottom of 100mm vertical line, with a mood word at the top of the line (see Figure 1.). Participants draw a line on the scale that best describes how they are currently feeling.



Forced Choice Recognition (Optional)

Circle the examinee's responses. If the examinee says "I don't know," say, "Take your best guess or Which one do you think was on the first list?"

Now I am going to read you 16 pairs of words. After I read both words, say the word from the first list, the one I read to you several times.

Read the word pairs, asking for each pair Was _____ or _____ on the first list?

			Score (1 or 0)
boat	or	flag	
cake	or	desk	
planet	or	cow	
celery	or	aspirin	
bookcase	or	tissue	
blender	or	truck	
onion	or	copper	
baseball	or	zebra	
branch	or	cabinet	
squirrel	or	cloud	
blanket	or	cabbage	
subway	or	waterfall	
needle	or	spinach	
giraffe	or	towel	
cable	or	motorcycle	
lamp	or	sprinkler	
Total Hits			

Notes:

Forced Choice Recognition (Optional)

Circle the examinee's responses. If the examinee says "I don't know," say, "Take your best guess or Which one do you think was on the first list?"

Now I am going to read you 16 pairs of words. After I read both words, say the word from the first list, the one I read to you several times.

Read the word pairs, asking for each pair Was _____ or _____ on the first list?

			Score (1 or 0)
boat	or	flag	
cake	or	desk	
planet	or	cow	
celery	or	aspirin	
bookcase	or	tissue	
blender	or	truck	
onion	or	copper	
baseball	or	zebra	
branch	or	cabinet	
squirrel	or	cloud	
blanket	or	cabbage	
subway	or	waterfall	
needle	or	spinach	
giraffe	or	towel	
cable	or	motorcycle	
lamp	or	sprinkler	
Total Hits			

Notes:

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

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

Total Correct: C

Total Repetitions: R

Total Intrusions: I

List A - Long Delay

Recall 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 or she cannot remember any more words).

Tell me all the words from the first list that are furniture.
Tell me all the words from the first list that are vegetables.

Cued Recall

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	Resp Type	Vegetables	Resp Type	Ways of Traveling	Resp Type	Animals	Resp Type
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
Total Correct: C		Total Repetitions: R		Total Intrusions: I			

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.

If the examinee says "I don't know" or does not respond at all, provide a single prompt, such as Take your best guess or Tell me whether you think (repeat the word) was on the first list.

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

T = Target

Character types: BS = List B Shared; BN = List B Nonshared; PR = Prototypical; UN = Unrelated

Total Hits

Total False Positives

10
minutes

The delay interval between the end of the Long Delay Yes/No Recognition trial and the start of the Forced Choice Recognition trial should last approximately 10 minutes. Do not tell the examinee that there will be another trial.

Stop Time

:

Continue on page 5

List B • Immediate Free Recall

Read List B at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. After you say the last word, say, Go ahead. Record all responses verbatim, in the order recalled.

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, and then say, Go ahead.

List B		Resp Type
violin	1	
cucumber	2	
elephant	3	
closet	4	
turnip	5	
guitar	6	
basement	7	
sheep	8	
clarinet	9	
garage	10	
corn	11	
rabbit	12	
patio	13	
saxophone	14	
tiger	15	
radishes	16	
	17	
	18	
	19	
	20	
Total Correct C		
Total Repetitions R		
Total Intrusions I		

List A • Short Delay 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 or she cannot remember any more words).

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		Resp Type
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	
	19	
	20	
Total Correct C		
Total Repetitions R		
Total Intrusions I		

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		Resp Type
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
Vegetables		Resp Type
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
Ways of Traveling		Resp Type
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
Animals		Resp Type
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
Total Correct C		
Total Repetitions R		
Total Intrusions I		

Long Delay Interval

20 min

The delay between the completion of the Short Delay Cued Recall trial and the start of the Long Delay Free Recall trial should last approximately 20 minutes.

Do not tell the examinee that there will be later trials.

Stop Time

:

Continue on page 4.

List A • Immediate Free Recall

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. Record all responses verbatim, in the order recalled.

Prompt only once (e.g., Anything else?) at the end of each free recall trial (i.e., after 15 seconds with no response or when the examinee says he or she cannot remember any more words).

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, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order, including words from the list you've said before.

Read List A, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order.

Read List A, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order.

Read List A, and then say, Go ahead.

I'm going to read the same list one more time. Like before, tell me as many of the words as you can.

Read List A, and then say, Go ahead.

List A	Trial 1	Resp. Type	Trial 2	Resp. Type	Trial 3	Resp. Type	Trial 4	Resp. Type	Trial 5	Resp. Type
truck	1		1		1		1		1	
spinach	2		2		2		2		2	
giraffe	3		3		3		3		3	
bookcase	4		4		4		4		4	
onion	5		5		5		5		5	
motorcycle	6		6		6		6		6	
cabinet	7		7		7		7		7	
zebra	8		8		8		8		8	
subway	9		9		9		9		9	
lamp	10		10		10		10		10	
celery	11		11		11		11		11	
cow	12		12		12		12		12	
desk	13		13		13		13		13	
boat	14		14		14		14		14	
squirrel	15		15		15		15		15	
cabbage	16		16		16		16		16	
	17		17		17		17		17	
	18		18		18		18		18	
	19		19		19		19		19	
	20		20		20		20		20	
Total Correct C			Total Correct C		Total Correct C		Total Correct C		Total Correct C	
Total Repetitions R			Total Repetitions R		Total Repetitions R		Total Repetitions R		Total Repetitions R	
Total Intrusions I			Total Intrusions I		Total Intrusions I		Total Intrusions I		Total Intrusions I	

CVLT3

California Verbal Learning Test
THIRD EDITION

Dean C. Delis • Joel H. Kramer • Edith Kaplan • Beth A. Ober

Standard Form

Examinee Name: _____
 Examiner Name: _____
 Gender: _____ Years of Education: _____ Handedness: _____

Score	Raw Score	Scaled Scores		
		Trials 1-5	Delayed Recall	Total Recall
Trial 1 Correct		T1 Correct		T1 Correct
Trial 2 Correct		T2 Correct		T2 Correct
Trial 3 Correct		T3 Correct		T3 Correct
Trial 4 Correct		T4 Correct		T4 Correct
Trial 5 Correct		T5 Correct		T5 Correct
List B Correct				List B Correct
Short Delay Free Recall Correct			SDRF Correct	SDRF Correct
Short Delay Cued Recall Correct			SDCR Correct	SDCR Correct
Long Delay Free Recall Correct			LDRF Correct	LDRF Correct
Long Delay Cued Recall Correct			LDCR Correct	LDCR Correct

Sum of Scaled Scores to Index Score Conversion	Trials 1-5 Correct	Delayed Recall Correct	Total Recall Correct
Sum of Scaled Scores			
Index Score			
Percentile Rank			

Calculation of Examinee's Age			
	Year	Month	Day
Test Date			
Birth Date			
Test Age			

Score	Raw Score	Scaled Score
Trials 1-5 Intrusions		T1-5 Intr
Free Recall Intrusions		Free Recall Intr
Cued Recall Intrusions		Cued Recall Intr
Total Intrusions		Total Intr
Total Repetitions		Total Rep
Y/N Recognition Total Hits		Hits
Y/N Recognition Total False Positives		FP
Y/N Recognition Discriminability Nonparametric		Recog Discrim NP

Calculation of Y/N Recognition Discriminability Nonparametric Raw Score	
$t = \left(\frac{1}{10} + \left(\frac{10 - 1}{10} \right) \right) \times 100 =$	

Score	Raw Score	Base Rate
Forced Choice Total Hits		

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5 6 7 8 9 10 11 12 A B C D E

Product Number 0158009924

CVLT3

California Verbal Learning Test
THIRD EDITION

Dean C. Delis • Joel H. Kramer • Edith Kaplan • Beth A. Ober

Alternate Form

Examinee Name: _____

Examiner Name: _____

Gender: _____ Years of Education: _____ Handedness: _____

Score	Raw Score	Scaled Scores		
		Trials 1-5	Delayed Recall	Total Recall
Trial 1 Correct		T1 Correct		T1 Correct
Trial 2 Correct		T2 Correct		T2 Correct
Trial 3 Correct		T3 Correct		T3 Correct
Trial 4 Correct		T4 Correct		T4 Correct
Trial 5 Correct		T5 Correct		T5 Correct
List B Correct				List B Correct
Short Delay Free Recall Correct			SDRR Correct	SDRR Correct
Short Delay Cued Recall Correct			SDCR Correct	SDCR Correct
Long Delay Free Recall Correct			LDRR Correct	LDRR Correct
Long Delay Cued Recall Correct			LCRR Correct	LCRR Correct

Sum of Scaled Scores to Index Score Conversion	Trials 1-5 Correct	Delayed Recall Correct	Total Recall Correct
Sum of Scaled Scores			
Index Score			
Percentile Rank			

Calculation of Examinee's Age

	Year	Month	Day
Test Date			
Birth Date			
Test Age			

Score	Raw Score	Scaled Score
Trials 1-5 Intrusions		T1-5 Int
Free Recall Intrusions		Free Recall Int
Cued Recall Intrusions		Cued Recall Int
Total Intrusions		Total Int
Total Repetitions		Total Rep
Y/N Recognition Total Hits		Y/N
Y/N Recognition Total False Positives		FP
Y/N Recognition Discriminability Nonparametric		Recog Discrim NP

Calculation of Y/N Recognition Discriminability Nonparametric Raw Score

$$\left[1 - \left(\frac{1}{16} + \left(\frac{16 - \text{Raw Score}}{16} \right) \right) \right] \times 100 = \text{Raw Score}$$

Score	Raw Score	Base Rate
Forced Choice Total Hits		

PEARSON

PsychCorp

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5 6 7 8 9 10 11 12 A B C D E

Product Number 0158009959

List A - Immediate Free Recall

Read List A at an even pace, taking slightly longer than one second per word, so the entire list takes 16 to 20 seconds. Then say, Go ahead. Record all responses verbatim, in the order recalled.

Prompt only once (e.g., Anything else?) at the end of each free recall trial (i.e., after 15 seconds with no response or when the examinee says he or she cannot remember any more words).

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, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order, including words from the list you've said before.

Read List A, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order.

Read List A, and then say, Go ahead.

I'm going to read the same list again. Like before, tell me as many of the words as you can, in any order.

Read List A, and then say, Go ahead.

I'm going to read the same list one more time. Like before, tell me as many of the words as you can.

Read List A, and then say, Go ahead.

List A	Trial 1	Resp Type
drill	1	
watermelon	2	
coat	3	
butterfly	4	
peaches	5	
chisel	6	
termite	7	
shorts	8	
wrench	9	
grasshopper	10	
tangerines	11	
fat	12	
cricket	13	
pliers	14	
vest	15	
cherries	16	
	17	
	18	
	19	
	20	
Total Correct	C	
Total Repetitions	R	
Total Intrusions	I	

Trial 2	Resp Type
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Total Correct	C
Total Repetitions	R
Total Intrusions	I

Trial 3	Resp Type
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Total Correct	C
Total Repetitions	R
Total Intrusions	I

Trial 4	Resp Type
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Total Correct	C
Total Repetitions	R
Total Intrusions	I

Trial 5	Resp Type
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
Total Correct	C
Total Repetitions	R
Total Intrusions	I

List B • Immediate Free Recall

Read List B at an even pace, taking slightly longer than one second per word, so the entire list takes 18 to 20 seconds. After you say the last word, say, *Go ahead*. Record all responses verbatim, in the order recalled.

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, and then say, *Go ahead*.

List B		Resp. Type
notebook	1	
pineapple	2	
gloves	3	
shampoo	4	
lemon	5	
envelope	6	
perfume	7	
sweater	8	
paper clip	9	
comb	10	
strawberries	11	
jeans	12	
lipstick	13	
typewriter	14	
belt	15	
plums	16	
	17	
	18	
	19	
	20	
Total Correct		C
Total Repetitions		R
Total Intrusions		I

List A • Short Delay 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 or she cannot remember any more words).

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		Resp. Type
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total Correct		C
Total Repetitions		R
Total Intrusions		I

Cued Recall

Tell me all the words from the first list that are tools.
Tell me all the words from the first list that are fruits.
Tell me all the words from the first list that are insects.
Tell me all the words from the first list that are clothing.

Tools		Resp. Type
1		
2		
3		
4		
5		
6		
7		
8		
Total Correct		C
Total Repetitions		R
Total Intrusions		I

Fruits		Resp. Type
1		
2		
3		
4		
5		
6		
7		
8		
Total Correct		C
Total Repetitions		R
Total Intrusions		I

Insects		Resp. Type
1		
2		
3		
4		
5		
6		
7		
8		
Total Correct		C
Total Repetitions		R
Total Intrusions		I

Clothing		Resp. Type
1		
2		
3		
4		
5		
6		
7		
8		
Total Correct		C
Total Repetitions		R
Total Intrusions		I

Long Delay Interval

The delay between the completion of the Short Delay Cued Recall trial and the start of the Long Delay Free Recall trial should last approximately 20 minutes.

Do not tell the examinee that there will be later trials.

Stop Time

:

Continue on page 4.

1. Read the words from the first list that are tools.
2. Read the words from the first list that are fruits.
3. Read the words from the first list that are insects.
4. Read the words from the first list that are clothing.

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

Total Correct: ☐	Total Incorrect: ☐
Total Questions: ☐	Total Questions: ☐
Total Instructions: ☐	Total Instructions: ☐

Total Correct: ☐	Total Incorrect: ☐
Total Questions: ☐	Total Questions: ☐
Total Instructions: ☐	Total Instructions: ☐

Total Correct: ☐	Total Incorrect: ☐
Total Questions: ☐	Total Questions: ☐
Total Instructions: ☐	Total Instructions: ☐

Total Correct: ☐	Total Incorrect: ☐
Total Questions: ☐	Total Questions: ☐
Total Instructions: ☐	Total Instructions: ☐

Continue on page 4.

3

1. Read the words from the first list that are tools.
2. Read the words from the first list that are fruits.
3. Read the words from the first list that are insects.
4. Read the words from the first list that are clothing.

List A

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

Read the words from the first list that are tools.
Read the words from the first list that are fruits.
Read the words from the first list that are insects.
Read the words from the first list that are clothing.

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

Word	Tool	Fruit	Insect	Clothing
hammer	✓			
apple		✓		
beetle			✓	
shirt				✓
paper clip	✓			
carrot		✓		
broccoli		✓		
grass		✓		
spoon	✓			
sock				✓
typewriter	✓			
bat			✓	
plum		✓		

The story begins between the end of the Long Delay (15-20 seconds) and the start of the Long Delay (15-20 seconds) and ends at the end of the Long Delay (15-20 seconds). Do not tell the examinee that there will be another task.

Continue on page 5.

4

List A - Long Delay

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 or she cannot remember any more words).

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

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

Total Correct C

Total Repetitions R

Total Intrusions I

Tell me all the words from the first list that are tools.
Tell me all the words from the first list that are fruits.

Tools		Fruits	
	Resp		Type
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	

Total Correct C Total Repetitions R Total Intrusions I

Cued Recall

Tell me all the words from the first list that are insects.
Tell me all the words from the first list that are clothing.

Insects		Clothing	
	Resp		Type
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	

Total Correct C Total Repetitions R Total Intrusions I

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.

If the examinee says "I don't know" or does not respond at all, provide a single prompt, such as Take your best guess or Tell me whether you think (repeat the word) was on the first list.

Response				Response				Response				Response			
	Y	N	Item		Y	N	Type		Y	N	Item		Y	N	Type
newspaper	Y	N	UN	comb	Y	N	BN	pants	Y	N	PR	jeans	Y	N	BS
vest	Y	N	T	chisel	Y	N	T	wrench	Y	N	T	drill	Y	N	T
lipstick	Y	N	BN	daisy	Y	N	UN	gasoline	Y	N	UN	butterfly	Y	N	T
strawberries	Y	N	BS	screwdriver	Y	N	PR	shorts	Y	N	T	oranges	Y	N	PR
pliers	Y	N	T	hat	Y	N	T	perfume	Y	N	BN	kite	Y	N	UN
shoes	Y	N	PR	watermelon	Y	N	T	cherries	Y	N	T	paper clip	Y	N	BN
typewriter	Y	N	BN	gloves	Y	N	BS	belt	Y	N	BS	coat	Y	N	T
cricket	Y	N	T	ant	Y	N	PR	mosquito	Y	N	PR	lemon	Y	N	BS
tangerines	Y	N	T	spoon	Y	N	UN	pineapple	Y	N	BS	microscope	Y	N	UN
puzzle	Y	N	UN	grasshopper	Y	N	T	tent	Y	N	UN	peaches	Y	N	T
apple	Y	N	PR	plums	Y	N	BS	envelope	Y	N	BN	hammer	Y	N	PR
sweater	Y	N	BS	notebook	Y	N	BN	termite	Y	N	T	shampoo	Y	N	BN

T = Target
Objective Types: BS = List B Shared; BN = List B Nonshared; PR = Prototypical; UN = Unrelated

Total Hits
Total False Positives



The delay interval between the end of the Long Delay Yes/No Recognition trial and the start of the Forced Choice Recognition trial should last approximately 10 minutes. Do not tell the examinee that there will be another trial.

Stop Time

:

Continue on page 5.

Multi-Source Interference Task (MSIT)

While undergoing fMRI, participants will complete the MSIT, a well-validated cognitive interference task that produces consistent and robust activation patterns within the cingulo-frontal-parietal attention network during fMRI. Our version of the MSIT was identical to that used in the initial studies by Bush and colleagues, and consisted of an alternating series of two conditions performed within the MRI scanner.

During each trial, the participant is presented with a row of three digits on a video screen. On each presentation, two of the digits are always the same, while one digit differs from the others, and participants are required to indicate the location of the inconsistent digit by making a keypress on a button box in their right hand. For the “control” trials, the two distractor digits are always “0” and the inconsistent digit is always congruent with its physical position in the series and therefore matches its location on the button box (e.g., “100” = press button “1”; “020” = press button “2”; “003” = press button “3”). For the “interference” trials, the distractor digits are numbers other than zero and the inconsistent digit is never in the same spatial position as the required button press (e.g., “331” = press button “1”; “211” = press button “2”; “232” = press button “3”). During each trial, the digit sets were presented for 1750 ms, with a prerelease of 500 ms, yielding a stimulus presentation of 1250 ms and an interstimulus interval of 500 ms. Four blocks of control trials were alternated with four blocks of interference trials, with each block consisting of 24 digit set presentations, yielding a total of 192 sets. A 30-second fixation cross occurred at the beginning and end of the run, for a total run time of 6 min and 36 s. The task was presented from a laptop computer via a rear projection system to a translucent screen viewed through the mirror mounted to the head coil.

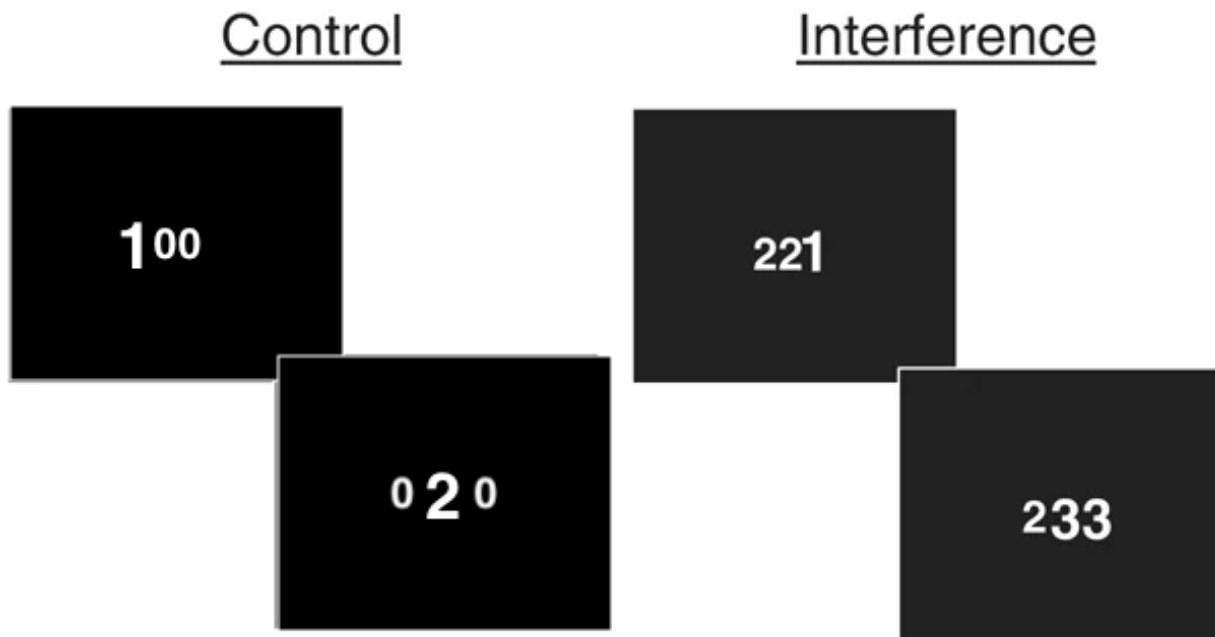


Figure 1. Example stimulus for the MSIT from Bush, G., Shin, L. M., Holmes, J., Rosen, B. R., & Vogt, B. A. (2003). The Multi-Source Interference Task: Validation study with fMRI in individual subjects. *Molecular Psychiatry*, 8(1), 60-70. doi:10.1038/sj.mp.4001217

Volunteer #:	Date: ____/____/_____ (DD/MON/YYYY)
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SYMPTOM CHECKLIST

Read the following prompt to the volunteer: "I am going to ask you if you are **CURRENTLY** experiencing any of the following symptoms. If you are, I'll ask you to rate its severity, and tell me when you first noticed it."

Note: If exact time onset is unknown, try to estimate onset within a 15-minute range based on study events.

ITEM	Y / N (circle one)	IF "YES" CIRCLE ONE			Time of Onset
Nervousness	Y / N	mild	moderate	severe	
Excitation	Y / N	mild	moderate	severe	
Feelings of Aggression	Y / N	mild	moderate	severe	
Headache	Y / N	mild	moderate	severe	
Feelings of happiness or elation	Y / N	mild	moderate	severe	
Pain in abdomen or stomach area	Y / N	mild	moderate	severe	
Dry mouth	Y / N	mild	moderate	severe	
Pounding heart	Y / N	mild	moderate	severe	
Racing heartbeat	Y / N	mild	moderate	severe	
Tremor	Y / N	mild	moderate	severe	
Nausea	Y / N	mild	moderate	severe	
Jitteriness or shakiness	Y / N	mild	moderate	severe	
Facial discomfort	Y / N	mild	moderate	severe	
Nonspecific discomfort	Y / N	mild	moderate	severe	
Muscle discomfort	Y / N	mild	moderate	severe	
Lightheadedness	Y / N	mild	moderate	severe	
Eye pain	Y / N	mild	moderate	severe	
Skin irritation	Y / N	mild	moderate	severe	

"Do you have anything else going on **RIGHT NOW** that I haven't asked you about?" - If yes, ask volunteer to describe symptom or event. Write down their description VERBATIM. Ask volunteer to rate severity and give time of onset.

ITEM	Y / N (circle one)	IF "YES" CIRCLE ONE			Time of Onset
	Y / N	mild	moderate	severe	
	Y / N	mild	moderate	severe	

	Y / N	mild	moderate	severe	
	Y / N	mild	moderate	severe	

Reviewer Initials

/

DD/MON/YYYY

Overnight # _____

Date: __/__/__

Participant ID: _____

Pre-TMS Symptom Assessment

1. *[Did the patient lose consciousness or have a seizure during the session]*

(1) Yes [Ensure that team lead, Dr. Killgore, Emily Taylor, and on-call physician have been notified]

(2) No

2. Are you currently experiencing any of the following? [Circle all that apply]

(a) Headache **Yes / No**

(b) Neck Pain **Yes / No**

(c) Scalp Pain/Burns **Yes / No**

(d) Jaw Pain **Yes / No**

(e) Toothache **Yes / No**

(f) Changes in Hearing (hearing loss, tinnitus, or aural fullness) **Yes / No**

(g) Trouble Thinking or Remembering **Yes / No**

(h) Mood change, since before the TMS session **Yes / No**

(j) Any other change since before the TMS session **Yes / No**

If yes to any of the above, please describe:

Sleep Diary B

Reflecting on the previous day and this morning, please fill out all required and applicable questions on the diary below. We will send you an email on the last day of sleep diaries notifying you that all of the needed questionnaires are complete.

If you have any questions or have trouble loading the survey, please call us immediately at 520-428-5141

Sleep Diary

Today's Date:

Bedtimes

What time did you wake up for the day?

(In standard time HH:MM)

AM or PM

☐ AM

☐ PM

What time did you get out of bed this morning?

(In standard time HH:MM)

AM or PM

☐ AM

☐ PM

What time did you get into bed last night?

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

What time did you try to go to sleep?

(In standard time HH:MM)

AM or PM

- ☐ AM ☐ PM

It took me ____ (hr): ____ (min) to fall asleep

(example: 15 min = 00:15)

I woke up ____ times during the night

- ☐ 0
☐ 1
☐ 2
☐ 3
☐ 4 or more

My first awakening lasted ____ minutes

(example: 2.5 hours = 150)

My second awakening lasted ____ minutes

(example: 2.5 hours = 150)

My third awakening lasted ____ minutes

(example: 2.5 hours = 150)

My fourth awakening, or subsequent awakenings lasted
____ minutes (if more than 4 awakenings, separate
each time with a comma)

(example: 2.5 hours = 150)

Nightmares

Did you have a nightmare last night?

- ☐ Yes
☐ No

How vivid was the nightmare?

- ☐ 1 (Not at all)
☐ 2
☐ 3 (Vivid)
☐ 4
☐ 5 (Very vivid)

How distressing was the nightmare?

- ☐ 1 (Not at all)
☐ 2
☐ 3 (Distressing)
☐ 4
☐ 5 (Very distressing)

Napping

I took a nap yesterday

- ☐ Yes ☐ No

Nap 1 (Skip if Not Applicable)

I started napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

I finished napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

Nap 2 (Skip if Not Applicable)

I started napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

I finished napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

Nap 3 (Skip if Not Applicable)

I started napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

I finished napping at:

(In standard time HH:MM)

AM or PM

- ☐ AM
☐ PM

Caffeine

I consumed____caffeinated beverages yesterday

I consumed caffeine yesterday:

- ☐ Morning
☐ Afternoon
☐ Evening
☐ Not Applicable

General Questions

I woke up this morning feeling:

- ☐ Refreshed
☐ Somewhat refreshed
☐ Fatigued

For most of yesterday I felt:

- ☐ 1 (Very Sleepy)
☐ 2
☐ 3
☐ 4 (Neutral)
☐ 5
☐ 6
☐ 7 (Very Alert)

Yesterday my mood was:

- ☐ 1 (Very Poor)
☐ 2
☐ 3
☐ 4 (Neutral)
☐ 5
☐ 6
☐ 7 (Very Good)

Did you use any electronic media (e.g. computer, television, mobile phone) after 9:00 PM last night?

- ☐ Yes
☐ No

Actiwatch

Did you press the marker button on your actiwatch last night before getting into bed?

- ☐ Yes
☐ No

Did you press the marker button on your actiwatch today when you got out of bed?

- ☐ Yes
☐ No

Functional Connectivity of Brain Networks Predicts Polysomnographically Measured Sleep

William D. S. Killgore, Samantha Jankowski, Kymberly Henderson-Arredondo, Lindsey Hildebrand, Heidi Elledge, Daniel A. Lucas, & Natalie S. Dailey

¹University of Arizona, Tucson, AZ

Objective: The arousal hypothesis predicts that increased cognitive and somatic arousal interfere with sleep among patients with insomnia. Evidence suggests that the connectivity of the brain's default mode network (DMN) may play an important role in this process. Here, we examined the association between whole cortex resting state functional connectivity and subsequent polysomnographically (PSG) assessed sleep the same night in a sleep laboratory among individuals with documented insomnia.

Methods: We collected data from twenty participants (12 female; age=26.9, SD=6.6 years) meeting criteria for insomnia/sleep disorder. Each participant completed a baseline resting state functional connectivity (rsFC) scan in the early evening and then retired to their own private bedroom in a sleep laboratory. Participants were monitored throughout the night with polysomnography and evaluated for various sleep parameters. Data were analyzed using the CONN Toolbox, v17f. Total Sleep Time from PSG was extracted and entered as a covariate into the whole brain connectivity analysis. Connectivity across the regions identified in the Automated Anatomical Labeling Atlas was assessed using the ROI-to-ROI analysis approach, with a peak signal threshold of $p < .001$ (uncorrected) and False-Discovery-Rate (FDR) correction seed level correction. We focused on the anterior and posterior medial regions of the DMN.

Results: The analysis showed that TST was significantly negatively correlated with numerous regions throughout the brain ($p < .05$, FDR corrected), while there were no regions of positive connectivity. Consistent with our hypothesis, we found that greater TST was associated with anticorrelated activation between the anterior cingulate cortex and regions associated with language processing (i.e., Heschl's gyrus), sensory motor function (precentral and postcentral gyri), superior temporal gyrus, parietal occipital gyrus, temporal pole, and occipital cortex.

Conclusions: Findings suggest that the connectivity of the anterior DMN with language, sensory, motor, and emotional processing regions is related to subsequent PSG measured sleep. Prior work has suggested that stronger anticorrelations between the DMN and task-positive regions is associated with better cognitive performance. Our findings also suggest that stronger anticorrelations between the anterior DMN and these other cortical regions are highly related to sleep among individuals with insomnia.

Abstract submitted to the SLEEP 2023 Conference, June 3-7, 2023, Indianapolis, IN.

Improving Sleep with Continuous Theta Burst Transcranial Magnetic Stimulation (TMS) of the Default Mode Network

William D. S. Killgore, Samantha Jankowski, Kymberly Henderson-Arredondo, Lindsey Hildebrand, Christopher Trapani, Daniel A. Lucas, Emmet J. Suckow, Shivani Desai, Melissa Reich-Fuehrer, Gabriela Franca, Deva Reign, Alisa Huskey, Yu-Chin Chen, Ying-Hui Chou, & Natalie S. Dailey

¹University of Arizona, Tucson, AZ

Objective: Chronic insomnia is a disorder associated with increased cognitive arousal. Insomnia is also associated with activation/connectivity within the default mode network (DMN) of the brain, consistent with the hyperarousal theory. We hypothesized that suppression of the DMN with a type of repetitive transcranial magnetic stimulation (rTMS) known as continuous theta burst stimulation (cTBS) would lead to improved overnight sleep.

Methods: Twenty participants (12 female; age=26.9, SD=6.6 years) meeting criteria for insomnia/sleep disorder completed a counterbalanced sham-controlled crossover study in which they served as their own controls on two separate nights of in-laboratory polysomnography (PSG) monitored sleep. In-lab visits occurred on separate weeks at least 5 days apart. Sessions included two resting state functional magnetic resonance imaging (fMRI) sessions separated by a brief 40 second cTBS rTMS session applied over an easily accessible cortical surface node of the DMN located at the left inferior parietal lobe. After scanning/stimulation, participants were allowed an 8-hour sleep opportunity from 2300 to 0700 monitored with PSG.

Results: One session of active cTBS significantly altered functional connectivity ($p < .05$, FDR corrected) within the DMN, while the sham condition produced no changes in functional connectivity from pre- to post-treatment. After controlling for age and IQ, active treatment was associated with significant ($p < .05$) improvements in PSG measured Total Sleep Time (TST; $\eta_p^2 = .28$), latency to Slow Wave Sleep (SWS; $\eta_p^2 = .23$), Sleep Efficiency (SE; $\eta_p^2 = .28$), and a lower Arousal Index ($\eta_p^2 = .22$). Overall, individuals obtained 16 minutes more sleep after active cTBS compared to sham. Moreover, changes in brain connectivity following cTBS significantly ($p < .05$) predicted sleep outcomes, including TST, sleep latency, SE, minutes of wake, SWS, number of awakenings, arousals, and arousal index, and a trend toward increased REM ($p = .06$).

Conclusions: A brief targeted 40-second stimulation with cTBS altered DMN brain functioning, and improved PSG measured sleep outcomes during the night following stimulation. The effect sizes often exceeded those reported for other established treatments such as cognitive behavioral therapy for insomnia or hypnotic sleep medications. Further work involving multiple stimulations over several days or weeks will be necessary to demonstrate the potential utility of this approach as a treatment for insomnia.

Abstract submitted to the SLEEP 2023 Conference, June 3-7, 2023, Indianapolis, IN.

Author and Institutions:

Lindsey Hildebrand, Social, Cognitive, and Affective Neuroscience (SCAN) Lab (**Primary Presenter**)

Samantha Jankowski, Kymberly Henderson-Arredondo, Christopher Trapani, Salma I. Patel, Yu-Chin Chen, Ying-Hui Chou, Natalie S. Dailey, William D.S. Killgore

Abstract Title:

Continuous Theta Burst Transcranial Magnetic Stimulation for Insomnia and its Effects on Verbal Recall Performance

Introduction:

In this project, we studied the efficacy of focused inhibitory stimulation using continuous theta burst stimulation (cTBS) repetitive transcranial magnetic stimulation (rTMS) on an easily accessible region of the default mode network (DMN). As reported elsewhere, we found that cTBS improved brain connectivity and objectively measured sleep. However, there is little known about the side effects of rTMS in the treatment of insomnia, so here we evaluated the effects on verbal memory recall.

Methods:

Twenty adults with clinical insomnia completed this study ($M_{age}=26.90$, $SD=6.56$). Participants conducted two overnight visits during the study; one where they received active cTBS and one where they received a sham cTBS prior to sleep. Participants completed the California Verbal Learning Test (CVLT) before stimulation and again completed the recall portion following a night of laboratory monitored sleep. We analyzed CVLT recall performance with a repeated measures ANOVA with factors of condition (active cTBS vs. sham cTBS) and session (Short Recall, Long Recall, Cued Recall, and Recognition).

Results:

Contrary to our hypothesis, our analyses indicate there was no significant effects on recall performance due to active cTBS. There was no main effect of condition on recall scores post-TMS administration ($F(1, 18)=1.162$, $p=.220$, $\eta_p^2 = 0.082$). There was no interaction effect of active or sham cTBS on recall performance ($F(4, 15)=.828$, $p=.528$, $\eta_p^2=0.181$). Posthoc pairwise comparisons demonstrated that there was no significant difference post-TMS administration between active cTBS and sham cTBS conditions on long recall, cued recall, or recognition ($p>.05$). There was no significant difference post-TMS administration on short-term recall performance. Participants scored lower on short term recall after receiving active cTBS ($M=12.632$; $SD=2.910$) than after sham cTBS administration ($M=13.42$; $SD=2.545$) ($p=.048$).

Conclusions:

Compared to sham, active cTBS was not associated with any significant difference in long-term recall performance after TMS administration. While the results demonstrate there are short term effects to recall after administration, recall scores bounce back shortly after administration. While participants didn't necessarily improve with active cTBS, it is beneficial to know there are no long-term harmful effects of active cTBS on recall as side effect of insomnia treatment.

Author and Institutions:

Lindsey Hildebrand, Social, Cognitive, and Affective Neuroscience (SCAN) Lab (**Primary Presenter**)

Samantha Jankowski, Kymberly Henderson-Arredondo, Christopher Trapani, Salma I. Patel, Yu-Chin Chen, Ying-Hui Chou, Natalie S. Dailey, William D.S. Killgore

Abstract Title:

Continuous Theta Burst Transcranial Magnetic Stimulation and Signal Detection Performance on a Military Go/No-Go Task

Introduction:

Repetitive transcranial Magnetic Stimulation (rTMS) is an emerging non-pharmacological treatment method utilized to treat multiple clinical diagnoses to include anxiety, depression, and now insomnia. As part of a larger project, we showed that a single rTMS stimulation with continuous theta burst stimulation (cTBS) to the default mode network (DMN) was associated with improved sleep. However, there is little known about potential effects on attention and vigilance because of cTBS to the DMN. We hypothesized that active cTBS would have no significant impact on signal detection tasks post-TMS administration.

Methods:

Twenty adults with clinical insomnia completed this study ($M_{\text{age}}=26.90$, $SD=6.56$). Participants completed two overnight visits in total; one where they received active cTBS and one where they received sham cTBS over an easily accessible node of the DMN (left angular gyrus). We analyzed signal detection performance utilizing a Go-No-Go (GNG) task. Three variables were calculated as a result: hit rate, correct rejection rate, and false alarm rate. Higher scores on hit rate and correct rejection rate indicate higher correct responses. Higher scores on false alarm rate indicates a higher number of incorrect responses. We conducted a repeated measures ANOVA with factors of condition, administration, and reversal.

Results:

There was no main effect of condition on GNG hit rate ($F(1,17)=1.365$, $p=.259$, $\eta_p^2=.074$), GNG false alarm rate ($F(1,17)=.210$, $p=.091$, $\eta_p^2=.244$), or GNG correct rejection rate ($F(1,17)=1.677$, $p=.213$, $\eta_p^2=.090$). We also found there were no significant interaction effects of TMS condition on performance on reversal conditions for GNG hit rate ($F(1,17)=0.45$, $p=.834$, $\eta_p^2=.003$), GNG false alarm rate ($F(1,17)=1.572$, $p=.227$, $\eta_p^2=.085$), or GNG correct rejection rate ($F(1,17)=1.510$, $p=.236$, $\eta_p^2=.082$). Posthoc pairwise comparisons demonstrated that participants did not significantly differ on GNG hit rate, false alarm rate, or correct rejection rate between their active cTBS and sham cTBS session ($p>.05$).

Conclusions:

Active cTBS was not significantly associated with any decline in response inhibition or signal detection. It is helpful for future recipients to know they are not adversely affected in attention or vigilance after receiving cTBS rTMS of the DMN for treatment of insomnia.

Primary Contact:

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Michael A. Grandner, Sleep and Health Research Program

William D.S. Killgore, Social, Cognitive, and Affective Neuroscience (SCAN) Lab

Abstract Title: Sex Differences in the Effects of TMS on Depression

Abstract:**Objective:**

As part of a larger study to examine the effects of repetitive transcranial magnetic stimulation (rTMS) over a single node of the default mode network (DMN) on sleep quality, we also examined secondary effects on depression. We hypothesized that rTMS would be more effective in females, rather than males, due to previously established higher rates of depression in the female population.

Participants and Methods:

We administered continuous theta burst stimulation (cTBS) rTMS or sham stimulation, in a counterbalanced order separated by at least 5 days, over the left inferior parietal node of the DMN in 20 participants with clinical insomnia, 8 males ($M_{age}=31.6$, $SD=6.7$) and 12 females ($M_{age}=23.8$, $SD=4.3$). Beck Depression Inventory (BDI) scores obtained immediately before and after the stimulation sessions were compared using mixed (condition x time x sex) ANOVA to determine the effectiveness of rTMS in reducing symptoms of depression between the sexes.

Results:

Overall, there was a large effect size ($\eta p^2=0.207$, $p=0.077$) in BDI scores between scores after the sham cTBS TMS session ($M=12.47$, $SD=2.54$) and scores after the active cTBS TMS session ($M=10.00$, $SD=2.01$). However, when separating for sex, males did not show a statistically significant reduction in depressive symptoms for the active session compared to the sham session ($\eta p^2=0.08$, $F(1,6)=19.00$, $p=0.508$). While the treatment did not significantly change depressive symptoms in females, large effect size was observed ($\eta p^2=0.261$, $F(1,7)=18.06$, $p=0.16$), suggesting potential efficacy of the treatment. Post-hoc pairwise comparisons reveal a greater change in depression symptom scores for active vs sham cTBS TMS in women ($M=-4.00$, $SD=2.00$), than men ($M=-0.71$, $SD=1.43$).

Conclusions:

An intervention using cTBS rTMS to improve sleep also led to a trend toward reduced depression, that was more evident among women. As reported elsewhere, this treatment significantly improved polysomnographic sleep, and the present preliminary results suggest that it may also be useful for modestly improving depressive mood, but further research will be necessary due to the limited sample size. It is not clear whether the trends toward mood among women was due simply to higher baseline depression scores in that group, but the findings suggest that additional work is warranted.

Primary Contact

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All Authors:

Gabriela Franca (**Primary Presenter**), Lindsey Hildebrand, Samantha Jankowski, Kymberly Henderson-Arredondo, Christopher Trapani, Salma I. Patel, Yu-Chin Chen, Ying-Hui Chou, Natalie S. Dailey, William D.S. Killgore

Social, Cognitive, and Affective Neuroscience (SCAN) Lab, University of Arizona

Abstract Title:

A Preliminary Study of the Effects of Continuous Theta Burst Stimulation of the Default Mode Network on Subjective Sleepiness Before and After a Night of Sleep

Introduction:

Repetitive transcranial Magnetic Stimulation (rTMS) is a noninvasive intervention commonly used to treat clinical depression by modulating brain activity in specific regions. We investigated rTMS of the default mode network (DMN) as a potential treatment for insomnia. The DMN is associated with internally focused cognition and rumination. Therefore, we expected that modulation of this network would improve sleep. As reported elsewhere, this trial showed that active cTBS to the DMN improved polysomnographically (PSG) measured sleep. Here, we hypothesized that participants who were treated with active continuous theta burst stimulation (cTBS) rTMS over the DMN versus sham cTBS would report reduced subjective sleepiness following post-treatment sleep.

Methods:

Twenty adults with clinical insomnia completed this study ($M_{\text{age}}=26.90$, $SD=6.56$). Participants completed two overnight visits; one where they received active cTBS treatment and one where they received sham TMS treatment. We analyzed the Karolinska Sleepiness Scale (KSS), which was administered six times throughout each visit. KSS 1-3 were administered prior to treatment and KSS 4-6 were post TMS treatment. We used a repeated measures ANOVA to analyze effects of TMS on reported daytime sleepiness.

Results:

There was no main effect of condition on sleepiness score $F(1,18)=1.165$, $p=0.295$, $\eta^2=0.061$. There was a significant interaction effect of condition and pre/post intervention on reported subjective sleepiness $F(1,18)=3.079$, $p=0.013$, $\eta^2=0.146$, although follow-up analyses did not reveal significant differences. Nonetheless, there was a continuous negative trend toward reduced sleepiness for post TMS administration after overnight sleep in active cTBS ($M = 4.8$, $SD = 1.96$) compared to the sham cTBS session ($M = 5.2$, $SD = 1.91$) ($p = 0.366$).

Conclusions:

As reported elsewhere, this trial of a single administration of cTBS showed improved PSG sleep. Here we saw that there was no significant change in subjective sleepiness following a night of sleep with or without the trial of cTBS, but there was a nonsignificant trend toward declining sleepiness for the active cTBS group relative to the sham condition. This preliminary study is encouraging and suggests that further research into this approach is warranted.

Primary Contact

Melissa Reich-Fuehrer, Social, Cognitive, and Affective Neuroscience (SCAN) Lab

All Authors:

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Social, Cognitive, and Affective Neuroscience (SCAN) Lab, University of Arizona

Abstract Title:

Effects of Transcranial Magnetic Stimulation (TMS) on Treatment of Intrusive Thinking in Insomniac Populations

Abstract:**Objective:**

Patients with clinical insomnia commonly report intrusive thinking (IT) as a common contributor to delayed sleep onset. Evidence suggests that the default mode network (DMN) may contribute to this intrusive thinking. Therefore, we employed continuous theta burst (cTBS) repetitive transcranial magnetic stimulation (rTMS) to modulate DMN activation, and thus reduce IT before sleep.

Participants and Methods:

In a counterbalanced cross-over design, active or sham cTBS was administered to 20 participants with clinical insomnia, 8 males ($M_{age}=31.63$, $SD=6.74$) and 12 females ($M_{age}=23.75$, $SD=4.29$), with sessions separated by at least 5 days. To assess intrusive thoughts prior to sleep, participants took the Glasgow Content of Thoughts Inventory (GCTI). We utilized the subscale of the GCTI measuring sleep and wakefulness. Higher scores indicate more persistent intrusive thoughts. We conducted a mixed ANOVA to examine effects of sham and active cTBS conditions on intrusive thoughts.

Results:

There was a medium effect size ($\eta_p^2=.087$) but no significant variance ($p>.05$) in average IT scores between participants sham cTBS ($M=19.100$, $SD=5.349$) and active cTBS ($M=18.200$, $SD=4.502$) Post-TMS sessions. There was a significant interaction between sex, TMS, and administration ($F(1,18)=4.697$; $\eta_p^2=.207$; $p=.044$). We then conducted a simple effects analysis between males and females. There was no significant effect of cTBS condition on reported intrusive thinking post-TMS administration ($F(1,7)=.628$; $\eta_p^2=.082$; $p=.454$). However, there was a significant interaction of cTBS condition on intrusive thoughts post-TMS administration for females ($F(1,11)=5.894$; $\eta_p^2=.349$; $p=.034$). Post-hoc pairwise comparison revealed that females reported significantly greater intrusive thinking post-TMS administration ($M=20.167$,

$SD=5.68$) compared to pre-TMS administration ($M=17.5$, $SD=5.73$) during their sham cTBS session ($p=.042$). This was not present post-TMS administration during active cTBS ($p>.05$).

Conclusions:

There was a decrease in intrusive thoughts relating to sleep and wakefulness in females, but not males, following active TMS. Interestingly, we also observed an increase in intrusive thoughts for the sham condition, suggesting that participants may have developed expectations of improvement and been sensitized to these cognitions when sleep was not improved. These findings are encouraging suggesting that cTBS may improve IT, although preliminary data suggest this may differ between males and females.

Slow-wave Sleep Onset Latency Mediates Improvements in Attention and Processing Speed Following Continuous Theta-Burst Transcranial Magnetic Stimulation (TMS) of the Default Mode Network

Alisa Huskey, William D. S. Killgore, Samantha Jankowski, Kimberly Henderson-Arredondo, Lindsey Hildebrand, Christopher Trapani, Heidi Elledge, Daniel A. Lucas, Emmet J. Suckow, Melissa Reich-Fuehrer, Gabriela Franca, Deva Reign, Yu-Chin Chen, Ying-Hui Chou, & Natalie S. Dailey

Background: Insomnia causes substantial health-care cost burden, estimated at \$100 billion US dollars per year, and is a risk factor for neurocognitive impairment. Increased default mode network (DMN) activity has been implicated in the hyperarousal theory of insomnia. In this pilot clinical trial, DMN was targeted via the left inferior parietal lobe using a brief 40 second cTBS rTMS. We hypothesized that neurocognitive improvements due to cTBS would be mediated by polysomnographic (PSG) parameters of slow wave sleep, due to prior findings suggesting that slow wave sleep plays a role in learning.

Method: Twenty participants (12 female; age=26.9, SD=6.6 years) meeting criteria for insomnia/sleep disorder completed a counterbalanced sham-controlled crossover design in which they served as their own controls on two separate nights of in-laboratory PSG monitored sleep on separate weeks. Sessions for both conditions included neurocognitive assessments at baseline, after stimulation (cTBS/SHAM) before bed and the following morning. After stimulation and neurocognitive testing, participants were allowed an 8-hour sleep opportunity from 2300 to 0700 monitored with PSG. The symbol coding (simple attention and processing speed) and digit span (simple attention) subtests of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) exam are the main assessments in the current investigation.

Results: Improvements in attention and processing speed were observed after a night of sleep following both active TMS (cTBS; $B = 11.05$, $p < .001$) and sham TMS conditions ($B = 8.10$, $p = .002$) the prior day. In the cTBS condition only, these improvements in attention were mediated by latency to slow wave sleep (N3), such that shorter latencies were related to greater improvements on a simple attention task (RBANS digit span; $B = -0.75$, $p < .001$). Effects of N3 latency on improvements in processing speed and simple attention (RBANS coding) were trending toward significance in both the cTBS ($p = .093$) and sham ($p = .077$) conditions. This effect of night to morning improvement in attention and processing speed was also found in the sham condition for the coding task ($B = 60.81$, $p < .001$), but not for digit span. No effects of slow wave sleep duration on RBANS coding or digit span were observed in either condition.

Conclusions: Neurocognitive improvements in simple attention performance in response to cTBS may be, in part, due to slow wave sleep parameters. Moreover, results suggest that simple attention may have been more sensitive to the effects of cTBS, whereas processing speed may have been a factor of lower slow wave sleep onset latency.

Curriculum Vitae

DATE PREPARED: August 28, 2022 

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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 - 6/17 Associate Professor of Psychology in the Department of Psychiatry
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
University of Arizona College of Medicine, Tucson, AZ

9/14- Professor of Psychology
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 DoD Contractor, Chief Psychologist, GovSource, Inc., U.S. Department of Defense (DoD)

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 -6/17 Research Psychologist, McLean Hospital, Belmont, MA

7/10 - 6-11 DoD Contractor, Consulting Psychologist, Clinical Research Management (CRM)

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

3/16 -12/18 ORISE Knowledge Preservation Fellow; Walter Reed Army Institute of Research, Silver Spring, MD

1/19- Senior Statistical Analyst: TechWerks, LLC; Walter Reed Army Institute of Research, Silver Spring, MD

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 – 9/19	Lieutenant Colonel, Medical Service Corps, United States Army Reserve (USAR)
3/16 -	Deputy Consultant to the Surgeon General of the Army (SGA) for 71F Research Psychology, US Army Reserves
9/19-	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, 27 th U.S. Army Science Conference
2011	Published paper included in <i>Best of Sleep Medicine 2011</i>
2011	Blue Ribbon Finalist, 2011 Top Poster Award in Clinical and Translational Research, Society of Biological Psychiatry
2012	Defense Advanced 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
2017	Trainee Abstract Merit Award (mentor/co-author), Sleep Research Society
2018	Trainee Abstract Merit Award (mentor/co-author), Sleep Research Society.
2020	Nelson Butters Award for Best Paper by a Postdoctoral Fellow (mentor/co-author), International Neuropsychological Society

SERVICE/OUTREACH

Local/State Service/Outreach

2003	Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
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2005	Scientific Review Committee, Walter Reed Army Institute of Research (WRAIR), Silver Spring, MD
2012-14	McLean Hospital Research Committee, McLean Hospital, Belmont, MA
2016	House Ad Hoc Committee on Treatment of Traumatic Brain Injuries and Benefits of Hyperbaric Oxygen Therapy, Arizona House of Representatives

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	External Member, Doctoral Thesis Committee, Belinda J. Liddle, Ph.D., University of Sydney, Australia
2007	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
2008-2011	Long-Distance High School Research Mentor, Christina Song, NY
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
2016-	Sleep Research Society Member
2017-2018	External Reviewer, Doctoral Thesis Reviewer, Kalina R. Rossa, Queensland University of Technology, Australia.
2018	Marsden Fund Council Grant Proposal Referee, Royal Society Te Aparangi, New Zealand.
2018	External Faculty Promotion Dossier Reviewer, Oregon Health & Science University
2018-2020	Long-Distance High School Research Mentor, Taleen Postian, Byram Hills HS, NY
2019	External Reviewer, Doctoral Thesis Reviewer, William Ryan McMahon, Monash University, Australia.
2020-	Long-Distance High School Research Mentor, Shivani Desai, Phoenix, AZ

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	Imaging Excellence Cluster Hire Search Committee, Department of Medical Imaging, University of Arizona, Tucson, AZ
2015-	Member, Mentoring Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2016	Member, Chief of Neuroradiology Faculty Search Committee, Department of Medical Imaging, University of Arizona, Tucson, AZ
2016-2017	Member, Dissertation Committee, Brian Arizmendi, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Member, Masters Thesis Committee, Saren Seeley, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Member, Masters Thesis Committee, Mairead McConnell, Department of Psychology, University of Arizona, Tucson, AZ
2016-2018	Member, Masters Thesis Committee, John Vanuk, Department of Psychology, University of Arizona, Tucson, AZ
2016-2017	Faculty Advisor, Undergraduate Honor Thesis Committee, Matthew Nettles, Neuroscience/Cognitive Science, University of Arizona, Tucson, AZ
2016-	Scientific Review Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2017-2018	Faculty Advisor, Undergraduate Honors Thesis Committee, Debby Waugaman, Psychology, University of Arizona, Tucson, AZ
2017-2018	Faculty Advisor, Undergraduate Honors Thesis Committee, Jun Lee, Department of Psychology, University of Arizona, Tucson, AZ
2017-	Chair, Psychiatry Research Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2017-	Member, Promotion and Tenure Committee, Department of Psychiatry, University of Arizona, Tucson, AZ
2019	Member, Comprehensive Examination Committee, Ji-Soo Kim, Department of Psychology, University of Arizona, Tucson, AZ
2019	Member, Comprehensive Examination Committee, John Vanuk, Department of Psychology, University of Arizona, Tucson, AZ
2019-2020	Member, Masters Thesis Committee, Veronica Kraft, Department of Psychology, University of Arizona, Tucson, AZ

2019-2020	Faculty Advisor, Undergraduate Honors Thesis Committee, Giovanna Gutierrez, Department of Neuroscience and Cognitive Science, University of Arizona, Tucson, AZ
2019-2020	Faculty Advisor, Undergraduate Honors Thesis Committee, Corinne Meinhausen, Department of Neuroscience and Cognitive Science, University of Arizona, Tucson, AZ
2019-2020	Faculty Advisor, Undergraduate Honors Thesis Committee, Jared Kleiner, Department of Neuroscience and Cognitive Science, University of Arizona, Tucson, AZ
2020	Member, Comprehensive Examination Committee, Sophie Pinkston, Department of Psychology, University of Arizona, Tucson, AZ
2020-	Co-Chair, Dissertation Committee, John Vanuk, Department of Psychology, University of Arizona, Tucson, AZ.
2020-	Member, Comprehensive Examination Committee, Veronica Kraft, Department of Psychology, University of Arizona, Tucson, AZ
2021	Chair, Research Task Force for College of Medicine Strategic Plan, Department of Psychiatry, University of Arizona, Tucson, AZ

University Committees/Service

2014	Ad Hoc Member, Interview Committee for Defense and Security Research Institute Director Position, University of Arizona, Tucson, AZ.
2014-2018	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-	MRI Operations Committee, University of Arizona, Tucson, AZ
2016	Faculty Mentor, Undergraduate Biology Research Program (UBRP), University of Arizona, Tucson, AZ
2016	Faculty Mentor, Border Latino & American Indian Summer Exposure to Research (BLAISER) Program, University of Arizona, Tucson, AZ
2016	Faculty Mentor, Medical Student Research Committee (MSRC) Program, University of Arizona College of Medicine, Tucson, AZ
2018	Administrative Review Committee: Psychiatry Department Chair
2019	Reviewer, Psychology Department Faculty Pilot Grant Program
2019	Reviewer, Arizona Alzheimer's Consortium
2019-	3T Faculty Advisory Committee, University of Arizona, Tucson, AZ
2019	Faculty Mentor, Steps 2 STEM High School Research Internship Program, Tucson, AZ
2020	Sleep & Circadian Science Center Construction Manager at Risk Search Committee, Tucson, AZ
2020-	Sleep & Circadian Science Center Oversight Committee, Tucson, AZ.

Editorial Board Membership

2009-2018	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 (108 Journals)

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
2004-2022	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
2005-2022	Reviewer, Behavioral Brain Research
2005-2021	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
2006-2022	Reviewer, Journal of Sleep Research
2006-2016	Reviewer, Physiology and Behavior
2006-2022	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
2009-2018	Reviewer, International Journal of Eating Disorders
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
2009-2022	Reviewer, Personality 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
2011-2019	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
2012-2017	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
2012-2021	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
2013-2020	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
2015-2021	Reviewer, Scientific Reports
2016-2018	Reviewer, Neuroscience & Biobehavioral Reviews
2016	Reviewer, Psychological Science
2016-2021	Reviewer, Medicine & Science in Sports and Exercise
2016	Reviewer, Archives of Clinical Neuropsychology
2016	Reviewer, Advances in Cognitive Psychology
2017	Reviewer, Data in Brief

2017	Reviewer, Neuroscience
2017-2018	Reviewer, Sleep Health
2017	Reviewer, Journal of Experimental Social Psychology
2017-2018	Reviewer, Neural Plasticity
2018	Reviewer, NeuroImage: Clinical
2018	Reviewer, Journal of Psychiatric Research
2018	Reviewer, Journal of Clinical Sleep Medicine
2019	Reviewer, Harvard Review of Psychiatry
2019	Reviewer, Progress in Brain Research
2020	Reviewer, Journal of Experimental Psychology: Learning, Memory, and Cognition
2020-2022	Reviewer, Psychiatry Research
2021	Reviewer, Health Promotion international
2021	Reviewer, Medicine & Science in Sports & Exercise
2021-2022	Reviewer, Military Behavioral Health
2022	Reviewer, Military Psychology

PUBLICATIONS/CREATIVE ACTIVITY

Refereed Journal Articles

1. **Killgore WD.** The Affect Grid: a moderately valid, nonspecific measure of pleasure and arousal. Psychol Rep. 83(2):639-42, 1998.
2. **Killgore WD.** Empirically derived factor indices for the Beck Depression Inventory. Psychol Rep. 84(3 Pt 1):1005-13, 1999.
3. **Killgore WD.** Affective valence and arousal in self-rated depression and anxiety. Percept Mot Skills. 89(1):301-4, 1999.
4. **Killgore WD, Adams RL.** Prediction of Boston Naming Test performance from vocabulary scores: preliminary guidelines for interpretation. Percept Mot Skills. 89(1):327-37, 1999.
5. **Killgore WD, Gangestad SW.** Sex differences in asymmetrically perceiving the intensity of facial expressions. Percept Mot Skills. 89(1):311-4, 1999.
6. **Killgore WD.** The visual analogue mood scale: can a single-item scale accurately classify depressive mood state? Psychol Rep. 85(3 Pt 2):1238-43, 1999.
7. **Killgore WD, DellaPietra L, Casasanto DJ.** Hemispheric laterality and self-rated personality traits. Percept Mot Skills. 89(3 Pt 1):994-6, 1999.
8. **Killgore WD, Glosser G, Casasanto DJ, French JA, Alsop DC, Detre JA.** Functional MRI and the Wada test provide complementary information for predicting post-operative seizure control. Seizure. 8(8):450-5, 1999.

9. **Killgore WD.** Evidence for a third factor on the Positive and Negative Affect Schedule in a college student sample. *Percept Mot Skills.* 90(1):147-52, 2000.
10. **Killgore WD, Dellapietra L.** Item response biases on the logical memory delayed recognition subtest of the Wechsler Memory Scale-III. *Psychol Rep.* 86(3 Pt 1):851-7, 2000.
11. **Killgore WD, Casasanto DJ, Yurgelun-Todd DA, Maldjian JA, Detre JA.** Functional activation of the left amygdala and hippocampus during associative encoding. *Neuroreport.* 11(10):2259-63, 2000.
12. Yurgelun-Todd DA, Gruber SA, Kanayama G, **Killgore WD, Baird AA, Young AD.** fMRI during affect discrimination in bipolar affective disorder. *Bipolar Disord.* 2(3 Pt 2):237-48, 2000.
13. **Killgore WD.** Sex differences in identifying the facial affect of normal and mirror-reversed faces. *Percept Mot Skills.* 91(2):525-30, 2000.
14. **Killgore WD, DellaPietra L.** Using the WMS-III to detect malingering: empirical validation of the rarely missed index (RMI). *J Clin Exp Neuropsychol.* 22(6):761-71, 2000.
15. **Killgore WD.** Academic and research interest in several approaches to psychotherapy: a computerized search of literature in the past 16 years. *Psychol Rep.* 87(3 Pt 1):717-20, 2000.
16. Maldjian JA, Detre JA, **Killgore WD, Judy K, Alsop D, Grossman M, Glosser G.** Neuropsychologic performance after resection of an activation cluster involved in cognitive memory function. *AJR Am J Roentgenol.* 176(2):541-4, 2001.
17. **Killgore WD, Oki M, Yurgelun-Todd DA.** Sex-specific developmental changes in amygdala responses to affective faces. *Neuroreport.* 12(2):427-33, 2001.
18. **Killgore WD, Yurgelun-Todd DA.** Sex differences in amygdala activation during the perception of facial affect. *Neuroreport.* 12(11):2543-7, 2001.
19. Casasanto DJ, **Killgore WD, Maldjian JA, Glosser G, Alsop DC, Cooke AM, Grossman M, Detre JA.** Neural correlates of successful and unsuccessful verbal memory encoding. *Brain Lang.* 80(3):287-95, 2002.
20. **Killgore WD.** Laterality of lesions and trait-anxiety on working memory performance. *Percept Mot Skills.* 94(2):551-8, 2002.
21. **Killgore WD, Cupp DW.** Mood and sex of participant in perception of happy faces. *Percept Mot Skills.* 95(1):279-88, 2002.
22. Yurgelun-Todd DA, **Killgore WD, Young AD.** Sex differences in cerebral tissue volume and cognitive performance during adolescence. *Psychol Rep.* 91(3 Pt 1):743-57, 2002.
23. Yurgelun-Todd DA, **Killgore WD, Cintron CB.** Cognitive correlates of medial temporal lobe development across adolescence: a magnetic resonance imaging study. *Percept Mot Skills.* 96(1):3-17, 2003.

24. **Killgore WD**, Young AD, Femia LA, Bogorodzki P, Rogowska J, Yurgelun-Todd DA. Cortical and limbic activation during viewing of high- versus low-calorie foods. *Neuroimage*. 19(4):1381-94, 2003.
25. **Killgore WD**, Yurgelun-Todd DA. Activation of the amygdala and anterior cingulate during nonconscious processing of sad versus happy faces. *Neuroimage*. 21(4):1215-23, 2004.
26. **Killgore WD**, Yurgelun-Todd DA. Sex-related developmental differences in the lateralized activation of the prefrontal cortex and amygdala during perception of facial affect. *Percept Mot Skills*. 99(2):371-91, 2004.
27. **Killgore WD**, Glahn DC, Casasanto DJ. Development and Validation of the Design Organization Test (DOT): a rapid screening instrument for assessing visuospatial ability. *J Clin Exp Neuropsychol*. 27(4):449-59, 2005.
28. **Killgore WD**, Yurgelun-Todd DA. Body mass predicts orbitofrontal activity during visual presentations of high-calorie foods. *Neuroreport*. 16(8):859-63, 2005.
29. Wesensten NJ, **Killgore WD**, Balkin TJ. Performance and alertness effects of caffeine, dextroamphetamine, and modafinil during sleep deprivation. *J Sleep Res*. 14(3):255-66, 2005.
30. **Killgore WD**, Yurgelun-Todd DA. Social anxiety predicts amygdala activation in adolescents viewing fearful faces. *Neuroreport*. 16(15):1671-5, 2005.
31. **Killgore WD**, Yurgelun-Todd DA. Developmental changes in the functional brain responses of adolescents to images of high and low-calorie foods. *Dev Psychobiol*. 47(4):377-97, 2005.
32. Kahn-Greene ET, Lipizzi EL, Conrad AK, Kamimori GH, **Killgore WD**. Sleep deprivation adversely affects interpersonal responses to frustration. *Pers Individ Dif*. 41(8):1433-1443, 2006.
33. McBride SA, Balkin TJ, Kamimori GH, **Killgore WD**. Olfactory decrements as a function of two nights of sleep deprivation. *J Sens Stud*. 24(4):456-63, 2006.
34. **Killgore WD**, Yurgelun-Todd DA. Ventromedial prefrontal activity correlates with depressed mood in adolescent children. *Neuroreport*. 17(2):167-71, 2006.
35. **Killgore WD**, Vo AH, Castro CA, Hoge CW. Assessing risk propensity in American soldiers: preliminary reliability and validity of the Evaluation of Risks (EVAR) scale--English version. *Mil Med*. 171(3):233-9, 2006.
36. **Killgore WD**, Balkin TJ, Wesensten NJ. Impaired decision making following 49 h of sleep deprivation. *J Sleep Res*. 15(1):7-13, 2006.
37. **Killgore WD**, Stetz MC, Castro CA, Hoge CW. The effects of prior combat experience on the expression of somatic and affective symptoms in deploying soldiers. *J Psychosom Res*. 60(4):379-85, 2006.

38. **Killgore WD**, McBride SA, Killgore DB, Balkin TJ. The effects of caffeine, dextroamphetamine, and modafinil on humor appreciation during sleep deprivation. *Sleep*. 29(6):841-7, 2006.
39. **Killgore WD**, McBride SA. Odor identification accuracy declines following 24 h of sleep deprivation. *J Sleep Res*. 15(2):111-6, 2006.
40. **Killgore WD**, Yurgelun-Todd DA. Affect modulates appetite-related brain activity to images of food. *Int J Eat Disord*. 39(5):357-63, 2006.
41. Kendall AP, Kautz MA, Russo MB, **Killgore WD**. Effects of sleep deprivation on lateral visual attention. *Int J Neurosci*. 116(10):1125-38, 2006.
42. Yurgelun-Todd DA, **Killgore WD**. Fear-related activity in the prefrontal cortex increases with age during adolescence: a preliminary fMRI study. *Neurosci Lett*. 406(3):194-9, 2006.
43. **Killgore WD**, Killgore DB, Ganesan G, Krugler AL, Kamimori GH. Trait-anger enhances effects of caffeine on psychomotor vigilance performance. *Percept Mot Skills*. 103(3):883-6, 2006.
44. **Killgore WD**, Yurgelun-Todd DA. Unconscious processing of facial affect in children and adolescents. *Soc Neurosci*. 2(1):28-47, 2007.
45. **Killgore WD**, Yurgelun-Todd DA. The right-hemisphere and valence hypotheses: could they both be right (and sometimes left)? *Soc Cogn Affect Neurosci*. 2(3):240-50, 2007.
46. **Killgore WD**, Killgore DB. Morningness-eveningness correlates with verbal ability in women but not men. *Percept Mot Skills*. 104(1):335-8, 2007.
47. **Killgore WD**, Killgore DB, Day LM, Li C, Kamimori GH, Balkin TJ. The effects of 53 hours of sleep deprivation on moral judgment. *Sleep*. 30(3):345-52, 2007.
48. Rosso IM, **Killgore WD**, Cintron CM, Gruber SA, Tohen M, Yurgelun-Todd DA. Reduced amygdala volumes in first-episode bipolar disorder and correlation with cerebral white matter. *Biol Psychiatry*. 61(6):743-9, 2007.
49. Kahn-Greene ET, Killgore DB, Kamimori GH, Balkin TJ, **Killgore WD**. The effects of sleep deprivation on symptoms of psychopathology in healthy adults. *Sleep Med*. 8(3):215-21, 2007.
50. **Killgore WD**. Effects of sleep deprivation and morningness-eveningness traits on risk-taking. *Psychol Rep*. 100(2):613-26, 2007.
51. **Killgore WD**, Gruber SA, Yurgelun-Todd DA. Depressed mood and lateralized prefrontal activity during a Stroop task in adolescent children. *Neurosci Lett*. 416(1):43-8, 2007.
52. **Killgore WD**, Yurgelun-Todd DA. Positive affect modulates activity in the visual cortex to images of high calorie foods. *Int J Neurosci*. 117(5):643-53, 2007.

53. Vo AH, Satori R, Jabbari B, Green J, **Killgore WD**, Labutta R, Campbell WW. Botulinum toxin type-a in the prevention of migraine: a double-blind controlled trial. *Aviat Space Environ Med.* 78(5 Suppl):B113-8, 2007.
54. **Killgore WD**, Yurgelun-Todd DA. Neural correlates of emotional intelligence in adolescent children. *Cogn Affect Behav Neurosci.* 7(2):140-51, 2007.
55. **Killgore WD**, Kendall AP, Richards JM, McBride SA. Lack of degradation in visuospatial perception of line orientation after one night of sleep loss. *Percept Mot Skills.* 105(1):276-86, 2007.
56. **Killgore WD**, Lipizzi EL, Kamimori GH, Balkin TJ. Caffeine effects on risky decision making after 75 hours of sleep deprivation. *Aviat Space Environ Med.* 78(10):957-62, 2007.
57. **Killgore WD**, Richards JM, Killgore DB, Kamimori GH, Balkin TJ. The trait of Introversion-Extraversion predicts vulnerability to sleep deprivation. *J Sleep Res.* 16(4):354-63, 2007.
58. **Killgore WD**, Kahn-Green ET, Killgore DB, Kamimori GH, Balkin TJ. Effects of acute caffeine withdrawal on Short Category Test performance in sleep-deprived individuals. *Percept Mot Skills.* 105(3 pt.2):1265-74, 2007.
59. **Killgore WD**, Killgore DB, McBride SA, Kamimori GH, Balkin TJ. Odor identification ability predicts changes in symptoms of psychopathology following 56 hours of sleep deprivation. *J Sensory Stud.* 23(1):35-51, 2008.
60. **Killgore WD**, Rupp TL, Grugle NL, Reichardt RM, Lipizzi EL, Balkin TJ. Effects of dextroamphetamine, caffeine and modafinil on psychomotor vigilance test performance after 44 h of continuous wakefulness. *J Sleep Res.* 17(3):309-21, 2008.
61. Huck NO, McBride SA, Kendall AP, Grugle NL, **Killgore WD**. The effects of modafinil, caffeine, and dextroamphetamine on judgments of simple versus complex emotional expressions following sleep deprivation. *Int. J Neuroscience.* 118(4):487-502, 2008.
62. **Killgore WD**, Kahn-Greene ET, Lipizzi EL, Newman RA, Kamimori GH, Balkin TJ. Sleep deprivation reduces perceived emotional intelligence and constructive thinking skills. *Sleep Med.* 9(5):517-26, 2008.
63. **Killgore WD**, Grugle NL, Killgore DB, Leavitt BP, Watlington GI, McNair S, Balkin TJ. Restoration of risk-propensity during sleep deprivation: caffeine, dextroamphetamine, and modafinil. *Aviat Space Environ Med.* 79(9):867-74, 2008.
64. **Killgore WD**, Muckle AE, Grugle NL, Killgore DB, Balkin TJ. Sex differences in cognitive estimation during sleep deprivation: effects of stimulant countermeasures. *Int J Neurosci.* 118(11):1547-57, 2008.
65. **Killgore WD**, Cotting DI, Thomas JL, Cox AL, McGurk D, Vo AH, Castro CA, Hoge CW. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. *J Psychiatr Res.* 42(13):1112-21, 2008.

66. **Killgore WD**, Gruber SA, Yurgelun-Todd DA. Abnormal corticostriatal activity during fear perception in bipolar disorder. *Neuroreport*. 19(15):1523-7, 2008.
67. **Killgore WD**, McBride SA, Killgore DB, Balkin TJ, Kamimori GH. Baseline odor identification ability predicts degradation of psychomotor vigilance during 77 hours of sleep deprivation. *Int J Neurosci*. 118(9):1207-1225, 2008.
68. **Killgore WD**, Rosso HM, Gruber SA, Yurgelun-Todd DA. Amygdala volume and verbal memory performance in schizophrenia and bipolar disorder. *Cogn Behav Neur*. 22(1):28-37, 2009.
69. **Killgore WD**, Kahn-Greene ET, Grugle NL, Killgore DB, Balkin TJ. Sustaining executive functions during sleep deprivation: A comparison of caffeine, dextroamphetamine, and modafinil. *Sleep*. 32(2):205-16, 2009.
70. **Killgore WD**, Grugle NL, Reichardt RM, Killgore DB, Balkin TJ. Executive functions and the ability to sustain vigilance during sleep loss. *Aviat Space Environ Med*. 80(2):81-7, 2009.
71. Picchioni, D, **Killgore, WD**, Braun, AR, & Balkin, TJ. Positron emission tomography correlates of EEG microarchitecture waveforms during non-REM sleep. *Int J Neurosci*. 119: 2074-2099, 2009.
72. **Killgore, WD**, Lipizzi, EL, Grugle, NL, Killgore, DB, & Balkin, TJ. Handedness correlates with actigraphically measured sleep in a controlled environment. *Percept Mot Skills*. 109: 395-400, 2009.
73. **Killgore, WD**, Killgore, DB, Grugle, NL, & Balkin, TJ. Odor identification predicts executive function deficits during sleep deprivation. *Int J Neurosci*, 120: 328-334, 2010.
74. **Killgore, WD**, Ross, AJ, Kamiya, T, Kawada, Y, Renshaw, PF, & Yurgelun-Todd, DA. Citicoline affects appetite and cortico-limbic responses to images of high calorie foods. *Int J Eat Disord*. 43: 6-13, 2010.
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*, 1: 33-43, 2010.
76. **Killgore, WD**, & Yurgelun-Todd, DA. Sex differences in cerebral responses to images of high vs low calorie food. *Neuroreport*, 21: 354-358, 2010.
77. **Killgore, WD**, Grugle, NL, Killgore, DB, & Balkin, TJ. Sex differences in self-reported risk-taking propensity on the Evaluation of Risks scale. *Percept Mot Skills*, 106: 693-700, 2010.
78. **Killgore, WD**, Kelley, AM, & Balkin, TJ. So you think you're bulletproof: Development and validation of the Invincibility Belief Index. *Mil Med*, 175: 499-508, 2010.
79. **Killgore, WD**, Castro, CA, & Hoge, CW. Preliminary Normative Data for the Evaluation of Risks Scale—Bubble Sheet Version (EVAR-B) for Large Scale Surveys of Returning Combat

Veterans. *Mil Med*, 175: 725-731, 2010.

80. Britton, JC, Rauch, SL, Rosso, IM, **Killgore, WD**, Price, LM, Ragan, J, Chosak, A, Hezel, D, Pine, DS, Leibenluft, E, Pauls, DL, Jenike, MA, Stewart, SE. Cognitive inflexibility and frontal cortical activation in pediatric obsessive-compulsive disorder. *J Am Acad Child Adolesc Psychiatry*, 49: 944-953, 2010.
81. Britton, JC, Stewart, SE, **Killgore, WD**, Rosso, IM, Price, LM, Gold, AL, Pine, DS, Wilhelm, S, Jenike, MA, & Rauch, SL. Amygdala activation in response to facial expressions in pediatric obsessive-compulsive disorder. *Depress Anxiety*, 27: 643-651, 2010.
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.
83. Rosso, IM, Makris, N, Britton, JC, Price, LM, Gold, AL, Zai, D, Bruyere, J, Deckersbach, T, **Killgore, WD**, & Rauch, SL. Anxiety sensitivity correlates with two indices of right anterior insula structure in specific animal phobia. *Depress Anxiety*, 27: 1104-1110, 2010.
84. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Neural correlates of anxiety sensitivity during masked presentation of affective faces. *Depress Anxiety*, 28: 243-249, 2011.
85. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine protects against increased risk-taking propensity during severe sleep deprivation. *J Sleep Res* 20: 395-403, 2011.
86. Capaldi, VF, Guerrero, ML, & **Killgore, WD**. Sleep disruption among returning combat veterans from Iraq and Afghanistan. *Mil Med*, 176: 879-888, 2011.
87. **Killgore, WD**, Grugle, NL, & Balkin, TJ. Gambling when sleep deprived: Don't bet on stimulants. *Chronobiol Int*, 29: 43-54, 2012.
88. Gruber, SA, Dahlgren, MK, Sagar, KA, Gonenc, A, & **Killgore, WD**. Age of onset of marijuana use impacts inhibitory processing. *Neurosci Lett* 511(2):89-94, 2012.
89. **Killgore, WD**, Capaldi, VF, & Guerrero, ML. Nocturnal polysomnographic correlates of daytime sleepiness. *Psychol Rep*, 110(10), 63-72, 2012.
90. **Killgore, WD**, Weber, M, Schwab, ZJ, DelDonno, SR, Kipman, M, Weiner, MR, & Rauch, SL. Grey matter correlates of trait and ability models of emotional intelligence. *Neuroreport* 23, 551-555, 2012.
91. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M. Voxel-based morphometric grey matter correlates of daytime sleepiness. *Neurosci Lett*, 518(1), 10-13, 2012.
92. **Killgore, WD**, Schwab, ZJ, & Weiner, MR. Self-reported nocturnal sleep duration is associated with next-day resting state functional connectivity. *Neuroreport*, 23, 741-745, 2012.

93. **Killgore, WD**, & Schwab, ZJ. Sex differences in the association between physical exercise and cognitive ability. *Perceptual and Motor Skills*, 115, 605-617, 2012.
94. Kipman, M, Weber, M, Schwab, ZJ, DelDonno, SR, & **Killgore, WD**. A funny thing happened on the way to the scanner: Humor detection correlates with gray matter volume. *Neuroreport*, 23, 1059-1064, 2012.
95. **Killgore, WD**, Schwab, ZJ, Weber, M, Kipman, M, DelDonno, SR, Weiner, MR, & Rauch, SL. Daytime sleepiness affects prefrontal regulation of food intake. *NeuroImage*, 71, 216-223, 2013.
96. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. Insomnia-related complaints correlate with functional connectivity between sensory-motor regions. *Neuroreport*, 24, 233-240, 2013.
97. Weber, M, Webb, CA, DelDonno, SR, Kipman, M, Schwab, ZJ, Weiner, MR, & **Killgore, WD**. Habitual 'Sleep Credit' is associated with greater gray matter volume of the medial prefrontal cortex, higher emotional intelligence, and better mental health. *Journal of Sleep Research*, 22, 527-534, 2013.
98. Weber, M., **Killgore, WD**, Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, Simon, NM, Pollack, MH, & Rauch, SL. Voxel-based morphometric gray matter correlates of posttraumatic stress disorder. *Journal of Anxiety Disorders*, 27, 413-419, 2013.
99. **Killgore, WD**, Schwab, ZJ, Tkachenko, O, Webb, CA, DelDonno, SR, Kipman M, Rauch SL, and Weber M. Emotional intelligence correlates with functional responses to dynamic changes in facial trustworthiness. *Social Neuroscience*, 8, 334-346, 2013.
100. **Killgore, WD**. Self-reported sleep correlates with prefrontal-amygdala functional connectivity and emotional functioning. *Sleep*, 36, 1597-1608, 2013.
101. **Killgore, WD**, Kipman, M, Schwab, ZJ, Tkachenko, O, Preer, L, Gogel, H, Bark, JS, Mundy, EA, Olson, EA, & Weber, M. Physical exercise and brain responses to images of high calorie food. *Neuroreport*, 24, 962-967, 2013.
102. **Killgore, WD**, Weber, M, Schwab, ZJ, Kipman, M, DelDonno, SR, Webb, CA, & Rauch, SL. Cortico-limbic responsiveness to high-calorie food images predicts weight status among women. *International Journal of Obesity*, 37, 1435-1442, 2013.
103. Thomas, JJ, Hartman, AS, & **Killgore, WD**. Non-fat-phobic eating disorders: Why we need to investigate implicit associations and neural correlates. *International Journal of Eating Disorders*, 46, 416-419, 2013.
104. Webb, CA, Schwab, ZJ, Weber, M, DelDonno, SR, Kipman M, Weiner, MR, & **Killgore WD**. Convergent and divergent validity of integrative versus mixed model measures of emotional intelligence. *Intelligence*, 41, 149-156, 2013.

105. Weber, M, Webb, CA, & **Killgore, WD**. A brief and selective review of treatment approaches for sleep disturbance following traumatic brain injury. *Journal of Sleep Disorders and Therapy*, 2 (2), 1-5, 2013 (electronic publication).
106. **Killgore, WD**, Olson, EA, & Weber, M. Physical exercise habits correlate with gray matter volume of the hippocampus in healthy humans. *Scientific Reports*, 3, 3457, doi: 10.1038/srep0347, 2013.
107. **Killgore, WD**, Britton, JC, Schwab, ZJ, Price, LM, Weiner, MR, Gold, AL, Rosso, IM, Simon, NM, Pollack, MH, & Rauch, SL. Cortico-Limbic Responses to Masked Affective Faces Across PTSD, Panic Disorder, and Specific Phobia. *Depression & Anxiety*, 31, 150-159, 2014.
108. Cohen-Gilbert, JE, **Killgore, WD**, White, CN, Schwab, ZJ, Crowley, DJ, Covell, MJ, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on decision-making during an inhibitory control task in adolescence and adulthood. *Developmental Science*, 17, 212-223, 2014.
109. Dillon, DG, Rosso, IM, Pechtel, P, **Killgore, WD**, Rauch, SL, & Pizzagalli, DA. Peril and pleasure: An RDoC-inspired examination of threat responses and reward processing in anxiety and depression. *Depression and Anxiety*, 31, 233-249, 2014.
110. Preer, L, Tkachenko, O, Gogel, H., Bark, JS, & **Killgore, WD**. Personality traits associated with sleep initiation problems. *Journal of Sleep Disorders: Treatment and Care*, 3, 1-5, doi:10.4172/2325-9639.1000127, 2014.
111. Tkachenko, O, Olson, EA, Weber, M, Preer, LA, Gogel, H, & **Killgore, WD**. Sleep difficulties are associated with elevated symptoms of psychopathology. *Experimental Brain Research*, 232, 1567-1574, 2014.
112. Cui, J., Olson, EA, Weber, M, Schwab, ZJ, Rosso, IM, Rauch, SL, & **Killgore, WD**. Trait emotional suppression is associated with increased activation of the rostral anterior cingulate cortex in response to masked angry faces. *NeuroReport*, 25, 771-776, 2014.
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.
114. **Killgore WD**, & Gogel, H. The Design Organization Test (DOT): Further Demonstration of Reliability and Validity as a Brief Measure of Visuospatial Ability. *Applied Neuropsychology: Adult*, 21, 297-309, 2014.
115. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD**. Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of mild depressive symptoms: A voxel-based morphometric analysis. *Psychological Medicine*, 44, 2833-2843, 2014.
116. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine improves the efficiency of planning and sequencing abilities during sleep deprivation. *Journal of Clinical Psychopharmacology*, 34,

660-662, 2014.

117. Rosso, IM, Olson, EA, Britton, JC, Steward, SE, Papadimitriou, G, **Killgore, WD**, Makris, N, Wilhelm, S, Jenike, MA, & Rauch SL. Brain white matter integrity and association with age at onset in pediatric obsessive-compulsive disorder. *Biology of Mood & Anxiety Disorders*, 4:13, 1-10, 2014.
118. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Preer, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Bark, JS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Microstructure of frontoparietal connections predicts individual resistance to sleep deprivation. *NeuroImage*, 106, 123-133, 2015.
119. Brennan, BP, Tkachenko, O, Schwab, ZJ, Juelich, RJ, Ryan, EM, Athey, AJ, Pope, HG, Jenike, MA, Baker, JT, **Killgore, WD**, Hudson, JJ, Jensen, JE, & Rauch, SL. An examination of rostral anterior cingulate cortex function and neurochemistry in obsessive-compulsive disorder. *Neuropsychopharmacology*, 40, 1866-1876, 2015.
120. Alkozei, A, & **Killgore WD**. Emotional intelligence is associated with reduced insula responses to angry faces. *NeuroReport*, 26, 567-571, 2015.
121. Mundy, EA, Weber, M, Rauch, SL, **Killgore, WD**, Simon, NM, Pollack, MH, & Rosso, IM. Adult anxiety disorders in relation to trait anxiety and perceived stress in childhood. *Psychological Reports*, 117, 1-17, 2015.
122. **Killgore, WD**, Vanuk, JR, Knight, SA, Markowski, SM, Pisner, D, Shane B, Fridman, A, & Alkozei, A. Daytime sleepiness is associated with altered resting thalamocortical connectivity. *NeuroReport*, 26, 779-784, 2015.
123. Olson, EA, Rosso, IM, Demers, LA, Divatia, S., & **Killgore, WD**. Sex differences in psychological factors associated with social discounting. *Journal of Behavioral Decision Making*, 29, 60-66, 2016.
124. Alkozei, A, Schwab, ZJ, & **Killgore, WD**. The role of emotional intelligence during an emotionally difficult decision-making task. *Journal of Nonverbal Behavior*, 40, 39-54, 2016.
125. **Killgore, WD**, Singh, P, Kipman, M, Pisner, D, Fridman, A, and Weber, M. Gray matter volume and executive functioning correlate with time since injury following mild traumatic brain injury. *Neuroscience Letters*, 612, 238-244, 2016.
126. Alkozei, A, Smith, R, & **Killgore, WD**. Exposure to blue wavelength light modulates anterior cingulate cortex activation in response to ‘uncertain’ versus ‘certain’ anticipation of positive stimuli. *Neuroscience Letters*, 616, 5-10, 2016.
127. Olson, EA, Weber, M, Rauch, SL, & **Killgore, WD**. Daytime sleepiness is associated with reduced integration of temporally distant outcomes on the Iowa Gambling Task. *Behavioral Sleep Medicine*, 14, 200-211, 2016.

128. **Killgore, WD**, Sonis, LA, Rosso, IM, & Rauch, SL. Emotional intelligence partially mediates the association between anxiety sensitivity and anxiety symptoms. *Psychological Reports*, 118, 23-40, 2016.
129. Freed, MC, Novak, LA, **Killgore, WD**, Rauch, S, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rizzo, AS, Andrews, A, & Engle, CC. IRB and research regulatory delays within the military healthcare setting: Do they really matter? And if so, why and for whom? *American Journal of Bioethics*, 16, 30-37, 2016.
130. Alkozei, A, Smith, R, Pisner, D, Vanuk, JR, Markowski, SM, Fridman, A, Shane, BR, Knight, SA, & **Killgore, WD**. Exposure to blue light increases later functional activation of the prefrontal cortex during working memory. *SLEEP*, 39, 1671-1680, 2016.
131. Smith, R, Alkozei, A, Lane, RD, & **Killgore, WD**. Unwanted reminders: The effects of emotional memory suppression on subsequent neuro-cognitive processing. *Consciousness and Cognition*, 44, 103-113, 2016.
132. Kelly, MR, **Killgore, WD**, Haynes, PL. Understanding recent insights in sleep and posttraumatic stress disorder from a research domain criteria (RDoC) framework. *Current Sleep Medicine Reports*, 2, 223-232, 2016.
133. Rosso, IM, **Killgore, WD**, Olson, EA, Webb, CA, Fukunaga, R, Auerbach, RP, Gogel, H, Buchholz, JL, & Rauch, SL. Internet-based cognitive behavior therapy for major depressive disorder: A randomized controlled trial. *Depression and Anxiety*, 34, 236-245, 2017.
134. Alkozei, A, Smith, R, Kotzin, MD, Waugaman, DL, & **Killgore, WD**. The association between trait gratitude and self-reported sleep quality is mediated by depressive mood state. *Behavioral Sleep Medicine*, 1-9, 2017.
135. Smith, R, Alkozei, A, & **Killgore, WD**. Contributions of self-report and performance-based individual differences measures of social cognitive ability on large-scale network functioning. *Brain Imaging and Behavior*, 11, 685-697, 2017.
136. Pisner, DA, Smith, R, Alkozei, A, Klimova, A, & **Killgore, WD**. Highways of the emotional intellect: White matter microstructural correlates of an ability-based measure of emotional intelligence. *Social Neuroscience*, 12, 253-267, 2017.
137. **Killgore, WD**, Balkin, TJ, Yarnell, AM, & Capaldi, VF. Sleep deprivation impairs recognition of specific emotions. *Neurobiology of Sleep and Circadian Rhythms*, 3, 10-16, 2017.
138. Smith, R, Lane, R, Alkozei, A, Bao, J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. Maintaining the feelings of others in working memory is associated with activation of the left anterior insula and left frontal-parietal control networks. *Social, Cognitive, and Affective Neuroscience*, 12, 848-860, 2017.
139. Marin, MF, Zsido, RG, Song, H, Lasko, NB, **Killgore, WD**, Rauch SL, Simon, NM, & Milad, MR. Skin conductance responses and neural activations during fear conditioning and extinction

recall across anxiety disorders. *JAMA Psychiatry*, 74, 622-631, 2017.

140. Alkozei, A*, **Killgore, WD***, Smith, R, Dailey, NS, Bajaj, S, & Haack M. Chronic sleep restriction increases negative implicit attitudes toward Arab Muslims. *Scientific Reports*, 7: 4285, 1-6, 2017. (*authors contributed equally).
141. **Killgore, WD**, Smith, R, Olson EA, Weber, M, Rauch, SL, & Nickerson, LD. Emotional intelligence is associated with connectivity within and between resting state networks. *Social Cognitive and Affective Neuroscience*, 12, 1624-1636, 2017.
142. Smith, R, Alkozei, A, Bao, J, Lane, RD, & **Killgore, WD**. Resting state functional connectivity correlates of emotional awareness. *NeuroImage*, 159, 99-106, 2017.
143. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, & **Killgore, WD**. Acute exposure to blue wavelength light during memory consolidation improves verbal memory performance. *PLoS One*, 12, e0184884, 2017.
144. Bajaj, S, Vanuk, JR, Smith, R, Dailey, NS, & **Killgore, WD**. Blue light therapy following mild traumatic brain injury: Effects on white matter water diffusion in the brain. *Frontiers in Neurology*, 8, 616, 2017.
145. Bajaj, S, Alkozei, A, Dailey, NS, & **Killgore, WD**. Brain aging: Uncovering cortical characteristics of healthy aging in you adults. *Frontiers in Aging Neuroscience*, 9, 412, 2017.
146. 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. *Psychological Reports*, 121, 93-111, 2018.
147. Alkozei, A, Smith, R, & **Killgore, WD**. Gratitude and subjective wellbeing: A Proposal of two causal frameworks. *Journal of Happiness Studies*, 5, 1519-1542, 2018.
148. Smith, R, Alkozei, A, & **Killgore, WD**. Conflict-related dorsomedial frontal cortex activation during healthy food decisions is associated with increased cravings for high-fat foods. *Brain Imaging and Behavior*, 12, 685-696, 2018.
149. Webb, CA, Olson, EA, **Killgore, WD**, Pizzagalli, DA, Rauch, SL, & Rosso, IM. Rostral anterior cingulate cortex morphology predicts treatment response to internet-based CBT for depression. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, 3, 255-262, 2018.
150. Smith, R, **Killgore, WD**, & Lane, RD. The structure of emotional experience and its relation to trait emotional awareness: A theoretical review. *Emotion*, 18, 670-692, 2018.
151. Smith, R, Alkozei, A, **Killgore, WD**, & Lane, RD. Nested positive feedback loops in the maintenance of major depression: An integration and extension of previous models. *Brain, Behavior, and Immunity*, 67, 374-397, 2018.
152. Alkozei, A, **Killgore, WD**, Smith, R, Dailey, N.S., Bajaj, S, Raikes, A, & Haack, M. Chronic sleep restriction differentially affects implicit biased toward food among men and women:

Preliminary evidence. *Journal of Sleep Research*, 27, e12629, 2018.

153. Smith, R, Bajaj, S, Dailey, NS, Alkozei, A, Smith, C, Sanova, A, Lane, RD, & **Killgore, WD**. Greater cortical thickness within the limbic visceromotor network predicts higher levels of trait emotional awareness. *Consciousness and Cognition*, 57, 54-61, 2018.
154. Bajaj, S, Dailey, NS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Time-dependent differences in cortical measures and their associations with behavioral measures following mild traumatic brain injury. *Human Brain Mapping*, 39, 1886-1897, 2018.
155. Smith, R, Lane, RD, Alkozei, A, Bao, J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. The role of medial prefrontal cortex in the working memory maintenance of one's own emotional responses. *Scientific Reports*, 8, 3460, 2018.
156. **Killgore, WD**, Kent, HC, Knight, SA, & Alkozei, A. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. *NeuroReport*, 29, 488-494, 2018.
157. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Increases in emotional intelligence after an online training program are associated with better decision-making in the Iowa Gambling Task. *Psychological Reports*, 33294118771705, 2018.
158. Dailey, NS, Smith, R, Bajaj, S, Alkozei, A, Gottschlich, MK, Raikes, AC, Satterfield, BC, & **Killgore, WD**. Elevated aggression and reduced white matter integrity in mild traumatic brain injury: A DTI study. *Frontiers in Behavioral Neuroscience*, 12, 118, 2018.
159. Raikes, AC, Bajaj, S, Dailey, NS, Smith, R, Alkozei, A, Satterfield, BC, & **Killgore, WD**. Diffusion tensor imaging (DTI) correlates of self-reported sleep quality and depression following mild traumatic brain injury. *Frontiers in Neurology*, 9, 468, 2018.
160. Smith, R, Sanova, A, Alkozei, A, Lane, RD, & **Killgore, WD**. Higher levels of trait emotional awareness are associated with more efficient global information integration throughout the brain: A graph-theoretic analysis of resting state functional connectivity. *Social Cognitive and Affective Neuroscience*, 13, 665-675, 2018.
161. Alkozei, A, Smith, R, & **Killgore, WD**. Implicit self-esteem is associated with higher levels of trait gratitude in women but not men. *Journal of Positive Psychology*, DOI: 10.1080/17439760.2018.1497691, 2018.
162. Bajaj, S, Raikes, A, Smith, R, Dailey, NS, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The relationship between general intelligence and cortical structure in healthy individuals. *Neuroscience*, 388, 36-44, 2018.
163. Alkozei, A, Haack, M, Skalamera, J, Smith, R, Satterfield, BC, Raikes, A, & **Killgore, WD**. Chronic sleep restriction affects the associations between implicit bias and explicit social decision-making. *Sleep Health*, 4, 456-462, 2018.

164. Raikes, A, & **Killgore, WD**. Potential for the development of light therapies in mild traumatic brain injury. *Concussion*, 3, CNC57, 2018.
165. Smith, R, Lane, RD, Sanova, A, Smith, C, & **Killgore, WD**. Common and unique neural systems underlying the working memory maintenance of emotional vs. bodily reactions to affective stimuli: The moderating role of trait emotional awareness. *Frontiers in Human Neuroscience*, 12, 370, 2018.
166. Dailey, NS, Smith, R, Vanuk, JR, Raikes, AC, & **Killgore, WD**. Resting-state functional connectivity as a biomarker of aggression in mild traumatic brain injury. *NeuroReport*, 29, 1413-1417, 2018.
167. McConnell, MH, **Killgore, WD**, & O'Connor, MF. Yearning predicts subgenual anterior cingulate activity in bereaved individuals. *Heliyon*, 4, e00852, 2018.
168. Smith, R, **Killgore, WD**, Alkozei, A, & Lane, RD. A neuro-cognitive process model of emotional intelligence. *Biological Psychology*, 139, 131-151, 2018.
169. Raikes, AC, Satterfield, BC, & **Killgore, WD**. Evidence of actigraphic and subjective sleep disruption following mild traumatic brain injury. *Sleep Medicine*, 54, 62-69, 2019.
170. Smith, R, Weihs, KL, Alkozei, A, **Killgore, WD**, & Lane RD. An embodied neurocomputational framework for organically integrating biopsychosocial processes: An application to the role of social support in health and disease. *Psychosomatic Medicine*, 81, 125-145, 2019.
171. Satterfield, BC, Raikes, AC, & **Killgore, WD**. Rested-baseline responsivity of the ventral striatum is associated with caloric and macronutrient intake during one night of sleep deprivation. *Frontiers in Psychiatry*, 9, 749, 2019.
172. Raikes, AC, Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Insomnia and daytime sleepiness: Risk factors for sports-related concussion. *Sleep Medicine*, 58, 66-74 (2019).
173. Smith, R, Alkozei, A, & **Killgore, WD**. Parameters as trait indicators: Exploring a complementary neurocomputational approach to conceptualizing and measuring trait differences in emotional intelligence. *Frontiers in Psychology*, 10, 848 (2019).
174. Vanuk, JR, Alkozei, A, Raikes, AC, Allen, JJB, & **Killgore, WD**. Ability-based emotional intelligence is associated with greater cardiac vagal control and reactivity. *Frontiers in Human Neuroscience*, 11, 181 (2019).
175. Bajaj, S, Raikes, AC, Smith RS, Vanuk, JR, & **Killgore WD**. The role of prefrontal cortical surface area and volume in preclinical suicidal ideation in a non-clinical sample. *Frontiers in Psychiatry*, 21, 445 (2019).
176. Alkozei, A, Smith, R, Waugaman, D, Kotzin, M, Bajaj, S, & **Killgore, WD**. The mediating role of interpretation bias on the relationship between trait gratitude and depressive symptoms.

International Journal of Applied Positive Psychology, 4, 135-147 (2019).

177. Bajaj, S, & **Killgore, WD**. Sex differences in limbic network and risk-taking propensity in healthy individuals. *Journal of Neuroscience Research*, 98, 371-383 (2020).
178. Satterfield, BC & **Killgore, WD**. Habitual sleep duration predicts caloric and macronutrient intake during sleep deprivation. *Sleep Health*, 6, 88-91 (2020).
179. Bajaj, S, & **Killgore, WD**. Vulnerability to mood degradation during sleep deprivation is influenced by white-matter compactness of the triple-network model. *NeuroImage*, 202, 116123 (2020).
180. **Killgore, WD**, Vanuk, JR, Shane, BR, Weber, M, & Bajaj, S. A randomized, double-blind, placebo-controlled trial of blue wavelength light exposure on sleep and recovery of brain structure, function and cognition following mild traumatic brain injury. *Neurobiology of Disease*, 134, 104679 (2020).
181. Li, Huanjie, Smith, SM, Gruber, S, Lukas, SE, Silveri, MM, Hill, KP, **Killgore, WD**, & Nickerson, LD. Denoising scanner effects from multimodal MRI data using linked independent component analysis. *NeuroImage*, 208, 116288 (2020).
182. Grandner, MA, Olivier, K, Gallagher, R, Hale, L, Barrett, M, Branas, C, **Killgore, WD**, Parthasarathy, S, Gehrels, J, & Alfonso-Miller, P. Quantifying impact of real-world barriers to sleep: The Brief Index of Sleep Control (BRISC). *Sleep Health*, 6, 587-593 (2020).
183. Grandner, MA, Hall, C, Jaszewski, A., Alfonso-Miller, P, Gehrels, J, **Killgore, WD**, & Athey, A. Mental health in student athletes: Associations with sleep duration, sleep quality, insomnia, fatigue, and sleep apnea symptoms. *Athletic Training and Sports Health Care* (in press).
184. Raikes, AC, Dailey, NS, Shane, BR, Forbeck, B, Alkozei, A, & **Killgore WD**. Daily morning blue light therapy improves daytime sleepiness, sleep quality, and quality of life following a mild traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 35, E405-E421 (2020).
185. Khader, W, Tubbs, AS, Haghighi, Athey, A, **Killgore, WD**, Gehrels, J, Alfonso-Miller, P, Perlis, ML, Fernandez, F, & Grandner, MA. Onset insomnia and insufficient sleep duration predict suicide ideation in university students and athletes. *Journal of Affective Disorders*, 274, 1161-1164 (2020).
186. **Killgore, WD**, & Kamimori, GH. Multiple caffeine doses maintain vigilance, attention, complex motor sequence expression, and manual dexterity during 77 hours of total sleep deprivation. *Neurobiology of Sleep and Circadian Rhythms*, 9, 100051 (2020).
187. **Killgore, WD**, Cloonan, SA, Taylor, EC, & Dailey, NS. Loneliness: A signature mental health concern in the era of COVID-19. *Psychiatry Research*, 290, 113117 (2020).
188. **Killgore, WD**, Cloonan, SA, Taylor, EC, Fernandez, F, Grandner, MA, & Dailey, NS. Suicidal ideation during the COVID-19 pandemic: The role of insomnia. *Psychiatry Research*, 290,

113134 (2020).

189. **Killgore, WD**, Taylor, EC, Cloonan, SA, & Dailey, NS. Psychological resilience during the COVID-19 lockdown. *Psychiatry Research*, 291, 113216 (2020).
190. **Killgore, WD**, Dailey, NS, Raikes, AC, Vanuk, JR, Taylor E, & Alkozei, A. Blue light exposure enhances neural efficiency of the task positive network during a cognitive interference task. *Neuroscience Letters*, 735, 135242 (2020).
191. Khader, WS, Fernandez, FX, Seixas, A, Knowlden, A, Ellis, J, Williams, N, Perlis, ML, Jean-Louis, G, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. What makes people want to make changes to their sleep? Assessment of Perceived risks of insufficient sleep as a predictor of intent to improve sleep. *Sleep Health*, 7, 98-104 (2021).
192. Martin, LF, Patwardhan, AM, Jain, SV, Salloum, MM, Freeman, J, Khanna, R, Gannala, P, Goel V, Jones-MacFarland, FN, **Killgore, WD**, Porreca, F, & Ibrahim, MM. The effect of green light exposure on headache frequency and quality of life in migraine patients: A preliminary one-way cross-over clinical trial. *Cephalalgia*, 41, 135-147 (2021).
193. **Killgore, WD**, Cloonan, SA, Taylor, EC, Allbright, MC, & Dailey, NS. Trends in suicidal ideation over the first three months of COVID-19 lockdowns. *Psychiatry Research*, 293, 113390 (2020).
194. **Killgore, WD**, Cloonan, SA, Taylor EC, Miller, MM, and Dailey, NS. Three months of loneliness during the COVID-19 lockdown. *Psychiatry Research*, 293, 113392 (2020).
195. **Killgore, WD**. Lightening the mood: Evidence for blue light exposure in the treatment of post-concussion depression. *Expert Review of Neurotherapeutics*, 20, 1081-1083 (2020).
196. Martin, L, Porreca, F, Mata, EE, Salloum, M, Goel, V, Gunnala, P, **Killgore, WD**, Jones-MacFarland, FN, Khanna, R, Patwardhan, A, & Ibrahim, MM. Exposure to green light improves pain scores and quality of life in patients with fibromyalgia: A cross over clinical trial. *Pain Medicine*, 22, 118-130 (2021).
197. **Killgore, WD**, Cloonan, SA, Taylor, EC, Lucas, DA, & Dailey, NS. Loneliness during the first half-year of the COVID-19 lockdowns. *Psychiatry Research*, 294, 113551 (2020).
198. Nunez, A, Rhee, JU, Haynes, P, Chakravorty, S, Patterson, F, **Killgore, WD**, Gallagher, RA, Hale, L, Branas, C, Carrasco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Smoke at night and sleep worse? The associations between cigarette smoking with insomnia severity and sleep duration. *Sleep Health*, 7, 177-182 (2021).
199. **Killgore, WD**, Cloonan, SA, Taylor, EC, Lucas, DA, & Dailey, NS. Alcohol dependence during COVID-19 lockdowns. *Psychiatry Research*, 296, 113676 (2021).
200. Bajaj, S. & **Killgore, WD**. Association between emotional intelligence and effective brain connectome: A large scale spectral DCM study. *NeuroImage*, 229, 117750 (2021).

201. Raikes, AC, Dailey, NS, Forbeck, B, Alkozei, A, & **Killgore, WD**. Daily morning blue light therapy for post-mTBI sleep disruption: Effects on brain structure and function. *Frontiers in Neurology*, 12, 625431 (2021).
202. Bajaj, S., Raikes, AC, Razi, A, Miller, MA, & **Killgore, WD**. Blue-light therapy strengthens resting-state effective connectivity with default mode network after mild TBI. *Journal of Central Nervous System Disease*, 13, 1-16 (2021).
203. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, and **Killgore, WD**. Exposure to blue wavelength light is associated with increases in bidirectional amygdala-DLPFC connectivity at rest. *Frontiers in Neurology*, 12, 625443 (2021).
204. Charest, J, Bastien, CH, Ellis, J, **Killgore WD**, & Grandner, MA. The impact of perceived sleep, mood, and alcohol use on verbal, physical, and sexual assault experiences among student-athletes and student non-athletes. *International Journal of Environmental Research and Public Health*, 18, 2883 (2021).
205. **Killgore, WD**, Cloonan, SA, Taylor, EC, & Dailey, NS. Mental health during the first weeks of the COVID-19 pandemic in the United States. *Frontiers in Psychiatry*, 12, 561898, 2021.
206. **Killgore, WD**, Cloonan, SA, Taylor, EC, & Dailey, NS. The COVID-19 vaccine is here—Now who is willing to get it? *Vaccines*, 9, 339 (2021).
207. Wills, C, Ghani, S, Tubbs, A, Fernandez, FX, Athey, A, Turner, R, Robbins, R, Patterson, F, Warlick, C, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Chronotype and social support among student athletes: Impact on depressive symptoms. *Chronobiology International*, 38, 1319-1329 (2021).
208. **Killgore, WD**, Cloonan, SA, Taylor, EC, Anlap, I, & Dailey, NS. Increasing aggression during the COVID-19 lockdowns. *Journal of Affective Disorders Reports*, 5, 100163 (2021).
209. Kennedy, KE, Onyeonwu, C, Nowakowski, S, Hale, L, Branas, C, **Killgore, WD**, Wills, CC, & Grandner, MA. Menstrual regularity and bleeding is associated with sleep duration, sleep quality, and daytime sleepiness in a community sample. *Journal of Sleep Research*; 31: E13434, 1-9 (2022).
210. Ghani, SB, Taneja, K, Wills, CC, Tubss, A, Delgadillo, ME, Valencia, D, Halane, M, **Killgore, WD**, and Grandner, MA. Culturally-consistent diet among individuals of Mexican descent at the US-Mexico border is associated with sleep duration and snoring. *BMC Nutrition*, 7, 53 (2021).
211. Kennedy, KE, Bastien, C, Ruby P, **Killgore, WD**, Wills, CC, & Grandner, MA. Nightmare content during the COVID-19 pandemic: Influence of COVID-related stress and sleep disruption. *Journal of Sleep Research*, 31: E13439, 1-14 (2022).
212. Persich, MR, Smith, R, Cloonan, SA, Woods-Lubbert, R, Strong, M, & **Killgore, WD**. Emotional intelligence training as a protective factor for mental health during the COVID-19 pandemic. *Depression & Anxiety*, 38, 1018-1025 (2021).

213. Smith, R, Taylor, S, Wang, S, Wilson, RC, Chuning, AE, Persich, MR, and **Killgore, WD**. Lower levels of directed exploration and reflective thinking are associated with greater anxiety and depression. *Frontiers in Psychiatry*, 12, 782136 (2021).
214. **Killgore, WD**, Vanuk, JR, Persich, MR, Cloonan, SA, Grandner, MA, & Dailey, NS. Sleep quality and duration are associated with greater trait emotional intelligence. *Sleep Health*, 8, 230-233 (2022).
215. **Killgore, WD**, Cloonan, SA, Taylor, EC, Vanuk, JR, & Dailey, NS. Morning drinking during COVID-19 lockdowns. *Psychiatry Research*, 307, 114320 (2022).
216. Smith, R, Persich, M, Lane, RD, & **Killgore, WD**. Higher emotional awareness is associated with greater domain-general reflective tendencies. *Scientific Reports*, 12, 3123 (2022).
217. Tubbs, AS, Ghani, SB, Jean-Louis, G, **Killgore, WD**, Fernandez, FX, & Grandner, MA. Racial/ethnic minorities have greater declines in sleep duration with higher risk of cardiometabolic disease: An analysis of the U.S. National Health Interview Survey. *Sleep Epidemiology*, 2, 100022 (2022).
218. **Killgore, WD**, Alkozei, A, Vanuk, JR, Reign, D, Grandner, MA, & Dailey, NS. Blue light exposure increases functional connectivity between dorsolateral prefrontal cortex and multiple cortical regions. *NeuroReport*, 33, 236-241 (2022).
219. Hanuka, S, Olson, EA, Adomon, R, Webb, CA, **Killgore, WD**, Rauch, SL, Rosso, IM, & Pizzagalli, DA. Reduced anhedonia following internet-based cognitive behavioral therapy for depression is mediated by enhanced reward circuit activation. *Psychological Medicine*, 1-10 (2022).
220. Vanuk, JR, Pace-Schott, E, Esbit, S, Bullock, A, Dailey, NS, & **Killgore, WD**. Morning blue light treatment improves sleep complaints, symptom severity, and retention of fear extinction memory in PTSD. *Frontiers in Behavioral Neuroscience* (in press).
221. **Killgore, WD**, Vanuk, JR, & Dailey, NS. Treatment with morning blue light increases amygdala volume and sleep duration among individuals with posttraumatic stress disorder. *Frontiers in Behavioral Neuroscience* (in press).
222. Raikes, AC, Hernandez, GD, Mullins, VA, Wang, Y, Lopez, C, **Killgore, WD**, Chilton, FH, & Brinton, R. Effects of docosahexaenoic acid (DHA) supplementation on white matter integrity after repetitive subconcussive head impacts during American football. *Frontiers in Neurology* (in press).

Book Chapters/Editorials/Other Published Articles

1. **Killgore, WD**. Cortical and limbic activation during visual perception of food. In Dube, L, Bechara, A, Dagher, A, Drewnowski, A, Lebel, J, James, P, & Yada, R. (Eds), *Obesity Prevention: The Role of Brain and Society on Individual Behavior*. Elsevier, Boston, 2010,

pp. 57-71.

2. **Killgore, WD.** Asleep at the trigger: Warfighter judgment and decision-making during prolonged wakefulness. In Bartone, P. (Ed), *Applying Research Psychology to Improve Performance and Policy*. 2010, pp. 59-77.
3. **Killgore, WD.** Effects of Sleep Deprivation on Cognition. In Kerkhof, G. & Van Dongen, H. *Progress in Brain Research: Sleep and Cognition*. Elsevier, B.V. New York, 2010, pp. 105-129.
4. **Killgore, WD.** Caffeine and other alerting agents. In Thorpy, M. & Billiard, M. (Eds), *Sleepiness: Causes, Consequences, Disorders and Treatment*. Cambridge University Press, UK, 2011, pp. 430-443.
5. **Killgore WD.** Priorities and challenges for caffeine research: Energy drinks, PTSD, and withdrawal reversal. *The Experts Speak Column, J Caffeine Res*, 1, 11-12, 2011.
6. **Killgore, WD.** Odor identification ability predicts executive function deficits following sleep deprivation. In Lee-Chiong, T (Ed), *Best of Sleep Medicine 2011*. National Jewish Health, Denver CO, 2011, pp. 31-33.
7. **Killgore, WD.** Socio-emotional and neurocognitive effects of sleep loss. In Matthews, G. (Ed), *Handbook of Operator Fatigue*. Ashgate, London UK, 2012, pp. 227-243.
8. **Killgore, WD.** Sleepless nights and bulging waistlines (Editorial). *Journal of Sleep Disorders: Treatment and Care*, 1(1), doi: [10.4172/jsdtc.1000e101](https://doi.org/10.4172/jsdtc.1000e101), 2012.
9. **Killgore, WD, & Penetar, DM.** Sleep and Military Operational Effectiveness. In Kushida, CA (Ed), *The Encyclopedia of Sleep*, 2013, vol. 1, pp. 311-319. Academic Press, Waltham, MA.
10. **Killgore, WD, Weiner, MR, & Schwab, ZJ.** Sleep deprivation, personality, and psychopathic changes. In Kushida, CA (Ed), *The Encyclopedia of Sleep*, 2013, vol. 1, pp. 264-271. Academic Press, Waltham, MA.
11. Schoenberg, MR, & **Killgore, WD.** Psychologic and Psychiatric Assessment. In Kushida, CA (Ed), *The Encyclopedia of Sleep*, 2013, vol. 2, pp. 23-26. Academic Press, Waltham, MA.
12. **Killgore, WD.** Sleep loss and performance. In Moore, BA, & Barnett, JE (Eds), *Military Psychologists' Desk Reference*, 2013, pp. 241-246. Oxford University Press, New York.
13. Weber, M., & **Killgore, WD.** What are the emerging therapeutic uses of bright light therapy for neurological disorders? (Editorial). *Future Neurology*, 8, 495-497, 2013.
14. **Killgore WD & Weber, M.** Sleep deprivation and cognitive performance. In Bianchi, M (Ed), *Sleep Deprivation and Disease: Effects on the Body, Brain and Behavior*, 2014, pp. 209-229. Springer, New York.

15. **Killgore, WD.** Sleep deprivation and behavioral risk taking. In Watson, RR, Sleep Modulation by Obesity, Diabetes, Age and Diet, 2015, pp. 279-287. Elsevier, San Diego, CA.
16. **Killgore, WD.** Lighting the way to better sleep and health (Editorial). *Journal of Sleep Disorders: Treatment and Care*, 5:1, 2016.
17. Singh, P, & **Killgore WD.** Time dependent differences in gray matter volume post mild traumatic brain injury. *Neural Regeneration Research*, 11, 920-921, 2016.
18. Klimova, A, Singh, P, & **Killgore WD.** White matter abnormalities in MS: Advances in diffusion tensor imaging/tractography. In Watson, RR & Killgore, WD (Eds), *Nutrition and Lifestyle in Neurological Autoimmune Diseases: Multiple Sclerosis*. Elsevier, San Diego, CA, pp. 21-28, 2017.
19. Alkozei, A, Smith, R, & **Killgore, WD.** Grateful people are happy and healthy—But why? *Frontiers for Young Minds* (in press).
20. Smith, R, Alkozei, A, & **Killgore WD.** How do emotions work? *Frontiers for Young Minds* (in press).
21. Satterfield, BC, & **Killgore, WD.** Sleep loss, executive function, and decision-making. In Grandner, MG (Ed), *Sleep and Health*. Elsevier, San Diego (in press).
22. Satterfield, BC, Raikes, AC, & **Killgore, WD.** Sleep in social cognition and judgment. In Krizan, Z. (Ed), *Sleep, Personality, and Social Behavior*. Springer Nature (in press).
23. Raikes, AC, Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Author response: Concussion assessment tools—A possible measure of sleepiness? *Sleep Medicine*, 66, 260-261, 2020.
24. **Killgore, WD**, Penetar, DM, & Capaldi, VF. Military operational effectiveness. In Kushida, CA (Ed), *Encyclopedia of Sleep and Circadian Rhythms* (2nd Edition). (2021).
25. **Killgore, WD**, & Doty, TJ. Personality and psychopathic changes. In Kushida, CA (Ed), *Encyclopedia of Sleep and Circadian Rhythms* (2nd Edition). (2021).
26. Doty, TJ, Shoenberg, MR, Dailey, NS, & **Killgore, WD.** Psychologic and psychiatric assessment. In Kushida, CA (Ed), *Encyclopedia of Sleep and Circadian Rhythms* (2nd Edition). (2021).
27. Cloonan, SA, Taylor, EC, Persich, MR, Dailey, NS, & **Killgore, WD.** Sleep and resilience during the COVID-19 pandemic. In Gabrielli, F, and Irtelli, F (Eds.). *Anxiety, Uncertainty, and Resilience During the Pandemic Period – Anthropological and Psychological Perspectives*. IntechOpen (2021).
28. Krupp, K, Madhivanan, P, **Killgore, WD**, Ruiz, JM, Carvajal, S, & Grandner, MA. Neurological manifestations in COVID-19: An unrecognized crisis in our elderly?

(Commentary). *Advances in Geriatric Medicine and Research* (2021).

Books

1. Watson, RR, & **Killgore, WD** (Eds.). *Nutrition and lifestyle in neurological autoimmune diseases: Multiple Sclerosis*. Elsevier, San Diego, CA, 2017.

Published U.S. Government Technical Reports

1. **Killgore, WD**, Estrada, A, Rouse, T, Wildzunas, RM, Balkin, TJ. Sleep and performance measures in soldiers undergoing military relevant training. USAARL Report No. 2009-13. June, 2009.
2. Kelley, AM, **Killgore, WD**, Athy, JR, Dretsch, M. Risk propensity, risk perception, and sensation seeking in U.S. Army Soldiers: A preliminary study of a risk assessment battery. USAARL Report No. 2010-02. DTIC #: ADA511524. October, 2009.

CONFERENCES/SCHOLARLY PRESENTATIONS

Colloquia

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|------|---|
| 2000 | <i>The Neurobiology of Emotion in Children</i> , McLean Hospital, Belmont, MA [<i>Invited Lecture</i>] |
| 2001 | <i>The Neurobiology of Emotion in Children and Adolescents</i> , McLean Hospital, Belmont, MA [<i>Invited Lecture</i>] |
| 2002 | Cortico-Limbic Activation in Adolescence and Adulthood, Youth Advocacy Project, Cape Cod, MA [<i>Invited Lecture</i>] |
| 2008 | Lecture on <i>Sleep Deprivation, Executive Function, and Resilience to Sleep Loss</i> ; 105 th IMA Detachment, U.S. Army Reserve Center, Boston, MA [<i>Invited Lecture</i>] |
| 2008 | Lecture on <i>The Role of Research Psychology in the Army</i> ; 105 th IMA Detachment, U.S. Army Reserve Center, Boston, MA [<i>Invited Lecture</i>] |
| 2008 | Lecture on <i>Combat Stress Control: Basic Battlemind Training</i> ; 105 th IMA Detachment, U.S. Army Reserve Center, Boston, MA [<i>Invited Lecture</i>] |
| 2009 | Lecture entitled <i>Evaluate a Casualty, Prevent Shock, and Prevent Cold Weather injuries</i> ; 105 th IMA Detachment, U.S. Army Reserve Center, Boston, MA [<i>Invited Lecture</i>] |
| 2009 | Lecture on <i>Combat Exposure and Sleep Deprivation Effects on Risky Decision-Making</i> ; 105 th IMA Detachment, U.S. Army Reserve Center, Boston, MA [<i>Invited Lecture</i>] |

- 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 Basis of Emotional Trauma and Practical Issues in Supporting Victims of Trauma*, U.S. Department of Justice, United States Attorneys Office, Serving Victims of Crime Training Program, Holyoke, 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*]
- 2016 Presentation entitled: *SCAN Lab Traumatic Stress and TBI Studies*. Presented at the Tucson Veteran Center, Tucson AZ [*Invited Lecture*]
- 2016 Lecture entitled *The Battle for Mosul: An S2 Brief*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [*Invited Lecture*]
- 2017 Lecture entitled *A New Experimental Treatment for Sleep Problems Following Mild TBI*; 105th IMA Detachment, U.S. Army Reserve Center, Boston, MA [*Invited Lecture*]

- 2017 Lecture entitled *Basics of Neuroimaging Research*; UA Psychiatry Resident Neuroscience Course, University of Arizona Department of Psychiatry, Tucson, AZ [Invited Lecture]

- 2019 Presentation entitled Physiology Student Opportunities in the Social Cognitive and Affective Neuroscience Lab. Presented at the University of Arizona Physiology Honors Academy, Tucson, AZ [Invited Discussant]

- 2019 Presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presented at the University of Arizona Sleep Lecture Series, Tucson, AZ [Invited Lecture]

- 2019 Presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presented at the Annual Club Hypnos Meeting Datablitz, San Antonio, TX [Invited Lecture]

- 2021 Presentation entitled Modulating Sleep and Circadian Rhythms to Facilitate Recovery from PTSD. Presented at the University of Arizona MARC Program Lecture Series, Tucson, AZ [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 *Functional Neuroimaging, Cognitive Assessment, and the Enhancement of Soldier Performance*, 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]

- 2006 Briefing to the Chairman of the Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program, entitled *Optimization of Judgment and Decision Making Capacities in Soldiers Following Sleep Deprivation*, Walter Reed Army Institute of Research [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]

- 2006 Lecture on *Norming a Battery of Tasks to Measure the Cognitive Effects of Operationally Relevant Stressors*, Cognitive Performance Assessment Program Area Steering Committee, U.S. Army Military Operational Medicine Research Program, 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 Briefing on the *Measurement of Sleep-Wake Cycles and Cognitive Performance in Combat Aviators*, U.S. Department of Defense, Defense Advanced Research Projects Agency (DARPA), Washington, DC [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 on *Sleep Deprivation, Executive Function, and Resilience to Sleep Loss*: Walter Reed Army Institute of Research AIBS Review, Washington DC [Invited Lecture]
- 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]
- 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]
- 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 Grand Rounds Lecture entitled *Sleep Loss, Brain Function, and Performance of the Emotional-Executive System*. University of Arizona Psychiatry Grand Rounds, Tucson, AZ [*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*]
- 2014 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*]
- 2014 Lecture Entitled *The Neurobiological Basis and Potential Modification of Emotional Intelligence Through Affective/Behavioral Training*, Military Operational Medicine Research Program In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [*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]
- 2015 Lecture entitled *Sleep Deprivation Selectively Impairs Emotional Aspects of Cognition*. Presented at the Pamela Turbeville Speaker Series, McClelland Institute for Children, Youth, and Families, 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 Sleep Deprivation Selectively Impairs Emotional Aspects of Cognition. Presented at the Pamela Turbeville Speaker Series, McClelland Institute for Children, Youth, and Families, 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 Lecture entitled *Translational Neuroimaging: Using MRI Techniques to Promote Recovery and Resilience*. Functional Neuroimaging Course, Spring 2016, Psychology Department, University of Arizona, Tucson, AZ [Invited Lecture]

- 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 2016 Resilience In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [*Invited Lecture*]
- 2017 Lecture Entitled *Bright Light Therapy for Treatment of Sleep Problems following Mild TBI*, Military Operational Medicine Research Program Combat Casualty Care In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [*Invited Lecture*]
- 2017 Lecture Entitled *Refinement and Validation of a Military Emotional Intelligence Training Program*, Military Operational Medicine Research Program 2017 Resilience In Progress Review (IPR) Briefing, U.S. Army Medical Research and Materiel Command, Fort Detrick, MD [*Invited Lecture*]
- 2018 Lecture Entitled *Introduction to Chronobiology (Part 1)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD [*Invited Lecture*]
- 2018 Lecture Entitled *Introduction to Chronobiology (Part 2)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD [*Invited Lecture*]
- 2018 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*]
- 2018 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*]

- 2019 Lecture Entitled *Update: 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*]
- 2019 Lecture Entitled *Update: 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*]
- 2019 Grand Rounds Lecture entitled *Light Therapy: Implications for Recovery Following PTSD and mTBI*. University of Arizona Psychiatry Grand Rounds, Tucson, AZ [*Invited Lecture*]
- 2020 Lecture Entitled *Introduction to Chronobiology (Part 1)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD [*Invited Lecture*]
- 2020 Lecture Entitled *Introduction to Chronobiology (Part 2)*, Sleep Research Seminar Series, Walter Reed Army Institute of Research, Silver Spring, MD [*Invited Lecture*]
- 2020 Lecture Entitled *Modulating Sleep and Circadian Rhythms to Facilitate Recovery from PTSD*, McLean Hospital Neuroscience Seminar Speaker Series, Harvard Medical School, Belmont, MA [*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. [*Submitted Presentation*]
- 2002 Oral Platform Presentation *Gray and white matter volume during adolescence correlates with cognitive performance: A morphometric MRI study*, 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada. [*Submitted Presentation*]

- 2004 Lecture on *Sleep Deprivation, Cognition, and Stimulant Countermeasures*: Seminar Presented at the Bi-Annual 71F Research Psychology Short Course, Ft. Detrick, MD, U.S. Army Medical Research and Materiel Command [*Invited Lecture*]
- 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*]
- 2004 Oral Platform Presentation entitled *Regional cerebral metabolic correlates of electroencephalographic activity during stage-2 and slow-wave sleep: An H215O PET Study*, 18th Associated Professional Sleep Societies Annual Meeting, Philadelphia, PA. [*Submitted Presentation*]
- 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*]
- 2007 Symposium on *Cortical and Limbic Activation in Response to Visual Images of Low and High-Caloric Foods*, 6th Annual Meeting of the International Society for Behavioral Nutrition and Physical Activity (ISBNPA), Oslo, Norway [*Invited Lecture*]
- 2008 Lecture on *Sleep Deprivation, Executive Function, & Resilience to Sleep Loss*, First Franco-American Workshop on War Traumatism, IMN SSA, 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 [Invited Lecture]
- 2015 Symposium Entitled presentation entitled *Sleep Deprivation and Emotional Decision Making*, Virginia Tech Sleep Workshop, Arlington, VA [Invited Symposium]
- 2016 Oral Platform presentation entitled *Default Mode Activation Predicts Vulnerability to Sleep Deprivation in the Domains of Mood, Sleepiness, and Vigilance*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Denver, CO [Invited Lecture]
- 2016 Symposium presentation entitled *Short Wavelength Light Therapy Facilitates Recovery from Mild Traumatic Brain Injury*, 2016 Military Health Systems Research Symposium (MHSRS), Orlando, FL [Invited Lecture]

- 2017 Lecture Entitled: *Military Update on Blue Light Therapy for mTBI*. Lecture presented at the DoD Sleep Research Meeting breakout session at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA [*Invited Lecture*]
- 2017 Symposium entitled: *Judgment and Decision Making During Sleep Loss*. Invited symposium presentation at the SLEEP 2017 Trainee Symposium Series, Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA [*Invited Lecture*]
- 2017 Oral Platform presentation entitled *Short Wavelength Light Therapy Facilitates Recovery from Mild Traumatic Brain Injury*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Boston, MA [*Invited Lecture*]
- 2017 Symposium entitled: What makes a super-soldier: Identifying the neural correlates of individual differences in resilience against sleep deprivation. Invited symposium presentation at the 2017 Military Health Systems Research Symposium (MHSRS), Orlando, FL [*Invited Lecture*]
- 2018 Oral Platform presentation entitled: Short Wavelength Light Therapy Enhances Brain and Cognitive Recovery Following Mild Traumatic Brain Injury. Presentation given at the Arizona Research Institute for Biomedical Imaging (ARIBI) Workshop, Tucson, AZ [*Invited Lecture*]
- 2018 Session Chair: Healthy Shiftwork? Measures, Mitigation and Functional Outcomes. Session presented at the Associated Professional Sleep Societies (APSS) SLEEP Conference (Session O02), Baltimore, MD [*Session Chair*]
- 2018 Lecture Entitled: *Lapses During Sleep Loss are Predicted by Gray Matter Volume of the Ascending Reticular Activating Systems*. Lecture presented at the 2nd Annual DoD Sleep Research Meeting breakout session at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Baltimore, MD [*Invited Lecture*]
- 2018 Oral Platform presentation entitled *Resistance to Sleep Deprivation is Predicted by Gray Matter Volume in the Posterior Brain Stem*. Presentation given at the Associated Professional Sleep Societies (APSS) SLEEP meeting, Baltimore, MD [*Invited Lecture*]
- 2018 Oral Platform presentation entitled *Why Can't You Just Stay Awake? Resistance to Sleep Deprivation is Associated with Measurable Differences in Brainstem Gray Matter*. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2018 Meeting, Orlando, FL [*Invited Lecture*]
- 2019 Oral Platform presentation entitled Morning Blue Light Exposure Improves Sleep and Fear Extinction Recall in PTSD. Presentation given at the Associated

Professional Sleep Societies (APSS) SLEEP 2019 meeting, San Antonio, TX
[Invited Lecture]

- 2019 Oral Platform presentation entitled Blue Light Exposure Enhances Sleep and Fear Extinction Recall in PTSD. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2019 Meeting, Orlando, FL *[Invited Lecture]*
- 2019 Oral Platform presentation entitled Baseline GABA Levels are Associated with Time-on-Task Performance During Sleep Deprivation. Presentation given at the Military Health Systems Research Symposium (MHSRS) 2019 Meeting, Orlando, FL *[Invited Lecture]*
- 2020 Oral Platform presentation entitled GABA Levels at Baseline Predict Resistance to Time-on-Task Deficits During Sleep Deprivation. Presentation given at the DoD Sleep Workshop, Feb 2020, Arlington, VA *[Invited Lecture]*
- 2020 Oral Platform presentation entitled Resilience to Inhibitory Deficits During Sleep Deprivation is Predicted by Prefrontal Gray Matter Volume. Presentation given at the DoD Sleep Workshop, Feb 2020, Arlington, VA *[Invited Lecture]*
- 2020 Oral Platform presentation entitled Resilience to Inhibitory Deficits During Sleep Deprivation is Predicted by Gray Matter Volume in the Ventrolateral and Ventromedial Prefrontal Cortex. Presentation given at the SLEEP 2020 Virtual Meeting, Philadelphia, PA *[Invited Lecture]*
- 2021 Symposium Session Moderator for *College of Medicine Research Day Data Blitz*, University of Arizona College of Medicine, Tucson, AZ *[Invited Moderator]*
- 2021 Oral Platform presentation entitled Trait Extraversion is Associated with Increased Suicidal Ideation During Total Sleep Deprivation and Insomnia. Presentation given at the SLEEP 2021 Virtual Meeting *[Invited Lecture]*
- 2021 Oral Platform presentation entitled Insomnia as a Risk for PTSD During the COVID-19 Pandemic. Presentation given at the SLEEP 2021 Virtual Meeting *[Invited Lecture]*

PEER REVIEWED PUBLISHED ABSTRACTS

1. **Killgore, WD.** Development and validation of a new instrument for the measurement of transient mood states: The facial analogue mood scale (FAMS) [Abstract]. Dissertation Abstracts International: Section B: The Sciences & Engineering 1995; 56 (6-B): 3500.
2. **Killgore, WD, & Locke, B.** A nonverbal instrument for the measurement of transient mood

states: The Facial Analogue Mood Scale (FAMS) [Abstract]. Proceedings of the Annual Conference of the Oklahoma Center for Neurosciences 1996, Oklahoma City, OK.

3. **Killgore, WD**, Scott, JG, Oommen, KJ, & Jones, H. Lateralization of seizure focus and performance on the MMPI-2 [Abstract]. Proceedings of the Annual Conference of the Oklahoma Center for Neurosciences 1996, Oklahoma City, OK.
4. **Killgore, WD**, & Adams, RL. Vocabulary ability and Boston Naming Test performance: Preliminary guidelines for interpretation [Abstract]. Archives of Clinical Neuropsychology 1997; 13(1).
5. **Killgore, WD**, Glosser, G, Cooke, AN, Grossman, M, Maldjian, J, Judy, K, Baltuch, G, King, D, Alsop, D, & Detre, JA. Functional activation during verbal memory encoding in patients with lateralized focal lesions [Abstract]. Epilepsia 1998; 39(Suppl. 6): 99.
6. **Killgore, WD**. A new method for assessing subtle cognitive deficits: The Clock Trail Making Test [Abstract]. Archives of Clinical Neuropsychology 1998; 14(1): 92.
7. **Killgore, WD**, & DellaPietra, L. Item response biases on the WMS-III Auditory Delayed Recognition Subtests [Abstract]. Archives of Clinical Neuropsychology 1998; 14(1): 92.
8. **Killgore, WD**, Glosser, G, Alsop, DC, Cooke, AN, McSorley, C, Grossman, M, & Detre, JA. Functional activation during material specific memory encoding [Abstract]. NeuroImage 1998; 7: 811.
9. **Killgore, WD**, & DellaPietra, L. Using the WMS-III to detect malingering: Empirical development of the Rarely Missed Index. [Abstract]. Journal of the International Neuropsychological Society 1999; 5(2).
10. **Killgore, WD**, Glosser, G, & Detre, JA. Prediction of seizure outcome following anterior temporal lobectomy: fMRI vs. IAT [Abstract]. Archives of Clinical Neuropsychology 1999; 14(1): 143.
11. **Killgore, WD**, Glosser, G, King, D, French, JA, Baltuch, G, & Detre, JA. Functional MRI lateralization during memory encoding predicts seizure outcome following anterior temporal lobectomy [Abstract]. Journal of the International Neuropsychological Society 1999; 5(2): 122.
12. **Killgore, WD**, Casasanto, DJ, Maldjian, JA, Alsop, DC, Glosser, G, French, J, & Detre, J. A. Functional activation of mesial temporal lobe during nonverbal encoding [abstract]. Epilepsia, 1999; 40 (Supplement 7): 188.
13. **Killgore, WD**, Casasanto, DJ, Maldjian, JA, Gonzales-Atavales, J, & Detre, JA. Associative memory for faces preferentially activates the left amygdala and hippocampus [abstract]. Journal of the International Neuropsychological Society, 2000; 6: 157.
14. Casasanto, DJ, **Killgore, WD**, Maldjian, JA, Gonzales-Atavales, J, Glosser, G, & Detre, JA. Task-dependent and task-invariant activation in mesial temporal lobe structures during fMRI explicit encoding tasks [abstract]. Journal of the International Neuropsychological Society, 2000;

6: 134. [**Winner of Rennick Research Award for Best Research by a Graduate Student*].

15. **Killgore, WD**, Glahn, D, & Casasanto, DJ. Development and validation of the Design Organization Test (DOT): A rapid screening instrument for assessing for visuospatial ability [abstract]. Journal of the International Neuropsychological Society, 2000; 6: 147.
16. Casasanto DJ, **Killgore, WD**, Glosser, G, Maldjian, JA, & Detre, JA. Hemispheric specialization during episodic memory encoding in the human hippocampus and MTL. Proceedings of the Society for Cognitive Science 2000: Philadelphia, PA.
17. Casasanto, DJ, Glosser, G, **Killgore, WD**, Siddiqi, F, Falk, M, Maldjian, J, Lev-Reis, I, & Detre, JA. fMRI evidence for the functional reserve model of post-ATL neuropsychological outcome prediction. Poster Presented at the David Mahoney Institute of Neurological Sciences 17th Annual Neuroscience Retreat, University of Pennsylvania, April 17, 2000.
18. Casasanto, DJ, **Killgore, WD**, Maldjian, JA, Glosser, G, Grossman, M, Alsop, D. C, & Detre, JA. Neural Correlates of Successful and Unsuccessful Verbal Encoding [abstract]. Neuroimage, 2000 11: S381.
19. Siddiqui, F, Casasanto, DJ, **Killgore, WD**, Detre, JA, Glosser, G, Alsop, DC, & Maldjian, JA. Hemispheric effects of frontal lobe tumors on mesial temporal lobe activation during scene encoding [abstract]. Neuroimage, 2000 11: S448.
20. Oki, M, Gruber, SA, **Killgore, WD**, Yurgelun-Todd, DA. Bilateral thalamic activation occurs during lexical but not semantic processing [abstract]. Neuroimage, 2000 11: S353.
21. Yurgelun-Todd, DA, Gruber, SA, **Killgore, WD**, & Tohen, M. Neuropsychological performance in first-episode bipolar disorder [Abstract]. Collegium Internationale Neuro-Psychopharmacologicum. Brussels, Belgium. July, 2000.
22. **Killgore, WD**, & DellaPietra, L. Detecting malingering with the WMS-III: A revision of the Rarely Missed Index (RMI) [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 143-144.
23. Casasanto, DJ, Glosser, G, **Killgore, WD**, Siddiqi, F, Falk, M, Roc, A, Maldjian, JA, Levy-Reis, I, Baltuch, G, & Detre, JA. Presurgical fMRI predicts memory outcome following anterior temporal lobectomy [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 183.
24. **Killgore, WD**, & Yurgelun-Todd, DA. Amygdala but not hippocampal size predicts verbal memory performance in bipolar disorder [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 250-251.
25. **Killgore, WD**, Kanayama, G, & Yurgelun-Todd, DA. Sex differences in functional activation of the amygdala during the perception of happy faces [abstract]. Journal of the International Neuropsychological Society, 2001; 7 (2): 198.
26. **Killgore, WD**, Gruber, SA, Oki, M, & Yurgelun-Todd, DA. Amygdalar volume and verbal

memory in schizophrenia and bipolar disorder: A correlative MRI study [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.

27. Kanayama, G, **Killgore, WD**, Gruber, SA, & Yurgelun-Todd, DA. fMRI BOLD activation of the supramarginal gyrus in schizophrenia [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.
28. Gruber, SA, **Killgore, WD**, Renshaw, PF, Pope, HG. Jr, Yurgelun-Todd, DA. Gender differences in cerebral blood volume after a 28-day washout period in chronic marijuana smokers [abstract]. Meeting of the International Congress on Schizophrenia Research. Whistler, British Columbia. April 2001.
29. Rohan, ML, **Killgore, WD**, Eskesen, JG, Renshaw, PF, & Yurgelun-Todd, DA. Match-warped EPI anatomic images and the amygdala: Imaging in hard places. Proceedings of the International Society for Magnetic Resonance in Medicine, 2001; 9: 1237.
30. **Killgore, WD** & Yurgelun-Todd, DA. Developmental changes in the lateralized activation of the prefrontal cortex and amygdala during the processing of facial affect [Abstract]. Oral platform paper presented at the 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada, February 13-16, 2002.
31. Yurgelun-Todd, DA. & **Killgore, WD**. Gray and white matter volume during adolescence correlates with cognitive performance: A morphometric MRI study [Abstract]. Oral platform paper presented at the 30th Annual Meeting of the International Neuropsychological Society, Toronto, Ontario, Canada, February 13-16, 2002.
32. **Killgore, WD**, Reichardt, R. Kautz, M, Belenky, G, Balkin, T, & Wesensten, N. Daytime melatonin-zolpidem cocktail: III. Effects on salivary melatonin and performance [abstract]. Poster presented at the 17th Annual Meeting of the Associated Professional Sleep Societies, Chicago, Illinois, June 3-8, 2003.
33. **Killgore, WD**, Young, AD, Femia, LA, Bogorodzki, P, Rogowska, J, & Yurgelun-Todd, DA. Cortical and limbic activation during viewing of high- versus low-calorie foods [abstract]. Poster Presented at the Organization for Human Brain Mapping Annual Meeting, New York, NY, June 18-22, 2003.
34. **Killgore, WD**, & Yurgelun-Todd, DA. Amygdala activation during masked presentations of sad and happy faces [abstract]. Poster presented at the Organization for Human Brain Mapping Annual Meeting, New York, NY, June 18-22, 2003.
35. **Killgore, WD**, Stetz, MC, Castro, CA, & Hoge, CW. Somatic and emotional stress symptom expression prior to deployment by soldiers with and without previous combat experience [abstract]. Poster presented at the 6th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2003. [**Winner: Best Paper Award*]
36. Wesensten, NJ, Balkin, TJ, Thorne, D, **Killgore, WD**, Reichardt, R, & Belenky, G. Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation: I. Performance and alertness effects [abstract]. Poster presented at the 75th Annual Meeting of the Aerospace

Medical Association, Anchorage, AK, May 2-6 2004.

37. **Killgore, WD**, Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ. Regional cerebral metabolic correlates of electroencephalographic activity during stage-2 and slow-wave sleep: An H215O PET Study [abstract]. Oral platform presentation at the 18th Associated Professional Sleep Societies Annual Meeting, Philadelphia, PA, June 5-10, 2004.
38. **Killgore, WD**, Arora, NS, Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ. Sleep strengthens the effective connectivity among cortical and subcortical regions: Evidence for the restorative effects of sleep using H215O PET [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.
39. **Killgore, WD**, Arora, NS, Braun, AR, Belenky, G, Wesensten, NJ, & Balkin, TJ. An H215O PET study of regional cerebral activation during stage 2 sleep [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.
40. Wesensten, N, **Killgore, WD**, Belenky, G, Reichardt, R, Thorne, D, & Balkin, T. Caffeine, dextroamphetamine, and modafinil during 85 H of sleep deprivation. II. Effects of tasks of executive function [abstract]. Poster presented at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.
41. Balkin, T, Reichardt, R, Thorne, D, **Killgore, WD**, Belenky, G, & Wesensten, N. Caffeine, dextroamphetamine, and modafinil during 85 hours of sleep deprivation. I. Psychomotor vigilance and objective alertness effects [abstract]. Oral paper presentation at the 17th Congress of the European Sleep Research Society, Prague, Czech Republic, October 5-9, 2004.
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, 2004.
43. Vo, A, Green, J, Campbell, W, **Killgore, WD**, Labutta, R, & Redmond, D. The quantification of disrupted sleep in migraine via actigraphy: A pilot study [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A281.
44. Kendall, AP, **Killgore, WD**, Kautz, M, & Russo, MB. Left-visual field deficits in attentional processing after 40 hours of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A143.
45. Reichardt, RM, Grugle, NL, Balkin, TJ, & **Killgore, WD**. Stimulant countermeasures, risk propensity, and IQ across 2 nights of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A145.
46. Killgore, DB, McBride, SA, Balkin, TJ, & **Killgore, WD**. Post-stimulant hangover: The effects

of caffeine, modafinil, and dextroamphetamine on sustained verbal fluency following sleep deprivation and recovery sleep [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A137.

47. **Killgore, WD**, Balkin, TJ, & Wesensten, NJ. Impaired decision-making following 49 hours of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A138.
48. **Killgore, WD**, McBride, SA, Killgore, DB, & Balkin, TJ. Stimulant countermeasures and risk propensity across 2 nights of sleep deprivation [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A136.
49. McBride, SA, Balkin, TJ, & **Killgore, WD**. The effects of 24 hours of sleep deprivation on odor identification accuracy [abstract]. Abstract presented at the Associated Professional Sleep Societies 19th Annual Meeting, Denver, CO, June 18-23, 2005. SLEEP, 28 (Supplement), A137.
50. Picchioni, D, **Killgore, WD**, Braun, AR, & Balkin, TJ. PET correlates of EEG activity during non-REM sleep. Poster presentation at the annual UCLA/Websciences Sleep Training Workshop, Lake Arrowhead, CA, September, 2005.
51. **Killgore, WD**, Killgore, DB, McBride, SA, & Balkin, TJ. Sustained verbal fluency following sleep deprivation and recovery sleep: The effects of caffeine, modafinil, and dextroamphetamine. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.
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 Neuropsychological Society, Boston, MA, February 1-4, 2006.
53. **Killgore, WD**, & Yurgelun-Todd, DA. Neural correlates of emotional intelligence in adolescent children. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.
54. **Killgore, WD**, & Yurgelun-Todd, DA. Social anxiety predicts amygdala activation in adolescents viewing fearful faces. Poster presented at the 34th Meeting of the International Neuropsychological Society, Boston, MA, February 1-4, 2006.
55. McBride, SA & **Killgore, WD**. Sleepy people smell worse: Olfactory deficits following extended wakefulness. Paper presented at the Workshop on Trace Gas Detection Using Artificial, Biological, and Computational Olfaction. Monell Chemical Senses Center, Philadelphia, PA, March 29-31, 2006.
56. **Killgore, WD**, Day LM, Li, C, Kamimori, GH, Balkin, TJ, & Killgore DB. Moral reasoning is affected by 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), A137.

57. **Killgore, WD**, Killgore DB, Kahn-Green, E, Conrad, A, Balkin, TJ, & Kamimori, G. H. Introversion-Extroversion predicts resilience to 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), A137.
58. Newman, R, Kamimori, GH, **Killgore, WD**. Sleep deprivation diminishes constructive thinking [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A136-137.
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.
61. McBride, SA, **Killgore, WD**, Kahn-Green, E, Conrad, A, & Kamimori, GH. Caffeine administered to maintain overnight alertness does not disrupt performance during the daytime withdrawal period [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.
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 17-22, 2006. SLEEP, 29 (Supplement), A135.
63. Day, LM, Li, C, Killgore, DB, Kamimori, GH, & **Killgore, WD**. Emotional intelligence moderates the effect of sleep deprivation on moral reasoning [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A135.
64. Murray, CJ, Killgore, DB, Kamimori, GH, & **Killgore, WD**. Individual differences in stress management capacity predict responsiveness to caffeine 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.
65. Murray, CJ, Newman, R, O'Sullivan, M, Killgore, DB, Balkin, TJ, & **Killgore, WD**. Caffeine, dextroamphetamine, and modafinil fail to restore Stroop performance 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), A370-371.
66. Richards, J, Killgore, DB, & **Killgore, WD**. The effect of 44 hours of sleep deprivation on mood using the Visual Analog Mood Scales [abstract]. Abstract presented at the 20th Meeting of the

Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A132.

67. 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.
68. Lipizzi, EL, Leavitt, BP, Killgore, DB, Kamimori, GH, & **Killgore, WD**. Decision making capabilities decline with increasing duration of wakefulness [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A131.
69. Lipizzi, EL, Killgore, DB, Kahn-Green, E, Kamimori, GH, & **Killgore, WD**. Emotional intelligence scores decline 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), A131.
70. Kahn-Green, E, Day, L, Conrad, A, Leavitt, BP, Killgore, DB, & **Killgore, WD**. Short-term vs. long-term planning abilities: Differential effects of stimulants on executive function in sleep deprived individuals [abstract]. Abstract presented at the 20th Meeting of the Associated Professional Sleep Societies, Salt Lake City, UT, June 17-22, 2006. SLEEP, 29 (Supplement), A370.
71. Kahn-Green, E, Conrad, A, Killgore, DB, Kamimori, GH, & **Killgore, WD**. Tired and frustrated: Using a projective technique for assessing responses to stress 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), A130.
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.
73. Killgore, DB, McBride, SA, Balkin, TJ, Leavitt, BP, & **Killgore, WD**. Modafinil improves humor appreciation 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), A42.
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.
79. Krugler, AL, **Killgore, WD**, & Kamimori, G. H. Trait anger predicts resistance to 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), A129.
80. **Killgore, WD**, Cotting, DI, Vo, A. H, Castro, CA, & Hoge, CW. The invincibility syndrome: Combat experiences predict risk-taking propensity following redeployment [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.
81. **Killgore, WD**, Wesensten, NJ, & Balkin, TJ. Stimulants improve tactical but not strategic planning during prolonged wakefulness [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.
82. **Killgore, WD**, Balkin, TJ, Wesensten, NJ, & Kamimori, G. H. The effects of sleep loss and caffeine on decision-making [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.
83. **Killgore, WD**, Balkin, TJ, & Kamimori, GH. Sleep loss can impair moral judgment [abstract]. Abstract presented at the 9th Annual Force Health Protection Conference, Albuquerque, NM, August 6-11, 2006.
84. **Killgore, WD**, Lipizzi, EL, Reichardt, RM, Kamimori, GH, & Balkin, TJ. Can stimulants reverse the effects of sleep deprivation on risky decision-making [abstract]? Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.
85. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Sleep deprivation impairs the emotional intelligence and moral judgment capacities of Soldiers [abstract]. Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.
86. **Killgore, WD**, Cotting, DI, Vo, AH, Castro, C.A, & Hoge, CW. The post-combat invincibility syndrome: Combat experiences increase risk-taking propensity following deployment [abstract]. Abstract presented at the 25th Army Science Conference, Orlando, FL, November 27-30, 2006.

87. Adam, GE, Szelenyi, ER, **Killgore, WD**, & Lieberman, HR. A double-blind study of two days of caloric deprivation: Effects on judgment and decision-making. Oral paper presentation at the Annual Scientific Meeting of the Aerospace Medical Association, New Orleans, LA, May, 2007.
88. Killgore, DB, Kahn-Greene, ET, Kamimori, GH, & **Killgore, WD**. The effects of acute caffeine withdrawal on short category test performance in sleep deprived individuals [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A43.
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.
91. Lipizzi, EL, Richards, JM, Balkin, TJ, Grugle, NL, & **Killgore, WD**. Morningness-Eveningness affects risk-taking propensity 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), A136.
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 presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A135.
93. Smith, KL, McBride, S. A, Kamimori, GH, & **Killgore, WD**. Individual differences in odor discrimination predict mood dysregulation following 56 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), A136.
94. McBride, SA, Leavitt, BP, Kamimori, GH, & **Killgore, WD**. Odor identification accuracy predicts resistance to sleep loss. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A137.
95. Killgore, DB, McBride, SA, Balkin, TJ, Grugle, NL, & **Killgore, WD**. Changes in odor discrimination predict executive function deficits following 45 hours of wakefulness [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A136.
96. Rupp, TL, Killgore, DB, Balkin, TJ, Grugle, NL, & **Killgore, WD**. The effects of modafinil, dextroamphetamine, and caffeine on verbal and nonverbal fluency in sleep deprived individuals [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A43.

97. Newman, RA, Krugler, AL, Kamimori, GH, & **Killgore, WD**. Changes in state and trait anger following 56 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), A138.
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.
99. **Killgore, WD**, Lipizzi, EL, Balkin, TJ, Grugle, NL, & Killgore, DB. The effects of sleep deprivation and stimulants on self-reported sensation seeking propensity [abstract]. Abstract presented at the 21st Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 9-14, 2007. SLEEP, 30 (Supplement), A42.
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.
101. Newman, RA, Smith, KL, Balkin, TJ, Grugle, NL, & **Killgore, WD**. The effects of caffeine, dextroamphetamine, and modafinil on executive functioning following 45 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), A45.
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.
103. **Killgore, WD**, & Yurgelun-Todd, DA. Cortical and Limbic Activation in Response to Visual Images of Low and High-Caloric Food [abstract]. Oral symposium presented at the 6th Annual Conference of the Society of Behavioral Nutrition and Physical Activity (ISBNPA), Oslo, Norway, June 20-23, 2007. Proceedings of the ISBNPA, 2007, 75.
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.
105. **Killgore, WD**, Lipizzi, EL, Smith, KL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, T. J. Nonverbal intelligence is inversely related to the ability to resist sleep loss [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A134.
106. **Killgore, WD**, Lipizzi, EL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, TJ. Emotional intelligence predicts declines in emotion-based decision-making following sleep deprivation

[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.
108. Newman, R, **Killgore, WD**, Rupp, T. L, & Balkin, TJ. Better baseline olfactory discrimination is associated with worse PVT and MWT performance with sleep restriction and recovery [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A375.
109. Smith, KL, Reid, CT, **Killgore, WD**, Rupp, TL, & Balkin, TJ. Personality factors associated with performance and sleepiness during sleep restriction and recovery [abstract]. Abstract presented at the 22nd Meeting of the Associated Professional Sleep Societies, Baltimore, MD, June 7-12, 2008. SLEEP, 31 (Supplement), A376.
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, Albuquerque, NM, August, 9-15, 2008.
112. **Killgore, WD**, Estrada, A, Balkin, TJ, & Wildzunas, RM. Sleep duration during army training predicts course performance [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.
113. **Killgore, WD**, Lipizzi, EL, Smith, KL, Killgore, DB, Rupp, TL, Kamimori, GH, & Balkin, TJ. Higher cognitive ability is associated with reduced relative resistance to sleep loss [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.
114. **Killgore, WD**, Rupp, TL, Grugle, NL, Lipizzi, EL, & Balkin, TJ. Maintaining alertness during sustained operations: Which stimulant is most effective after 44 hours without sleep [abstract]? Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.
115. **Killgore, WD**, Newman, RA, Lipizzi, EL, Kamimori, GH, & Balkin, TJ. Sleep deprivation increases feelings of anger but reduces verbal and physical aggression in Soldiers [abstract]. Poster presented at the 11th Annual Force Health Protection Conference, Albuquerque, NM, August, 11-17, 2008.
116. Kelley, AM, Dretsch, M, **Killgore, WD**, & Athy, JR. Risky behaviors and attitudes about risk in Soldiers. Abstract presented at the 29th Annual Meeting of the Society for Judgment and

Decision Making, Chicago, IL, November, 2008.

117. **Killgore, WD**, Ross, AJ, Silveri, MM, Gruber, SA, Kamiya, T, Kawada, Y, Renshaw, PF, & Yurgelun-Todd, DA. Citicoline affects appetite and cortico-limbic responses to images of high calorie foods. Abstract presented at the Society for Neuroscience, Washington DC, November 19, 2008.
118. Britton, JC, Stewart, SE, Price, LM, **Killgore, WD**, Gold, AL, Jenike, MA, & Rauch, SL. Reduced amygdalar activation in response to emotional faces in pediatric Obsessive-Compulsive Disorder. Abstract presented at the Annual meeting of the American College of Neuropsychopharmacology, Scottsdale, AZ, December 7-11, 2008.
119. **Killgore, WD**, Balkin, TJ, Estrada, A, & Wildzunas, RM. Sleep and performance measures in soldiers undergoing military relevant training. Abstract presented at the 26th Army Science Conference, Orlando, FL, December 1-4, 2008.
120. **Killgore, WD** & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses during non-conscious perception of affective faces in adolescent children. Abstract presented at the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.
121. **Killgore, WD**, Killgore, DB, Grugle, NL, & Balkin, TJ. Odor identification ability predicts executive function deficits following sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.
122. **Killgore, WD**, Rupp, TL, Killgore, DB, Grugle, NL, and Balkin, TJ. Differential effects of stimulant medications on verbal and nonverbal fluency during sleep deprivation. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.
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.
124. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Introversion is associated with greater amygdala and insula activation during viewing of masked affective stimuli. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.
125. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Amygdala responses of specific animal phobics do not differ from healthy controls during masked fearful face perception. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society, Atlanta, GA, February 11-14, 2009.
126. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Small animal phobics show sustained amygdala activation in response to masked happy facial expressions. Abstract presented the 37th Annual Meeting of the International Neuropsychological Society,

Atlanta, GA, February 11-14, 2009. [**Merit Poster Award*]

127. Price, LM, **Killgore, WD**, Britton, JC, Kaufman, ML, Gold, AL, Deckersbach, T, & Rauch, SL. Anxiety sensitivity correlates with insula activation in response to masked fearful faces in specific animal phobics and healthy subjects. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.
128. **Killgore, WD**, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, & Rauch, SL. Neuroticism is inversely correlated with amygdala and insula activation during masked presentations of affective stimuli. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.
129. **Killgore, WD**, Kelley, AM, & Balkin, TJ. Development and validation of a scale to measure the perception of invincibility. Abstract presented at the Annual Conference of the Anxiety Disorders Association of America, Santa Ana Pueblo, New Mexico, March 12-15, 2009.
130. Kelly, AM, **Killgore WD**, Athy, J, & Dretsch, M. Risk propensity, risk perception, risk aversion, and sensation seeking in U.S. Army soldiers. Abstract presented at the 80th Annual Scientific Meeting of the Aerospace Medical Association, Los Angeles, CA, May 3-7, 2009.
131. Britton, JC, Stewart, SE, Price, LM, **Killgore, WD**, Jenike, MA, & Rauch, SL. The neural correlates of negative priming in pediatric obsessive-compulsive disorder (OCD). Abstract presented at the 64th Annual Scientific Meeting of the Society of Biological Psychiatry, Vancouver, Canada, May 14-16, 2009.
132. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine protects against increased risk-taking behavior during severe sleep deprivation. Abstract presented at the 23rd Annual Meeting of the Associated Professional Sleep Societies, Seattle, Washington, June 7-12, 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.
135. **Killgore, WD**, Kelley, AM, & Balkin, TJ. A new scale for measuring the perception of invincibility. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.
136. **Killgore, WD**, Killgore, DB, Grugle, NL, & Balkin, TJ. Executive functions contribute to the ability to resist sleep loss. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.
137. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine reduces risk-taking behavior during severe sleep deprivation. Abstract presented at the 12th Annual Force Health

Protection Conference, Albuquerque, New Mexico, August 14-21, 2009. [**Winner Best Paper Award: Research*]

138. **Killgore, WD**, Castro, CA, & Hoge, CW. Normative data for the Evaluation of Risks Scale—Bubble Sheet Version (EVAR-B) for large scale surveys of returning combat veterans. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.
139. **Killgore, WD**, Castro, CA, & Hoge, CW. Combat exposure and post-deployment risky behavior. Abstract presented at the 12th Annual Force Health Protection Conference, Albuquerque, New Mexico, August 14-21, 2009.
140. **Killgore, WD**, Price, LM, Britton, JC, Simon, N, Pollack, MH, Weiner, MR, Schwab, ZJ, Rosso, IM, & Rauch, SL. Paralimbic responses to masked emotional faces in PTSD: Disorder and valence specificity. Abstract presented at the Annual McLean Hospital Research Day, January 29, 2010.
141. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine minimizes behavioral risk-taking during 75 hours of sleep deprivation. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.
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.
143. **Killgore, WD**, Smith, KL, Reichardt, RM., Killgore, DB, & Balkin, TJ. Intellectual capacity is related to REM sleep following sleep deprivation. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.
144. **Killgore, WD** & Yurgelun-Todd, DA. Cerebral correlates of amygdala responses to masked fear, anger, and happiness in adolescent and pre-adolescent children. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.
145. **Killgore, WD**, Post, A, & Yurgelun-Todd, DA. Sex differences in cortico-limbic responses to images of high calorie food. 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.
147. **Killgore, WD**, Price, LM, Britton, JC, Gold, AL, Deckersbach, T, & Rauch, SL. Neural correlates of anxiety sensitivity factors during presentation of masked fearful faces. Abstract presented at the 38th Annual Meeting of the International Neuropsychological Society, Acapulco, Mexico, February 3-6, 2010.

148. **Killgore, WD**, Grugle, NL, Conrad, TA, & Balkin, TJ. Baseline executive function abilities predict risky behavior following sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
149. **Killgore, WD**, Grugle, NL, & Balkin, TJ. Judgment of objective vigilance performance is affected by sleep deprivation and stimulants. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
150. Killgore, DB, **Killgore, WD**, Grugle, NL, & Balkin, TJ. Resistance to sleep loss and its relationship to decision making during sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
151. Killgore DB, **Killgore, WD**, Grugle, NL, & Balkin, TJ. Subjective sleepiness and objective performance: Differential effects of stimulants during sleep deprivation. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
152. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Oral presentation at the “Data Blitz” section at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
153. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Extraverts may be more vulnerable than introverts to sleep deprivation on some measures of risk-taking and executive functioning. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
154. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is differentially mediated by social exposure in extraverts vs. introverts. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
155. Capaldi, VF, Guerrero, ML, & **Killgore, WD**. Sleep disorders among OIF and OEF Soldiers. Abstract presented at the 24th Annual Meeting of the Associated Professional Sleep Societies, San Antonio, Texas, June 5-9, 2010.
156. **Killgore, WD**, Killgore, DB, Kamimori, GH, & Balkin, TJ. Caffeine reduces behavioral risk-taking during sleep deprivation. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.
157. **Killgore, WD**, Price, LM, Britton, JC, Simon, N, Pollack, MH, Weiner, MR, Schwab, ZJ, Rosso, IM, & Rauch, SL. Paralimbic responses to masked emotional faces in PTSD: Disorder and valence specificity. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.
158. Rosso, IM, Makris, N, Britton, JC, Price, LM, Gold, AL, Deckersbach, T, **Killgore, WD**, & Rauch SL. Anxiety sensitivity correlates with insular cortex volume and thickness in specific animal phobia. Abstract presented at the 65th Annual Meeting of the Society for Biological Psychiatry, New Orleans, Louisiana, May 20-22, 2010.

159. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Vulnerability to sleep deprivation is mediated by social exposure in extraverts versus introverts. Oral platform presentation at the 20th Congress of the European Sleep Research Society, Lisbon, Portugal, September 14-18, 2010.
160. **Killgore, WD**, Estrada, A, & Balkin, TJ. A tool for monitoring soldier fatigue and predicting cognitive readiness: The Sleep History and Readiness Predictor (SHARP). Abstract presented at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.
161. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeinated gum minimizes risk-taking in soldiers during prolonged sleep deprivation. Abstract presented at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.
162. **Killgore, WD**, Britton, JC, Schwab, ZJ, Weiner, MR, Rosso, IM, & Rauch, SL. Exaggerated amygdala responses to masked fearful faces are specific to PTSD versus simple phobia. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010. [**Winner Best Paper in Neuroscience*]
163. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Sleep deprivation selectively impairs emotional aspects of cognitive functioning. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.
164. Rupp, TL, **Killgore, WD**, & Balkin, TJ. Evaluation of personality and social exposure as individual difference factors influencing response to sleep deprivation. Oral platform presentation at the 27th Army Science Conference, Orlando, FL, November 29-December 2, 2010.
165. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Shared and differential patterns of amygdalo-cortical activation across anxiety disorders. Abstract presented at the 49th Annual Meeting of the American College of Neuropsychopharmacology, Miami Beach, FL, December 5-9, 2010.
166. Rosso, IM, **Killgore, WD**, Britton, JC, Weiner, MR, Schwab, ZJ, & Rauch, SL. Neural correlates of PTSD symptom dimensions during emotional processing: A functional magnetic resonance imaging study. Abstract presented at the 49th Annual Meeting of the American College of Neuropsychopharmacology, Miami Beach, FL, December 5-9, 2010.
167. **Killgore, WD**, Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, & Rauch, SL. Cortico-limbic activation differentiates among anxiety disorders with and without a generalized threat response. Abstract presented at the McLean Hospital Research Day, January 13, 2011.
168. Weiner, MR, Schwab, ZJ, Rauch, SL, & **Killgore WD**. Personality factors predict brain responses to images of high-calorie foods. Abstract presented at the McLean Hospital Research Day, January 13, 2011.
169. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Emotional and cognitive intelligence: Support for the neural efficiency hypothesis. Abstract presented at the McLean Hospital Research Day, January 13, 2011.

170. Crowley, DJ, Covell, MJ, **Killgore, WD**, Schwab, ZJ, Weiner, MR, Acharya, D, Rosso, IM, & Silveri, MM. Differential influence of facial expression on inhibitory capacity in adolescents versus adults. Abstract presented at the McLean Hospital Research Day, January 13, 2011.
171. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Similarities and differences in cortico-limbic responses to masked affect probes across anxiety disorders. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
172. Rosso, IM, **Killgore, WD**, Britton, JC, Weiner, MR, Schwab, ZJ, & Rauch, SL. Hyperarousal and reexperiencing symptoms of post-traumatic stress disorder are differentially associated with limbic-prefrontal brain responses to threatening stimuli. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
173. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Neural correlates of cognitive and emotional intelligence in adults. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
174. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Cognitive and emotional intelligences: Are they distinct or related constructs? Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
175. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Discrepancy scores between cognitive and emotional intelligence predict neural responses to affective stimuli. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
176. **Killgore, WD**, Schwab, ZJ, Weiner, MR, & Rauch, SL. Smart people go with their gut: Emotional intelligence correlates with non-conscious insular responses to facial trustworthiness. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
177. **Killgore, WD**, Weiner, MR, Schwab, ZJ, & Rauch, SL. Whom can you trust? Neural correlates of subliminal perception of facial trustworthiness. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
178. Weiner, MR, Schwab, ZJ, & Rauch, SL, **Killgore, WD**. Impulsiveness predicts responses of brain reward circuitry to high-calorie foods. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
179. Weiner, MR, Schwab, ZJ, & Rauch, SL, **Killgore, WD**. Conscientiousness predicts brain responses to images of high-calorie foods. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
180. Crowley, DJ, Covell, MJ, **Killgore, WD**, Schwab, ZJ, Weiner, MR, Acharya, D, Rosso, IM, & Silveri, MM. Differential influence of facial expression on inhibitory capacity in adolescents versus adults. Abstract presented at the 39th Annual Meeting of the International

Neuropsychological Society, Boston, MA, February 2-5, 2011.

181. Gruber, SA, Dahlgren, MK, **Killgore, WD**, Sagar, KA, & Racine, MT. Marijuana: Age of onset of use impacts executive function and brain activation. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
182. **Killgore, WD**, Conrad, TA, Grugle, NL, & Balkin, TJ. Baseline executive function abilities correlate with risky behavior following sleep deprivation. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
183. **Killgore, WD**, Grugle, NL, Killgore, DB, & Balkin, TJ. Resistance to sleep loss and decision making during sleep deprivation. Abstract presented at the 39th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 2-5, 2011.
184. **Killgore, WD**, Rosso, IM, Britton, JC, Schwab, ZJ, Weiner, MR, & Rauch, SL. Cortico-limbic activation differentiates among anxiety disorders with and without a generalized threat response. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011. [**Blue Ribbon Finalist: Clinical/Translational*]
185. Schwab, ZJ, Weiner, MR, Rauch, SL, & **Killgore, WD**. Emotional and cognitive intelligence: Support for the neural efficiency hypothesis. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011.
186. Weiner, MR, Schwab, ZJ, Rauch, SL, & **Killgore WD**. Personality factors predict brain responses to images of high-calorie foods. Abstract presented at the 66th Annual Meeting of the Society for Biological Psychiatry, San Francisco, CA, May 12-14, 2011.
187. **Killgore, WD**, Grugle, NL, & Balkin, TJ. Sleep deprivation impairs recognition of specific emotions. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.
188. **Killgore, WD**, & Balkin, TJ. Does vulnerability to sleep deprivation influence the effectiveness of stimulants on psychomotor vigilance? Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.
189. Killgore, DB, **Killgore, WD**, Grugle, NJ, & Balkin, TJ. Sleep deprivation impairs recognition of specific emotions. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.
190. Weiner, MR, Schwab, ZJ, & **Killgore, WD**. Daytime sleepiness is associated with altered brain activation during visual perception of high-calorie foods: An fMRI study. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.
191. Schwab, ZJ, Weiner, MR, & **Killgore, WD**. Functional MRI correlates of morningness-eveningness during visual presentation of high calorie foods. Abstract presented at the 25th Annual Meeting of the Associated Professional Sleep Societies, Minneapolis, MN, June 11-15, 2011.

192. **Killgore, WD**, Weiner, MR, & Schwab, ZJ. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the McLean Hospital Research Day, January 11, 2012.
193. Kipman, M, Schwab ZJ, Weiner, MR, DelDonno, S, Rauch SL, & **Killgore WD**. The insightful yet bitter comedian: The role of emotional versus cognitive intelligence in humor appreciation. Abstract presented at the McLean Hospital Research Day, January 11, 2012.
194. Weber, M, & **Killgore, WD**. Gray matter correlates of emotional intelligence. Abstract presented at the McLean Hospital Research Day, January 11, 2012.
195. Schwab, ZJ, & **Killgore, WD**. Sex differences in functional brain responses to food. Abstract presented at the McLean Hospital Research Day, January 11, 2012.
196. DelDonno, S, Schwab, ZJ, Kipman M, Rauch, SL, & **Killgore, WD**. The influence of cognitive and emotional intelligence on performance on the Iowa Gambling Task. Abstract presented at the McLean Hospital Research Day, January 11, 2012.
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 ability. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
198. Kipman, M, Schwab, ZJ, DelDonno, S, & **Killgore, WD**. Gender differences in the contribution of cognitive and emotional intelligence to the left visual field bias for facial perception. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
199. Kipman, M., Schwab, ZJ, Weiner, MR, DelDonno, S, Rauch, SL, & **Killgore, WD**. Contributions of emotional versus cognitive intelligence in humor appreciation. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
200. Schwab, ZJ, & **Killgore, WD**. Disentangling emotional and cognitive intelligence. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
201. Schwab, ZJ, & **Killgore, WD**. Sex differences in functional brain responses to food. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
202. DelDonno, S, Schwab, ZJ, Kipman, M, Rauch, SL, & **Killgore, WD**. The influence of cognitive and emotional intelligence on performance on the Iowa Gambling Task. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
203. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, Weiner, MR, & Rauch, SL. Shared and unique patterns of cortico-limbic activation across anxiety disorders. Abstract presented at the

40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.

204. **Killgore, WD**, & Balkin, TJ. Sleep deprivation degrades recognition of specific emotions. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
205. **Killgore, WD**, & Schwab, ZJ. Emotional intelligence correlates with somatic marker circuitry responses to subliminal cues of facial trustworthiness. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
206. **Killgore, WD**, & Schwab, ZJ. Trust me! Neural correlates of the ability to identify facial trustworthiness. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
207. **Killgore, WD**, Schwab, ZJ, Weiner, MR, Kipman, M, DelDonno, S, & Rauch SL. Overeating is associated with altered cortico-limbic responses to images of high calorie foods. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
208. **Killgore, WD**, Weiner, MR, & Schwab, ZJ. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the 40th Annual Meeting of the International Neuropsychological Society, Montreal, CA, February 15-18, 2012.
209. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the Harvard Medical School Research Day, Boston, MA, March 28, 2012.
210. **Killgore, WD**. Overlapping and distinct patterns of neurocircuitry across PTSD, Panic Disorder, and Simple Phobia. Abstract presented at the 32nd Annual Conference of the Anxiety Disorders Association of America, Arlington, VA, April 12-15, 2012.
211. **Killgore, WD**, Britton, JC, Rosso, IM, Schwab, ZJ, & Rauch, SL. Shared and unique patterns of cortico-limbic activation across anxiety disorders. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.
212. **Killgore, WD**, Schwab, ZJ, & Rauch, SL. Daytime sleepiness affects prefrontal inhibition of food consumption. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.
213. Rosso, IM, Britton, JC, Makris, N, **Killgore, WD**, Rauch SL, & Stewart ES. Impact of major depression comorbidity on prefrontal and anterior cingulate volumes in pediatric OCD. Abstract presented at the 67th Annual Meeting of the Society of Biological Psychiatry, Philadelphia, PA, May 3-5, 2012.
214. Kipman, M, Weber, M, DelDonno, S., Schwab, ZJ, & **Killgore, WD**. Morningness-Eveningness correlates with orbitofrontal gray matter volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.

215. Kipman, M, Schwab, ZJ, Weber, M, DelDonno, S, & **Killgore, WD**. Yawning frequency is correlated with reduced medial thalamic volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
216. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of daytime sleepiness. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
217. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
218. DelDonno, S, Weber, M, Kipman M, Schwab, ZJ, & **Killgore, WD**. Resistance to insufficient sleep correlates with olfactory cortex gray matter. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
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 Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
220. Schwab, ZJ, DelDonno, S, Weber, M, Kipman M, & **Killgore, WD**. Habitual caffeine consumption and cerebral gray matter volume. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
221. Schwab, ZJ, & **Killgore, WD**. Daytime sleepiness affects prefrontal regulation of food intake. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
222. **Killgore, WD**, Schwab, ZJ, DelDonno S, Kipman, M, Weber M, & Rauch, SL. Greater nocturnal sleep time is associated with increased default mode functional connectivity. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
223. **Killgore, WD**, Kamimori, GH, & Balkin, TJ. Caffeine improves efficiency of planning and sequencing abilities during sleep deprivation. Abstract presented at the 26th Annual Meeting of the Associated Professional Sleep Societies, Boston, MA, June 9-13, 2012.
224. Sneider, JT, **Killgore, WD**, Crowley, DJ, Cohen-Gilbert, JE, Schwab, ZJ, & Silveri, MM. Inhibitory capacity in emerging adult binge drinkers: Influence of Facial Cues. Abstract presented at the 35th Annual Scientific Meeting of the Research Society on Alcoholism, San Francisco, CA, June 23-27, 2012.
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*]
226. Cohen-Gilbert, JE, **Killgore WD**, Crowley, DJ, Covell, MJ, Schwab, ZJ, Weiner, MR, Acharya,

D, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on inhibitory control across adolescence and adulthood. Abstract presented at the Society for Neuroscience 2012 Meeting, New Orleans, LA, October 13-17, 2012.

227. Weber, M, DelDonno, S, Kipman M, Schwab, ZJ, & **Killgore WD**. Grey matter correlates of self-reported sleep duration. Abstract presented at the Harvard Division of Sleep Medicine Annual Poster Session, Boston, MA, September 27, 2012.
228. Weber, M, DelDonno, SR, Kipman, M, Preer, LA, Schwab ZJ, Weiner, MR, & **Killgore, WD**. The effect of morning bright light therapy on sleep, cognition and emotion following mild traumatic brain injury. Abstract presented at the 2012 Sleep Research Network Meeting, 22-23 October 2012, Bethesda, MD.
229. Sneider, JT, **Killgore, WD**, Crowley, DJ, Cohen-Gilbert, JE, Schwab, ZJ, & Silveri, MM. Inhibitory capacity in emerging adult binge drinkers: Influence of Facial Cues. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
230. Cohen-Gilbert, JE, **Killgore WD**, Crowley, DJ, Covell, MJ, Schwab, ZJ, Weiner, MR, Acharya, D, Sneider, JT, & Silveri, MM. Differential influence of safe versus threatening facial expressions on inhibitory control across adolescence and adulthood. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
231. Tkachenko, O, Schwab, ZJ, Kipman, M, DelDonno, S, Gogel, H., Preer, L, & **Killgore, WD**. Smarter women need less sleep. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
232. DelDonno, S, Kipman, M, Schwab, ZJ, & **Killgore, WD**. The contributions of emotional intelligence and facial perception to social intuition. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
233. Kipman, M, Schwab, ZJ, DelDonno, S, Weber, M, Rauch, SL, & **Killgore, WD**. The neurocircuitry of impulsive behavior. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
234. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, & **Killgore, WD**. Emotional intelligence as a mediator of the association between anxiety sensitivity and anxiety symptoms. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
235. Gogel, H, DelDonno, S, Kipman M, Preer, LA, Schwab, ZJ, Tkachenko, O, & **Killgore, WD**. Validation of the Design Organization Test (DOT) in a healthy population. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.
236. Brennan, BP, Schwab, ZS, Athey, AJ, Ryan, EM, Pope, HG, **Killgore, WD**, Jenike, MA, & Rauch, SL. A functional magnetic resonance imaging study of rostral anterior cingulate cortex activation in obsessive-compulsive disorder using an emotional counting stroop paradigm. Abstract presented at the Annual McLean Hospital Research Day, January 16, 2013.

237. Cohen-Gilbert, JE, Schwab, ZJ, **Killgore, WD**, Crowley, DJ, & Silveri MM. Influence of Binge Drinking on the Neural Correlates of Inhibitory Control during Emotional Distraction in Young Adults. Abstract presented at the 3rd International Conference on Applications of Neuroimaging to Alcoholism (ICANA-3), New Haven, CT, February 15-18, 2013.
238. Weber, M, & **Killgore, WD**. The interrelationship between ‘sleep credit’, emotional intelligence and mental health – a voxel-based morphometric study. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.
239. Cohen-Gilbert, JE, Schwab, ZJ, **Killgore, WD**, Crowley, DJ, & Silveri MM. Influence of Binge Drinking on the Neural Correlates of Inhibitory Control during Emotional Distraction in Young Adults. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.
240. Mundy, EA, Weber, M, Rauch, SL, **Killgore, WD**, & Rosso, IM. The relationship between subjective stress levels in childhood and anxiety as well as perceived stress as an adult. Abstract presented at Harvard Medical School Psychiatry Research Day, April 10, 2013.
241. Webb, CA, **Killgore, WD**, Britton, JC, Schwab, ZJ, Price, LM, Weiner, MR, Gold, AL, Rosso, IM, Simon, NM, Pollack, MH, & Rauch, SL. Comparing categorical versus dimensional predictors of functional response across three anxiety disorders. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
242. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Linking Sleep Trouble to Neuroticism, Emotional Control, and Impulsiveness. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
243. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Emotional Intelligence as a Mediator of the Association between Anxiety Sensitivity and Anxiety Symptoms. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
244. Kipman, M, Schwab, ZJ, DelDonno, S, Weber, M, Rauch, SL, & **Killgore, WD**. The neurocircuitry of impulsive behavior. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
245. Weber, M, **Killgore, WD**, Rosso, IM, Britton, JC, Simon, NM, Pollack, MH, & Rauch, SL. Gray matter correlates of posttraumatic stress disorder—A voxel based morphometry study. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
246. Weber, M, Penetar, DM, Trksak, GH, DelDonno, SR, Kipman, M, Schwab, ZJ, & **Killgore, WD**. Morning blue wavelength light therapy improves sleep, cognition, emotion and brain function following mild traumatic brain injury. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
247. Tkachenko, O, Schwab, ZJ, Kipman, M, Preer, LA, Gogel, H, DelDonno, SR, Weber, M, Webb, CA, Rauch, SL, & **Killgore, WD**. Difficulty in falling asleep and staying asleep linked to a sub-

clinical increase in symptoms of psychopathology. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.

248. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Rauch, SL, & Weber, M. Problems with sleep initiation and sleep maintenance correlate with functional connectivity among primary sensory cortices. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
249. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, Rauch, SL, & Weber, M. A Couple of Hours Can Make a Difference: Self-Reported Sleep Correlates with Prefrontal-Amygdala Connectivity and Emotional Functioning. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
250. Brennan, BP, Schwab, ZS, Athey, AJ, Ryan, EM, Pope, HG, **Killgore, WD**, Jenike, MA, & Rauch, SL. A functional magnetic resonance imaging study of rostral anterior cingulate cortex activation in obsessive-compulsive disorder using an emotional counting stroop paradigm. Abstract presented at the 68th Annual Meeting of the Society of Biological Psychiatry, San Francisco, CA, May 16-18, 2013.
251. Weber, M, & **Killgore, WD**. The interrelationship between ‘sleep credit’, emotional intelligence and mental health – a voxel-based morphometric study. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.
252. Weber, M, Penetar, DM, Trksak, GH, DelDonno, SR, Kipman, M, Schwab, ZJ, & **Killgore, WD**. Morning blue wavelength light therapy improves sleep, cognition, emotion and brain function following mild traumatic brain injury. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.
253. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. Problems with Sleep Initiation and Sleep Maintenance Correlate with Functional Connectivity Among Primary Sensory Cortices. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.
254. **Killgore, WD**, Schwab, ZJ, Kipman, M, DelDonno, SR, & Weber, M. A Couple of Hours Can Make a Difference: Self-Reported Sleep Correlates with Prefrontal-Amygdala Connectivity and Emotional Functioning. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.
255. Tkachenko, O, Schwab, ZJ, Kipman, M, DelDonno, SR, Preer, LA, Gogel, H, Weber, M, Webb, CA, & **Killgore, WD**. Difficulty in falling asleep and staying asleep linked to a sub-clinical increase in symptoms of psychopathology. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.
256. Preer, LA, Tkachenko, O, Gogel, H, Schwab, ZJ, Kipman, M, DelDonno, SR, Weber, M, Webb, CA, & **Killgore, WD**. Linking Sleep Initiation Trouble to Neuroticism, Emotional Control, and Impulsiveness. Abstract presented at the SLEEP 2013 Annual Meeting, Baltimore, MD, June 1-5, 2013.

257. **Killgore, WD.** Sleep duration contributes to cortico-limbic functional connectivity, emotional functioning, & psychological health. Abstract presented at the 52nd Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 8-12, 2013.
258. Preer, L, Tkachenko, O, Gogel, H, Bark, JS, Kipman, M, Olson, EA, & **Killgore, WD.** The role of personality in sleep initiation problems. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.
259. Demers, LA, Olson, EA, Weber, M, Divatia, S, Preer, L, & **Killgore, WD.** Paranoid traits are related to deficits in complex social decision-making and reduced superior temporal sulcus volume. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.
260. Tkachenko, O, Weber, M, Gogel, H, & **Killgore, WD.** Predisposition towards unhealthy foods linked with increased gray matter in the cerebellum. Abstract presented at the Annual McLean Hospital Research Day, January 22, 2014.
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 McLean Hospital Research Day, January 22, 2014.
262. 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 Annual McLean Hospital Research Day, January 22, 2014.
263. Gogel, H, & **Killgore WDS.** A psychometric validation of the Design Organization Test (DOT) in a healthy sample. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
264. **Killgore, WD,** Kipman, M, Tkachenko, O, Gogel, H., Preer, L, Demers, LA, Divatia, SC, Olson, EA, & Weber, M. Predicting resilience against sleep loss with multi-modal neuroimaging. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
265. **Killgore, WD,** Weber, M, Bark, JS, Kipman, M, Gogel, H, Preer, L, Tkachenko, O, Demers, LA, Divatia, SC, & Olson, EA. Physical exercise correlates with hippocampal volume in healthy adults. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
266. **Killgore, WD,** Tkachenko, O, Weber, M, Kipman, M, Preer, L, Gogel, H, & Olson, EA. The association between sleep, functional connectivity, and emotional functioning. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
267. Preer, L, Tkachenko, O, Gogel, H, Bark, JS, Kipman, M, Olson, EA, & **Killgore, WD.** The role of personality in sleep initiation problems. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
268. Tkachenko, O, Weber, M, Olson, EA, Gogel, H, Preer, LA, Divatia, SC, Demers, LA, &

Killgore, WD. Gray matter volume within the medial prefrontal cortex correlates with behavioral risk taking. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.

- 269. Olson, EA, Weber, M, Bark JS, Demers L, Divatia, SC, Gogel, H, Kipman M, Preer, L, Tkachenko, O, & **Killgore, WD.** Sex differences in threat evaluation of emotionally neutral faces. Abstract presented at the 42nd Annual Meeting of the International Neuropsychological Society, Seattle WA, February 12-15, 2014.
- 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.
- 271. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD.** Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of depressive symptoms: A voxel-based morphometric analysis. Abstract presented at the 36nd Annual Conference of the Anxiety Disorders Association of America, Chicago, IL, March 27-30, 2014.
- 272. Weber, M, Penetar, DM, Trksak, GH, Kipman, M, Tkachenko, O, Bark, JS, Jorgensen, AL, Rauch, SL, & **Killgore, WD.** Light therapy may improve sleep and facilitate recovery from mild traumatic brain injury. Abstract presented at the 10th World Congress on Brain Injury, San Francisco, CA, March 19-22, 2014.
- 273. 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 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.
- 274. Divatia, S, Demers, LA, Preer, L, Olson, EA, Weber, M, & **Killgore, WD.** Advantageous decision making linked with increased gray matter volume in the ventromedial prefrontal cortex. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.
- 275. Demers, LA, Olson, EA, Weber, M, Divatia, S, Preer, L, & **Killgore, WD.** Paranoid traits are related to deficits in complex social decision making and reduced superior temporal sulcus volume. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.
- 276. Preer, LA, Weber, M, Tkachenko, O, Divatia, S, Demers, LA, Olson, EA, & **Killgore, WD.** Gray matter volume in the amygdala is associated with facial assessments of trustworthiness. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.
- 277. Tkachenko, O, Weber, M, Gogel, H, & **Killgore, WD.** Predisposition towards unhealthy foods linked with increased gray matter volume in the cerebellum. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.
- 278. Olson, EA, Weber, M, Gogel, H, & **Killgore, WD.** Daytime sleepiness is associated with

decreased integration of remote outcomes on the IGT. Abstract presented at the 21st Annual Meeting of the Cognitive Neuroscience Society, Boston, MA, April 5-8, 2014.

279. Demers, LA, Preer, LA, Gogel, H, Olson, EA, Weber, M, & **Killgore, WD**. Left-hemifield bias on sad chimeric face task correlates with interpersonal emotional intelligence. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.
280. Weber, M, **Killgore, WD**, Olson, EA, Rosso, IM, & Rauch, SL. Morphological brain network organization in relation to trauma and posttraumatic stress disorder. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.
281. Divatia, S, Demers, LA, Preer, L, Gogel, H, Kipman, M, & **Killgore, WD**. Schizotypal and manic traits are associated with poorer perception of emotions in healthy individuals. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.
282. **Killgore, WD**, Weber, M, Olson, EA, & Rauch, SL. Sleep reduction and functioning of the emotion regulation circuitry. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014. [**Blue Ribbon Finalist for Top Poster Award: Basic Neuroscience*]
283. Webb, CA, Weber, M, Mundy, EA, & **Killgore, WD**. Reduced gray matter volume in the anterior cingulate, orbitofrontal cortex and thalamus as a function of depressive symptoms: A voxel-based morphometric analysis. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.
284. Marin MF, Song H, Landau AJ, Lasko NB, Foy Preer LA, Campbell A, Pace-Schott EF, **Killgore WD**, Orr SP, Pitman RK, Simon NM, Milad MR (2014). Psychophysiological and Neuroimaging Correlates of Fear Extinction Deficits Across Anxiety Disorders. Abstract presented at the 69th Annual Meeting of the Society of Biological Psychiatry, New York, NY, May 8-10, 2014.
285. **Killgore, WD**. The effects of sleep loss on food preference. Abstract presented at SLEEP 2014, Minneapolis, MN, May 31-June 4, 2014.
286. Weber, M, & **Killgore, WD**. Sleep habits reflect in functional brain network organization. Abstract presented at SLEEP 2014, Minneapolis, MN, May 31-June 4, 2014. [**2014 AASM Young Investigator Award, Honorable Mention*]
287. Freed, MC, Novak, LA, **Killgore, WD**, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rauch S, Rizzo, A, Engle, CC. DoD IRB delays: Do they really matter? And if so, why and for whom? Abstract presented at the Military Health System Research Symposium, Fort Lauderdale, FL, August 18-21, 2014.
288. Freed, MC, Novak, LA, **Killgore, WD**, Koehlmoos, TP, Ginsberg, JP, Krupnick, J, Rauch S, Rizzo, A, Engle, CC. DoD IRB delays: Do they really matter? And if so, why and for whom? Abstract presented at the AMSUS Annual Meeting, Washington DC, December 2-5, 2014.

289. **Killgore, WD**, Demers, LA, Olson, EA, Rosso, IM, Webb, CA, & Rauch, SL. Anterior cingulate gyrus and sulcus thickness: A potential predictor of remission following internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 53rd Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.
290. Olson, EA, Buchholz, J, Rosso, IM, **Killgore, WD**, Webb, CA, Gogel, H, & Rauch, SL. Internet-based cognitive behavioral therapy effects on symptom severity in major depressive disorder: preliminary results from a randomized controlled trial. Abstract presented at the 53rd Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.
291. Brennan, B, Tkachenko, O, Schwab, Z, Ryan, E, Athey, A, Pope, H, Dougherty, D, Jenike, M, **Killgore, WD**, Hudson, J, Jensen, E, & Rauch SL. Abstract presented at the 53rd Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ, December 7-11, 2014.
292. Alkozei, A, Pisner, D, & **Killgore, WD**. Emotional intelligence is differentially correlated with prefrontal cortical responses to backward masked fearful and angry faces. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
293. Alkozei, A, Schwab, Z, & **Killgore, WD**. Looking for evil intent: Emotional intelligence and the use of socially relevant facial cues during an emotional decision making task. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
294. Shane, BR, Alkozei, A, & **Killgore, WD**. The contribution of general intelligence and emotional intelligence to the ability to appreciate humor. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
295. Markowski, SM, Alkozei, A, & **Killgore, WD**. Sleep onset latency and duration are associated with self-perceived invincibility. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
296. Pisner, D, Alkozei, A, & **Killgore, WD**. Visuospatial reasoning mediates the relationship between emotion recognition and emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
297. Vanuk, JR, Fridman, A, Demers, LA, Divatia, S, & **Killgore, WD**. Engaging in meditation and internet based training as a means of enhancing emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
298. Vanuk, JR, Divatia, S, Demers, LA, Markowski, SM, & **Killgore, WD**. Napping in conjunction with brief internet-based training as a means of enhancing emotional intelligence. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.

299. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Preer, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Bark, JS, Rosso, IM, Rauch, SL, & **Killgore, WD**. Fractional Anisotropy of frontoparietal connections predicts individual resistance to sleep deprivation. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
300. **Killgore, WD**, Olson, EA, Weber, M, Rauch, SL, & Nickerson, LD. Emotional intelligence is associated with coordinated resting state activity between emotion regulation and interoceptive experience networks. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
301. **Killgore, WD**, Demers, LA, Divatia, S, Kipman, M, Tkachenko, O, Weber, M, Preer, LA, Gogel, H, Olson, EA, Vanuk, JR, & Rauch, SL. Enhancing emotional intelligence via brief internet-based training. Abstract presented at the 43rd Annual Meeting of the International Neuropsychological Society, Denver, CO, February 4-7, 2015.
302. Buchholz, JL, Rosso, IM, Olson, EA, **Killgore, WD**, Fukunaga, R, Webb, CA, & Rauch, SL. Internet-based cognitive behavioral therapy is associated with symptom reduction and cognitive restructuring in adults with major depressive disorder. Abstract presented at the Anxiety and Depression Conference, Miami, FL, April 9-12, 2015.
303. Alkozei, A, Pisner, D, Rauch, SL, & **Killgore, WD**. Emotional intelligence and subliminal presentations of social threat. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
304. Shane, BR, Alkozei, A, Vanuk, JR, Weber, M, & **Killgore, WD**. The effect of bright light therapy for improving sleep among individuals with mild traumatic brain injury. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
305. Vanuk, JR, Shane, BR, Alkozei, A, & **Killgore, WD**. Trait emotional intelligence is associated with greater resting state functional connectivity within the default mode and task positive networks. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
306. Vanuk, JR, Fridman, A, Demers, LA, & **Killgore, WD**. Engaging in meditation and internet-based training as a means of enhancing emotional intelligence. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
307. Pisner, D, Alkozei, A, & **Killgore, WD**. Trait emotional suppression is associated with decreased activation of the insula and thalamus in response to masked angry faces. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
308. Markowski, SM, Alkozei, A, & **Killgore, WD**. The trait of neuroticism predicts neurocognitive performance in healthy individuals. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.

309. Buchholz, JL, Rosso, IM, **Killgore, WD**, Fukunaga, R, Olson, EA, Demers, LA, & Rauch, SL. Amygdala volume is associated with helplessness in adults with major depressive disorder (MDD). Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
310. Sneider, JT, **Killgore, WD**, Rauch, SL, Jensen, JE, & Silveri, MM. Sex differences in the associations between prefrontal GABA and resistance to sleep deprivation. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
311. **Killgore, WD**, Rosso, IM, Rauch, SL, & Nickerson, LD. Emotional intelligence correlates with coordinated resting state activity between brain networks involved in emotion regulation and interoceptive experience. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
312. **Killgore, WD**, Demers, LA, Divatia, S, Rosso, IM, & Rauch, SL. Boosting Emotional intelligence with a brief internet-based program. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
313. **Killgore, WD**, Vanuk, JR, Alkozei, A, Markowski, SM, Pisner, D, Shane, BR, Fridman, A, & Knight, SA. Greater daytime sleepiness correlates with altered thalamocortical connectivity. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
314. **Killgore, WD**, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, & Rauch, SL. Activation of the ventral striatum predicts overeating during subsequent sleep loss. Abstract presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Ontario, CA, May 14-16, 2015.
315. Alkozei, A, Markowski, SM, Shane, BR, Rauch, SL, & **Killgore, WD**. Emotional resilience is not associated with increased emotional resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
316. Alkozei, A, Pisner, D, Markowski, SM, Rauch, SL, & **Killgore, WD**. The effect of emotional resilience on changes in appetite for high-sugary food during sleep loss. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
317. Markowski, SM, Alkozei, A, Rauch, SL, & **Killgore, WD**. Self-perceived invincibility is associated with sleep onset latency and duration. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
318. Markowski, SM, Alkozei, A, Rauch, SL, & **Killgore, WD**. Sex differences in the association between personality and resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
319. Shane, BR, Alkozei, A, & **Killgore, WD**. Physical exercise may contribute to vulnerability to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.

320. Cui, J, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, Rauch, SL, & **Killgore, WD**. Resistance to sleep deprivation involves greater functional activation and white matter connectivity within a fronto-parietal network. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
321. Vanuk, JR, Rosso, IM, Rauch, SL, Alkozei, A, Markowski, SM, Pisner, D, Shane, BR, Fridman A, Knight, SA, & **Killgore, WD**. Daytime sleepiness is associated with altered thalamocortical connectivity. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
322. Sneider, JT, Jensen JE, Silveri, MM, & **Killgore, WD**. Prefrontal GABA predicts resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
323. **Killgore, WD**, Tkachenko, O, Gogel, H, Kipman, M, Sonis, LA, Weber, M, Divatia, SC, Demers, LA, Olson, EA, Buchholz, JL, Rosso, IM, & Rauch, SL. Individual differences in rested activation of the ventral striatum predict overeating during sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
324. **Killgore, WD**, Tkachenko, O, Rosso, IM, Rauch, SL, & Nickerson, LA. Multimodal neuroimaging to predict resistance to sleep deprivation. Abstract presented at the SLEEP 2015 Meeting, Seattle, WA, June 6-10, 2015.
325. Nickerson, LD & **Killgore, WD**. Resting state brain circuits underpinning a neurobiological model of Theory of Mind and Mentalizing. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, 2015, Honolulu, HI, June 14-18, 2015.
326. Rosso, IM, Olson, EA, **Killgore WD**, Fukunaga, R, Webb, CA, & Rauch SL. A randomized trial of internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 54th Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 6-10, 2015.
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.
328. Klimova, A, Pisner, D & **Killgore, WD**. Neural correlates of cognitive and emotional impairments in acute versus chronic mild traumatic brain injury: a diffusion tensor imaging study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
329. Markowski, S, Alkozei, A, & **Killgore, WD**. Greater neuroticism predicts higher performance in immediate memory, language, and attention in healthy individuals. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
330. Alkozei, A & **Killgore, WD**. Exposure to blue wavelength light suppresses anterior cingulate cortex activation in response to uncertainty during anticipation of negative or positive stimuli. 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 performance post mild traumatic injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 333. **Killgore, WD**. Baseline responsiveness of the ventral striatum predicts overeating during subsequent sleep deprivation. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 334. **Killgore, WD** & Nickerson, LD. Predicting resistance to sleep deprivation using multimodal neuroimaging. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 335. Sneider, J, Jensen, JE, Silveri, MM, & **Killgore, WD**. Prefrontal GABA correlates with the ability to sustain vigilance during sleep deprivation. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 336. Buchholz, JL, Olson, EA, Fukunaga, R, Webb, CA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Expressive suppression is associated with greater lateral orbitofrontal cortex volume in adults with major depressive disorder. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 337. Fridman, A, Pisner, D, Singh, P, & **Killgore, WD**. Gray matter volume in left medial prefrontal cortex is related to life satisfaction in individuals with mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 338. Singh, P, Pisner, D, Fridman, A, Roberts, S, & **Killgore, WD**. Volumetric differences in gray matter in healthy versus overweight/obese individuals post mild traumatic brain injury: A voxel based morphometric study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 339. **Killgore, WD** & Weber, M. Blue wavelength light therapy reduces daytime sleepiness following mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 340. **Killgore, WD**, Weber, M, & Penetar, D. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
- 341. Pisner, D, Smith, R, Alkozei, A, Klimova, A, & **Killgore, WD**. Highways of the emotional

intellect: White matter microstructural correlates of an ability-based measure of emotional intelligence. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.

342. Vanuk, JR, Smith, R, Knight, S, & **Killgore, WD**. Resting RSA correlates with coordinated resting state activity between brain networks involved in emotion perception. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
343. Vanuk, JR, Alkozei, A, Markowski, S, & **Killgore WD**. Greater resting state functional connectivity within the default mode and task positive networks is associated with trait emotional intelligence. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
344. Fukunaga, R, Webb, CA, Olson, EA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Reduced rostral anterior cingulate volume is associated with greater frequency of negative automatic thoughts in adults with major depressive disorder. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
345. Olson, EA, Fukunaga, R., Webb, CA, Rosso, IM, **Killgore, WD**, & Rauch, SL. Delay discounting and anhedonia are independently associated with suicidal ideation in depression. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
346. Pisner, D, Singh, P, Fridman, A, & **Killgore, WD**. Resilience following mild traumatic brain injury is associated with gray matter volume in the left precentral gyrus. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
347. Sing, P, Fridman, A, Pisner, D, & **Killgore, WD**. Time dependent differences in gray matter volume in individuals post mild traumatic brain injury: A voxel based morphometric study. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
348. Smith, C, Smith, R, Sanova, A, & **Killgore, WD**. The neural basis of emotional working memory and its relation to adaptive emotional functioning. Abstract presented at the 44th Annual Meeting of the International Neuropsychological Society, Boston, MA, February 3-6, 2016.
349. Quan, M, Gruber, SA, Lukas, SE, Hill, KP, **Killgore, WD**, & Nickerson, LD. Altered functional connectivity within large-scale brain networks during a cognitive task in chronic marijuana smokers. Abstract presented at the Harvard Psychiatry Research Day, Boston, MA, March 23, 2016. [**Semi Finalist Poster: Harvard Medical School Mysell Award*]
350. Fukunaga, R, Webb, CA, Olson, EA, **Killgore, WD**, Rauch, SL, & Rosso, IM. Improvement in negative automatic thoughts as a mediator of symptom improvement in internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the 2016 Meeting of the Anxiety and Depression Association of America, Philadelphia, PA, March 31-April 3, 2016.

351. Bernstein, AS, Pisner, D, Klimova, A, Umapathy, L, Do, L, Squire, S, **Killgore, WD**, & Trouard, T. Effects of multiband acceleration on high angular resolution diffusion imaging data collection, processing, and analysis. Abstract presented at the 24th Annual Meeting of the International Society for Magnetic Resonance in Medicine (IMSRM), Singapore, May 7-8, 2016.
352. Alkozei, A, Markowski, SM, Pisner, D, Fridman, A, Shane, BR, Vanuk, JR, Knight, SA, & **Killgore, WD**. Exposure to blue wavelength light reduces activation within the anterior cingulate cortex during anticipation of certain reward stimuli. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
353. Alkozei, A., Pisner, D, Markowski, SM, Vanuk, JR, Fridman, A, Shane, BR, Knight SA, & **Killgore, WD**. Increases in prefrontal activation after exposure to blue versus amber wavelength light during cognitive load. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
354. Pisner, DA, Smith, R, Alkozei, A, Klimova, A, Millan, M, & **Killgore, WD**. Highways of the emotional intellect: White matter microstructural correlates of an ability-based measure of emotional intelligence. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
355. Singh, P, Pisner, D, Fridman, A, Singh A, Millan, M, & **Killgore, WD**. A voxel based morphometric analysis of ventromedial prefrontal cortex volume related with executive function task performance post mild traumatic brain injury. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
356. Smith, R, Smith, C, Khodr, O, Nettles, M, Sanova, A, & **Killgore, WD**. Emotional working memory: A relatively unexplored aspect of emotional and cognitive ability. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
357. Smith, R, Nettles, M, Khodr, O, Sanova, A, Smith, C, Alkozei, A, & **Killgore, WD**. Conflict-related dorsomedial frontal activation during healthy food decisions is associated with increased cravings for high-fat foods. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
358. Smith, R, Sanova, A, Nettles, M, Khodr, O, Smith, C, Alkozei, A, Lane, RD, & **Killgore, WD**. Unwanted reminders: The effects of emotional memory suppression on later neuro-cognitive processing. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
359. **Killgore, WD**, Weber, M, Palmer, W, & Penetar, D. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry, Atlanta, GA, May 12-14, 2016.
360. **Killgore, WD**, Tkachenko, O, Palmer, W, & Rauch, SL. Default mode activation predicts vulnerability to sleep deprivation in domains of mood, sleepiness, and vigilance. Abstract presented at the 71st Annual Scientific Convention of the Society for Biological Psychiatry,

Atlanta, GA, May 12-14, 2016.

361. Alkozei, A, Markowski, SM, Pisner, D, Fridman, A, Shane, BR, Vanuk, JR, Knight, SA, Grandner, MA, & **Killgore, WD**. Exposure to blue wavelength light reduces activation within the anterior cingulate cortex during anticipation of certain reward stimuli. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
362. 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 increased dorsolateral prefrontal cortex responses and increases in response times during a working memory task. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
363. Davis, B, Yang, R, **Killgore, WD**, Gallagher, RA, Carrazco, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Nightmares in a community sample: Prevalence and associations with daytime function independent of poor sleep quality and depression. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
364. Fisseha, E, Havens, C, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration's important role in the relationship among difficulty concentrating, fatigue, stress, and depressed mood: Data from the SHADES study. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
365. Graham, PM, Goldstein, M, David, BM, Perlis, ML, Perfect, MM, Frye, S, **Killgore, WD**, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Longitudinal analysis of sleep duration using actigraphy and sleep diary: Stability and agreement over 8-11 months. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
366. Granados, K, Rojo-Wissar, DM, Chakravorty, S, Prather, A, Perfect, MM, Frye, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Adverse childhood exposures associated with adult insomnia symptoms. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
367. Grandner, MA, **Killgore, WD**, Khader, W, & Perlis, ML. Positive and negative mood ratings across 24-hours. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
368. Hall, C, Forbush, S, Youngstedt, S, **Killgore, WD**, Barilla, H, Gehrels, J, Alfonso-Miller, P, Palmer, W, Carrazco, N, & Grandner, MA. Habitual sleep duration and health: A possible role for exercise. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
369. Jackson, N, Patterson, F, Seixas, A, Jean-Louis, G, **Killgore, WD**, & Grandner, MA. Using big

data to determine the social, behavioral, and environmental, determinants of sleep duration in the U.S. population: Application of a machine learning approach to data from approximately 700,000 Americans. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

370. **Killgore, WD**, Tkachenko, O, Grandner, MA, & Rauch, SL. Default mode activation predicts vulnerability to sleep deprivation in the domains of mood, sleepiness, and vigilance. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
371. **Killgore, WD**, Weber, M, Grandner, MA, & Penetar, DM. Blue wavelength light therapy improves balance following mild traumatic brain injury. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
372. Knight, SA & Killgore, WD. Typical sleep duration is associated with constructive thinking patterns. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
373. Kotzin, MD, Alkozei, A, Knight, SA, Grandner, MA, & **Killgore, WD**. The effects of trait gratitude on quality of sleep, intrusiveness, of pre-sleep cognitions, and daytime energy in healthy individuals. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
374. Markowski, SM, Alkozei, A, McIntosh, MB, Grandner, MA, & **Killgore, WD**. Chronotype and risk-taking propensity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
375. McIntosh, MB, Markowski, SM, Grandner, MA, & **Killgore, WD**. Prior-night sleep duration is negatively associated with impulsivity in women. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
376. Ocano, D, Jean-Louis, G, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and decreased social support from family, friends, and significant other: Influence of insomnia and perceived stress level. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
377. Okuagu, A, Perlis, ML, Ellis, JA, Prather, AA, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Does thinking keep people awake? Or does it matter what they are thinking about? Self-directed cognitions associated with insomnia and insufficient sleep. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
378. Olivier, K, Gallagher, RA, **Killgore, WD**, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Development and initial validation of the Assessment of Sleep Environment: A novel inventory for describing and quantifying the impact of environmental factors on sleep. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies

(SLEEP 2016), Denver, CO, June 11-15, 2016.

379. Paine, KN, Forbush, S, Ellis, J, Nowakowski, S, Newman-Smith, K, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and satisfaction with life, health, finances and relationship. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
380. Rhee, JU, Haynes, P, Chakravorty, S, Patterson, F, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Susceptibility to smoking during the day and its relationship with insomnia and sleep duration. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
381. Roberts, SE, Singh, P, Grandner, MA, & **Killgore, WD**. Later wake up time and impulsivity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
382. Saccone, J, Davis, B, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Habitual caffeine use and motivation to consume caffeine: Associations with sleep duration, sleepiness, fatigue, and insomnia severity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
383. Singh, A, Fridman, A, Silveri, MM, Grandner, MA, & **Killgore, WD**. Medial prefrontal GABA predicts hunger ratings during sleep deprivation for men but not women. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
384. Vanuk, JR, Alkozei, A, Smith, R, Pisner, D, Markowski, SM, Shane, BR, Fridman, A, Knight, SA, Grandner, MA, & **Killgore, WD**. Changes in heart rate variability due to light exposure predict frontoparietal connectivity. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
385. Vanuk, JR, Alkozei, A, Knight, SA, Fridman, A, Markowski, SM, Pisner, D, Shane, BR, Grandner, MA, & **Killgore, WD**. The effects of light exposure on heart rate variability predict sleepiness and vigilance. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
386. Warlick, C, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Timing of alcohol intake associated with insomnia symptoms. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
387. Waugaman, DL, Markowski, SM, Alkozei, A, Grandner, MA, & **Killgore, WD**. Chronotype and Emotional Intelligence. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
388. Weber, M, Grandner, MA, & **Killgore, WD**. Smaller gray matter volume of the visual cortex

predicts vulnerability to sleep deprivation. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.

389. Weber, M, Grandner, MA, & **Killgore, WD**. Blue wavelength light therapy reduces daytime sleepiness following mild traumatic brain injury. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
390. Yang, R, Ocano, D, Chakravorty, S, **Killgore, WD**, Gallagher, RA, Carrazco, N, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Relationship between insomnia and depression moderated by caffeine. Abstract presented at the 30th Annual Meeting of the Associated Professional Sleep Societies (SLEEP 2016), Denver, CO, June 11-15, 2016.
391. **Killgore, WD**, Vanuk, JR, Pisner, D, Penetar, DM, & Weber, M. Short wavelength light therapy facilitates recovery from mild traumatic brain injury. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.
392. **Killgore, WD**, Alkozei, A, Smith, R, Divatia, S, & Demers, L. Enhancing emotional intelligence skills with a brief internet-based program: A pilot study. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.
393. **Killgore, WD**, Rosso, IM, Olson, EA, Webb, CA, Fukunaga, R, Gogel, H, Buchholz, JL, & Rauch, SL. Efficacy of an internet-based cognitive behavior therapy program for major depression. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.
394. **Killgore, WD**, & Nickerson, LA. Linked analysis of multimodal neuroimaging identifies neural systems associated with the ability to resist sleep deprivation. Abstract presented at the 2016 Military Health System Research Symposium (MHSRS), Orlando, FL, August 15-18, 2016.
395. Vanuk, JR, Allen, JJB, & **Killgore, WD**. Heart rate variability during light exposure and subsequent network connectivity patterns. Abstract presented at the Annual Meeting of the Society for Psychophysiological Research, Minneapolis, MN, September 21-25, 2016.
396. Haberman, JT, Olson, EA, Webb, CA, **Killgore, WD**, Rauch, SL, & Rosso, IM. The relation between treatment expectancies and outcome in internet-based cognitive behavioral therapy for major depressive disorder. Abstract presented at the Association for Behavioral and Cognitive Therapies, New York, NY, October 27-30, 2016.
397. Rosso, IM, Olson, EA, Thomas, MO, Webb, CA, **Killgore, WD**, & Rauch, SL. Anterior cingulate cortex morphology predicts remission from major depression following internet-based cognitive behavior therapy. Abstract presented at the 55th Annual Meeting of the American College of Neuropsychopharmacology, Hollywood, FL, December 4-8, 2016.
398. Shane, BR, Vanuk, JR, Bajaj, S, Millan, M, **Killgore, WD**. Multimodal brain imaging in patients receiving bright light therapy following a mild traumatic brain injury. Abstract presented at the Western Medical Research Conference, Carmel CA, January 26-28, 2017.
399. Franco, J, Millan, M, Shane, BR, Castellanos, A, **Killgore, WD**. Blue wavelength light therapy

increases thalamic grey matter volume following mild traumatic brain injury. Abstract presented at the 45th Annual Meeting of the International Neuropsychological Society, New Orleans, LA, February 1-4, 2017.

400. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract accepted for oral platform presentation at the 45th Annual Meeting of the International Neuropsychological Society, New Orleans, LA, February 1-4, 2017.
401. Li, H, Gruber, S, Lukas, S, Silveri, M, Hill, K, **Killgore, WD**, & Nickerson, LD. Data fusion to investigate the effect of chronic heavy marijuana use on brain structure. Abstract presented at the 2017 Harvard Psychiatry Research Day Poster Session, Boston, MA, April 12, 2017.
402. Challener, S, Alkozei, A, Fridman, A, Dormer, A, & **Killgore, WD**. Higher depressive symptoms are associated with lower activation in the orbitofrontal cortex when anticipating negative stimuli in individuals with PTSD. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
403. Alkozei, A, Smith, R, Fridman, A, Dormer, A, Challener, S, & **Killgore, WD**. Neural responses to emotional stimuli in individuals with PTSD after daily morning blue light exposure. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
404. Alkozei, A, Smith, R, Fridman, A, Dormer, A, Challener, S, & **Killgore, WD**. The role of trait gratitude on functional brain activation changes when anticipating negative events in individuals with PTSD. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
405. Fridman, AJ, Alkozei, A, Smith, R, Challener, S, Knight, SA, & **Killgore, WD**. Resiliency is associated with reduced activation within the retrosplenial cortex and secondary motor area for individuals with PTSD during anticipation of a negative event. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
406. Vanuk, JR, Millan, M, Shane, BR, Bajaj, S, & **Killgore, WD**. Blue light therapy following a mild traumatic brain injury improves MPFC-amygdala functional connectivity and mood. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
407. **Killgore, WD**, Shane, BR, Vanuk, JR, Franco, J, Castellanos, A, Millan, M, Grandner, MA, & Bajaj, S. Light therapy facilitates thalamo-cortical brain recovery from mild traumatic brain injury. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
408. Smith, R, Lane, RD, Alkozei, A, Bao, J, Smith, C, Sanova, A, Nettles, M, & **Killgore, WD**. Common and unique neural systems underlying the maintenance of emotional vs. bodily reactions to affective stimuli: the moderating role of emotional awareness. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.

409. Bajaj, S, Alkozei, A & **Killgore, WD**. Effect of bright light therapy on white matter abnormalities following a mild traumatic brain injury. Abstract presented at the 72nd Annual Convention of the Society for Biological Psychiatry, San Diego, CA, May 18-20, 2017.
410. Alkozei, A, Smith, R, Fridman, A, Dormer A, Challener, S, Grandner, MA, & **Killgore, WD**. Daily morning blue light exposure leads to changes in functional brain responses during emotional anticipation in individuals with PTSD. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
411. Gottschlich, MK, Hyman, S, Millan M, Pisner, D, Singh, A, Knight, SA, Grandner, MA, & **Killgore, WD**. Post-concussion severity is associated with sleep problems and neuropsychological status. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
412. Vanuk, JR, Shane, BR, Millan, M., Bajaj, S, Grandner, MA, & **Killgore, WD**. Short-wavelength light therapy as a way of improving sleep, cognition, and functional connectivity following mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
413. **Killgore, WD**, Shane, BR, Vanuk, JR, Franco, J, Castellanos, A, Millan, M, Grandner, MA, & Bajaj, S. Short wavelength light therapy facilitates recovery from mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
414. **Killgore, WD**, Capaldi, VF, Balkin, TJ, & Kamimori, GH. The trait of introversion-extraversion contributes to sustained performance on planning and sequencing abilities during sleep deprivation. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
415. Bajaj, S, Alkozei, A, Grandner, MA, & **Killgore, WD**. Effect of bright light therapy on brain and behavioral abnormalities following a mild traumatic brain injury. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
416. Oliver, K, Gallagher, R, Hale, L, Barrett, M, Branas, C, **Killgore, WD**, Parthasarathy, S, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Development and initial validation of a brief measure of control over sleep. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
417. Grandner, MA, Athey, A, **Killgore WD**, Alfonso-Miller, P. Preliminary results of a sleep health intervention in student athletes: Changes in sleep, energy level, and mental well-being, and body weight. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
418. Yang, R, Gallagher, R, Hale, L, Perlis, M, Barrett, M, Branas, C, **Killgore, WD**, Parthasarathy, S, Alfonso-Miller, P, Gehrels, J, Grandner, MA. Would you call yourself a short or long sleeper? Perceptions of sleep category associated with reported sleep duration, insomnia, and health. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
419. Fisseha, E, Gallagher, R, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Alfonso-Miller, P, Jean-Louis, G, Seixas, A, Williams, N, Gehrels, J, & Grandner, MA. Habitual weekday sleep duration associated with multiple dimensions of socioeconomic status. Abstract presented at the SLEEP

Meeting, Boston, MA, June 3-7, 2017.

420. Poling, K, Gallagher, R, Hale, L, Branas, C, Seixas, A, Jean-Louis, G, **Killgore, WD**, Alfonso-Miller, P, Parthasarathy, S, Gehrels, J, & Grandner, MA. Sleep partially mediates the association between food insecurity and obesity: Roles of short sleep duration, insomnia, and socioeconomic factors. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
421. Forbush, S, Fisseha, E, Gallagher, R, Hale, L, Malone, S, Patterson, F, Branas, C, Barrett, M, **Killgore, WD**, Gehrels, J, Alfonso-Miller, P, & Grandner, MA. Sociodemographics, poor overall health, cardiovascular disease, depression, fatigue, and daytime sleepiness associated with social jetlag independent of sleep duration and insomnia. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
422. Till, K, Athey, A, Chakravorty, S, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Insomnia and daytime tiredness in student athletes associated with risky behaviors and poor decision making when under the influence of alcohol. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
423. Warlick, C, Hall, C, Athey, A, Chakravorty, S, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Difficulty sleeping associated with substance use among student athletes. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
424. Jaszewski, A, Athey, A, **Killgore, WD**, Alfonso-Miller, P, Gehrels, J, & Grandner, MA. Sleep duration and quality associated with mental well-being in student athletes. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
425. Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Preliminary results of a sleep health intervention in student athletes: Perceived changes to sleep, performance, and mental and physical wellbeing. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
426. Goel, N, Taylor, DM, Abel, T, **Killgore, WD**, Pearson-Leary, J, & Bhatnagar, S. MicroRNAs are cross-species markers of sleep loss in humans and rats. Abstract presented at the Organization for Human Brain Mapping Conference, Boston, MA, June 3-7, 2017.
427. Meridew, C, Jaszewski, A, Athey, A, Alfonso-Miller, P, **Killgore, WD**, Gehrels, J, & Grandner, MA. Impact of time and activity demands on sleep of student athletes: It's not about reduced sleep opportunity. Abstract presented at the SLEEP Meeting, Boston, MA, June 3-7, 2017.
428. Bajaj, S, Rosso, IM, Rauch, SL, & **Killgore WD**. Impact of bright light therapy on volume and cortical thickness of the brain following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping Conference, Vancouver, Canada, June 25-29, 2017.*[selected for travel award]
429. Bajaj, S, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of bright light therapy on white matter abnormalities following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping Conference, Vancouver, Canada, June 25-29, June 3-7, 2017.
430. Alkozei, A, Haack, M, Smith, R, Dailey, N, Bajaj, S, & **Killgore, WD**. Chronic sleep restriction

increases negative implicit attitudes toward Arab Muslims. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.

431. **Killgore WD**, Vanuk, JR, Bajaj, S. Blue wavelength light therapy increases axonal myelination in mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.
432. **Killgore WD**. What makes a Super-Soldier: Identifying the neural correlates of individual differences in resilience against sleep deprivation. Abstract presented at the Military Health Systems Research Symposium (MHSRS), Kissimmee, FL, August 27-30, 2017.
433. Dailey, NS, Bajaj, S, Alkozei, A, & **Killgore WD**. Neural correlates of aggression during chronic and subacute stages of recovery from mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.
434. Bajaj, S, Alkozei, A, & **Killgore WD**. Short wavelength light therapy following mild traumatic brain injury: Can we normalize the abnormal diffusion and quantity of water within the brain? Abstract presented at the Military Health Systems Research Symposium, Kissimmee, FL, August 27-30, 2017.
435. Goel, N, Taylor, DM, Abel, T, **Killgore, WD**, Pearson-Leary, J, & Bhatnagar, S. MicroRNAs are cross-species markers of sleep loss in humans and rats. Abstract presented at the Society for Neuroscience, Washington, DC, November 11-15, 2017.
436. Dailey, NS, Bajaj, S, Alkozei, A, Smith, R, Knight, SA, & **Killgore, WD**. Neural correlates of aggression in the chronic and post-acute stages of recovery from mild traumatic brain injury: A diffusion tensor imaging study. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
437. Challener, S, Alkozei, A, Fridman, A, Dormer, A, & **Killgore, WD**. Higher depressive symptoms are associated with lower activation in the orbital frontal cortex when anticipating negative stimuli in individuals with PTSD. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
438. Alkozei, A, Smith, R, Demers, L, Divatia, S, Weber, M, Berryhill, S, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
439. Satterfield, B, Raikes, AC, & **Killgore, WD**. A voxel-based morphometric analysis of resilience to vigilant attention impairment during sleep deprivation. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
440. Singh, A, Thurston, MD, Gottschlich, MK, Miller, MA, & **Killgore, WD**. Trait anxiety predicts hostile tendencies post-traumatic brain injury. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
441. Raikes, AC, Satterfield, BC, Knight, SA, & **Killgore, WD**. Grey matter volumetric differences

with increasing numbers of previous mild traumatic brain injuries: A voxel-based morphometric study. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.

442. Bajaj, S, Dailey, N, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Preservation of limbic network structure in healthy young adults. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
443. Alkozei, A, **Killgore, WD**, Smith, R, Dailey, NS, Bajaj, S, & Haack, M. Chronic sleep restriction increases negative implicit attitudes toward Arab Muslims. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
444. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. Chronic sleep restriction increases racial bias and affects actual decision-making about people. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
445. Alkozei, A, Smith, R, & **Killgore, WD**. Increases in prefrontal activation after exposure to blue versus amber wavelength light during cognitive load. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
446. Knight, SA, & **Killgore, WD**. Typical sleep duration is associated with constructive thinking patterns. Abstract presented at the University of Arizona Junior Investigator Poster Forum, Tucson, AZ, November 17, 2017.
447. Nickerson, L, Li, H, Smith, S, Lukas, S, Silveri, M, Hill, K, **Killgore, WD**, & Gruber, S. Combining multi-site/study MRI data: A novel linked-ICA denoising method for removing scanner and site variability from multi-modal MRI data. Abstract presented at the American College of Neuropsychopharmacology (ACNP) 56th Annual Meeting, Palm Springs, CA, December 3-7, 2017.
448. Bajaj, S, Raikes, AC, Dailey, NS, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Changes in cortical structure, sleep, and anxiety symptoms following blue-wavelength light therapy in individuals with mild traumatic brain injury. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.
449. Dailey, NS, Raikes, AC, Smith, R, Alkozei, A, & **Killgore, WD**. The executive control network after mild traumatic brain injury: Associations between functional connectivity and aggression. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.
450. Raikes, AC, Satterfield, BC, Dailey, NS, Bajaj, S, & **Killgore, WD**. Self-reported sleep quality is related to cerebellar grey matter volume after mild traumatic brain injury. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.
451. Raikes, AC, Bajaj, S, Dailey, NS, Satterfield, BC, Alkozei, A, Smith, R, & **Killgore, WD**. White matter correlates of self-reported sleep quality after a mild traumatic brain injury: A DTI study. Abstract presented at the Big Sky Athletic Training Sports Medicine Conference, Big Sky, MT, February 4-8, 2018.

452. Satterfield, BC, Raikes, AC, & **Killgore, WD**. A voxel-based morphometric analysis of resilience to vigilant attention impairment during sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
453. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, Knight SA, & **Killgore, WD**. Exposure to blue wavelength light during memory consolidation improves long-delay verbal memory performance. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
454. Alkozei, A, Smith, R, Dailey, NS, Bajaj, S, Haack, M, & **Killgore, WD**. Men, but not Women, show a decrease in implicit preferences for low-calorie food after 3 weeks of chronic sleep restriction. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
455. Alkozei, A, Smith, R, & **Killgore, WD**. A positive cognitive style mediates the relationship between trait gratitude and depressive symptoms. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
456. Bajaj, S, Dailey, NS, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Preservation of limbic network structure in healthy young adults. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
457. Alkozei, A, Smith, R, Demers, LA, Divatia, S, Weber, M, Berryhill, SM, & **Killgore, WD**. Emotional intelligence can be trained via an online training program and is associated with better performance on the IGT. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
458. Dailey, NS, Bajaj, S, Alkozei, A, Smith, R, Knight, SA, & **Killgore, WD**. Neural correlates of aggression in the chronic and post-acute stages of recovery from mild traumatic brain injury: A diffusion tensor imaging study. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
459. **Killgore, WD**, Shane, BR, Vanuk, JR, Millan, M, Knight, SA, & Bajaj, S. Blue light therapy accelerates brain and cognitive recovery from mild traumatic brain injury. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
460. **Killgore, WD**. Default mode activation and the ability to resist sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
461. **Killgore, WD**, Capaldi, VF, Balkin, TJ, & Kamimori, GH. Personality traits predict the ability to sustain executive function abilities during sleep deprivation. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.

462. Raikes, AC, & **Killgore, WD**. Increased cerebellar grey matter in the presence of decreased subjective sleep quality following mild traumatic brain injury. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
463. Raikes, AC, Satterfield, BC, Knight, SA, & **Killgore, WD**. Gray matter volumetric differences with increasing numbers of previous mild traumatic brain injuries: A voxel-based morphometric study. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
464. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. Chronic sleep restriction increases implicit racial biases and affects actual decision-making about people. Abstract presented at the 46th Annual Meeting of the International Neuropsychological Society, Washington, DC, February 14-17, 2018.
465. Huanjie, L, Silveri, M, Lukas, SE, Hill, K, **Killgore, WD**, Gruber, S, & Nickerson, LD. Data fusion to investigate multimodal MRI patterns associated with chronic heavy marijuana use. Abstract presented at the Harvard Psychiatry Day Poster Session, Boston, MA, April 4, 2018.
466. Bajaj, S, Dailey, NS, Vanuk, JR, Raikes, A, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of blue light therapy on cortical volume, sleep and anxiety symptoms following mild traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.
467. Knight, SA, & **Killgore, WD**. Constructive thinking patterns correlate with typical sleep habits. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.
468. Raikes, AC, Dailey, NS, Bajaj, S, & **Killgore, WD**. White matter structure changes associated with depressive symptoms following recent mild traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.
469. Singh, A, Thurston, MD, Gottschlich, MK, Miller, MA, & **Killgore, WD**. Trait anxiety predicts hostile tendencies post-traumatic brain injury. Abstract presented at the Anxiety and Depression Association of America (ADAA) Conference, Washington, DC, April 5-8, 2018.
470. Bajaj, S, Raikes, AC, Alkozei, A, Dailey, NS, Satterfield, BC, Vanuk, JR, & **Killgore, WD**. Association between suicidal ideation and cortical volume in a sub-clinical sample of young individuals. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
471. Challener, S, Alkozei, A, Young, A, Ozcan, M, Raikes, AC, & **Killgore, WD**. Sleep problems are associated with greater default mode network activation when anticipating negative stimuli in individuals with PTSD. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
472. Dailey, NS, Smith, R, Raikes, AC, Alkozei, A, & **Killgore, WD**. Reduced functional

connectivity in the executive control network following mild traumatic brain injury: Implications for emotional regulation. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.

- 473. **Killgore, WD**, Kent, HC, Knight, SA, & Alkozei, A. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
- 474. **Killgore, WD**, Alkozei, A, & Weber, M. Blue light therapy improves executive function following mild traumatic brain injury. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
- 475. Ozcan, M, Challener, S, Yung, A, Alkozei, A, Raikes, AC, & **Killgore, WD**. Daytime sleepiness in individuals with PTSD is associated with greater activation in the right angular gyrus when viewing negative images. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
- 476. Smith, R, Sanova, A, Lane, RD, & **Killgore, WD**. Graph-theoretic correlates of trait differences in emotional awareness. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
- 477. Yung, A, Challener, S, Ozcan, M, Alkozei, A, Raikes, AC, & **Killgore, WD**. Improvements in PTSD symptom severity are associated with greater activation in the hippocampus during anticipation of negative stimuli. Abstract presented at the Society of Biological Psychiatry 73rd Annual Meeting, New York, NY, May 10-12, 2018.
- 478. Satterfield, BC, Silveri, M, Alkozei, A, Raikes, AC, & **Killgore, WD**. GABA: A neural marker of resilience to psychomotor vigilance impairment during sleep deprivation. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018. [*Trainee Merit Award]
- 479. Satterfield, BC, Alkozei, A, Raikes, AC, & **Killgore, WD**. Habitual sleep duration predicts caloric and macronutrient intake during sleep deprivation. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 480. Bajaj, S, Raikes, A, Dailey, NS, Vanuk, JR, Satterfield, BC, Alkozei, A, Weber, M, Rosso, IM, Rauch, SL, Grandner, MA, & **Killgore, WD**. Impact of blue light therapy on cortical structure, sleep, and anxiety symptoms following mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 481. Challener, S, Alkozei, A, Yung, A, Ozcan, M, Raikes, AC, & **Killgore, WD**. Functional impairment due to excessive daytime sleepiness is associated with greater activation in the default mode network when anticipating negative stimuli in individuals with PTSD. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 482. **Killgore, WD**, Alkozei, A, Knight, SA, Miller, MA, Grandner, MA, & Weber, M. Daily morning blue light exposure enhances executive functioning in individuals with mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.

- 483. **Killgore, WD**, & Nickerson, LA. Resistance to sleep deprivation is predicted by gray matter volume in the posterior brain stem. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 484. Alkozei, A, Kent, HC, Knight, SA, & **Killgore, WD**. Changes in morning salivary melatonin correlate with prefrontal responses during working memory performance. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 485. Ozcan, M, Alkozei, A, Raikes, A, & **Killgore, WD**. Pre-sleep cognitions partially mediate the relationship between depression and daytime energy. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 486. Raikes, AC, Dailey, NS, Satterfield, BC, Bajaj, S, & **Killgore, WD**. Self-reported sleep quality is associated with reductions in white-matter integrity following recent mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 487. Raikes, AC, Satterfield, BC, Dailey, NS, Bajaj, S, & **Killgore, WD**. Subjectively poor sleep quality is associated with increased cerebellar grey matter volume following mild traumatic brain injury. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 488. Skalamera, J, Alkozei, A, Haack, M, & **Killgore, WD**. The effect of chronic sleep restriction on implicit racial biases and explicit judgmental decision-making. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 489. Sanchez, C, Hale, L, Branas, C, Gallagher, R, **Killgore, WD**, Gehrels, J, Alfonso-Miller, P, & Grandner, MA. Relationships between dietary supplement intake and sleep duration, insomnia, and fatigue. Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 490. Tubbs, A, Perlis, M, Chakravorty, S, Basner, M, **Killgore, WD**, Gehrels, J, Alfonso-Miller, P, & Grandner, MA. Does increased risk of suicide at night favor one method of suicide over another? Abstract presented at the SLEEP 2018 Annual Meeting, Baltimore, MD, June 2-6, 2018.
- 491. Huanjie, L, Gruber, S, Smith, SM, Lukas, SE, Silveri, M, Hill, KP, **Killgore, WD**, & Nickerson, LD. Combining multi-site/study MRI data: A novel linked-ICA denoising method for removing scanner and site variability from multi-modal MRI data. Abstract presented at the Joint Annual Meeting of ISMRM-ESMRMB, Paris, France, June 16-21, 2018. [*Trainee Stipend Award]
- 492. Bajaj, S, Raikes, AC, Alkozei, A, Dailey, NS, Vanuk, J, Satterfield, BC, & **Killgore, WD**. Suicidal ideation is associated with diminished cortical volume in a sub-clinical population. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.
- 493. Bajaj, S, Raikes, AC, Dailey, NS, Vanuk, J, Alkozei, A, Satterfield, BC, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of blue light therapy on cortical volume, sleep, and anxiety symptoms following mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.

494. Dailey, NS, Bajaj, S, Smith, R, Raikes, AC, Alkozei, A, & **Killgore, WD**. Disrupted functional connectivity and elevated aggression in young adults with mild traumatic brain injury. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.
495. Raikes, AC, Bajaj, S, Dailey, NS, Alkozei, A, Smith, R, & **Killgore, WD**. Post-mTBI white matter correlates of self-reported sleep quality: A DTI study. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.
496. Nickerson, LD, Li, H, , Silveri, MM, Lukas, SE, Hill, KP, **Killgore, WD**, & Gruber, SA. Multimodal MRI data fusion reveals structure-function patterns associated with chronic heavy marijuana use. Abstract presented at the Organization for Human Brain Mapping (OHBM) Annual Meeting, Singapore, June 17-21, 2018.
497. Raikes, AC, Satterfield, BC, Alkozei, A, & **Killgore, WD**. Blue light therapy improves self-reported sleep quality in individuals with a recent mild traumatic brain injury. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August 20-23, 2018.
498. **Killgore, WD**. Executive functioning in individuals with mild traumatic brain injury is enhanced by daily morning blue light therapy. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August, 20-23, 2018.
499. **Killgore, WD**, & Nickerson, LA. Why can't you just stay awake? Resistance to sleep deprivation is associated with measurable differences in brainstem gray matter. Abstract presented at the Military Health Systems Research Symposium, Orlando, FL, August 20-23, 2018.
500. Dailey, NS, Smith, R, Satterfield, BC, Raikes, AC, & **Killgore, WD**. Verbal fluency following mild traumatic brain injury: The strength of switching. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.
501. Forbeck, B, Dailey, NS, Esbit, S, & **Killgore, WD**. Reduced information processing speed: A dynamic deficit in mild traumatic brain injury. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.
502. Raikes, AC, Dailey, NS, & **Killgore, WD**. Neural and neurocognitive correlates of responsiveness to blue light therapy following mild traumatic brain injury. Abstract presented at the American Speech-Language-Hearing Association Annual Convention, Boston, MA, November 15-17, 2018.
503. Burns, AI, Ozcan, M, Shepard, KC, Alkozei, A, & **Killgore, WD**. The association between PTSD severity and life satisfaction is mediated by trait gratitude. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
504. Burns, AI, Shepard, KC, Ozcan, M, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The association

between morningness-eveningness and nightmares in PTSD. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

505. Dailey, NS, Meinhausen, C, & **Killgore, WD**. Self-initiated recall strategies in mild traumatic brain injury: Identifying the neural correlates. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
506. Esbit, S, Dailey, NS, & **Killgore, WD**. Making a list and checking it twice: Episodic verbal recall in mild traumatic brain injury. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
507. Esbit, S, LaFollette, K, Botello, R, Satterfield, BC, Alkozei, A, & **Killgore, WD**. High self-perceived adroitness: An altered perception of reality during sleep deprivation. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
508. **Killgore, WD**, Vanuk, JR, & Bajaj, S. Improving executive functioning in mild traumatic brain injury with daily morning blue light therapy. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
509. **Killgore, WD**, & Nickerson, LA. Vulnerability and resistance to sleep deprivation are associated with measurable differences in brainstem gray matter. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
510. LaFollette, K, Satterfield, BC, Lazar, M, & **Killgore, WD**. Predicting psychosocial stress reactivity from ability and trait-based emotional intelligence. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
511. LaFollette, K, Satterfield, BC, Lazar, M, & **Killgore, WD**. Stay negative? Positive affect is associated with increased psychosocial stress reactivity. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
512. Meinhausen, C, Dailey, NS, & **Killgore, WD**. Identifying memory retrieval strategies following a mild traumatic brain injury using the CVLT-II. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
513. Ozcan, M, Shepard, KC, Burns, AI, Alkozei, A, & **Killgore, WD**. Trait gratitude and the impact of daytime sleepiness on daily functioning predict PTSD severity over time. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
514. Raikes, AC, & **Killgore, WD**. Anterior cingulate gyrus volume predicts changes in post-mTBI daytime sleepiness following blue wavelength light therapy. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.

515. Satterfield, BC, LaFollette, K, Lazar, M, & **Killgore, WD**. Prolonged psychosocial stress impairs cognitive flexibility. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
516. Shepard, KC, Burns, AI, Ozcan, M, Alkozei, A, & **Killgore, WD**. Racial differences regarding the effectiveness of blue light therapy in reducing PTSD severity. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
517. Shepard, KC, Ozcan, M, Burns, AI, Alkozei, A, Vanuk, JR, & **Killgore, WD**. Differences in anxiety reduction between minority and majority racial groups participating in morning blue light exposure. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
518. Vanuk, JR., Smith, R, Raikes, AC, Alkozei, A, Skalamera, J, & **Killgore, WD**. Ability based emotional intelligence is associated with greater cardiac vagal tone. Abstract presented at the Annual Meeting of the International Neuropsychological Society (INS), New York, NY, February 20-23, 2019.
519. Vanuk, JR, Shields, S, Slavich, M, & **Killgore, WD**. Lifetime stress exposure during adulthood is associated with lower trait-based emotional intelligence. Abstract presented at the Annual Meeting of the American Psychosomatic Society, Vancouver, BC, March 6-9, 2019.
520. Raikes, AC, Satterfield, BC, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces persistent post-mild traumatic brain injury daytime sleepiness and post-concussion. Abstract presented at the Rocky Mountain Athletic Trainer's Association Annual Meeting, Phoenix, AZ, April 12, 2019.
521. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Effect of blue light therapy on cortical volume and reaction time following mild TBI. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.
522. Bajaj, S, Raikes, AC, & **Killgore, WD**. Water anisotropy within the default mode network predicts mod shifts following sleep deprivation. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.
523. Bajaj, S, Raikes, AC, Razi, A, & **Killgore, WD**. Blue-wavelength light strengthens default mode network following mild TBI: A DCM-DTI study. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.
524. Bajaj, S, & **Killgore, WD**. Sex differences in limbic and risk-taking propensity in healthy individuals. Abstract presented at the Organization for Human Brain Mapping Annual Meeting, June 9-13, 2019.
525. Raikes, AC, Satterfield, BC, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces persistent post-mild traumatic brain injury daytime sleepiness and post-concussion. Abstract

presented at the Rocky Mountain Athletic Trainer's Association Annual Meeting, Phoenix, AZ, April 12, 2019.

526. Raikes, AC., Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Self-reported insomnia and daytime sleepiness increase athletes' sports-related concussion risk. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
527. Raikes, AC, Satterfield, BC, Bajaj, S, Grandner, MA, & **Killgore, WD**. Daily blue light therapy reduces daytime sleepiness and post-concussion symptoms after mild traumatic brain injury. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
528. Burns, AI, Shepard, KC, Ozcan, M, LaFollette, K, Alkozei, A, Vanuk, JR, Raikes, AC, Grandner, MA, & **Killgore, WD**. Gratitude and frequency of naps predict resilience for individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
529. Burns, AI, Ozcan, M, Shepard, KC, LaFollette, K, Alkozei, A, Grandner, MA, & **Killgore, WD**. The association between PTSD severity and insomnia is mediated by nightmares. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
530. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Grandner, MA, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of light therapy on brain structure and simple reaction time following mild traumatic brain injury. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
531. Bajaj, S, Raikes, AC, Grandner, MA, & **Killgore, WD**. Quantitative anisotropy within the default-mode network predicts mood degradation following sleep-deprivation. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
532. Dailey, NS, Satterfield, BC, Raikes, AC, Strong, MJ, Forbeck, B, Grandner, MA, & **Killgore, WD**. Disrupted thalamocortical connectivity following mild traumatic brain injury: Associations with daytime sleepiness. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
533. Shepard, KC, Ozcan, M, Burns, AI, Grandner, MA, & **Killgore, WD**. Use of anger words in trauma narratives is negatively associated with sleep quality for single individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
534. Shepard, KC, Ozcan, M, Burns, AI, Vanuk, JR, Grandner, MA, Alkozei, A, & **Killgore, WD**. The relationships between psychopathology and sleep problems differ between racial minority groups. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

535. **Killgore, WD**, & Kamimori, GH. Can caffeine sustain attention and vigilance under prolonged monotonous conditions during 77 hours of total sleep deprivation? Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
536. **Killgore, WD**, Pace-Schott, Ozcan, M, Shepard, KC, Burns, AI, Grandner, MA, Vanuk, JR, & Alkozei, A. Morning blue light exposure improves sleep and fear extinction recall in PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
537. LaFollette, K, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. Negative mood and poor sleep are associated with altered moral reasoning under stress. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
538. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. The effects of prior at-home sleep duration on reversal-learning during a “shoot/no-shoot” task. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
539. Ozcan, M, Shepard, KC, Burns, AI, Raikes, AC, Dailey, NS, Alkozei, A, Grandner, MA, & **Killgore, WD**. Individuals with PTSD whose traumatic experiences occurred within the home have worse sleep outcomes. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
540. Ozcan, M, Shepard, KC., Burns, AI, Raikes, AC, Dailey, NS, Alkozei, A, Grandner, MA, & **Killgore, WD**. PTSD severity and use of negative emotion words in trauma narratives predict nightmares in individuals with PTSD. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
541. Satterfield, BC, Silveri, MM, Grandner, MA, & **Killgore, WD**. Baseline GABA levels predict time-on-task performance during sleep deprivation. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
542. Skalamera, J, Huang, YH, Chinkers, M, Richards, MM, & **Killgore, WDS**. The influence of habitual sleep duration on rational thinking ability. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
543. Bliznak, V, Perlis, ML, Ellis, J, Hale, L, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. What is the ideal bedtime? Data from a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
544. Lane, E, Ellis, J, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Sociodemographic, socioeconomic, and behavioral correlates of nightmare frequency in a community sample. Abstract presented at the 2019 Annual Meeting of the Associated

Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

545. Jajoo, A, Taylor-Pilliae, R, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Types of habitual physical activity associated with habitual sleep duration, sleep quality, and daytime sleepiness. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
546. Khader, W, Fernandez, F, Seizas, A, Knowlden, A, Ellis, J, Williams, N, Hale, L, Perlis, M, Jean-Louis, G, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. What makes people want to make changes to their sleep? Assessment of perceived risks of insufficient sleep as a predictor of intent to improve sleep. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
547. Pham, B, Hale, L, St-Onge, M, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Habitual dietary quality associated with habitual sleep duration, insomnia, daytime sleepiness, and fatigue in a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
548. Begay, T, Gooneratne, N, Williams, N, Seixas, A, Jean-Louis, G, Gilles, A, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Sleep disparities in the United States and the impact of poverty. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
549. Griffen, N, Hale, L, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, & Grandner, MA. Aspects of disordered neighborhoods are associated with insomnia, sleepiness, fatigue and control over sleep. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
550. Liang, O, Seixas, A, Parthasarathy, S, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Healthcare financial hardship and habitual sleep duration, impact on sleep disparities, and impact on the sleep-obesity relationship. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
551. Olivier, K, Perlis, ML, Troxel, W, Basner, M, Chakravorty, S, Tubbs, A, Owens, J, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Influence of likely nocturnal wakefulness on 24-hour patterns of violent crime in adults and juveniles. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
552. Featherston, B, Perlis, ML, Ellis, J, Williams, N, Jean-Louis, G, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. The concept of “satisfaction with sleep: Associations with sleep continuity, sleep quality, daytime sleepiness, and related concepts of overall health, stress, depression, and anxiety. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
553. Fourte, DA, Patterson, F, Malhotra, A, Seixas, A, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Should habitual sleep duration be added to the American Heart Association’s “Life’s

Simple 7?" Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.

- 554. Wills, C, Athey, A, Robbins, R, Patterson, F, Turner, R, **Killgore, WD**, Tubbs, A, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Chronotype and social support among student athletes: Impact on depressive symptoms. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
- 555. Ramsey, T, Athey, A, Ellis, J, Tubbs, A, Turner, R, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Dose-response relationships between insufficient sleep and mental health symptoms I collegiate student athletes and non-athletes. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
- 556. Quiroz, H, Chakravorty, S, **Killgore, WD**, Warlick, C, Alfonso-Miller, P, & Grandner, MA. Sleep-related determinants of habitual cannabis use, desire to use, and problematic use: Data from a community sample. Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
- 557. Warlick, C, Williams, N, Hale, L, **Killgore, WD**, Alfonso-Miller, P, & Grandner, MA. Is relationship satisfaction associated with habitual sleep? Abstract presented at the 2019 Annual Meeting of the Associated Professional Sleep Societies (SLEEP) Conference, San Antonio TX, June 8-12, 2019.
- 558. Ozcan, M, Burns, AI, Shepard, KC, & **Killgore, WD**. The relationship between combat and non-combat trauma and risk-taking propensity in individuals with PTSD. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
- 559. Esbit, S, Satterfield, BC, & **Killgore, WD**. Exploration of emotional intelligence and self-perceived invincibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
- 560. LaFollette, KJ, Satterfield, BC, & **Killgore, WD**. Self-perceived invincibility is associated with greater cognitive flexibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
- 561. Strong, M, Esbit, S, LaFollette, KJ, Dailey, NS, & **Killgore, WD**. Big Five personality traits and how they relate to self-perceived invincibility. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
- 562. Shepard, KC, Ozcan, M, Burn, AI, Alkozei, A, & **Killgore, WD**. Blue light therapy differences in sleep quality improvement in military and civilian populations. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
- 563. Raikes, AC, Athey, A, Alfonso-Miller, P, **Killgore, WD**, & Grandner, MA. Moderate-to-severe self-reported insomnia and frequent daytime sleepiness increase athletes' risk for sustaining a sports-related concussion. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.

564. Bajaj, S, Dailey, NS, Raikes, AC, Vanuk, JR, Weber, M, Rosso, IM, Rauch, SL, & **Killgore, WD**. Impact of blue-wavelength light therapy on cortical volume and simple reaction time following mild TBI. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
565. Raikes, AC, Satterfield, BC, Bajaj, S, Grandner, MA, & **Killgore, WD**. Daily administered blue light therapy reduces daytime sleepiness and improves somatic symptoms following mild traumatic brain injury. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
566. Burns, AI, Ozcan, M, Shepard, KC, Alkozei, A, Vanuk, JR, & **Killgore, WD**. The relationship between sleep onset latency and gratitude. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
567. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, & **Killgore, WD**. Inadequate sleep quality and duration predicts disinhibited shooting on a “shoot/no shoot” task. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
568. Bajaj, S, & **Killgore, WD**. Sex differences in risk-taking behavior and brain morphometry in healthy individuals. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
569. Satterfield, BC, Silveri, MM, & **Killgore, WD**. Baseline GABA levels are associated with time-on-task performance during sleep deprivation. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
570. **Killgore, WD**, Ozcan, M, Shepard, KC, Burns, AI, Vanuk, JR, & Alkozei, A. Blue light exposure enhances sleep and fear extinction recall in PTSD. Abstract presented at the 2019 Military Health System Research Symposium, Kissimmee, FL, August 19-22, 2019.
571. LaFollette, K, Satterfield, BC, Lazar, M., **Killgore, WDS**. Disentangling the Effects of Subjective Task Load and Performance on Neuroendocrine Stress Response. Poster presented at the 49th Annual Society for Neuroscience Meeting, Chicago, IL, October, 2019.
572. Dailey, NS, & **Killgore, WD**. Disrupted thalamocortical connectivity following mild traumatic brain injury: Associations with daytime sleepiness. Oral presentation at the American Speech-Language Hearing Association Conference, Orlando, FL, November, 2019.
573. Dailey, NS, & **Killgore, WD**. Reading fluency in mild traumatic brain injury. Poster presented at the American Speech-Language Hearing Association Conference, Orlando, FL, November, 2019.
574. Raikes, AC, Alkozei, A, Vanuk, JR, Bajaj, S, Satterfield, BC, & **Killgore, WD**. Blue light therapy reduces daytime sleepiness as well as depressive and somatic post-concussive symptoms following mild traumatic brain injury. Abstract accepted for Oral presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020. *[*Winner of Nelson Butters Research Award for Best Paper by a Post-Doctoral Fellow].*

- 575. Raikes, AC, Bajaj, S, Dailey, NS, Vanuk, JR, Alkozei, A, & **Killgore, WD**. Vestibular and emotional symptoms are associated with altered large-scale network resting stated functional connectivity after mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 576. Esbit, S, Satterfield, BC, LaFollette, K, Lazar, M, & **Killgore, WD**. Gender differences and overriding misleading impulses. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 577. Esbit, S, Raygoza, D, Meinhausen, C, Dailey, NS, & **Killgore, WD**. Exploring verbal recall throughout mild traumatic brain injury recovery. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 578. Meinhausen, C, Esbit, S, Dailey, NS, & **Killgore, WD**. Self-initiated verbal recall strategies following mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 579. Anlap, I, Esbit, S, Alkozei, A, Satterfield, BC, & **Killgore, WD**. The effects of gratitude on wellbeing are mediated by social support. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 580. Dailey, NS, Raikes, AC, Bajaj, S, Alkozei, A, Sanasac, S, & **Killgore, WD**. Frontal cortical surface area is associated with lexical-semantic knowledge in adults with mild traumatic brain injury. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 581. **Killgore, WD**, Burns, AI, Shepard, KC, Vanuk, JR, & Alkozei, A. Enhancing fear extinction recall in PTSD using blue light therapy. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 582. **Killgore, WD**, & Kamimori, GH. The effects of caffeine under monotonous conditions during prolonged total sleep deprivation. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 583. **Killgore, WD**, & Kamimori, GH. Trait extraversion is associated with increased suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
- 584. Bullock, A, Burns, AI, Shepard, KC, Alkozei, A, & **Killgore, WD**. Alterations in cognitive symptoms of PTSD are correlated with somatic symptoms. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.

585. Taylor, E, & **Killgore, WD**. Caffeine and emotional control. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
586. Taylor, E, & **Killgore, WD**. Emotionally intelligent early birds. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
587. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD**. The effects of blue wavelength light on subsequent amygdala-DLPFC connectivity at rest. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
588. Vanuk, JR, Raikes, AC, Alkozei, A, Shields, GS, Slavich, GM, & **Killgore, WD**. Lifetime stress exposure during adulthood is associated with lower emotional intelligence. Abstract accepted for Poster presentation at the 48th Annual Meeting of the International Neuropsychological Society, Denver CO, February 5-8, 2020.
589. LaFollette, K, Satterfield, BC, Lazar, M., **Killgore, WD**. The propensity for model-based control is associated with individual differences in risk behavior. Abstract submitted for presentation at the Computational and Systems Neuroscience (Cosyne) 2020 Meeting, Denver, CO, February, 2020.
590. Vanuk, JR, Alkozei, A, Burns, AI, Bullock, AD, & **Killgore, WD**. Sleep and fear extinction recall in PTSD improves with morning blue light exposure therapy. Abstract accepted for oral presentation at the 78th Annual Scientific Meeting of the American Psychosomatic Society, Long Beach, CA, March 11-14, 2020.
591. **Killgore, WD**, Burns, AI, Bullock, A, Vanuk, J, Taylor, E, Alkozei, A. Using blue light to consolidate fear extinction memory in PTSD. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
592. **Killgore, WD**, & Kamimori, GH. Can caffeine sustain cognitive resilience during 77 hours of stressful total sleep deprivation? Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
593. **Killgore, WD**, Skalamera, J, Vanuk, J, Woods-Lubert, R, Cloonan, S, Alkozei, A, Dailey, N, Lane, R, Weihs, K, Allen, J, and Smith, R. Preliminary validation of a web-based emotional intelligence training program for enhancing emotional resilience. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.

594. **Killgore, WD,** & Kamimori, GH. Extraverts show increased suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
595. **Killgore, WD,** Cloonan, S, Woods-Lubert, R, Taylor, E, & Skalamera, J. Political perspective is associated with differences in trait anxiety and depression. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
596. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD.** Acute blue wavelength light exposure influences functional brain connectivity. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
597. Burns, A, Shepard, KC, Bullock, A, Esbit, S, Alkozei, A, Satterfield, B, & **Killgore, WD.** The association between life history strategy and anxiety is mediated by trait gratitude. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
598. Bullock, A, Shepard, KC, Burns, A, Raikes, A, Alkozei, A, & **Killgore, WD.** Use of family words in trauma narratives predicts a higher risk of insomnia in individuals with PTSD. Abstract accepted for Poster presentation at the 40th Annual Conference of the Anxiety and Depression Association of America, San Antonio, TX, March 19-22, 2020.
599. **Killgore, WD.** Blue light therapy enhances sleep and fear extinction recall in PTSD. Symposium abstract accepted for presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
600. **Killgore, WD,** & Kamimori, GH. Extraversion and caffeine intake relate to suicidal ideation during sleep deprivation. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
601. **Killgore, WD,** Burns, AI, Bullock, A, Vanuk, JR, Taylor, E, & Alkozei, A. Morning blue light improves consolidation of fear extinction memory in PTSD. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
602. **Killgore, WD,** & Kamimori, GH. Effects of repeated dosing of caffeine on cognitive performance during prolonged sleep deprivation. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
603. Alkozei, A, Dailey, NS, Bajaj, S, Vanuk, JR, Raikes, AC, & **Killgore, WD.** Blue wavelength light and its effects on functional brain connectivity. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2,

2020.

604. Lucas, DA, Dailey, NS, & **Killgore, WD**. Implications for targeted interventions following mild traumatic brain injury: Post-concussion symptom severity predicts cognitive flexibility. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
605. Jecmen, D, King, R, Gould, J, Mitchell, J, Ralston, K, Alkozei, A, & **Killgore, WD**. The effect of blue light therapy on functional brain responses to masked fearful stimuli in post-traumatic stress disorder. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
606. King, R, Jecmen, D, Mitchell, J, Ralston, K, Gould, J, Burns, A, Bullock, A, Alkozei, A, & **Killgore, WD**. Co-morbid depressive symptoms are associated with reduced functional brain responses within the insula and visual cortex in response to masked happy faces in individuals with PTSD. Abstract accepted for Poster presentation at the 75th Annual Meeting of the Society of Biological Psychiatry, New York, NY, April 30-May 2, 2020.
607. Dailey, NS, Raikes, AC, Alkozei, A, Grandner, MA, & **Killgore WD**. Reduced cortical thickness as a biomarker of daytime sleepiness in mild traumatic brain injury. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
608. Dailey, NS, Raikes, AC, Wager, ME, Grandner, MA, Alkozei, WD. The compounding impact of daytime sleepiness and brain injury on sustained vigilance. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
609. Anlap, I, Taylor, E, Grandner, MA, & **Killgore, WD**. Gray matter volume of the rostral medial prefrontal cortex is associated with resilience to mood decline during overnight sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
610. Raikes, AC, Dailey, NS, Alkozei, A, Vanuk, JR, Grandner, MA, & **Killgore, WD**. Daytime sleepiness, depression, and post-concussive symptoms improve following prescribed morning exposure to blue light. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
611. Raikes, AD, Dailey, NS, Vanuk, JR, Alkozei, A, Grandner, MA, **Killgore, WD**. Improved daytime sleepiness following daily morning blue light therapy is associated with altered resting-state network connectivity. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
612. Satterfield, BC, Anlap, I, Esbit, S, & **Killgore, WD**. Corticotropin-releasing hormone receptor 1 gene polymorphism modulates cognitive flexibility following acute stress and total sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference,

Philadelphia, PA, June 13-17, 2020.

613. Jecmen, D, King, R, Gould, J, Mitchell, J, Ralston, K, Burns, AI, Bullock, A, Grandner, MA, Alkozei, A, & **Killgore, WD**. The effects of morning blue light therapy on insomnia severity and PTSD symptoms in a clinical sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
614. Taylor, E, Grandner, MA, & **Killgore, WD**. Later bedtime is associated with differences in prefrontal gray matter volume and executive function deficit. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
615. Taylor, E, & **Killgore, WD**. Meta-analysis on the effects of caffeine on neurodegenerative cognitive decline. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
616. LaFollette, KJ, Satterfield, BC, Esbit, S, Lazar, M, Grandner, MA, & **Killgore, WD**. Emotion regulation during sleep deprivation and repeated physiological stress: Implications for motor skill learning and production. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
617. King, R, Jecmen, D, Mitchell, J, Ralston, K, Gould, J, Burns, AI, Bullock, A, Grandner, MA, Alkozei, A, & **Killgore, WD**. Habitual sleep duration is negatively correlated with emotional reactivity within the rostral anterior cingulate cortex in individuals with PTSD. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
618. King, R, Jecmen, D, Alkozei, A, Raikes, A, Grandner, MA, & **Killgore, WD**. Hippocampal gray matter volume in healthy adult population is associated with habitual sleep duration. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
619. Burns, AI, Bullock, A, Taylor, E, Grandner, MA, Alkozei, A, & **Killgore, WD**. The association between sleep problems and risk-taking behavior differs between racial majority and minority groups. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
620. Burns, AI, Bullock, A, Raikes, AC, Dailey, NS, Grandner, MA, & **Killgore, WD**. Daytime sleepiness correlates with increased gray matter volume in the right middle temporal gyrus in healthy young individuals. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
621. **Killgore, WD**, Dailey, NS, Raikes, AC, Vanuk, John R, Taylor, E, Grandner, MA, & Alkozei, A. Blue light exposure enhances neural efficiency of the task positive network during a cognitive interference task. Abstract submitted for Poster presentation at the 34th Annual SLEEP

Conference, Philadelphia, PA, June 13-17, 2020.

622. **Killgore, WD**, Dailey, NS, Raikes, AC, Vanuk, JR, Taylor, E, Grandner, MA, & Alkozei, A. Resilience to inhibitory deficits during sleep deprivation is predicted by gray matter volume in the ventromedial and ventrolateral prefrontal cortex. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
623. Bullock, A, Burns, A, Taylor, E, Grandner, MA, Miller, MM, Alkozei, A, & **Killgore, WD**. Self-referential language in trauma narratives predicts shorter sleep duration in women with PTSD. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
624. Vanuk, JR, Raikes, AC, Dailey, NS, Grandner, MA, & **Killgore, WD**. Grey matter volumetric differences are predictive of attentional lapses during sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
625. Meinhausen, CE, Vanuk, JR, Grandner, MA, & **Killgore, WD**. Gray matter volume correlates of psychomotor vigilance speed during sleep deprivation. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
626. Kapoor, A, Perlis, M, Bastien, C, Williams, N, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Disassembling Associations between Insomnia and Anxiety Symptoms: Which Elements of Insomnia are Associated with Which Elements of Anxiety? Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
627. Ramsey, T, Athey, A, Auerbach, A, Turner, R, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Symptoms Associated with Race/Ethnicity in Elite Collegiate Athletes. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
628. Piro, B, Garland, S, Jean-Pierre, P, Gonzalez, B, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Sleep Timing Associated with History of Breast, Prostate, and Skin Cancer: Data from a Nationally-Representative Sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
629. Bombarda, A, St-Onge, M, Seixas, A, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep Duration and Timing Associated with Eating Behaviors: Data from NHANES 2015-2016. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
630. Abdi, H, Athey, A, Auerbach, A, Turner, R, **Killgore, WD**, Wills, CC, & Grandner, MA. College Football Players Compared to Other Collegiate Athletes: Symptoms of Insufficient Sleep Duration, Insomnia, and Sleep Apnea. Abstract submitted for Poster presentation at the 34th

Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.

631. Holbert, C, Bastien, C, Chakravorty, S, **Killgore, WD**, Wills, CC, & Grandner, MA. Hallucinogen Use Among College and University Students: Associations with Insufficient Sleep and Insomnia. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
632. Onyeonwu, C, Nowakowski, S, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Menstrual Regularity and Bleeding Associated with Sleep Duration, Sleep Quality, and Daytime Sleepiness in a Community Sample. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
633. Ghani, S, Delgadillo, ME, **Killgore, WD**, Wills, CC, & Grandner, MA. Culturally Consistent Diet Among Individuals of Mexican Descent at the US-Mexico Border Is Associated with Sleep Duration and Quality. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
634. Mason, B, Tubbs, A, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Use of Mobile Devices at Night Associated with Mental Health in Young Adults. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
635. Gozar, A, Seixas, A, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, Grandner, MA. Mobile Device Use in Bed and Relationships to Work Productivity: Impact of Anxiety. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
636. Barker, M, St-Onge, M, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Dietary Macronutrients and Sleep Duration, Sleep Disturbance, and Daytime Fatigue. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
637. Phan, S, Perlis, ML, Hale, L, Branas, C, **Killgore, WD**, Wills, CC, & Grandner, MA. Reconsidering Stimulus Control: Activities in Bed Differentially Associated with Sleep-Related Outcomes. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
638. Grandner, MA, Tubbs, A, Jean-Louis, G, Seixas, A, Hale, L, Branas, C, **Killgore, WD**, & Wills, CC. Daytime Sleepiness in the Community: Implications for Sleep Health, Circadian Health, and Overall Physical Health. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
639. Begay, T, Tubbs, A, Jean-Louis, G, Hale, L, Branas, C, **Killgore, WD**, Wills, CC, & Grandner, MA. Demographic and Socioeconomic Implications of Excessive Daytime Sleepiness in the Community. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference,

Philadelphia, PA, June 13-17, 2020.

640. Khader, WS, Tubbs, A, Fernandez, F, Chakravorty, S, Hale, L, Branas, C, Barrett, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Community-Level Daytime Sleepiness and Substance Use: Implications of Sleep Time and Mental Health. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
641. Jajoo, A, Tubbs, A, Perlis, ML, Chakravorty, S, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Population-Level Suicide Ideation: Impact of Combined Roles of Sleep Duration, Sleep Disturbance, and Daytime Sleepiness. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
642. Clay, MA, Athey, A, Charest, J, Auerbach, A, Turner, R, **Killgore, WD**, Wills, CC, & Grandner, MA. Team-Based Athletes Sleep Less than Individual Athletes, But Do Not Report More Insomnia or Fatigue. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
643. Grandner, MA, Fernandez, F, Khader, S, Jean-Louis, G, Seixas, A, Williams, N, **Killgore, WD**, & Wills, CC. Decline in Habitual Sleep Duration over 10 Years and Worsening Sleep Disparities: Data From NHIS 2006-2015. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
644. Villalobos, KM, Seixas, A, Williams, N, Jean-Louis, G, **Killgore, WD**, Wills, CC, & Grandner, MA. Disparities in Sleep Timing in the US: Data from the National Health and Nutrition Examination Survey 2015-2016. Abstract submitted for Poster presentation at the 34th Annual SLEEP Conference, Philadelphia, PA, June 13-17, 2020.
645. Valencia, LR, Bullock, A, Miller, M, Johnson, J, **Killgore, WD**. Incorporation of cardio exercise is associated to increased levels of gratitude among PTSD patients. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
646. Cloonan, S, Persich, M, Woods-Lubbert, RA, Smith, R, Skalamera, J, & **Killgore, WD**. Examining changes to perceived and ability emotional intelligence following emotional intelligence-specific training. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
647. Johnson, J., Anlap, I, Taylor, EC, Valencia, LR, Bullock, A, Swift, N, Wellman, C, Vanuk, J, & **Killgore, WD**. The association between anxiety and intelligence is moderated by sex. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
648. Persich, M, Cloonan, S, Woods-Lubbert, RA, Smith, R, Skalamera, J, & **Killgore, WD**. Emotional intelligence training and improvements to emotional regulation. Abstract submitted for

presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.

649. Vanuk, J, Bullock, A, Forbeck, B, Dailey, NS, & **Killgore, WD**. Severity of PTSD symptoms is associated with greater levels of depression and deficits in short-term memory. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
650. **Killgore, WD**, Cloonan, S, Woods-Lubbert, RA, Vanuk, J, Persich, M, Dailey, NS, Strong, MJ, King, RJ, Lane, RD, & Smith, R. Enhancing emotional awareness with an online training program. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
651. **Killgore, WD**, Cloonan, S, Woods-Lubbert, RA, Vanuk, J, Persich, M, Dailey, NS, Strong, MJ, King, RJ, Lane, RD, and Smith, R. Training interoceptive awareness. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
652. **Killgore, WD**, Vanuk, J, Woods-Lubbert, RA, Cloonan, S, Persich, M, Dailey, NS, King, RJ, Strong, MJ, Lane, RD, and Smith, R. Can emotional resilience be trained? Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
653. **Killgore, WD**, Skalamera, J, Ozcan, M, Cloonan, S, Woods-Lubbert, RA, Persich, M, & Smith, R. Development and validation of the Interpersonal Affect Regulation Test (IPART). Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
654. Dailey, NS, Raikes, AC, Alkozei, A, Vanuk, J, & **Killgore, WD**. A shared biomarker of cognitive ability and sleep disruptions in mild traumatic brain injury. Abstract submitted for presentation at the Annual Meeting of the International Neuropsychological Society (INS), San Diego, CA, February 3-6, 2021.
655. Mason, BJ, Tubbs, AS, **Killgore, WD**, Fernandex, FX, & Grandner, MA. How much do blue-blockers block do block blue? Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
656. Bobadilla, V, Mason, BJ, Tubbs, AS, Fernandez, FX, **Killgore, WD**, & Grandner, MA. Blue blockers' ability to filter circadian-active light emitted from a tablet. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
657. Ruppel, D, Mason, BJ, Tubbs, AS, Fernandex FX, **Killgore, WD**, & Grandner, MA. Spectrophotometric properties of 31 different commercially available blue blocking glasses under room lighting. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual,

June 10-13, 2021.

- 658. Mason, BJ, Tubbs, AS, Fernandex, FX, **Killgore, WD**, & Grandner, MA. Spectrophotometric properties of commercial blue-blocking lenses in sunlight. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 659. Abdi, H, Kennedy, KE, **Killgore, WD**, Wills, CC, Charest, J, & Grandner, MA. Changes in physical activity during the COVID-19 pandemic associated with changes in sleep. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 660. Jajoo, A, Kennedy, KE, Lujan, M, **Killgore, WD**, Wills, CC, & Grandner, MA. Chanigni sleep during the COVID pandemic associated with daytime cognitive function. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 661. Ghani, SB, Kennedy, KE, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Changes in sleep due to COVID pandemic associated with changes to dietary patterns. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 662. Wills, CC, Kennedy, KE, Bastien, C, Ruby, P, **Killgore, WD**, & Grandner, MA. Changes in dream recall during the COVID-19 pandemic: Associations with sleep, stress and dream content. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 663. Holbert, C, Kennedy, KE, **Killgore, WD**, Wills, CC, & Grandner, MA. Changes in sleep due to the COVID pandemic associated with sleep environment. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 664. Lujan, M, Kennedy, KE, **Killgore, WD**, Wills, CC, & Grandner, MA. Sleep disturbance during the COVID-19 pandemic associated with worries and fears about possible infection. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 665. Kennedy, KE, Bastien, C, Ruby, P, **Killgore, WD**, Wills, CC, & Grandner, MA. Nightmare content during the COVID-19 pandemic: Influence of COVID-related stress and sleep disruption. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 666. VAnencia, D, Ghani, S, Delgadillo, ME, Madhivan, P, Krupp, K, Ruiz, J, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. COVID-19 pandemic sleep disturbances related to dietary behavior at the US-Mexico border. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 667. Isalva, L, Vanencia, D, Ghani, S, Delgadillo, ME, Bastien, C, Madhivan, P, Krupp, K, Ruiz, J, **Killgore, WD**, Wills, CC, & Grandner, MA. COVID-19 pandemic sleep and dreams at the US-Mexico border. Abstract submitted for presentation at the 35th Annual SLEEP Conference,

Virtual, June 10-13, 2021.

668. Arce, R, Valencia, D, Ghani, S, Delgadillo, ME, Madhivan, P, Krupp, K, Ruiz, J, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. COVID-19 pandemic sleep changes related to social and financial impacts at the US-Mexico border. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
669. Begay, T, Valencia, D, Ghani, S, Delgadillo, ME, Bastien, C, Madhivan, P, Krupp, K, Ruiz, J, **Killgore, WD**, Wills, CC, & Grandner, MA. COVID-19 pandemic nightmares at the US-Mexico border. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
670. Begay, T, Valencia, D, Ghani, S, Delgadillo, ME, Madhivan, P, Krupp, K, Ruiz, J, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. COVID-19 pandemic sleep disturbances related to stress experiences at the US-Mexico border. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
671. Grandner, MA, Ruby, P, **Killgore, WD**, Kennedy, KE, Wills, CC. An election during a pandemic: Relationship between political affiliation and pandemic-related sleep and dreams. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
672. Kennedy, KE, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Changes in sleep due to the COVID-19 pandemic associated with COVID-related general, financial, food, housing, family and relationship stress. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
673. Barker, M, Gilles, A, Ghani, S, **Killgore, WD**, Wills, CC, & Grandner, MA. Sociodemographic, behavioral, and health-related factors associated with sleep duration and quality among a nationally-representative sample of native Hawaiians and other Pacific Islanders. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
674. Craig, C, Kennedy, KE, Perlis, ML, Seixas, A, **Killgore, WD**, Wills, CC, & Grandner, MA. Relationships between habitual sleep duration and chronic pain conditions in the US population over a 10-year period: Implications for sleep health disparities. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
675. Hanley, B, Gorovoy, S, Chamberlain, S, Bushan, B, Ghani, S, **Killgore, WD**, Wills, CC, & Grandner, MA. Parent and child sleep quality and nighttime activities. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
676. **Killgore, WD**, Cloonan, SA, Taylor, EC, Grandner, MA, & Dailey, NS. Insomnia as a risk for PTSD during the COVID-19 pandemic. Abstract submitted for presentation at the 35th Annual

SLEEP Conference, Virtual, June 10-13, 2021.

- 677. **Killgore, WD**, Capaldi, VF, Grandner, MA, & Kamimori, GH. Trait extraversion is associated with increased suicidal ideation during total sleep deprivation and insomnia. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 678. Cloonan, SA, Grandner, MA, & **Killgore, WD**. Loneliness and lockdowns: The effects of the COVID-19 pandemic on insomnia symptoms. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 679. Janowski, S, Cloonan, SA, Grandner, MA, & **Killgore, WD**. Sleeping well during a pandemic: The role of various forms of social support in protecting against insomnia. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 680. Le, AJ, Dailey, NS, Grandner, MA, & **Killgore, WD**. Obstructive sleep apnea symptoms predict cognitive function following mild traumatic brain injury. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 681. Persich, M, Cloonan, SA, Grandner, MA, & **Killgore, WD**. Self-reported sleep and resilience. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 682. Persich, M, Cloonan, SA, Grandner, MA, & **Killgore, WD**. Sleep quality and duration are associated with greater trait emotional intelligence. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 683. Taylor, EC, Cloonan, SA, Grandner, MA, & **Killgore, WD**. Insomnia in those diagnosed with COVID-19. Abstract submitted for presentation at the 35th Annual SLEEP Conference, Virtual, June 10-13, 2021.
- 684. Cloonan, SA, Persich, MR, & **Killgore, WD**. Resilience mediates the effect of actual and perceived emotional intelligence on depression. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 685. **Killgore, WD**, Silveri, MM. Finding the secret recipe for good sleep: Clues from brain neurochemistry. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 686. **Killgore, WD**, & Capaldi, VF (II). Extraversion is associated with increased suicidal ideation during sleep deprivation. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 687. **Killgore, WD**, Dailey, NS, Vanuk, JR, & Raikes, AC. Morning blue light therapy for sleep and cognitive deficits following mild traumatic brain injury. Abstract submitted to the Military Health

Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.

- 688. **Killgore WD**, Ralston, KN, King, R, Dailey, NS, & Alkozei, A. Enhancing cognitive brain functions via light stimulation. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 689. **Killgore, WD**, Persich, MR, Cloonan, SA, Vanuk, JR, Dailey, NS, & Smith, R. Development and validation of a military emotional intelligence training program for enhancing emotional resilience. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 690. **Killgore, WD**, & Cloonan, SA. Increasing aggression during the COVID-19 lockdowns. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 691. Ralston, KN, King, R, Bullock, A, Alkozei, A, & **Killgore, WD**. Blue light therapy for sleep latency in individuals with PTSD: Sex differences. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 692. Satterfield, BC, Anlap, I, Esbit, S, LaFollette, KI, Lazar, M, & **Killgore, WD**. Corticotropin-releasing hormone receptor 1 gene polymorphism modulates cognitive flexibility following acute stress and total sleep deprivation. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 693. Persich, MR, Cloonan, SA, & **Killgore, WD**. Enhancing interoceptive awareness and dispositional mindfulness through a military emotional intelligence training program. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 694. Dailey, NS, Raikes, AC, Forbeck, BS, & **Killgore, WD**. Predicting neurocognitive function from structural neurocircuitry following mild traumatic brain injury. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 695. Dailey, NS, Le, AJ, & **Killgore, WD**. Identifying the relationships between post-concussion symptom severity, fractional anisotropy and neurocognitive function following mild traumatic brain injury. Abstract submitted to the Military Health Systems Research Symposium, 2021. Kissimmee, FL, August 23-26, 2021.
- 696. Lucas, DA, Cloonan, SA, Anlap, I, Bullock, A, Dailey, NS, & **Killgore, WD**. Increasing aggression in anxious COVID-19 positive individuals over the first six months of the COVID-19 pandemic: A cross-sectional analysis. Abstract submitted for presentation at the Society for Personality and Social Psychology Annual Convention (SPSP). San Francisco, CA, February 16-19, 2022.

697. Cloonan, SA, Persich, MR, Bullock, A, Anlap, I, Wellman, C, Swift, N, Johnson, J, King, R, Warren, M, & **Killgore, WD**. Further validation of an online, evidence-based emotional intelligence training program in a flexible, fully online setting. Abstract accepted for presentation at the Society for Personality and Social Psychology Annual Convention (SPSP). San Francisco, CA, February 16-19, 2022.
698. Grandner, MA, Tubbs, A, Ghani, S, Girardin, Jean-Louis, **Killgore, WD**, Fernandez, FX. Declining annual trends in US daily sleep duration are greater among racial/ethnic minorities: Implications for cardiometabolic disease disparities. Abstract accepted for presentation at the American Heart Association (AHA) Conference, Chicago, Ill, March 1-4, 2022.
699. Lucas, DA, & **Killgore, WD**. A year of social isolation: Lasting implications for depression and aggression in “at-risk” populations during and after COVID-19 lockdowns. Abstract accepted for presentation at the Anxiety and Depression Association of America Annual Conference, Denver, CO, March 17-20, 2022.
700. Lucas, DA, & **Killgore, WD**. Brief blue light exposure results in quicker decision time without sacrificing accuracy in a two-armed bandit task. Abstract accepted for presentation at the Society of Biological Psychiatry Annual Meeting, New Orleans, LA, April 28-30, 2022.
701. Mason, BJ, Wills, CC, Tubbs, AS, Seixas A, Turner, A, Girardin, JL, **Killgore, WD**, & Grandner, MA. Decreased risk of 2-year incidence of Alzheimer’s Disease among older adults who report sleep symptoms. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
702. Shah, SR, Mason, BJ, Wills, CC, Tubbs, AS, **Killgore, WD**, & Grandner, MA. Sleep problems are associated with treatment for anemia in the US population. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
703. Fuentes, B, Kennedy, KE, **Killgore, WD**, Wills, CC, & Grandner, MA. Bed sharing versus sleeping alone associated with sleep health and mental health. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
704. Blethen, C, Mason, BJ, Wills, CC, Tubbs, AS, **Killgore, WD**, & Grandner, MA. Relationship between congestive heart failure and poor sleep quality in the US population. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
705. Phan, S, Gorovoy, S, Begay, T, Valencia, D, Hale, L., Robbins, R, **Killgore, WD**, Wills, CC, & Grandner, MA. Geographic association between neighborhood sleep health and Child Opportunity Index: Data at the census tract level. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
706. Kuhler, C, Wills, CC, Mason, BJ, Tubbs, AS, Seixas, A, Turner, A, Girardin, JL, **Killgore WD**, & Grandner, MA. Sleep disorders as a potential risk factor for dementia in elderly adults. Abstract

submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.

707. Hamze, MM, Kennedy, KE, Hale, L, Branäs, CC, **Killgore, WD**, Wills, CC, & Grandner, MA. Drowsy driving in a community sample: Associations with sleep duration, insomnia severity, daytime sleepiness, and fatigue. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
708. Bobadilla, V, Fernandez F, Tubbs, A, Chakravorty, S, Perlis, ML, Hale, LE, Branäs, CC, **Killgore WD**, Wills, CC, & Grandner, MA. Sedative and stimulant misuse and suicide ideation in a community sample. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
709. Gorovoy, S, Phan, S, Begay, T, Valencia, D, Hale, L, **Killgore WD**, Wills, CC, & Grandner, MA. Neighborhood-level sleep health and Childhood Opportunity Index at the census tract level: Comparison to other health indicators. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
710. Thesz, I, Hale, L, Branäs, CC, **Killgore, WD**, Wills, CC, & Grandner, MA. Movement parasomnias in a community sample: Associations with sleep health and mental health. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
711. Abdi, H, Mason, BJ, Wills, CC, Tubbs, AS, **Killgore, WD**, & Grandner, MA. Population-level snoring and probable sleep-disordered breathing associated with greater sedentary activity. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
712. Jeppson, JM, Mason, BJ, Wills, CC, Tubbs, AS, **Killgore WD**, & Grandner, MA. Work hard, sheep hard: Vigorous workdays and sleep difficulties. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
713. Jankowski, S, Wellman, C, Reign, D, Grandner, MA, Dailey, NS, & **Killgore, WD**. Fear of death during the pandemic contributes to severe insomnia. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
714. **Killgore, WD**, Pace-Schott, E, Grandner MA, Vanuk, JR, Reign, D, & Dailey, NS. Using blue light therapy to facilitate recovery of sleep and psychological functioning in PTSD. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
715. **Killgore, WD**, Grandner, MA, Dailey, NS, Reign, D, & Silveri, MM. Sleeping well or sleeping poorly: Clues from brain neurochemistry. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
716. Reign, D, Dailey, NS, King, R, Grandner, MA, Alkozei, A, & **Killgore, WD**. Blue light exposure facilitates cortical neural efficiency exclusive of melatonin effects. Abstract submitted for

presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.

717. Reign, D, Dailey, NS, King, R, Grandner, MA, Alkozei, A, & **Killgore, WD**. Acute blue light exposure increases activation in the pulvinar nucleus. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
718. Wellman, C, Jankowski, S, Grandner, MA, Reign, D, Dailey, NS, & **Killgore, WD**. The role of social isolation on sleep problems interfering with daily functioning. Abstract submitted for presentation at the 36th Annual SLEEP Conference, Charlotte, NC, June 4-8, 2022.
719. Hanuka, S, Olson, EA, Admon, R, Webb, CA, **Killgore, WD**, Rauch, SL, Rosso, IM, & Pizzagalli, DA. Reduced anhedonia following internet-based cognitive behavioral therapy for depression is mediated by enhanced reward circuit activation. Abstract submitted for presentation at the Federation of European Neuroscience Societies (FENS) Forum 2022, Paris, FR, July 9-13, 2022.

AWARDED GRANTS AND CONTRACTS

Completed

- 2001-2003 fMRI of Unconscious Affect Processing in Adolescence.
NIH,
1R03HD41542-01 PI:
Killgore
- 2003-2006 The Effects of Sleep-Loss and Stimulant Countermeasures on Judgment and Decision Making.
U.S. Army Medical Research and Materiel Command (USAMRMC) Competitive Medical Research Proposal Program (CMRP); Intramural Funding,
PI: **Killgore** (Total Award:)
- 2004-2005 Sleep/wake Schedules in 3ID Aviation Brigade Soldiers.
Defense Advanced Research Projects Agency
(DARPA) PI: **Killgore** (Total Award:)
- 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
PI: **Killgore** (Total Award:)
- 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,
PI: **Killgore** (Total Award:

- 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 PI: **Killgore** (Total Award:
- 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),
PI: **Killgore** (Total Award:
Major Goal: To identify the neurobiological basis of cognitive and emotional intelligence using functional and structural magnetic resonance imaging.
- 2011-2016 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:
Major Goal: To evaluate the effectiveness of morning exposure to bright light as a treatment for improving in 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:
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:
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:
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.
- 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:

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.

- 2012-2020 A Model for Predicting Cognitive and Emotional Health from Structural and Functional Neurocircuitry following Traumatic Brain Injury (W81WH-12-0386)
Congressional Directed Medical Research Program (CDMRP), Psychological Health/Traumatic Brain Injury (PH/TBI) Research Program: Applied Neurotrauma Research Award.
PI: **Killgore** (Total Award:
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.
- 2014-2019 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:
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.
- 2014-2020 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:
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.
- 2017-2019 Emotional State and Personality: A Proof-of-Concept Model for Predicting Performance Under Stress (DM160347)
USAMRMC 2015
PI: **Killgore** (Total Award:
Percent Effort: 20%
Major Goal: To develop a statistical model to predict effective cognitive performance under stress using personality and state emotion metrics.
- 2018-2020 Understanding the Mechanisms of Blue Light Exposure on Cognitive Performance
USAMRDC
PI: **Killgore** (Total Award: Percent
Effort: 4%

Major Goal: To identify the subcortical systems responsible for acute cognitive improvement associated with blue light exposure in the scanner.

2020

Real-Time Caffeine Optimization during Total Sleep Deprivation
USAMRDC

Site PI: **Killgore** (Total Award:

Percent Effort: 40%

Major Goal: Determine the effectiveness of the 2B-Alert Caffeine Optimization Program during an in-laboratory sleep deprivation study.

Active

2016-2022

Refinement and Validation of a Military Emotional Intelligence Training Program
(JW150005)

Joint Warfighter Medical Research Program 2015

PI: **Killgore** (Total Award:

Percent Effort: 45%

Major Goal: To develop and validate a new internet-based training program to enhance emotional intelligence capacities in military Service Members.

2020-2022

Transcranial Magnetic Stimulation of the Default Mode Network to Improve Sleep
USAMRDC

PI: **Killgore** (Total Award:

Percent Effort: 5%

Major Goal: Determine whether continuous theta burst stimulation of the default mode network can improve sleep among individuals with insomnia.