Sex differences in brain activity and memory performance correlates in healthy older adults

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Cognitive/Behavioral disorders

Patients with Alzheimer's disease and related dementia (ADRD) have diminished memory performance, i.e. less accurate, more false alarm, and increased reaction times during a memory task. For many healthy older adults, it is not clear whether poor performance is part of normal aging or a risk of mild cognitive impairment (MCI) induced by ADRD. In the US, there are more older males than females who suffer from MCIs. Here we test the hypothesis that sex differences have differential effects on functional brain responses associated with either memory accuracy or response times. 44 older adults (25 females and 19 males; aged 65-93), from the University of Kentucky Alzheimer's Disease Center (UKADC) cohort, participated in the Bluegrass Short-Term (BeST) memory task under magnetic resonance imaging (MRI). Liner regression analyses were performed on event-related functional MRI and individual performance results both in separate sexes and in total. We found in all 44 subjects that the bilateral hippocampi and the right frontal eye field (FEF) showed significance, and that the dorsolateral prefrontal cortex (DLPFC) showed no significance. However, only females showed significant negative correlation in the left hippocampus in with reaction time ($R2=0.1578$; $p < 0.05$), whereas males showed no significant correlation in the hippocampus with any behavioral measures. We also discovered that in the frontal eye field, only males showed significant correlation in both the left and right frontal eye fields for measures of accuracy (including false alarms). In the dorsolateral prefrontal cortex (a classical region for working memory), we discovered that males showed significant correlation with false alarm and accuracy for both the left and right regions, whereas females showed significance in reaction time of only the right region. These results indicate that our hypothesis that sex differences have an impact on brain activity in correlation with memory performance is supported. The present results will allow us to test the next step hypothesis whether the memory performance and brain activity measures are associated with cerebrospinal fluid (CSF) AD biomarkers ß-amyloid (Aß42) and tau-related neurodegeneration (p-Tau181), hallmark for AD pathology.