Objective: Repetitive transcranial magnetic stimulation (TMS) is an evidenced based treatment for adults with treatment resistant depression (TRD). The standard clinical protocol for TMS is to stimulate the left dorsolateral prefrontal cortex (DLPFC). Although the DLPFC is a defining region in the cognitive control network of the brain and implicated in executive functions such as attention and working memory, we lack knowledge about whether TMS improves cognitive function independent of depression symptoms. This exploratory analysis sought to address this gap in knowledge by assessing changes in attention before and after completion of a standard treatment with TMS in Veterans with TRD.
Participants and Methods: Participants consisted of 7 Veterans (14.3% female; age M = 46.14, SD = 7.15; years education M = 16.86, SD = 3.02) who completed a full 30-session course of TMS treatment and had significant depressive symptoms at baseline (Patient Health Questionnaire-9; PHQ-9 score >5). Participants were given neurocognitive assessments measuring aspects of attention [Wechsler Adult Intelligence Scale 4th Edition (WAIS-IV) subtests: Digits Forward, Digits Backward, and Number Sequencing) at baseline and again after completion of TMS treatment. The relationship between pre and post scores were examined using paired-samples t-test for continuous variables and a linear regression to covary for depression and posttraumatic stress disorder (PTSD), which is often comorbid with depression in Veteran populations.
Results: There was a significant improvement in Digit Span Forward (p=.01, d=-.53), but not Digit Span Backward (p=.06) and Number Sequencing (p=.54) post-TMS treatment. Depression severity was not a significant predictor of performance on Digit Span Forward (f(1,5)=.29, p=.61) after TMS treatment. PTSD severity was also not a significant predictor of performance on Digit Span Forward (f(1,5)=1.31, p=.32).
Conclusions: Findings suggested that a standard course of TMS improves less demanding measures of working memory after a full course of TMS, but possibly not the more demanding aspects of working memory. This improvement in cognitive function was independent of improvements in depression and PTSD symptoms. Further investigation in a larger sample and with direct neuroimaging measures of cognitive function is warranted.

Categories: Neurostimulation/Neuromodulation
Keyword 1: attention
Keyword 2: depression
Keyword 3: neurostimulation
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72 Cognitive Training Paired with Bifrontal tDCS Decreases Depressive Symptoms in a Non-Clinical Sample of Older Adults: Preliminary Evidence

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Objective: Subthreshold depressive symptoms are both prevalent and associated with negative outcomes in older adults, including conversion to major depressive disorder and other medical conditions. Antidepressants are not recommended as first-line or sole intervention for subthreshold depression; thus, finding other efficacious interventions is important. In depressed adults, transcranial direct current stimulation (tDCS) applied to the frontal lobe has antidepressant properties and pairing tDCS with cognitive training results in additional benefit due to enhancement of frontal cortical activity. However, these studies have primarily targeted depressed adults under age 65 years and less is known about whether this intervention combination is beneficial or affects subthreshold depressive symptoms in older adults.
Participants and Methods: We are reporting secondary data analyses from Nissim et al. (2019), who recruited 30 non-demented healthy older adults and randomized them to receive active or sham tDCS in combination with cognitive training for 2 weeks. Active tDCS was delivered bifrontally over F3 (cathode) and F4 (anode) for 20-min at 2 mA intensity through two 5x7 cm^2 saline saturated sponge electrodes using the Soterix Medical 1x1 tDCS clinical trials device. Sham tDCS had identical set-up with 2 mA stimulation for 30-sec with 30-sec ramp up and down. Cognitive training was administered

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for 40-min daily using attention/processing speed and working memory modules from BrainHQ. The first 20-min of cognitive training was paired with active or sham tDCS. To allow room for symptom improvement, we only included participants with Beck Depression Inventory, 2nd edition (BDI-II) scores of 5 or greater ("minimal" depression severity). We identified 15 participants who met this cut-off (70.93 ± 5.41 years old, 10 females, 16.4 years ± 2.32 years education, MoCA = 27.27 ± 2.34; 7 active, 8 sham).
Results: tDCS conditions did not significantly differ in age, sex, years of education, MoCA scores, number of completed intervention days, or baseline BDI-II (active: 7.71 ± 2.93, sham: 11.38 ± 6.44). There were no differences in sensation ratings between groups or in confidence ratings for condition received (suggesting successful blinding). Results indicated the combination of active (and not sham) tDCS with cognitive training was associated with reduced depressive symptoms (2.7 vs. 1.4 points, active vs. sham). Including covariates (age, sex, education, MoCA scores, and number of completed intervention days) in the model further strengthened this discrepancy (3.7 vs. 0.51 points, active vs. sham).
Conclusions: While preliminary, these results suggest this intervention combination may be a potential method for improving subthreshold depressive symptoms in older adults via targeting prefrontal neural circuitry and promoting neuroplasticity of the underlying neural network. While baseline BDI-II scores did not significantly differ, the active tDCS group had a lower score than sham, but saw greater improvement in BDI-II scores post-intervention despite having less room for change. Adequate treatment of subthreshold depressive symptoms may prevent or reduce negative outcomes associated with depressive symptoms in at-risk older adults. Larger randomized clinical trials are needed to better understand tDCS plus cognitive training antidepressant effects in this age group.

Categories: Neurostimulation/Neuromodulation
Keyword 1: depression
Keyword 2: neurostimulation
Keyword 3: aging (normal)
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73 Sleep Onset Latency and Duration in rTMS Treatment in Veterans with Treatment-Resistant Major Depressive Disorder

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Objective: This study builds on the work by Rehman et al (2022) who argued that transcranial magnetic stimulation (TMS) treatment not only helps treat depression but also decreases sleep problems such as difficulty falling asleep,staying asleep, and waking too early. The present study further explores differences in sleep onset latency, meaning the time it takes to fall asleep, and duration of sleep per night in the pre and post treatment phases of rTMS. The information regarding major attributes of sleep is critical because recent research shows that about 90% of patients with major depressive disorder (MDD) also struggle with sleep disorders (Li et al., 2022), and sleeping for less than seven hours may eventually lead to sleep deprivation (Hirshkowitz et al., 2015), with increased risk of physical and mental health problems (Sheehan et al, 2019). Sleep onset latency estimates vary from individual to individual but typical sleep latency is considered between 10 to 20 minutes (Jung et al, 2013). As it has been shown that overall

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