

Scoping Review of Post-Acute COVID-19 Syndrome: Is it COVID-19 Virus or the Vaccines?

Isaac K. Agbenyezi

isaac.agbenyezi@stu.ucc.edu.gh

University of Cape Coast

Mercy D. Quarm

University of Cape Coast

Patrick L. K. Fianu

University of Cape Coast

Elizabeth Dudjin

University of Cape Coast

Edward W. Ansah

University of Cape Coast

Study protocol

Keywords: Post-Acute COVID-19 Syndrome, COVID-19, COVID-19 vaccine, Side/adverse effects, Scoping review

Posted Date: June 25th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10083725/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Introduction: COVID-19 pandemic affects physical, psychological and social well-being of many individuals globally. The emergence of COVID-19 vaccines minimised the risk of severe illness from COVID-19 and prevented many deaths. The aftermath of the pandemic emerged the Post-Acute COVID-19 Syndrome (PACS). PACS presents similar signs and symptoms as COVID-19 infection or the side effects of COVID-19 vaccines among some vaccinated persons. This review intends to search, collate and synthesise available global evidence to establish whether PACS are more related with COVID-19 virus infections or COVID-19 vaccinations.

Methods and analysis: The study will use the JBI protocol for performing scoping reviews and findings reported based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses- Scoping Reviews (PRISMA-ScR). Literature search will be conducted in PubMed/MEDLINE, SCOPUS, JSTOR, CINAHL, Embase, Web of Science, ScienceDirect, Dimensions AI and Cochrane CENTRAL Library, WHO COVID-19 Research Database, CDC COVID-19 guidance and reports, NIH/NIAID, and Public Health England, Africa CDC. The search process will end by 31st August, 2026. Studies that meet the inclusion criteria will be selected for this review. Data will be independently extracted with a pretested data extraction form and charted. The CADIMA web resource will be used for data summary, thematic analysis and narrative synthesis approaches will be used present the results and discussion. The findings will inform further research, policy and practice.

Strengths and limitations of the review

- i. This scoping review provides a comprehensive synthesis of existing global evidence on PACS, and COVID-19 vaccines side or adverse effects, to inform health research, policy and practice.
- ii. The planned consultation with stakeholders; medical professionals, persons who experienced PACS, adverse effects and complications of COVID-19 vaccines, would enhance the credibility and relevance of our findings.
- iii. The combination of peer-reviewed articles and grey literature broadens the scope of evidence base and increase the generalisability of the findings.
- iv. The quality appraisal component of the review ensures that all forms of possible biases and errors are minimised for validity of conclusions.
- v. The inclusion of studies conducted in English language or with English language translation only, potentially exclude evidence from other relevant studies conducted in other languages.

Introduction

The Coronavirus 2019 (COVID-19) was declared a disease of public health emergency of international concern on 30th January 2019 (World Health Organization [WHO], 2021). This zoonotic disease from a large family of viruses categorized as alpha, beta, gamma, and delta, was identified in human

populations in Wuhan, China in December 2019 (Johnson, 2020; Rothan & Byrareddy, 2020). The virus is associated with previous large epidemics such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome [MERS] (Rothan & Byrareddy, 2020). The first human coronavirus was detected in the mid-1960s (Centers for Disease Control and Prevention [CDC], 2020). The SARS CoV caused a global pandemic in 2002–2003, resulting in about 8,098 cases with 774 deaths, while MERS caused a significant disease outbreak in 2012 (CDC, 2020; Rothan & Byrareddy, 2020).

The emergence of COVID-19 disease has worsened the living conditions of many people and communities globally. For instance, United Nations (UN, 2022) stated that about 150 million people suffered severe food insecurity with 2.3 billion, representing 1 in every 3 persons, experiencing average to severe hunger globally. The UN also reported that the pandemic has exacerbated global food insecurity, leading to 22% of children suffering stunting, 6.7% suffering wasting and 5.7% overweight. Furthermore, the disruption of health services due to the pandemic has threatened the progress made in achieving Universal Health Coverage [UHC] (UN, 2022). COVID-19 accounted for 1.3% and 1.2% of the global burden of morbidity (752.2 million) and mortality (6.8 million) respectively (WHO, 2023). Again, analysis of seven studies involving 4,499 COVID-19 patients in Africa (Olumade & Uzairue, 2021) showed that common symptoms reported were fever (42.8%), cough (33.3%), headache (11.3%) and respiratory difficulties (16.8%). Less common symptoms included diarrhoea (7.5%) and runny nose (9.4%). The mortality rate was determined to be 5.6%, causing the introduction of various vaccines (Lin et al., 2024).

The pandemic has led to a significant increase in vaccine reactogenicity such as myocarditis, pericarditis and anaemia. Individuals with history of SARS-CoV-2 infection were found to have stronger vaccination reactogenicity than those without such history (Yaamika, Muralidas & Elumalai, 2023). Yaamika et al. maintained that more than 95% of their study participants had moderate and self-limiting side effects, with as much as 5% requiring medical evaluation and hospitalisation. Unfortunately, younger people, women, and those with comorbid conditions were found to be more likely to experience negative, potentially systemic, adverse effects after immunization with an inactivated vaccine (Urakawa et al., 2022). Again, injection site pain, fatigue, headache, muscle pain, fever and chills were commonly reported side effects identified with the COVID-19 vaccination. The distribution of side effects among the population studied was however, highly consistent with the manufacturers' data, especially in terms of their association with the younger age group and the second dose (Karuppannan et al., 2024). Overall, prevalence of some local and systemic side effects was higher than the manufacturers' reports (Riad et al., 2021).

Furthermore, there are many conditions associated with post-acute COVID-19 virus infection, which are similar to the adverse side effects from COVID-19 vaccination (Ganesan et al., 2022). Post-acute COVID-19 condition is characterised by the persistent physiological health symptoms three months into the initial infection and last for two months or more with no other known underlying cause other than the COVID-19 infection (WHO, 2021). The symptoms of this condition include fatigue, malaise, altered sense of smell and taste, breathlessness and cognitive impairments and in some cases, organ damage has also been reported (Aiyegbusi et al., 2021; Ansah et al., 2025). The most frequently reported symptoms

of post-acute COVID-19 syndrome (PACS) include fatigue or weakness (47%) and psychosocial symptoms (28%) which was prevalent across various systems. Lung function abnormalities were observed in recovering patients for extended periods (Huerne et al., 2023; Kaushalya et al., 2022). Patients with severe cases were more likely to report joint pain and decreased lung function compared to those with non-severe cases (Alkodaymi et al., 2022; WHO, 2021). Moreover, many studies revealed that individuals recovering from COVID-19 exhibit long-lasting symptoms affecting multiple human systems, with significant impacts on psychosocial well-being and lung function (Long et al., 2021; Mudgal et al., 2023).

Regional prevalences for PACS were estimated at 51% for Asia, 44% for Europe and 31% for United States of America. Africa contributed 1.92% cases, 3.85% deaths and 1.62% tests to the global COVID-19 prevalence by the end of 2022. Low-income African countries had lower values than middle-income countries with Southern Africa as the most affected. Central Africa however, was the least affected with 2,337 cases per million and 35 deaths per million (Alrasheedi, 2023). Again, Fernandez-de-las-Peñas et al. (2024) found the presence of PACS in 30% of patients two-years after COVID-19 infection with symptoms including fatigue, cognitive disorders, and pain as the most prevalent symptoms. Moreover, Fernandez-de-las-Peñas et al. found psychological disturbances and sleep problems, two-years after COVID-19 infection. In addition, Chen et al. (2022) estimated global prevalence of PACS at 43% with hospitalized and non-hospitalized patients estimated at 54% and 34% respectively.

The similarities in the presentations, signs and symptoms of adverse effects from COVID-19 vaccinations and PACS present a serious danger and challenge to healthcare practice especially in jurisdictions where evidence-based care delivery is low. This situation worsens the already precarious challenges surrounding objective assessment of vaccination, diagnoses and management of cases, which have dire consequences for public health, including error in care (Buonsenso et al., 2021). There is therefore, the need for comprehensive evidence review to answer the question as to whether PACS are distinctively from the vaccinations or COVID-19 virus infections or combinations? Determining whether PACS, commonly referred to as Long COVID, is primarily associated with SARS-CoV-2 infection, COVID-19 vaccination, or a combination of both is of considerable importance to patient care, public health policy, and future pandemic preparedness. From a patient care perspective, distinguishing between infection-related and vaccine-related post-acute symptoms is essential for accurate diagnosis, treatment, rehabilitation and prognosis. Clinicians require evidence-based guidance to identify the underlying causes of persistent symptoms and provide appropriate interventions. Misattribution of symptoms may lead to delayed diagnosis, ineffective treatment strategies, patient anxiety and reduced quality of life (Domingo, 2025; Tabacof et al., 2022). A clearer understanding of the relationship between PACS and COVID-19 vaccination could improve clinical decision-making, patient counseling, and long-term management of affected individuals.

In terms of public health systems, answering this question is critical for maintaining confidence in vaccination programmes while ensuring transparency regarding vaccine safety. Vaccination remains one of the most effective interventions for reducing COVID-19 morbidity and mortality (Sibanda & Haryanto,

2024). However, concerns about potential long-term adverse effects may contribute to vaccine hesitancy, reducing vaccine uptake that undermines public health efforts (Ansah et al., 2025; Bahreini et al., 2024). Robust evidence that differentiates the health consequences of COVID-19 infection from those potentially associated with vaccination could support effective risk communication, improve public trust, and inform vaccination policies. Furthermore, understanding the relative contribution of infection and vaccination to PACS could assist health systems in planning healthcare services, allocating resources, and developing rehabilitation programmes for affected populations. As the burden of chronic post-COVID conditions continues to place pressure on the global healthcare systems, this evidence base is needed to estimate disease burden accurately and prioritize interventions. Furthermore, synthesizing available evidence on this topic could identify knowledge gaps, methodological challenges, and areas requiring further investigation. Such evidence is also crucial for informing future vaccine development, post-marketing surveillance systems, clinical guidelines and preparedness strategies for future infectious disease outbreaks.

Several reviews have investigated the relationship between COVID-19 vaccination and PACS, including Byambasuren et al. (2023) who found evidence suggesting that vaccination before infection may reduce the risk of developing PACS, while the effects of vaccination among individuals already experiencing PACS remained uncertain. Similarly, Notarte et al (2022) reviewed the impact of vaccination on PACS symptomatology and reported mixed findings regarding symptom improvement, persistence or worsening after vaccination. Other studies focused on comparing the clinical manifestations of PACS and post-vaccination syndromes (Domingo, 2025; Scholkmann & May, 2023). There is however, the absence of a comprehensive synthesis distinguishing infection-related PACS from vaccine-associated PACS, which presents an important knowledge gap. As a result, this scoping review has become necessary to map the available evidence, identify methodological approaches used to determine the associations, summarize reported similarities and differences between the two antecedences to PACS, and highlight areas for further research. Mapping, examining and synthesizing global literature on this crucial subject matter will contribute to a clearer understanding of whether current evidence supports PACS as a consequence of SARS-CoV-2 infection, COVID-19 vaccination, or the combination of both.

The review sought to answer the following questions;

1. What is the prevalence and current state of evidence about the similarities in the clinical signs and symptoms of COVID-19 infection and reported side effects from COVID-19 vaccination among infected and vaccinated populations?
2. What socio-demographic and geographical factors influence the distribution of the signs and symptoms of the PACS and COVID-19 vaccines side effects among infected and vaccinated populations?
3. What are the methodological approaches used in studying the associations, summarize reported similarities and differences between PACS and COVID-19 vaccines side effects among infected and vaccinated populations?

Methods

This scoping review adheres to the updated version of JBI framework for conducting scoping reviews. Based on this framework, the authors (IKA, MDQ, PLKF and ED and EWA) will identify and state the research questions, search for and select relevant studies, extract and chart data from the selected studies, summarise, analyse and synthesise the data to inform relevant conclusions for this study (Aromataris et al., 2024). The findings from the review will be reported based on the Preferred Reporting Items for Systematic Reviews and Meta- analyses, Extension for Scoping Reviews (PRISMA-ScR) framework (Tricco et al., 2016). This framework provides a comprehensive and standardized outline for the transparent and systematic reporting of scoping reviews. The guideline is appropriate for this study because it is specifically developed to address the method and reporting needs of scoping reviews (Tricco et al., 2018). In addition, the PRISMA-ScR guideline enhances the rigor of methods, promotes consistency, reproducibility and transparency throughout the review process by ensuring clear reporting of the review rationale, eligibility criteria, search strategy, study selection procedures, data charting methods, and synthesis of findings (Tricco et al., 2018). This helps minimize reporting bias and improves the credibility and reliability of the review findings. Scoping reviews across diverse public health fields have adopted this guideline to ensure methodological quality and reporting transparency, including reviews by Rao et al. (2025) on synthetic data generation in biomedical research, Miller et al. (2026) on clinical document metadata extraction, Ni and Jia (2025) on artificial intelligence-driven mental health interventions and Ansah et al. (2025) who studied post-COVID-19 conditions and health effects in Africa.

Data Sources and Search

A comprehensive search will be conducted in nine main databases; PubMed/MEDLINE, SCOPUS, JSTOR, CINAHL, Embase, Web of Science, ScienceDirect, Dimensions AI and Cochrane CENTRAL Library. Other sources will include; WHO COVID-19 Research Database, CDC COVID-19 guidance and reports, NIH/NIAID, Public Health England, and Africa CDC. These databases have been selected based on their broad scope of both peer-reviewed records and grey literature exploring the COVID-19. Further targeted searches will be conducted in the Google, Google Scholar, WHO IRIS and ProQuest Dissertations and Theses Global databases to identify available grey literature. The key words, along with the inclusion and exclusion criteria guiding the search processes, are shown in Table 1.

An initial search will be conducted in PubMed using the Medical Subject Headings (MeSH) terms, controlled vocabularies and appropriate Boolean terms (See Table 2). The search strategies for the remaining targeted eight databases are contained in **supplementary material 1**. The review will begin from 1st July, 2026 and is expected to conclude in August 2026. The literature will cover relevant studies that meet the inclusion criteria (in Table 1), conducted from 1st January 2020 to August 2026. Chartered Librarians at the Sam Jonah Library at the University of Cape Coast is supporting the design of search teams and the search process. Where further important changes occurred to the protocol during the review, we will detail that in the final review for publication. The search strategy in the PubMed is provided in Table 2.

Table 1
General Search Strategy

Items	Search strategy
Database	PubMed/MEDLINE, SCOPUS, JSTOR, CINAHL, Embase, Web of Science, ScienceDirect, Dimensions AI and Cochrane CENTRAL Library, Google, Google Scholar, ProQuest Dissertations & Theses Global (grey literature), WHO (IRIS), WHO COVID-19 Research Database, CDC COVID-19 guidance and reports, NIH/NIAID, Public Health England, Africa CDC;
Language filter	English
Time filter	January 2019 to August 2026
Spatial	Global
Keywords	1. "Post-Acute COVID-19 Syndrome" OR "Post-COVID Conditions" OR "Long COVID" OR "COVID-19 Long-Term Effects" OR "Persistent COVID-19 Symptoms" OR "Post-COVID Syndrome" OR "Chronic COVID Syndrome" OR "Long-Haul COVID" OR "Long-Hauler Syndrome" OR "Sequelae of COVID-19" OR "Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)" AND 2. "COVID-19 virus" OR "SARS-CoV-2" OR "SARS CoV 2" OR "Severe Acute Respiratory Syndrome Coronavirus 2" OR "Novel Coronavirus" OR "Novel Corona Virus" OR "2019 Novel Coronavirus" OR "2019-nCoV" OR "nCoV-2019" OR "Wuhan Coronavirus" OR "Wuhan Virus" AND 3. "Vaccine" OR "BNT162b2" OR "Pfizer-BioNTech" OR "Pfizer Vaccine" OR "Comirnaty" OR "mRNA-1273" OR "Moderna Vaccine" OR "Spikevax" OR "ChAdOx1 nCoV-19" OR "AstraZeneca Vaccine" OR "Vaxzevria" OR "Ad26.COV2.S" OR "Janssen Vaccine" OR "Johnson & Johnson Vaccine" OR "CoronaVac" OR "Sinovac" OR "BBIBP-CorV" OR "Sinopharm" OR "Covaxin" OR "NVX-CoV2373" OR "Novavax" OR "Sputnik V"
Inclusion criteria	The paper should be; 1. An original peer- reviewed published study or grey literature. 2. Studies available in full text in English language 3. Focused on Post-Acute COVID-19 Syndrome and COVID-19 virus/ Corona Virus and COVID-19 vaccines. 4. Studies available online 5. All forms of studies, quantitative, qualitative or mixed method involving the variables under study. 6. All peer reviewed studies and publications and grey literature such as reports, dissertations and conference proceedings published in English language or with translation in English language involving the variables contained in the review.
Exclusion criteria	1. A study conducted on animals 2. A literature review, a report, an abstract, minutes, commentary, a letter to editors

Items	Search strategy
	3. A study outside the scope of interest
	4. Studies in languages other than English language without available English translations on the variables under study.

Table 2
Search Strategy in PubMed

Search #	Search terms
1.	"COVID-19"[Mesh] OR "COVID-19/complications"[Mesh] OR "Post-Acute COVID-19 Syndrome" OR "Convalescence"[Mesh] OR "Post-Viral Syndrome"[Mesh] OR "Fatigue Syndrome, Chronic"[Mesh] [All Fields]
2.	"COVID-19"[Mesh] OR "SARS-CoV-2"[Mesh] OR "Coronavirus Infections"[Mesh] OR "Betacoronavirus"[Mesh] [All Fields]
3.	"COVID-19 Vaccines"[Mesh] OR "Vaccination"[Mesh] OR "Vaccines"[Mesh] OR "Immunization Programs"[Mesh] [All Fields]
4.	"Adverse Effects"[MeSH] OR "Treatment Outcome"[Mesh] OR "Drug-Related Side Effects and Adverse Reactions"[Mesh] OR "Vaccination Adverse Events"[Mesh] OR "Post-Acute COVID-19 Syndrome/etiology" [MeSH] [All Fields]
5.	#1 AND #2 AND #3 AND #4

Study selection

The eligibility criteria as presented in Table 1 form the basis for screening the studies for inclusion in this review. Studies from the search results will be loaded into Mendeley referencing software. This software will be used to track and delete duplicate/triplicate studies to pave way for further screening. The reviewers (IKA, MDQ, PLKF and ED) will be supervised by EWA to individually screen titles and abstracts for full-text studies that meet the inclusion criteria. This is intended to ensure efficiency, systematic screening, accuracy and consistency in the selection of studies that meet the inclusion criteria. Reference list of the selected full-text articles will then be manually checked for additional relevant records to be evaluated for the review. The reviewers will now work in pairs to screen the selected full-text records to confirm their inclusion in the review. Moreover, there would be cross-over screening where one of group of authors screen the selected records by the other group, to aid accuracy, reliability and validity of the evidence base. This is done according to the inclusion criteria presented in Table 1. A model PRISMA-ScR diagram depicting the selection process is presented in Fig. 1.

Data extraction

This process involves development and pre-testing of a data extraction form. The aim is to aid transparency and promote commonality in data extracted among the various independent reviewers. Guided by reviewer EWA, the form will be pre-tested using four randomly selected full-text studies. The form could be revised as and when new variables emerged since data extraction is an iterative process. This form will be used to extract data on; author(s)/year of publication, country where study was conducted, purpose of the study, study design, population, sample size, data collection tool and findings/interventions (see **supplementary material 2**). Other variables including PACS, signs and symptoms of COVID-19 vaccination side effects and their prevalences, types of vaccines and associated side effects, among others, will also be extracted. Any discrepancy noticed will be resolved by the reviewers through consensus and consultation with subject experts.

The reviewers, IKA, MDQ, PLKF and ED will independently extract data from the various selected studies, using the validated data extraction form. There will be weekly update meetings among the reviewers moderated by the supervising reviewer, EWA, to address challenges encountered during the extraction process. This is intended to satisfy quality assurance requirements at this manual data extraction stage of the review process.

Collating, summarising and reporting of results

The process involves organising the extracted data into understandable groups based on identified patterns across the various results or interventions. The review team will conduct a thorough assessment of the identified pattern of ideas to discern various trends across these groups of ideas. The reviewers will then summarise by extracting the exact insight that are embedded in these patterns of ideas to generate themes, sub-themes and key observations according to the stated research questions. This ensures that every piece of idea contained in the data that is relevant is captured for a comprehensive review on the phenomenon under review. Reporting will involve the use of tables or figures and narratives to present the identified themes, sub-themes and key observations in a systematic and logical manner. The collation, summary and report processes will be guided by the research questions of the review. The CADIMA web resource designed for supporting the conduct of reviews will be used to assist in this process, to enhance the efficiency of the evidence synthesis process and ease the reporting of activities to enhance the quality of the review (Kohl et al., 2018). The authors will have regular meetings during this stage of the review for updates and consolidation of the work outputs.

Synthesis and analysis

Thematic analysis approach will be used in resending the findings of the review. The outcome of this analysis will further go through rigorous finetuning by conducting a cross-study comparison narrative synthesis (Rai et al., 2020) to ensure that the data is thoroughly synthesised. The analysis and synthesis approaches selected are amenable to qualitative, quantitative and mixed method studies involving

constructs contained in this review. The findings of this review will inform the recommendations directed towards further research, policy and practice.

Quality Assessment

The JBI method for qualitative research will guide the appraisal of the selected full-text articles. This guideline is capable of ensuring that the entire review process is systematically and logically executed. The appraisal process requires the researchers to answer eleven (11) yes, no, unclear or not applicable (Aromataris et al., 2024). In this regard, JBI quality assessment protocol is used to increase transparency and reproducibility requirements and to support evidence-based informed decision relating to the entire review. The process also helps to identify existing research gaps relating to the constructs contained in this review. The appraisal will assess the quality of the included articles, but no article will be excluded. This is because that is not an integral requirement for scoping review. However, the assessment gives us the opportunity to identify the methodological quality and gaps in the existing literature.

Patient, healthcare workers and public involvement

Healthcare workers or patients or the general public were not involved in the development of this protocol.

Consultation

This scoping review explores the state of current evidence about the prevalences, similarities, and distribution of the signs and symptoms of PACS, and the side effects of COVID-19 vaccines among infected and vaccinated populations. The JBI methodological framework and the PRISMA-ScR guide the review process. The cadima web resource supports the review process involving thematic analysis and narrative synthesis of the extracted data in line with the research questions. The synthesis focuses on gaps in the available body of knowledge in answering the research questions. The review team contend that the global body of knowledge available about the above variables should help clarify the dilemma of whether PACS are more associated with the COVID-19 virus infection and or the COVID-19 vaccines. This is critical in providing robust evidence to support practice and minimise errors in diagnosis and management of post-COVID-19 related conditions among different population globally. The outcome of this review will provide robust evidence that will positively influence COVID-19 management decisions and interventions in the interest of improved quality healthcare delivery across the globe.

Discussion

This scoping review explores the state of current evidence about the prevalences, similarities, and distribution of the signs and symptoms of PACS, and the side effects of COVID-19 vaccines among infected and vaccinated populations. The JBI methodological framework and the PRISMA-ScR guide the

review process. The cadima web resource supports the review process involving thematic analysis and narrative synthesis of the extracted data in line with the research questions. The synthesis focuses on gaps in the available body of knowledge in answering the research questions. The review team contend that the global body of knowledge available about the above variables should help clarify the dilemma of whether PACS are more associated with the COVID-19 virus infection and or the COVID-19 vaccines. This is critical in providing robust evidence to support practice and minimise errors in diagnosis and management of post-COVID-19 related conditions among different population globally. The outcome of this review will provide robust evidence that will positively influence COVID-19 management decisions and interventions in the interest of improved quality healthcare delivery across the globe.

Declarations

Contributors

Conceptualisation: IKA, EWA, MDQ, PLKF and ED, method: IKA and EWA, initial draft: IKA, EWA, MDQ, PLKF and ED, review: IKA and EWA, final review: EWA. All authors accept the intellectual and technical content of the review. EWA is the guarantor and accepts responsibility for the conduct of this review, the finished work and the decision to publish.

Funding: No funding support has been received by the authors from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests: None of the authors has declared any competing interest in this review.

Authors details:

Department of Health, Physical Education and Recreation, University of Cape Coast, Cape Coast, Ghana. (IKA-isaac.agbenyezi@stu.ucc.edu.gh , MDQ-mercy.quarms@stu.ucc.edu.gh, PLKF-patrick.fianu@stu.ucc.edu.gh and ED-elizabeth.dudjin@stu.ucc.edu.gh and EWA-edward.ansah@ucc.edu.gh

Healthcare workers consent for publication: Not applicable

Provenance and peer review: Not commissioned; review to be externally peer reviewed before publication.

Supplemental material: This content has been supported by the authors. It has not been vetted by BMJ Publishing Group Limited and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the authors and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access: This is an open access article distributed in accordance with the creative commons attribution non-commercial (...CC BY-NC 4.0...) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See:

ORCID iDs:

Isaac Kwabla Agbenyezi: <https://orcid.org/0009-0002-7384-6915>

Mercy Demaris Quarm

Patrick Lorlornyo Kwame Fianu

Elizabeth Dudjin

Edward Wilson Ansah: <https://orcid.org/0000-0001-9450-7774>

References

1. Aiyegbusi, O. L., Hughes, S. E., Turner, G., Rivera, S. C., McMullan, C., Chandan, J. S., Haroon, S., Price, G., Davies, E. H., Nirantharakumar, K., Sapey, E., & Calvert, M. J. (2021). Symptoms, complications and management of long COVID: a review. In *Journal of the Royal Society of Medicine* 114(9) 428–442. <https://doi.org/10.1177/01410768211032850>
2. Alkodaymi, M. S., Omrani, O. A., Fawzy, N. A., Abou Shaar, B., Almamlouk, R., Riaz, M., ... Tleyjeh, I. M. (2022). Prevalence of post-acute COVID-19 syndrome symptoms at different follow-up periods: A systematic review and meta-analysis. *Clinical Microbiology and Infection*, 28(5), 657–666.
3. Alrasheedi, A. A. (2023). Analysis of COVID-19 Prevalence in Africa based on the geographic division and income by the end of 2022: A Cross-Sectional Study. *Bahrain Medical Bulletin*, 45(3), 1632–1639.
4. Ansah, E. W., Salu, P. K., Daanko, M. S., Banaaleh, D. N., & Amoadu, M. (2025). Post-COVID-19 conditions and health effects in Africa: a scoping review. *BMJ Open* 15(1). <https://doi.org/10.1136/bmjopen-2024-088983>
5. Aromataris, Edoardo., Lockwood, Craig., Porritt, Kylie., Pilla, Bianca., & Jordan, Zoe. (2024). *JBI manual for evidence synthesis*. JBI. <https://synthesismanual.jbi.global>.
6. Bahreini, R., Sardareh, M., & Arab-Zozani, M. (2024). A scoping review of COVID-19 vaccine hesitancy: Refusal rate, associated factors, and strategies to reduce. *Frontiers in Public Health* 12(1). <https://doi.org/10.3389/fpubh.2024.1382849>
7. Buonsenso, D., Munblit, D., De Rose, C., Sinatti, D., Ricchiuto, A., Carfi, A., & Valentini, P. (2021). Preliminary evidence on long COVID in children. *Acta Paediatrica, International Journal of Paediatrics*, 110(7), 2208–2211. <https://doi.org/10.1111/apa.15870>

8. Byambasuren, O., Stehlik, P., Clark, J., Alcorn, K., & Glasziou, P. (2023). Effect of covid-19 vaccination on long covid: Systematic review. *BMJ Medicine*, 2(1) <https://doi.org/10.1136/bmjmed-2022-000385>
9. Chen, C., Hauptert, S. R., Zimmermann, L., Shi, X., Fritsche, L. G., & Mukherjee, B. (2022). Global prevalence of post-coronavirus disease 2019 (COVID-19) condition or long COVID: A Meta-Analysis and Systematic Review. *Journal of Infectious Diseases*, 226(9), 1593–1607. <https://doi.org/10.1093/infdis/jiac136>
10. Domingo, J. L. (2025). Differentiating COVID-19 vaccine-related adverse events from long COVID: A comprehensive review of clinical manifestations, pathophysiology, and diagnostic approaches. *Vaccine*, 66(1) <https://doi.org/10.1016/j.vaccine.2025.127842>
11. Fernandez-de-las-Peñas, C., Notarte, K. I., Macasaet, R., Velasco, J. V., Catahay, J. A., Ver, A. T., Chung, W., Valera-Calero, J. A., & Navarro-Santana, M. (2024). Persistence of post-COVID symptoms in the general population two years after SARS-CoV-2 infection: A systematic review and meta-analysis. *Journal of Infection*, 88(2), 77–88. <https://doi.org/10.1016/j.jinf.2023.12.004>
12. Ganesan, S., Al Ketbi, L. M. B., Al Kaabi, N., Al Mansoori, M., Al Maskari, N. N., Al Shamsi, M. S., Alderei, A. S., El Eissae, H. N., Al Ketbi, R. M., Al Shamsi, N. S., Saleh, K. M., Al Blooshi, A. F., Cantarutti, F. M., Warren, K., Ahamed, F., & Zaher, W. (2022). Vaccine side effects following COVID-19 vaccination among the residents of the UAE: An observational study. *Frontiers in Public Health*, 10(May), 1–9. <https://doi.org/10.3389/fpubh.2022.876336>
13. Huerne, K., Fillion, K. B., Grad, R., Ernst, P., Gershon, A. S., & Eisenberg, M. J. (2023). Epidemiological and clinical perspectives of long COVID syndrome. *American Journal of Medicine Open*, 9(22), 100033. <https://doi.org/10.1016/j.ajmo.2023.100033>
14. Johnson, M. (2020). Wuhan 2019 Novel Coronavirus – 2019-nCoV. *Materials and Methods*, 10(1), 1–5. <https://doi.org/10.13070/mm.en.10.2867>
15. Kaushalya, L., Bowatte, G., Welikannage, K., & Yasaratne, D. (2022). Post-acute COVID-19 Syndrome and Predicting Factors: A Narrative Review. *Sri Lankan Journal of Health Sciences*, 1(2), 36–47. <https://doi.org/10.4038/sljhs.v1i2.44>
16. Karuppannan, M., Ming, L. C., Abdul Wahab, M. S., Mohd Noordin, Z., Yee, S., & Hermansyah, A. (2024). Self-reported side effects of COVID-19 vaccines among the public. *Journal of Pharmaceutical Policy and Practice*, 17(1), 1–31. <https://doi.org/10.1080/20523211.2024.2308617>
17. Kohl, C., McIntosh, E. J., Unger, S., Haddaway, N. R., Kecke, S., Schiemann, J., & Wilhelm, R. (2018). Online tools supporting the conduct and reporting of systematic reviews and systematic maps: A case study on CADIMA and review of existing tools. *Environmental Evidence*, 7(1). <https://doi.org/10.1186/s13750-018-0115-5>
18. Lin, S., Liu, H., Qi, Q., Trees, I., Gao, D., Friedman, S., Xue, X. R., & Lawrence, D. (2024). Tracking temporal variations of fatality and symptomology correlated with COVID-19 dominant variants and vaccine effectiveness in the United States. *Frontiers in Public Health*, 12(9), 1–10. <https://doi.org/10.3389/fpubh.2024.1419886>

19. Mak, S., & Thomas, A. (2022). An introduction to scoping reviews. *Journal of Graduate Medical Education*, 14(5), 561–564. <https://doi.org/10.4300/JGME-D-22-00620.1>
20. Miller, K., Lu, Q., Hersh, W., Roberts, K., Bedrick, S., Wen, A., & Liu, H. (2026). Clinical document metadata extraction: A scoping review. *Journal of Biomedical Informatics*, 179, 105050. <https://doi.org/10.1016/j.jbi.2026.105050>
21. Ni, Y., & Jia, F. (2025). A Scoping Review of AI-Driven Digital Interventions in Mental Health Care: Mapping Applications Across Screening, Support, Monitoring, Prevention, and Clinical Education. In *Healthcare* 13(10). Multidisciplinary Digital Publishing Institute (MDPI). <https://doi.org/10.3390/healthcare13101205>
22. Notarte, K. I., Catahay, J. A., Velasco, J. V., Pastrana, A., Ver, A. T., Pangilinan, F. C., Peligro, P. J., Casimiro, M., Guerrero, J. J., Margarita, M., Gellaco, L., Lippi, G., Henry, B. M., Esar, C., & Andez-De-Las-Pe ~ Nas, F. (2022). Impact of COVID-19 vaccination on the risk of developing long-COVID and on existing long-COVID symptoms: A systematic review. *EClinicalMedicine*, 53, 101624. <https://doi.org/10.1016/j>
23. Olumade, T. J., & Uzairue, L. I. (2021). Clinical characteristics of 4499 COVID-19 patients in Africa: A meta-analysis. *Journal of Medical Virology*, 93(5), 3055–3061. <https://doi.org/10.1002/jmv.26848>
24. Rai, H. K., Barroso, A. C., Yates, L., Schneider, J., & Orrell, M. (2020). Involvement of people with dementia in the development of technology-based interventions: Narrative synthesis review and best practice guidelines. *Journal of Medical Internet Research* 22(12). <https://doi.org/10.2196/17531>
25. Rao, H., Liu, W., Wang, H., Huang, I.-C., He, Z., & Huang, X. (2025). A Scoping Review of Synthetic Data Generation for Biomedical Research and Applications. <https://doi.org/10.1007/s41666-026-00229-9>
26. Riad, A., Pokorná, A., Attia, S., Klugarová, J., Koščík, M., & Klugar, M. (2021). Prevalence of covid-19 vaccine side effects among healthcare workers in the Czech Republic. *Journal of Clinical Medicine*, 10(7), 1–18. <https://doi.org/10.3390/jcm10071428>
27. Scholkmann, F., & May, C. A. (2023). COVID-19, post-acute COVID-19 syndrome (PACS, “long COVID”) and post-COVID-19 vaccination syndrome (PCVS, “post-COVIDvac-syndrome”): Similarities and differences. *Pathology Research and Practice* 246(1). <https://doi.org/10.1016/j.prp.2023.154497>
28. Sibanda, B., & Haryanto, B. (2024). Assessing the Impact of COVID-19 Vaccination Programs on the Reduction of COVID-19 Cases: A Systematic Literature Review. *Annals of Global Health*, 90(1). <https://doi.org/10.5334/aogh.4484>
29. Tabacof, L., Tosto-Mancuso, J., Wood, J., Cortes, M., Kontorovich, A., McCarthy, D., Rizk, D., Rozanski, G., Breyman, E., Nasr, L., Kellner, C., Herrera, J. E., & Putrino, D. (2022). Post-acute COVID-19 syndrome negatively impacts physical function, cognitive function, health-related quality of life, and participation. *American Journal of Physical Medicine and Rehabilitation*, 101(1), 48–52. <https://doi.org/10.1097/PHM.0000000000001910>
30. Tricco, A. C., Lillie, E., Zarin, W., O’Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., ... Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-

- ScR): Checklist and explanation. *Annals of Internal Medicine* 169(7) 467–473.
<https://doi.org/10.7326/M18-0850>
31. Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Kastner, M., Levac, D., Ng, C., Sharpe, J. P., Wilson, K., Kenny, M., Warren, R., Wilson, C., Stelfox, H. T., & Straus, S. E. (2016). A scoping review on the conduct and reporting of scoping reviews. *BMC Medical Research Methodology* 16(1),
<https://doi.org/10.1186/s12874-016-0116-4>
32. United Nations. (2022). *The Sustainable Development Goals Report*.
<https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>
33. Urakawa, R., Isomura, E. T., Matsunaga, K., & Kubota, K. (2022). Young age, female sex, and no comorbidities are risk factors for adverse reactions after the third dose of BNT162b2 COVID-19 Vaccine against SARS-CoV-2: A prospective cohort study in Japan. *Vaccines*, 10(8).
<https://doi.org/10.3390/vaccines10081357>
34. World Health Organization. (2021). *The impact of COVID-19 on health and care workers: A closer look at deaths*. <https://iris.who.int/bitstream/handle/10665/345300/WHO-HWF-WorkingPaper-2021.1-eng.pdf>
35. World Health Organization. (2023). *COVID-19 Response in Africa bulletin*.
https://www.afro.who.int/sites/default/files/2023-04/Final_Dec_Feb23_COVID-19%20Bulletin_AFRO.pdf
36. Yaamika, H., Muralidas, D. and Elumalai, K. (2023). Review of adverse events associated with COVID-19 vaccines, highlighting their frequencies and reported cases. *Journal of Taibah University Medical Sciences*, 18 (6). 1646–1661; <https://doi.org/10.1016/j.jtumed.2023.08.004>

Figures

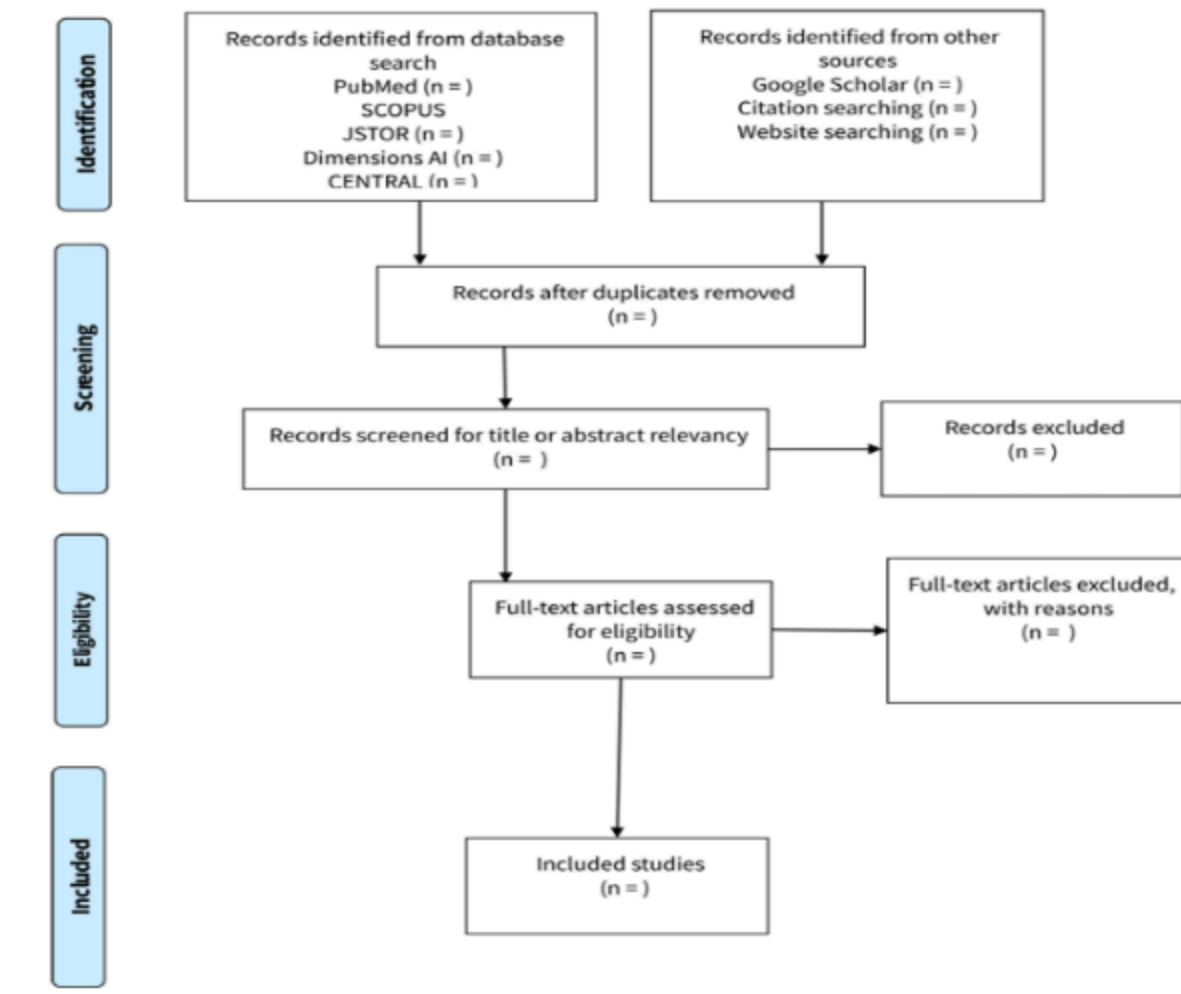


Figure 1

A Model PRISMA-ScR diagram

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SearchStrategyinDatabases.docx](#)
- [DataExtractionForm.docx](#)