In Reply We thank Vavougios and colleagues for their letter suggesting sleep-disordered breathing and cerebrovascular disease as potential driving variables in the association between COVID-19 hospitalization and neurocognitive sequelae found in our study. We acknowledge that sleep-disordered breathing and cerebrovascular disease can potentially influence the observed cognitive impairment and thus investigated this further in our data set.

Obstructive sleep apnea (OSA) is the most frequent sleep-disordered breathing diagnosis, but after reexamining the comorbidity data obtained via electronic health records, there was no statistically significant group difference in the prevalence of OSA diagnosis (OSA was present for 3 of 85 individuals with COVID-19 and 1 of 61 matched control individuals; \( P = .49 \)). Moreover, the Montreal Cognitive Assessment score remained significantly lower in the COVID-19 group (26.7; 95% CI, 26.2-27.2; \( P = .01 \)) compared with the control group (27.5; 95% CI, 27.0-27.9) when further adjusting for OSA diagnosis in our linear model. Nonetheless, OSA is considerably underestimated in clinical practice, and a more commonly measured risk factor for OSA is increased body mass index. The mean (SD) body mass index was significantly different in patients with COVID-19 vs control individuals in our study (28.0 [6] vs 25.8 [5], respectively; \( P = .02 \)); however, when adjusting for both body mass index and OSA, the Montreal Cognitive Assessment score remained significantly lower in the COVID-19 group (26.7; 95% CI, 26.2-27.2; \( P = .02 \)) compared with the control group (27.5; 95% CI, 27.0-27.9).

Regarding cerebrovascular disease as a secondary cause of cognitive impairment, we acknowledge that COVID-19–associated cerebrovascular disease can be extensive. However, a prior medium-term follow-up study that prospectively screened patients hospitalized with COVID-19 and control individuals with brain magnetic resonance imaging did not find significant differences in the prevalence of small-vessel disease or hemorrhagic or ischemic changes among patients with COVID-19 even though they showed considerable executive dysfunction. In our study, we did not prospectively screen patients with neuroimaging; however, a considerable number of participants had been evaluated with neuroimaging (brain computed tomography scan or magnetic resonance imaging) during admission (12 of 85 [14%] with COVID-19 vs 16 of 61 [26%] matched control individuals), with no significant group differences (\( P = .07 \)). Of those who underwent neuroimaging, 5 of 12 patients with COVID-19 vs 3 of 16 control individuals displayed abnormal results on neuroimaging, also with no significant difference (\( P = .18 \)). Moreover, the Montreal Cognitive Assessment score remained significantly lower in the COVID-19 group (26.7; 95% CI, 26.2-27.2; \( P = .01 \)) compared with the control group (27.5; 95% CI, 27.0-27.9) when adjusting for new-onset stroke and previous history of stroke and chronic infarction on neuroimaging.

Nevertheless, the low prevalence of OSA and cerebrovascular disease in this population might reflect relatively low sample sizes, and larger studies are needed to further investigate the impact of these conditions on cognitive impairment after COVID-19. Although it is a strength that we included a matched control group with comparable illness severity and showed that cognitive decline is significant in patients hospitalized with COVID-19, it is unclear if these moderate differences persist beyond 6-month follow-up. Therefore, our group is extending the follow-up period for previous participants and expanding the cohort size to increase the statistical power and insights into long-term outcomes following COVID-19. Furthermore, we will use more detailed cognitive evaluations for an in-depth analysis of the features of post–COVID-19 cognitive sequelae and investigate to what extent these sequelae are unique to patients after COVID-19 compared with the sequelae observed after non–COVID-19 illness of similar severity.

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