

Disrupted brain network integrity and the generalized cognitive deficit in schizophrenia: a graph theory approach to identifying specific mechanisms

Julia M Sheffield, Grega Repovs, Michael P Harms, Cameron S Carter, James M Gold, Angus MacDonald III, J Daniel Ragland, Steve Silverstein, Douglass Godwin, Deanna Barch

Individuals with schizophrenia exhibit deficits in multiple domains of cognition, leading to the suggestion that schizophrenia is associated with a generalized cognitive impairment. Here we tested the hypothesis that the integrity of the Fronto-Parietal Network (FPN) and Cingulo-Opercular Network (CON) are disrupted in schizophrenia, and that these disruptions are associated with cognitive ability across multiple domains, as a potential source of a “generalized” cognitive deficit. Using graph theory analysis of pseudo-resting state data in 43 patients with schizophrenia and 53 healthy controls, we found that global efficiency within the CON and FPN significantly predicted cognitive performance across all subjects. This relationship was not present for the Auditory network, providing specificity to this finding. Additionally, the participation coefficient of the right anterior insula (rAI), a measure of a region's centrality in between-network communication, significantly predicted cognition across all subjects, pointing to an integral role of the rAI in cognitive ability. When put in the same model, the relationships between the rAI, CON and cognition remained, suggesting that rAI participation and CON efficiency explain independent variance in cognitive ability. Together, these data provide support for the hypothesis that CON and FPN network integrity underlie a range of cognitive deficits in schizophrenia.