Abstract for

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"Social Challenges - Shared Responsibility in Psychiatry and Psychotherapy"

Presentation ☒ Workshop ☐

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Presentation title: **Electric Field Modeling in tDCS: Unraveling the Neural Substrates for Optimized Intervention in Dynamic Psychiatry**

Abstract text up to 15 lines in English:

Introduction. Transcranial Direct Current Stimulation (tDCS) has emerged as a promising intervention inthe dynamic psychiatry landscape, offering a potential avenue for modulating cortical excitability and addressing depressive disorders. However, the heterogeneity in electrode montage configurations and the resultant variation in electric field strength across studies have led to inconsistent therapeutic outcomes. Traditional meta-analytical approaches in dynamic psychiatry research often overlook the critical role of tDCS montage and electric field intensity, factors that contribute significantly to the variability in clinical responses. This study posits that incorporating these parameters into a meta-analysis could elucidate the neural substrates linked to the therapeutic effects of tDCS in depressive disorders, considering the inherent anatomical diversity among individuals.

Methods. Adopting an innovative electric field modeling meta-analysis framework, this research probed the association between clinical outcomes in dynamic psychiatry and electric field strength parameters. We analyzed the correlation between the alleviation of depressive symptoms, measured via standardized effect sizes, and the electric field intensity generated by various electrode montages. This analysis was conducted across eight distinct head models to address the impact of interindividual differences on tDCS efficacy.

Results. The analysis encompassed 29 tDCS studies involving 1766 patients with depression, spanning from January 2000 to January 2023. A moderate overall effect of tDCS treatment on depression was observed (Hedge's g = 0.965). Our findings underscore the significant influence of both tDCS montages and individual anatomical variability on the distribution of the electric field. More importantly, a pronounced correlation was identified between electric field strength and the magnitude of tDCS effects within specific brain regions, namely Brodmann areas 46, 10, and 11, which are pertinent to dynamic psychiatric interventions.

Conclusion. The insights garnered from this study accentuate the therapeutic potential of targeting the left anterior dorsolateral prefrontal cortex (DLPFC), as well as the anterior medial and orbitofrontal cortex, for optimizing tDCS application in the realm of dynamic psychiatry. These findings advocate for the development of simulation-guided, personalized intervention strategies that meticulously account for individual anatomical disparities, thereby enhancing the efficacy of tDCS in treating depressive disorders within a dynamic psychiatric framework.