

whether mental health variables such as internalizing symptom severity may moderate the association between COVID-19 illness and cognitive difficulties. This study examined how internalizing symptoms as indexed by depression and anxiety symptom scales may differentially influence performance on neuropsychological tests of memory between persons who have and have not had COVID-19.

**Participants and Methods:** In this cross-sectional study, 104 adults aged 19-80, were recruited in Ontario and British Columbia, Canada; 84 adults met inclusion criteria and participated in neuropsychological testing. There were 40 participants who tested positive for COVID-19 infection (N=44 with no suspected exposures or confirmed diagnosis of COVID-19). Participants had no history of dementia, mild cognitive impairment, or other known neurological disorder. Anxiety and depression symptoms were measured using the Generalized Anxiety Disorder-7 (GAD-7) and Center for Epidemiologic Studies Depression Scale (CES-D) via self-report on Qualtrics. Memory encoding and delayed recognition performance were assessed using the Hopkins Verbal Learning Test Revised (HVLT-R) and the Neuropsychological Assessment Battery Shape Learning subtest (NAB-SL). To test for potential moderating effects of anxiety and depression symptoms on the association between COVID-19 infection status and memory performance, a series of multiple linear regressions were conducted. Age and sex were included as covariates in all analyses.

**Results:** Moderation analyses revealed that the interaction between COVID-19 infection and anxiety symptoms accounted for a significant portion of variance in both HVLT-R recognition ( $B = -0.78$ ,  $SE = 0.34$ ,  $p < 0.05$ ) and NAB-SL delayed recognition scores ( $B = -0.83$ ,  $SE = 0.35$ ,  $p < 0.05$ ). Simple slopes analyses revealed that among participants who tested positive for COVID-19 infection, higher GAD-7 scores were associated with lower verbal and visual recognition scores. A similar interaction was observed between COVID-19 and depressive symptoms in accounting for variance in NAB-SL delayed recognition scores, however, for that model the threshold of  $p = 0.05$  was not met in our small sample ( $p = 0.07$ ).

**Conclusions:** Findings demonstrate that anxiety symptom severity had a moderating effect on the impact of COVID-19 on delayed retrieval of verbal and visual information from memory. Future work in a larger sample is

needed to further elucidate the potential moderating role of depression on memory in COVID-19 positive persons, as the current work suggests that depression symptoms could have a similar impact as anxiety. Further identifying the relationships between key modifiable psychological factors such as anxiety and memory following COVID-19 infection will provide insight into potential interventions to minimize the negative effects of internalizing symptoms on long-term cognitive outcomes.

**Categories:** Infectious Disease (HIV/COVID/Hepatitis/Viruses)

**Keyword 1:** memory complaints

**Keyword 2:** mood disorders

**Keyword 3:** infectious disease

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## 67 COVID-19 Mobile Brain Health

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**Objective:** Over 80% of hospitalized COVID-19 patients have neurological symptoms, including memory loss, attention difficulties, and trouble thinking clearly that can last for months. The long-term neurological impact of the SARS-CoV-2 virus is unknown and it remains to be seen whether it would create a surge in cases of dementia and cognitive decline years later, which is already a global public health challenge. Examining the cognitive effects of the virus will help with understanding its impact on the brain and inform treatment options. The goal of the present study was to examine cognitive performance among those who have had COVID-19 via mobile-based assessments using smartphone-based cognitive tests. Participants with a previous COVID-19 diagnosis (COVID+) were expected to have worse cognitive performance at baseline than those without COVID-19 (COVID-).

**Participants and Methods:** Participants (n=23) with self-reported positive or negative COVID-19 statuses based on polymerase chain reaction or antigen testing were recruited from the Boston area. Inclusion criteria included access to a smartphone with an Android or iOS operation

system and to internet connectivity, along with proficiency in English. Cognitive performance was measured using Defense Automated Neurobehavioral Assessment (DANA) from AnthroTronix. Welch's 2-sample t-test was used to compare cognitive performance among those with and without COVID-19.

**Results:** The sample was comprised primarily of COVID+ (59%), female (59%), and Caucasian (50%) participants that were generally well educated (77% with a bachelor's degree), and had  $\geq 1$  COVID vaccination (95%). About 50% of the sample reported symptoms of depression and mild anxiety. Results were not indicative of significant differences between COVID+ and COVID- groups at baseline: Simple Reaction Time (Immediate;  $M = 5.62$ ;  $p = 0.81$ ), Code Substitution ( $M = 1.25$ ;  $p = 0.77$ ), Procedural Reaction Time ( $M = -7.26$ ;  $p = 0.49$ ), Spatial Processing ( $M = -3.14$ ;  $p = 0.50$ ), Go No Go ( $M = -1.37$ ;  $p = 0.89$ ), Match to Sample ( $M = 2.00$ ;  $p = 0.57$ ), Memory Search ( $M = -2.62$ ;  $p = 0.75$ ), and Simple Reaction Time (Delayed;  $M = 2.99$ ;  $p = 0.81$ ).

**Conclusions:** Results indicate that cognitive performance at baseline does not differ based on COVID status, emphasizing the need for examination of longitudinal cognitive performance. Future directions include examining the impact of COVID disease severity and reinfection on cognition.

**Categories:** Infectious Disease (HIV/COVID/Hepatitis/Viruses)

**Keyword 1:** cognitive functioning

**Keyword 2:** medical disorders/illness

**Keyword 3:** memory disorders

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## 68 Subjective Cognitive Functioning Following Non-Severe COVID-19 Acute Infections: A Meta-Analysis

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**Objective:** Emerging evidence suggests that individuals recovering from COVID-19 perceive changes to their cognitive function and psychological health that persist for weeks to months following acute infection. Although there is a strong relationship between initial COVID-19 infection severity and development of prolonged symptoms, there is only a modest relationship between initial COVID-19 severity and self-reported severity of prolonged symptoms. While much of the research has focused on more severe COVID-19 cases, over 90% of COVID-19 infections are classified as mild or moderate. Previous work has found evidence that non-severe COVID-19 infection is associated with cognitive deficits with small-to-medium effect sizes, though patients who were not hospitalized generally performed better on cognitive measures than did those who were hospitalized for COVID-19 infection. As such, it is important to also quantify subjective cognitive functioning in non-severe (mild or moderate) COVID-19 cases. Our meta-analysis examines self-reported cognition in samples that also measured objective neuropsychological performance in individuals with non-severe COVID-19 infections in the post-acute (>28 days) period.

**Participants and Methods:** This study's design was preregistered with PROSPERO (CRD42021293124) and used the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist for reporting guidelines. Inclusion criteria were established prior to article searching and required peer-reviewed studies to have (1) used adult participants with a probable or documented diagnosis of non-severe (asymptomatic, mild, or moderate) COVID-19 who were in the post-acute stage (>28 days after initial infection); (2) used objective neuropsychological testing to document cognitive functioning; and (3) include a self-report measure of subjective cognition. At least two independent reviewers conducted all aspects of the screening, reviews, and extraction process. Twelve studies with three types of study design met full criteria and were included (total  $n=2,744$ ).

**Results:** Healthy comparison group comparison: Compared with healthy comparison participants, the post-COVID-19 group reported