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Association between executive functions and resting-state functional connectivity of the hippocampus and prefrontal cortex in periadolescent children: Preliminary findings from the PRANK study

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Executive functions (EFs) consist of a diverse range of cognitive abilities, including working memory, inhibitory processes, and mental flexibility. EFs have historically been linked to the prefrontal regions of the brain, but recent studies of brain networks and their functional connectivity have broadened these links to include brain regions such as the hippocampus (Hc). Dysfunction in EF due to neurodevelopmental disorders or neurodegenerative disease can result in attention deficits, decreased inhibition, and impaired decision-making abilities. An enhanced understanding of the functional networks that support EF may provide insight that can inform interventions and treatments for said disorders and diseases. Building upon recent findings, the current project investigated the association between decision making and hippocampal resting state functional connectivity (rs-FC) in periadolescent children. A cohort of healthy periadolescent children aged 8-13 (N = 75, 37 F) was sampled from the ongoing NIA-funded Polygenic Risk of Alzheimer's Disease in Nebraska Kids (PRANK) study. PRANK participants completed an array of cognitive and behavioral measures, in addition to an MRI of the brain that included resting-state fMRI. Executive functions were operationalized as performance on the NIH Toolbox Dimensional Change Card Sorting (DCCS) task. The resting state functional connectivity (rs-FC) between the Hc and regions of the prefrontal cortex (PFC) was measured, and its covariance with DCCS was assessed. Hippocampal rs-FC covaried with performance on the DCCS in the left dorsolateral prefrontal cortex (dlPFC) and dorsal anterior cingulate cortex (dACC). These anatomical regions are in line with larger intrinsic brain networks, such as the frontoparietal network (FPN) and the cingulo-opercular network (CON). These preliminary results suggest the Hc is associated with anatomical regions and intrinsic brain networks that are important for EFs. A better characterization of how EFs are supported by functional brain networks including the hippocampus could offer insight regarding interventions for treatment of executive dysfunction in developmental or older populations.