

# The efficacy of Transcranial Direct Current Stimulation (tDCS) combined with Cognitive Behavioral Therapy (CBT) for Major Depressive Disorder (MDD): A Systematic Review and Meta-analysis of Randomized Controlled Trials.

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## INTRODUCTION:

Major depressive disorder (MDD) affects approximately 5% of the global population and remains a leading cause of disability worldwide. Conventional therapeutic modalities encompass psychotherapy, pharmacotherapy, and neuromodulation. Cognitive behavioral therapy (CBT) is a first-line psychotherapeutic intervention with well-established efficacy. Transcranial direct current stimulation (tDCS) is a safe and non-invasive neuromodulation technique that delivers low-intensity electrical currents to modulate cortical excitability. Emerging evidence suggests that tDCS may enhance cognitive control and emotional regulation, potentially augmenting psychotherapeutic effects. While tDCS has shown modest benefits as a standalone or adjunctive intervention in some contexts, its specific additive effect when combined with CBT remains unclear. Finally, this study aimed to evaluate the efficacy of transcranial direct current stimulation combined with cognitive behavioral therapy in reducing depressive symptoms and improving remission and response rates in patients with major depressive disorder, compared to sham transcranial direct current stimulation combined with cognitive behavioral therapy.

## METHODS:



This systematic review and meta-analysis was conducted in accordance with PRISMA guidelines. Databases searched: PubMed, Embase e Cochrane Library.



Only randomized controlled trials (RCTs) being included in the meta-analysis. The primary outcome was change in depressive symptom severity from baseline to post-intervention. Secondary outcomes included remission and response rates.



Data were analysed using Review Manager 5.1.7 (Cochrane Collaboration). Standardised mean differences (SMDs) and risk ratios (RRs) were calculated using random effects models, with heterogeneity assessed via the I<sup>2</sup> statistic. Statistical significance was set at p < 0.05.

## CONCLUSIONS:

This meta-analysis suggests that combining transcranial direct current stimulation with cognitive behavioral therapy does not confer additional benefit over sham transcranial direct current stimulation with cognitive behavioral therapy for reducing depressive symptoms or improving remission and response rates in major depressive disorder. To our knowledge, this is the first meta-analysis addressing this question. Larger, rigorously designed randomized controlled trials are warranted to determine whether transcranial direct current stimulation has an adjunctive role alongside psychotherapy.

## RESULTS:

Five randomized controlled trials comprising 173 patients were included; 91 (52.6%) received active transcranial direct current stimulation plus cognitive behavioral therapy. Active tDCS plus CBT did not show a significant advantage over sham tDCS plus CBT for depressive symptoms reduction (**SMD = -0.14; 95% CI -0.68 to 0.39; p > 0.05; I<sup>2</sup> = 5%**). Likewise, no significant differences were found for response rates (**RR = 1.16; 95% CI 0.52 to 2.59; p > 0.05; I<sup>2</sup> = 4%**) or remission rates (RR = 1.49; 95% CI 0.61 to 3.64; p > 0.05; I<sup>2</sup> = 0%). The forest plots for the outcomes of reduction in depressive symptoms and response rates can be seen, respectively, in Figures 1 and 2.

Figure 1: Reduction in depressive symptom severity:

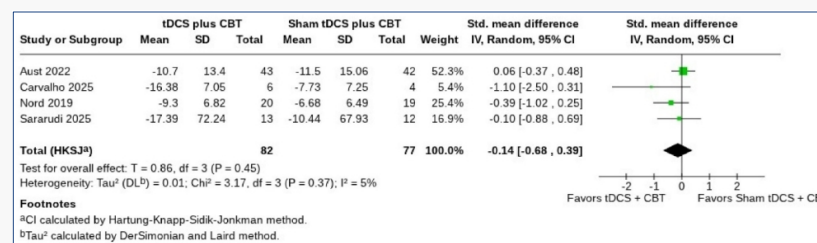
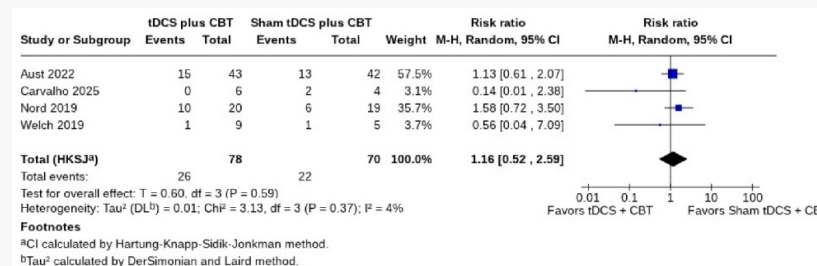


Figure 2: Improvement in response rates:



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