Measuring the impact of the COVID-19 pandemic on the prefrontal cortex structure of PTSD patients

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Introduction: Neuroimaging studies have found that the development of PTSD is linked to structural alterations in brain regions involved in stress and emotion processing, such as the prefrontal cortex. The global COVID-19 pandemic served as a prolonged stressor and induced financial strain, social isolation, and fear, which led to a significant decline in mental health across the population, including PTSD. Therefore, it is likely that the COVID-19 pandemic may induce structural brain changes which underlie psychological distress. However, knowledge about the pandemic's impact on the brain remains limited.

Objectives: This current study tested if 1) long-lasting stress induced by the pandemic was associated with PTSD symptoms, and 2) differential changes of cortical thickness in brain regions responsible for cognitive and emotional regulation were demonstrated in PTSD patients. Subjects who had undergone structural MRI (sMRI) scanning during and/or before the pandemic completed a PTSD diagnostic interview during the pandemic, and provided COVID-19 testing records were utilized to assess these objectives.

Methods: 53 subjects from previous neuroimaging research (age=35.2 ± 11.1, F/M=38/15) were utilized for this research effort. Available participants were evaluated via the self-report PTSD Checklist-5 (PCL-5) to assess PTSD symptoms since the pandemic and also underwent a PTSD diagnostic interview via the Clinician Administered PTSD Scale-5 (CAPS-5). A brain sMRI scan was taken of each participant to measure post-pandemic cortical thickness. The sMRI imaging data were compared across PTSD and non-PTSD groups, and a longitudinal analysis was conducted to study the effects of PTSD and pandemic stress on the trajectory of cortical thickness growth in prefrontal regions from before to during the pandemic. Partial correlations were also calculated to test for relationships between PTSD symptoms and cortical thicknesses.

Results: 18 subjects were diagnosed with PTSD, and 19 subjects tested positive for COVID-19. The post-pandemic cortical regions in the left rostral middle frontal (rMFG) and right superior frontal (SFG) cortex were significantly thicker in PTSD groups. The significant effects of PTSD and the PTSD*pandemic stress interaction were demonstrated in the increased thicknesses of the rMFG, inferior frontal (IFG), and frontal pole (FP) cortex for PTSD subjects post-

pandemic, whereas non-PTSD subjects demonstrated the opposite change in thickness. Furthermore, positive partial correlations were found between cortical thickness and PTSD symptoms post-pandemic.

Conclusion: The COVID-19 pandemic induced long-lasting stress and social isolation that worsened mental health conditions, including PTSD. The alterations of cortical structure in cognitive and emotional neurocircuitry may strongly contribute to PTSD in a pandemic environment.

