# Peer Community In



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# Evidence for General Long-Term Memory Impairment Following SARS-CoV-2 Infection

## A recommendation by **Vishnu Sreekumar** based on peer reviews by **Phivos Phylactou**, **Mitul Mehta** and 1 anonymous reviewer of the STAGE 2 REPORT:

Josefina Weinerova, Sabine Yeung, Panyuan Guo, Alice Yau, Connor Horne, Molly Ghinn, Lyn Curtis, Frances Adlard, Vidita Bhagat, Seraphina Zhang, Muzaffer Kaser, Mirjana Bozic, Denis Schluppeck, Andrew Reid, Roni Tibon, Lucy Cheke (2024) Changes in memory function in adults following SARS-CoV-2 infection: findings from the Covid and Cognition online study.

https://osf.io/83ymn/?view\_only=228165eb161d490b945ca019143ba98c, ver. 1,
peer-reviewed and recommended by Peer Community in Registered Reports.
https://osf.io/q5vu2?view\_only=228165eb161d490b945ca019143ba98c

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COVID-19 has been associated with cognitive impairments, particularly in memory performance (Guo et al., 2022). Given that associative memory typically declines earlier than item memory in conditions such as mild cognitive impairment (Chen & Chang, 2016), it remains an open question whether COVID-19 differentially affects item and associative memory. Furthermore, it is unclear whether such effects are specific to verbal or non-verbal material. To investigate these questions, Weinerova et al. (2024) recruited participants via long-COVID Facebook groups and clinical settings. They reported a significant detrimental effect of COVID-19 status on long-term memory performance across tasks. However, they did not find evidence for their preregistered hypothesis of an interaction between COVID-19 status and either memory type (item vs. associative) or stimulus type (verbal vs. non-verbal). In theStage 1 report, the authors preregistered a Bayes Factor threshold of 6 as the criterion for supporting the alternative hypothesis. All planned analyses were preregistered, incorporating both frequentist methods (to replicate Guo et al., 2022) and Bayesian ANCOVA (to test the preregistered hypotheses). As data collection had been completed at the time of Stage 1 submission, we assigned a Level 3 bias control to the Stage 1 report. In the Stage 2 report, the authors confirmed a general negative impact of

COVID-19 on long-term memory accuracy. Using frequentist ANCOVA, they successfully replicated Guo et al. (2022)'s findings of reduced accuracy in verbal item and non-verbal associative memory among individuals with prior COVID-19 infection. However, they did not replicate the previously observed effect on reaction times. The Bayesian ANCOVA analyses did not reach the preregistered evidential threshold (BF > 6). Verbal associative memory, which was not part of the original replication attempt, also showed reduced accuracy in individuals with prior infection. In contrast, performance on non-verbal item memory tasks showed a ceiling effect, possibly due to methodological differences from Guo et al. (2022). Across all four memory tasks, the authors found robust evidence for decreased accuracy associated with COVID-19 status but no effect on reaction times. Contrary to their hypotheses, models that included interactions between COVID-19 status and either memory type or stimulus type were less likely than the null model, suggesting a general, rather than specific, detrimental effect of COVID-19 on long-term memory. Analyses of vaccination status yielded inconclusive results, likely due to limited sample size and uncertainty in participants' self-reports of vaccination timing relative to infection. The question of whether vaccination has protective effects on cognition remains unresolved and merits further investigation. The authors also reported tentative exploratory findings, such as a potential association between longer time since infection and slower reaction times in verbal item memory tasks. These observations require confirmation in future studies. Overall, the study makes a valuable contribution by replicating prior findings and extending them to suggest a broad impairment of long-term memory associated with COVID-19. The Stage 2 report was reviewed by the same three reviewers who had evaluated the Stage 1 submission. All reviewers agreed that the authors had addressed prior comments and had adhered to the preregistered methodology and analysis plan. As in the Stage 1 evaluation, we note the potential for selection bias introduced by recruiting participants via long-COVID Facebook groups. Individuals with post-infection cognitive complaints may have been more likely to volunteer, limiting generalizability to the broader SARS-CoV-2-infected population. This and other limitations are clearly acknowledged in the Discussion section of the Stage 2 manuscript. The recommender judged that the manuscript met all Stage 2 criteria for recommendation. URL to the preregistered Stage 1 protocol: https://osf.io/tjs5u Level of bias control achieved: Level 3. At least some data/evidence that was used to the answer the research question had been accessed by the authors prior to in-principle acceptance (e.g. downloaded or otherwise received), but the authors certify that they had not yet observed ANY part of the data/evidence.

## List of eligible PCI RR-friendly journals:

- Collabra: Psychology
- Cortex
- F1000Research
- In&Vertebrates
- Journal of Cognition
- Peer Community Journal
- PeerJ
- Royal Society Open Science
- Studia Psychologica
- Swiss Psychology Open

#### **References:**

1. Chen, P.-C., & Chang, Y.-L. (2016, May). Associative memory and underlying brain correlates in older adults with mild cognitive impairment. Neuropsychologia, 85, 216–225. https://doi.org/10.1016/j.neuropsychologia.2016.03.032

Guo, P., Benito Ballesteros, A., Yeung, S. P., Liu, R., Saha, A., Curtis, L., ... Cheke, L. G. (2022b). COVCOG
Cognitive and memory deficits in long COVID: A second publication from the COVID and Cognition
Study. Frontiers in Aging Neuroscience, 14, 804937. https://doi.org/10.3389/fnagi.2022.804937

3. Weinerova, J., Yeung, S., Guo, P., Yau, A., Horne, C., Ghinn, M., Curtis, L., Adlard, F., Bhagat, V., Zhang, S., Kaser, M., Bozic, M., Schluppeck, D., Reid, A., Tibon, R., & Cheke, L. (2025). Changes in memory function in adults following SARS-CoV-2 infection: Findings from the Covid and Cognition online study [Stage 2]. Acceptance of Version 1 by Peer Community in Registered Reports.

https://osf.io/q5vu2?view\_only=228165eb161d490b945ca019143ba98c

## Reviews

## **Evaluation round #1**

## Reviewed by Phivos Phylactou <sup>(D)</sup>, 06 January 2025

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### Reviewed by anonymous reviewer 1, 27 March 2025

The authors have successfully followed the methodology and analysis plan outlined in the Stage 1 review. The results and interpretations adhere to the pre-registered hypotheses, and no substantial deviations from the approved protocol are evident. The adherence to the original plan strengthens the credibility of the findings and aligns with the principles of the Registered Report format.

However, a primary concern remains regarding the timing of data collection. It appears that a substantial portion of the dataset had already been collected before the Stage 1 review process. This raises concerns about whether this study fully meets the criteria of a Registered Report, given that many reviewer suggestions from Stage 1 could not be implemented due to the pre-existing dataset. The ability to make methodological changes is a crucial advantage of the Registered Report format, and its absence in this case is problematic.

Given these considerations, my recommendation is conditional. If the editorial team and managing board determine that the study meets the criteria for a Registered Report despite the data collection timeline, then I endorse its publication based on the fact that the study adheres to the pre-registered analytical plan and maintains transparency in its reporting. Nevertheless, this situation underscores the importance of ensuring that Stage 1 peer review is completed before substantial data collection occurs in future submissions.

Recommendation: **Conditional endorsement**, subject to the editorial board's determination of eligibility as a Registered Report.

### Reviewed by Mitul Mehta , 28 December 2024

I have followed the PCI RR stafge 2 review guide:

2A. I thank the authors for taking on those suggestions of mine which were possible. The data collected are suitable for testing the hypotheses. Potential bias in recruitment remains an issus, but the authors highlight this clearly in the discussion. While this may not affect the correlations so much, this may affect the pre-registered analyses.

2B. The introduction, rationale and stated hypotheses (where applicable) are the same as the approved Stage 1 submission.

2C. I agree that the authors adhered precisely to the registered study procedures.

2D. Other, unregistered exploratory analyses are justified, methodologically sound, and informative.

2E. The authors' conclusions are justified given the evidence and I agree with the limitations highlighted