Archives of Gerontology and Geriatrics Plus 1 (2024) 100073

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics Plus

journal homepage: www.sciencedirect.com/journal/archives-of-gerontology-and-geriatrics-plus

Long-COVID trends in the US: Analyzing sex and age among 50–59, 60–69, 70–79, and 80+ year olds

Dear Editor,

This study provides an overview of long COVID, a condition with persistent symptoms after SARS-CoV-2 infection. Using AI visualization techniques and CDC data, it reveals that 40.39 % of patients continue to experience symptoms, most commonly fatigue and coughing. The prevalence of long COVID varies by state in the U.S., with a notable increase among females and severity in the 50–59 age group. The study concludes that long COVID affects a significant number of individuals globally and calls for future research on interventions to improve health post-recovery.

NIH has been providing post covid resources in their site (NIH.GOV). Post-SARS-CoV-2 infection, many recover swiftly, but others experience lingering symptoms, sometimes for years, regardless of initial severity. Symptoms may reappear or new ones develop, even in those initially asymptomatic. This condition, known as long COVID, long-haul COVID, Post-COVID-19 condition, Chronic COVID, or Post-Acute Sequelae of SARS-CoV-2 (PASC), can trigger other health issues like diabetes or kidney disease. Its symptoms may resemble or differ from those of COVID-19[1].

This study provides an overview of Long COVID, a condition with persistent symptoms after SARS-CoV-2 infection. Using AI visualization techniques and CDC data, it reveals that 40.39 % of patients continue to experience symptoms, most commonly fatigue and coughing. The prevalence of Long COVID varies by state in the U.S., with a notable increase among females and severity in the 50–59 age group. The study concludes that long COVID affects a significant number of individuals globally and calls for future research on interventions to improve health post-recovery.

Chippa et al. presented that COVID-19, caused by SARS-CoV-2, has led to global morbidity and mortality (Chippa et al., 2024). Despite advancements in therapeutics and vaccines, many patients report lingering symptoms post-recovery. Their course explored the prevalence, symptoms, and treatment strategies for long COVID. They emphasized symptom management, rehabilitation, and tailored support services. Learners refined their diagnostic skills and learn to provide holistic care. Their course underscored the importance of an interprofessional approach to optimize patient outcomes (Chippa et al., 2024).

Sun et al. investigated the long-term effects of COVID-19 in China (Sun et al., 2024). Using a cross-sectional survey and propensity score matching, it found that 40.39 % of 307 participants had at least one persistent symptom, most commonly fatigue and coughing. Long COVID patients had lower health utility scores (0.94 vs 0.97) and experienced more anxiety and discomfort. Persistent symptoms and low income were linked to lower health utility values. Their study emphasized the need for interventions to improve health post-recovery (Sun et al., 2024).

Ford et al. addressed that Long COVID, a range of health problems persisting post-COVID-19, affected a significant number of adults (Ford et al., 2024). They revealed that the prevalence of Long COVID among U. S. adults varies by state, ranging from 1.9 % in the U.S. Virgin Islands to 10.6 % in West Virginia. Ongoing assessment of Long COVID prevalence can guide public health policies and support for affected individuals. The CDC's analysis of data from the Behavioral Risk Factor Surveillance System helped understand this prevalence and its implications (Ford et al., 2024).

This study, which leverages advanced generative AI visualization techniques and CDC data, highlights the severity of long COVID in the 50–59 age group. It emphasizes the importance of ongoing assessment of long COVID prevalence, effective symptom management, comprehensive rehabilitation, and the provision of tailored support services. The query input to the AI is crucial in generating accurate Python code involving multiple conversions.

This study's contributions are as follows: It leverages advanced AI visualization techniques and CDC data to highlight the severity of long COVID in the 50–59 age group. It underscores the importance of ongoing assessment of long COVID prevalence, effective symptom management, comprehensive rehabilitation, and tailored support services. The study also emphasizes the crucial role of the query input to the AI in generating accurate Python code involving multiple conversions. These findings contribute significantly to the understanding and management of long COVID.

Interactions with AI are pivotal in generating accurate Python code. The ensuing query was processed using Microsoft's Copilot. To visualize a trend graph by age and sex, users need to understand all variables, which are enclosed in single quotes. Download the dataset from the CDC website and rename it as data.csv. Achieving the desired outcome may require multiple conversations. The following query was initially utilized to generate Python code. After several iterations of conversation, the generated Python code is now publicly accessible on the GitHub site (GitHub.COM). Note that in this query, variable names are enclosed in single quotes.

Initial Query: show Python code using data.csv to visualize trends of multiple features. show unique values in Indicator and user is allowed to select one value by number.
show unique values in Group and user is allowed to select one value by number.
show unique values in Subgroup and user can select up to 4 values by number.
Time Period Start Date indicates X-axis while Value represents Y-axis.

https://doi.org/10.1016/j.aggp.2024.100073
Received 6 August 2024; Received in revised form 15 August 2024; Accepted 15 August 2024
Available online 18 August 2024

Draw a graph and legend with multiple horizontal black lines with solid, dotted, dashed, and dashdot and save the csv file as new.csv and result.png.

Run generated Python code, postcovid.py[5], on the system terminal by the following command to visualize the prevalence trends of long COVID. ($) indicates the system prompt.

$ python postcovid.py

This study examines the prevalence trends of Long COVID across different age groups and genders, utilizing the CDC dataset released on June 14, 2024. Advanced AI visualization techniques reveal that among all age groups (50–59, 60–69, 70–79, and 80+ years), individuals aged 50–59 experienced the most severe long COVID symptoms. Furthermore, the study found a monotonic increase of more than 20 % in the prevalence of long COVID among females, while the increase for males was 14 %.

Fig. 1 illustrates the trends of long COVID across various age groups in the U.S., spanning from June 1, 2022, to April 30, 2024, regarding to "Ever experienced long COVID, as a percentage of all adults".

Similarly, Fig. 2 presents the progression of long COVID differentiated by sex during the same timeframe in the U.S. These visualizations provide a comprehensive overview of the temporal patterns of long COVID prevalence.

Long COVID, a condition with lingering symptoms post-SARS-CoV-2 infection, affects a significant number of individuals globally. Studies reveal that 40.39 % of patients continue to experience symptoms, most commonly fatigue and coughing. The prevalence of long COVID varies by state in the U.S., with a notable increase among females. Our study, utilizing advanced AI visualization and CDC data, underscores the severity of long COVID in the 50–59, 60–69, 70–79, and 80+ age group. In 2024, a sudden rise was obserived in all age groups.

Moving forward, continuous assessment of long COVID prevalence is crucial to guide public health policies and provide necessary support. Emphasis should be on symptom management, rehabilitation, and tailored support services. An interprofessional approach is vital for holistic care and optimizing patient outcomes. Future research should focus on interventions to improve health post-recovery and further explore the impact of long COVID on various demographics.

The NIH has been providing resources for post-COVID-19 recovery, acknowledging the lingering symptoms experienced by many individuals post-SARS-CoV-2 infection. This condition has been the focus of several studies, all emphasizing the need for continuous assessment, symptom management, rehabilitation, and tailored support services.

Our study, leveraging advanced generative AI visualization techniques and CDC data, echoes these findings, particularly highlighting the severity of Long COVID in the 50–59 age group. The importance of the query input to the AI in generating accurate Python code involving multiple conversions was also underscored.

The study by Chippa et al. highlights the global morbidity and mortality caused by COVID-19, as well as the prevalence of "long COVID" symptoms post-recovery (Chippa et al., 2024). Similarly, Sun et al. found that 40.39 % of participants experienced at least one persistent symptom, with fatigue and coughing being the most common (Sun et al., 2024). These studies underscore the urgent need for interventions to improve health outcomes post-recovery.

Ford et al. revealed the varying prevalence of long COVID among U. S. adults, with a significant number affected (Ford et al., 2024). Our study supports these findings, showing a monotonic increase of more than 20 % in the prevalence of long COVID among females.

Fernandez-de-Las-Peñas et al. demonstrated that two years after contracting COVID-19, 30 % of patients continued to experience post-COVID symptoms (Fernandez-de-Las-Peñas et al., 2024). The most prevalent symptoms were fatigue, cognitive disorders, and pain. Furthermore, psychological disturbances and sleep problems persisted even after two years (Fernandez-de-Las-Peñas et al., 2024). Our finding that Long COVID symptoms are more prevalent among females is

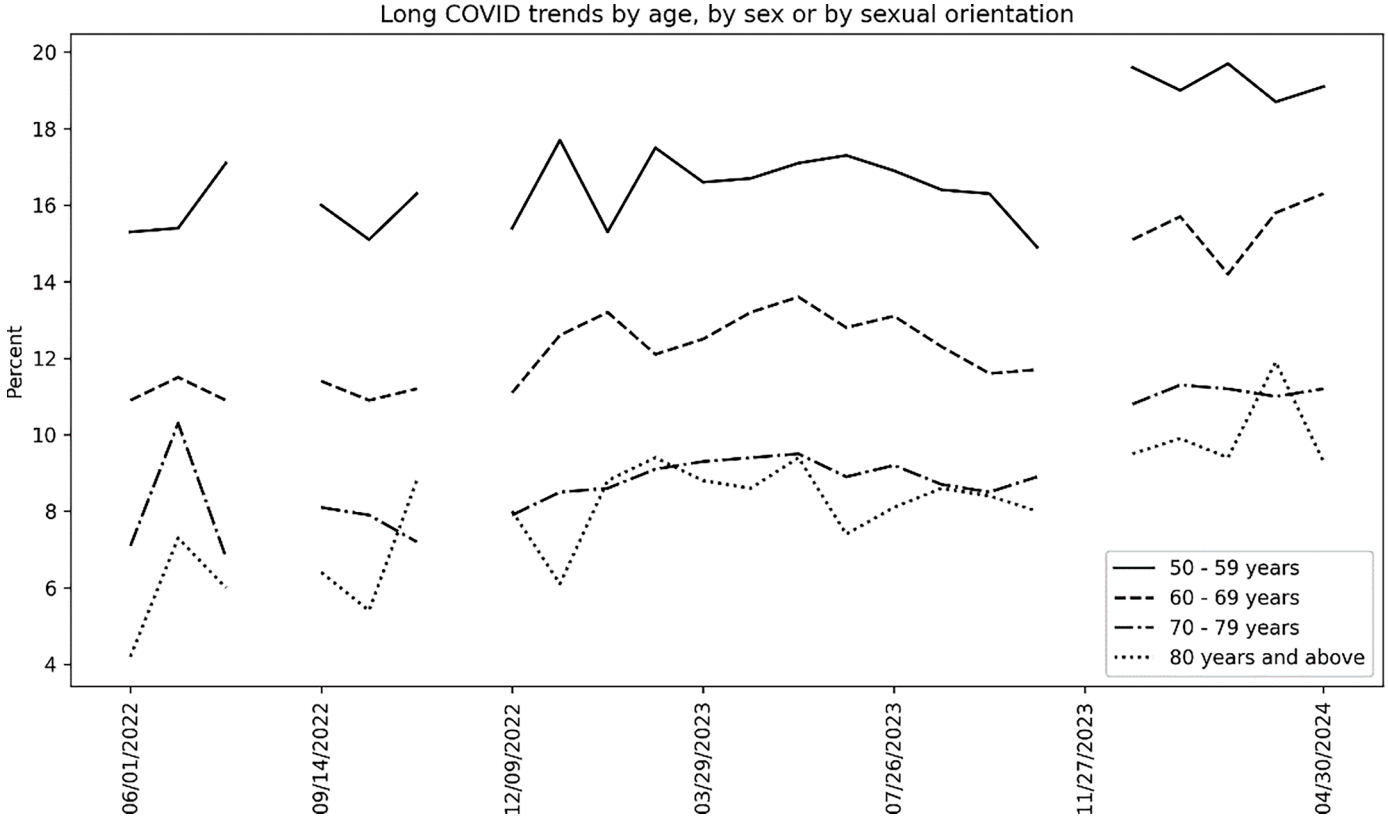

Fig. 1. Long COVID trends by age in US from June 1, 2022 to April 30, 2024.

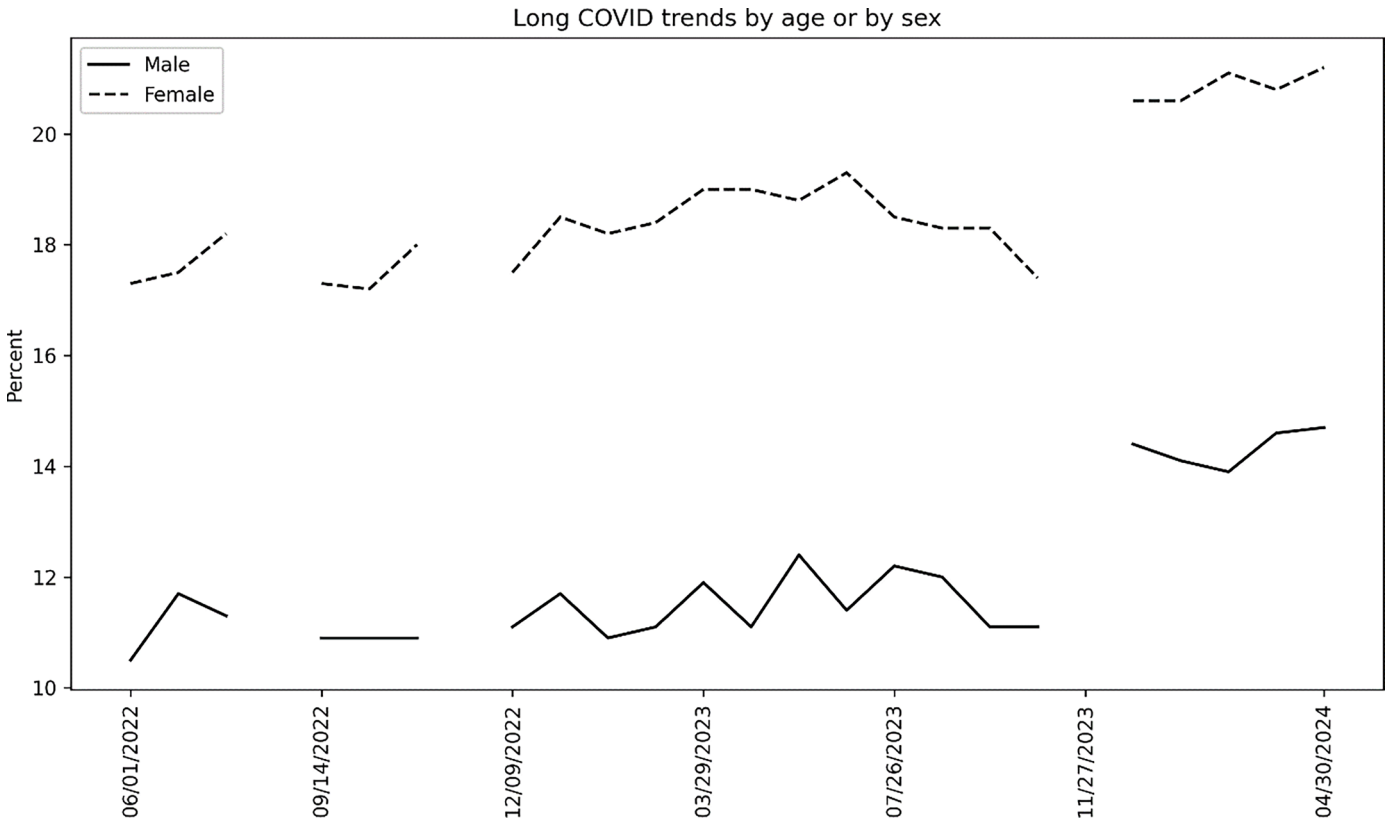

Fig. 2. Long COVID trends by sex in US from June 1, 2022 to April 30, 2024.

consistent with the previous study by Notarte et al. (Notarte et al., 2022).

The visualizations provided in this study offer a comprehensive overview of the temporal patterns of long COVID prevalence. They emphasize the importance of ongoing assessment to guide public health policies and provide necessary support.

Long COVID affects a significant number of individuals globally, with a notable increase among females and the 50–59 age group. Continuous assessment of long COVID prevalence, effective symptom management, comprehensive rehabilitation, and tailored support services are crucial. An interprofessional approach is vital for holistic care and optimizing patient outcomes. Future research should focus on interventions to improve health post-recovery and further explore the impact of Long COVID on various demographics. The role of AI in this process, as demonstrated by our study, is pivotal.

Funding

This research has no fund.

CRediT authorship contribution statement

Yoshiyasu Takefuji: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

References

Chippa, V., Aleem, A., & Anjum, F. (2024). Postacute coronavirus (COVID-19) syndrome. [updated 2024 Mar 19]. *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing. Jan-. Available from: Https://www.ncbi.nlm.nih.gov/books/NBK570608/.

Fernandez-de-Las-Peñas, C., Notarte, K. I., Macasaet, R., et al. (2024). Persistence of post-COVID symptoms in the general population two years after SARS-CoV-2 infection: A systematic review and meta-analysis. *The Journal of infection, 88*(2), 77–88. https://doi.org/10.1016/j.jinf.2023.12.004

Ford, N. D., Agedew, A., Dalton, A. F., Singleton, J., Perrine, C. G., & Saydah, S. (2024). Notes from the field: Long COVID prevalence among adults - United States, 2022. *MMWR. Morbidity and Mortality Weekly Report, 73*(6), 135–136. https://doi.org/10.15585/mmwr.mm7306a4. Published 2024 Feb 15.

GitHub.COM. postcovid.py. https://github.com/y-takefuji/postcovid/blob/main/postcovid.py.

NIH.GOV. Long COVID. Accessed on July 6, 2024. https://www.nhlbi.nih.gov/covid/long-covid.

Notarte, K. I., de Oliveira, M. H. S., Peligro, P. J., et al. (2022). Age, sex and previous comorbidities as risk factors not associated with SARS-CoV-2 infection for long COVID-19: A systematic review and meta-analysis. *Journal of Clinical Medicine, 11*(24), 7314. https://doi.org/10.3390/jcm11247314. Published 2022 Dec 9.

Sun, C., Liu, Z., Li, S., Wang, Y., & Liu, G. (2024). Impact of long COVID on health-related quality of life among patients after acute COVID-19 infection: a cross-sectional study. *Inquiry : A Journal of Medical Care Organization, Provision and Financing, 61*, Article 469580241246461. https://doi.org/10.1177/00469580241246461

Yoshiyasu Takefuji
Faculty of Data Science, Musashino University, 3-3-3 Ariake Koto-ku, Tokyo 135-8181, Japan
E-mail address: takefuji@keio.jp.