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RESEARCH

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Exploring the prevalence and factors associated with post-acute COVID syndrome in Egypt: a systematic review and meta-analysis

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Abstract

Background Post-COVID-19 survivors may experience long-term symptoms known as Post-acute COVID-19 syndrome (PACS). The PCAS symptom spectrum includes a wide range of symptoms affecting different organs. The prevalence and risk factors of PACS may vary across different regions, and a meta-analysis focused on Egypt can help understand the national prevalence and unique population-specific predictors.

Methods A comprehensive literature search was conducted following the PRISMA guidelines to identify studies published in Egypt that documented symptoms, signs, and post-COVID-19 outcomes in patient cohorts. The results were reported, based on the random effects model, as proportions (%) and odds ratios with 95% CI.

Results A total of 16 studies with 3097 COVID-19 survivors and an age range of 3 to 94 years were included in the analysis. The pooled prevalence of COVID-19 survivors experiencing at least one persistent symptom, regardless of hospitalization status, was high at 78.3%. A total of 54 clinical symptoms or conditions were reported among the survivors. The most commonly reported symptom was fatigue, which affected approximately half of all survivors (48.1%). Bone ache or myalgia, anorexia, anxiety, dyspnea, and depression were also among the most frequently reported symptoms at 32.9%, 32.8, 31.5, 19.9, and 19.5, respectively. The pooled prevalence of Post-COVID-19 pulmonary fibrosis (PCPF) among hospitalized Covid survivors was 40%. The study found that female sex, severe COVID, and the presence of any comorbidity were independent risk factors for PACS ($P < 0.05$).

Conclusion This meta-analysis of 16 studies conducted in Egypt highlights the high prevalence of post-acute COVID-19 syndrome. The high prevalence of Post-COVID-19 pulmonary fibrosis and psychological disorders, particularly anxiety and depression, is a cause for concern. There was also a single report on post-COVID diabetes mellitus, stroke, migraine, and coagulative ocular disorders that need further investigation. To the best of our knowledge, this is the first systematic review and meta-analysis conducted at a national level to determine the prevalence and predictors of post-COVID syndrome. Larger studies with a longer follow-up period are still needed to confirm these findings and explore other potential risk factors and modifiers of the Post-COVID syndrome.

Keywords Post-acute COVID-19 syndrome, Post COVID-19 condition, Long COVID, Meta-analysis, Egypt

Introduction

Many individuals who have recovered from COVID-19 have long-term symptoms that interfere with everyday activities. These post-COVID-19 survivors have 'chronic' or 'long' COVID-19, or, more recently, post-acute sequelae of COVID-19 or post-acute COVID-19 syndrome (PACS) [1]. Survivors of earlier coronavirus

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infections, such as the 2003 SARS pandemic and the 2012 Middle East respiratory syndrome (MERS) outbreak, have shown a similar cluster of persistent symptoms, raising concerns about clinically significant COVID-19 sequelae [2–5]. Although efforts are underway, a universally accepted definition for post-COVID-19 syndrome has not yet been established. According to the CDC, "Post-COVID conditions" are a wide range of new, returning, or ongoing health problems that people experience for more than 4 weeks after the initial phase of infection [6]. While, the WHO has developed a clinical case definition for post-COVID-19 syndrome, which encompasses individuals with a probable or confirmed SARS-CoV-2 infection that occurred roughly 3 months prior and who have been experiencing symptoms for at least 2 months that cannot be attributed to any other diagnosis [7].

The PACS has a wide symptom spectrum that includes, but is not limited to, nasopharyngeal, psychological, gastrointestinal, musculoskeletal, neurological, dermatological, cardiac, and ocular symptoms, with more than 50 long-term consequences reported [8]. There are multiple proposed mechanisms for the pathogenesis of PACS. These include immune dysregulation, disruption of the microbiota, autoimmunity, abnormalities in clotting and the endothelium, and dysfunctional signaling within the nervous system [9]. It is currently unclear how many people worldwide are living with PACS. However, in the UK, the Office for National Statistics (ONS) estimated that as of March 2023, approximately 1.9 million people (equivalent to 2.9% of the population) were reporting COVID-19 symptoms lasting more than 4 weeks [10]. In the United States, nearly one in five American adults who have had COVID-19 still have PACS [11]. According to estimates, the global pooled prevalence of post-COVID-19 conditions is 43% [12]. The highest estimates of prevalence rates are in Asia (51%), then in Europe (44%), and finally in the United States (31%) [12]. A recent meta-analysis revealed that certain demographic factors such as age and sex, pre-existing health conditions, and severe COVID-19 infection increase the risk of developing post-COVID-19 conditions (PCC). Conversely, vaccination, on the other hand, has been shown to have a protective effect against developing PCC [13].

As previously mentioned, the prevalence and risk factors of post-COVID syndrome may vary across different populations due to factors such as demographics, ethnicities, healthcare systems, cultural factors, and COVID-19 epidemiology. Given these differences, conducting a study focused on Egypt could help us understand the prevalence and unique population-specific predictors of post-COVID syndrome specific to the Egyptian population.

To the best of our knowledge, this is the first systematic review and meta-analysis conducted at a national level to determine the prevalence of post-COVID syndrome. The findings from this study can contribute to a better understanding of post-COVID syndrome in the Egyptian population and inform strategies to manage the condition.

Methods

Search strategy

A comprehensive literature search was conducted until July 30, 2023, in the following databases: MEDLINE [PubMed], Scopus, Google Scholar, and Web of Science, using the following keywords: "Post-Acute Sequelae of SARS-CoV-2 Infection" OR "PASC" OR "Post-Acute Sequelae of COVID-19" OR "Long COVID" OR "Long Haul COVID" OR "Long-Haul COVID" OR "COVID Long Haulers" OR "Chronic COVID Syndrome" OR "Post-COVID Syndrome" OR "Post-COVID Syndrome" OR "Post-Acute COVID-19 Syndrome" OR "Post-Acute COVID Syndrome" OR PACS) AND "Egypt*". The search was restricted to articles written in English. The Preferred Reporting Items for Systematic Reviewers and Meta-analysis (PRISMA) criteria were followed.

Eligibility criteria

The inclusion criteria were as follows: 1) Peer-reviewed research published in Egypt that documented symptoms and signs 4 weeks or longer after initial symptoms in COVID-19 survivors 2) All types of study designs were considered. For the post-COVID-19 pulmonary fibrosis outcome, studies with a clear definition of fibrosis that contained both fibrotic and non-fibrotic groups for comparison were included.

The exclusion criteria for this study included studies that were not written in English as well as studies in which all patients were not evaluated for a minimum of 28 days. Studies were selected based on the aforementioned inclusion and exclusion criteria by AZ and cross-checked by HK. The authors reached a consensus to resolve any disagreements.

Data extraction

AZ carried out the data extraction, and HK cross-checked it. From each included study, the following was extracted: the last name of the first author, publication year, study design, sample size, male to female percentage, percentage of individuals with mild/moderate/severe COVID, frequency of relevant outcomes, relevant data to calculate the odds ratio of potential risk factors, follow-up period, age range of participants, population studied, and assessment method.

Quality assessment

To assess the risk of bias among the included study designs, we used a checklist-based tool from the Joanna Briggs Institute, specifically designed for prevalence studies. This critical appraisal tool allowed us to thoroughly evaluate the quality of the studies and identify any potential sources of bias [14]. The quality of the studies was appraised independently by AZ and cross-checked by HK.

Data synthesis

The statistical analysis was conducted using Comprehensive Meta-Analysis (CMA) V3 software from Biostat, NJ. To determine the prevalence of persistent symptoms among COVID-19 survivors, results were presented as proportions (%) with a 95% confidence interval (CI). In assessing the risk factors associated with PACS, odds ratios with 95% CI were utilized. All results were reported based on the random effects model. I-squared and Cochran's Q were used to measure the heterogeneity between the studies. Sensitivity analyses using the leave-one-out approach were performed to test the robustness of the results. Publication bias was not tested if the number of included studies was less than 10 [15].

Results

Study selection

The identification and inclusion processes of the studies are illustrated in Fig. 1.

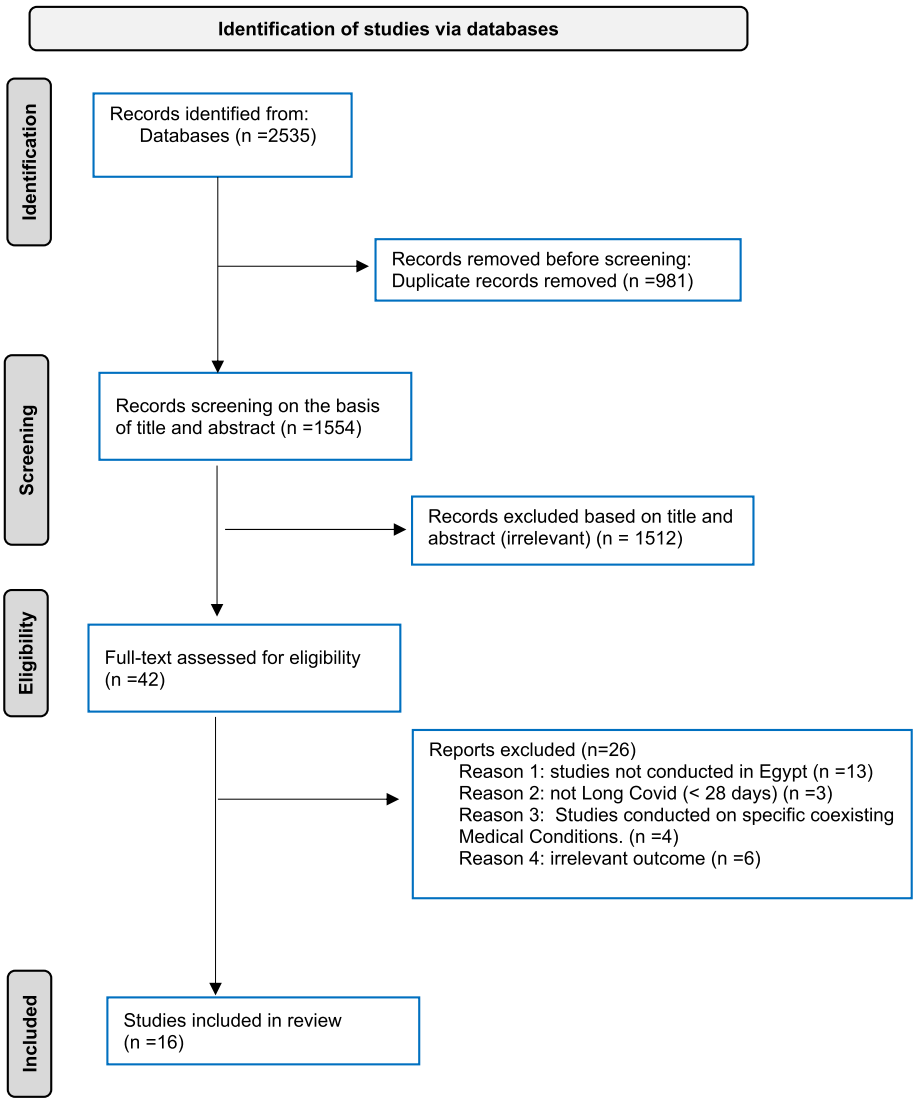

Fig. 1 Flow chart depicting the selection of publications

A comprehensive literature search yielded 2535 records, from which 981 duplicates were removed, leaving 1554 articles for title and abstract evaluation. Out of the 1554 articles, 1512 were deemed irrelevant and excluded. The remaining 42 articles underwent full-text evaluation for eligibility, and 26 were excluded, ultimately resulting in 16 studies being included [16–31]. The characteristics of the included studies can be found in Table 1. The checklist of items to include when reporting a systematic review or meta-analysis, the PubMed search strategy, and the quality assessment of the included studies are presented in Tables S1–S3, respectively.

Participants

A total of 3097 COVID-19 survivors, with an age range of 3 to 94 years, were included in the analysis. Among the 16 studies, 10 had a higher proportion of females compared to males, while 4 had a higher proportion of males compared to females. One study had an equal ratio of males to females, and another study had only female participants (Table 1). Most of the studies encompassed a heterogeneous cohort comprising patients with diverse COVID-19 severities, encompassing both hospitalized and non-hospitalized cases.

The assessment time

The assessment time for the included studies ranged from more than a month to 6 months following discharge. Some studies estimated the follow-up timing after hospital discharge, whereas others calculated it after the first episode of symptoms or hospitalization.

The prevalence of at least one symptom in post-COVID-19 survivors

The pooled prevalence of COVID-19 survivors experiencing at least one unresolved symptom, regardless of hospitalization status, was high at 78.3% (95% CI: 56.8 to 90.7) (Fig. 2). Fifty-four clinical symptoms or conditions (Fig. 3) have been reported; see supplementary file Tables S4–S11.

Table 1 The characteristics of the included studies

Author (Publication Year)	Study design	N	Age	Male to female ratio %	Mild / moderate/ severe %	Follow-up period (month)	Population	Assessment method
Abdelhafiz (2022) [23]	CS	396	41.4	33.3/66.7	81.3/18.7	> 1	general population	on-line
Kamal (2020) [22]	CS	287	32.3 ± 8.5	35.9/64.1	80.2/14.9/4.9	> 1	general population	on line
Khalaf (2022) [21]	CS	538	5–87	54.1/45.1	61.3/31/7.6	> 1	general population	phone / visit
Gamal (2022) [20]	prospective cohort	170	55.46 ± 16.07	37.7/62.3	55.9/27.6/16.5	1.5	general population	_
Aly (2021) [19]	CS	115	73.18 ± 6.42	100 females	_	1	elderly female	online
Ezzelregal (2021) [18]	CS	102	20– > 55	39.2/60.8	_	> 1	general population	in-person
Elmazny (2023) [31]	CS	1638	38.28 ± 13	34.7/65.3	83.4/11.8/4.8	2	general population	in-person
Galal (2021) [30]	CS	430	37.4 ± 12.6	36.3/63.7	_	_	general population	patient are recruited to fill in questionnaire
Magdy (2022) [29]	Case-control	204	36 (30–42.75)	26 /74	80.9/13.7/5.4	3	general population	in-person
Shendy (2021) [28]	CS	81	21–40	26/68	_	3 to 5	general population	in-person
Ibrahim (2022) [27]	CS	140	3_18	61.4/38.6	62.9/21.4/15.7	> 1	Children	in-person
Mady (2021) [26]	retrospective observational	164	17–82	54.9/45.1	50/37/13	3	general population	medical records
Tohamy (2021) [25]	retrospective comparative	100	55.5 ± 6.2	57/43	30/25/45	> 1	general population	in-person
Ahmed (2021) [16]	CS	182	46.49 ± 17.4	46.2/53.8	_	6	general population	in-person
Ali (2022) [24]	CS	80	43.2(25–75)	50/50	38/42	1.5–3	general population	in-person
Yasin (2021) [17]	Cohort	210	53.85(18–94)	29/71	_	> 1	general population	in-person

Abbreviation: *Cs* Cross sectional

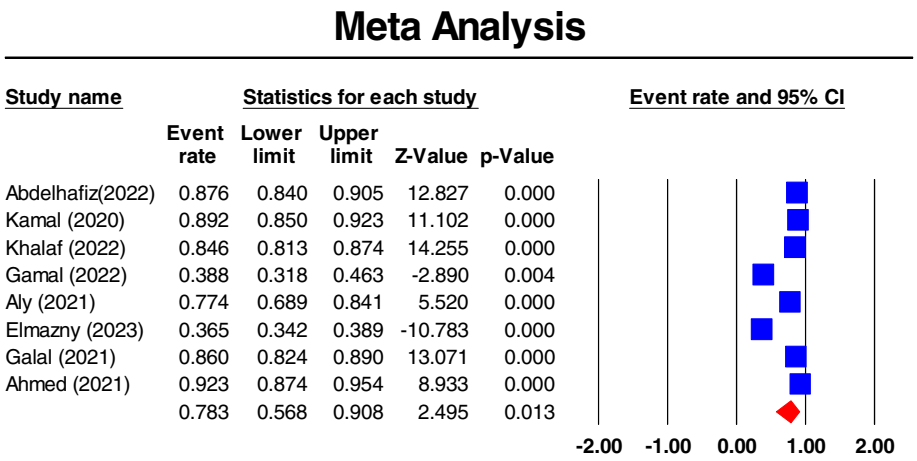

Fig. 2 The prevalence of at least one symptom in post-COVID-19 survivors

The prevalence of symptoms reported in two or more studies

Fatigue was the most commonly reported symptom across various studies of post-COVID survivors, affecting approximately half of all survivors at 48.1%, followed by bone ache or myalgia at 32.9%, anorexia at 32.8%, and anxiety at 31.5%. Figure 4 and Table 2 illustrate the long-term manifestations of COVID-19 in Egypt. Among musculoskeletal symptoms, bone ache or myalgia was the most frequently reported, while anorexia was the most frequent among gastrointestinal symptoms. Anxiety was the most common psychological symptom reported, while dyspnea was the most common respiratory symptom. Anosmia was the most frequent neurological manifestation reported. In contrast, obsessive-compulsive disorder, tinnitus, sore throat, vomiting or nausea, skin rash, and tingling and numbness were reported the least frequently among post-COVID survivors.

The prevalence of post-COVID-19 pulmonary fibrosis (PCPF)

Two studies, which had a combined total sample size of 290 hospitalized patients and provided a clear definition of fibrosis, reported the prevalence of pulmonary fibrosis among hospitalized Covid survivors as 31.3% and 48.1%, respectively. The pooled prevalence of pulmonary fibrosis from these two studies was 40% (95% CI 25 to 57) (Fig. 5).

Risk factors associated with PACS

Out of the 16 studies reviewed, three of them, which included a total of 2572 patients, investigated the relationship between severe COVID and sex as risk factors for PACS [21, 23, 31]. There were also three studies that reported the association between PCAS and the presence of any comorbidity, with a total sample size of 1104 patients [20, 21, 23]. The combined results of these studies showed that female sex was significantly associated with PACS (OR 1.6, 95% CI 1.4 to 1.2, $P<0.001$) (Fig. 6). Additionally, severe COVID and the presence of any comorbidity were found to be independent risk factors for PACS, with odds ratios of 2.3 (95% CI 1.4 to 4.7 $P=0.01$) and 1.8 (95% CI 1.2 to 2.6 $P=0.001$), respectively (Figs. 7 and 8).

Sensitivity analyses

The reliability of the combined estimates of the prevalence of any symptoms was confirmed through sensitivity analyses using the leave-one-out approach, which showed that the results were not dependent on any one study. However, in the association between PACS and the severity of COVID the pooled odds ratio appeared to be dependent on either Abdelhafiz [23] or Elmazny [31]. The absence of Abdelhafiz [23] and Elmazny [31] reduces the overall odds ratio, resulting in statistically insignificant results (Fig. 7). Otherwise, sensitivity analysis revealed that all pooled estimates are reliable (Figs. 6 and 8).

Discussion

The COVID-19 pandemic has had a significant impact on global health, with millions of people being infected and many experiencing long-term symptoms known as post-acute COVID-19 syndrome (PACS). This meta-analysis, focused on Egypt, provides valuable insights into the prevalence and risk factors associated with

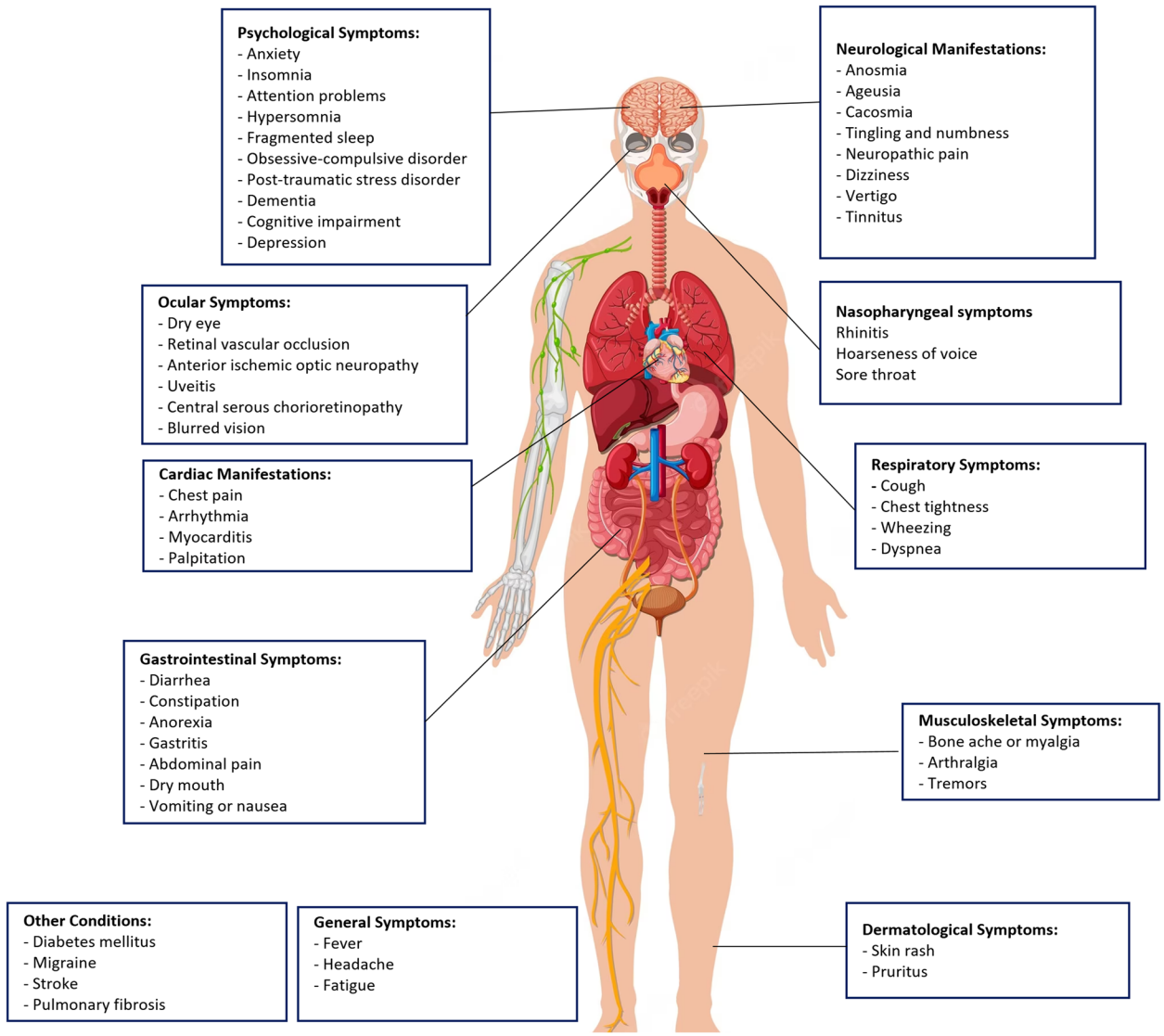

Fig. 3 Reported long-term manifestations and conditions of Coronavirus disease 2019 (COVID-19) in Egypt

PACS. The meta-analysis included 16 studies and 3097 COVID-19 survivors, with an age range of 3 to 94 years. The results showed that 78.3% of survivors experienced at least one unresolved symptom, indicating a high prevalence of PACS in Egypt. Fatigue was the most commonly reported symptom, affecting approximately half of all survivors, followed by bone ache, anorexia, anxiety, dyspnea, and anosmia. Notably, the study found that female sex, severe COVID, and the presence of any comorbidity were independent risk factors for PACS. Additionally, the pooled prevalence of post-COVID-19 pulmonary fibrosis among hospitalized COVID survivors was 40%, which is a significant concern given the potential long-term impact on respiratory health.

In context with the global prevalence, a meta-analysis of 50 studies on post-COVID-19 conditions estimated the pooled prevalence of post-COVID-19 conditions at 43%, with hospitalized patients having a higher prevalence than non-hospitalized patients and fatigue being the most commonly reported symptom, followed by memory problems [12]. In a more recent systematic review and meta-analysis of 194 studies involving 735,006 participants, with the majority of studies conducted in Europe and Asia, the results showed that at least 45% of COVID-19 survivors, regardless of hospitalization status, experienced at least one unresolved

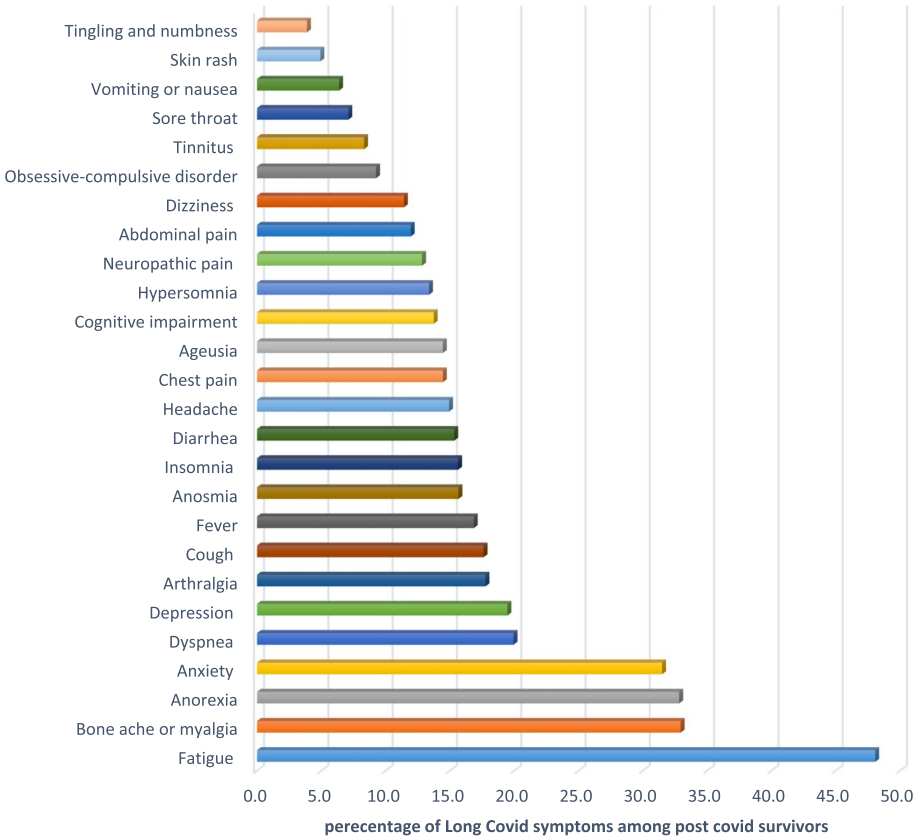

Fig. 4 Long-term manifestations of Coronavirus disease 2019 (COVID-19) in Egypt. Frequencies calculated by meta-analysis of reported studies

symptom, with fatigue being the most frequently reported symptom across hospitalized, non-hospitalized, and mixed cohorts [32].

There is also evidence of a regional difference in the prevalence of PACS. The regional prevalence estimates were highest in Asia, followed by Europe and the United States of America in one meta-analysis [12]. But in contrast to another meta-analysis that found that the pooled prevalence of at least one symptom was higher in Europe than in North America and Asia, The estimated pooled prevalence for Europe was 62.7%, compared to 38.9% in North America and 40.9% in Asia. This difference was statistically significant between Europe and Asia [32]. Overall, these studies highlight the importance of understanding regional differences in the prevalence of COVID-19 symptoms to improve treatment and support for affected populations.

A study that included 13 studies with a total of 2018 patients to investigate the prevalence and risk factors associated with post-COVID-19 pulmonary fibrosis found that the prevalence of PCPF was 44.9%, with fibrotic patients being older and more likely to suffer from persistent symptoms. The most common lung abnormalities found in fibrotic patients included parenchymal bands, ground-glass opacities, interlobular septal thickening, and consolidation [33].

Regarding risk factors associated with PACS, a global meta-analysis of 41 studies involving 860,783 patients found that female sex, age, high BMI, smoking, comorbidities, and previous hospitalization or ICU admission were associated with an increased risk of developing PACS [34]. However, patients who had been fully vaccinated against COVID-19 had a significantly lower risk of developing PCC [34]. According to our study, female sex, severe COVID, and the presence of any comorbidity were independent risk factors for PACS among the Egyptian population ($P < 0.05$).

Additionally, the type of medication administered during COVID-19 may be a potential risk factor for the development of PACS. Among the included studies, two reports addressed such associations [21, 23]. Khalaf et al. showed that treatment with hydroxychloroquine, azithromycin, and multivitamins were the only factors associated with PACS [21]. Similarly, Abdelhafez et al. found that the development of post-COVID symptoms significantly increased by 2 and 4 folds, respectively, with the administration of antibiotics and corticosteroids [23]. The association between antibiotics and PACS may

Table 2 Long-term manifestations of Coronavirus disease 2019 (COVID-19) in Egypt. Frequencies calculated by meta-analysis of reported studies

Symptoms	Number of Studies	Point estimate %	95% CI Lower limit %	95% CI Upper limit %	Q-value	*P*-value	I-squared
Fatigue	9	48.1	32.3	64.2	555.6	< 0.001	98.6
Bone ache or myalgia	5	32.9	12.5	62.8	406.8	< 0.001	99.0
Anorexia	2	32.8	17.7	52.5	35.5	< 0.001	97.2
Anxiety	5	31.5	19.4	11.2	110.2	< 0.001	96.4
Dyspnea	6	19.9	14.6	26.7	46.9	< 0.001	89.3
Depression	5	19.5	11.9	30.1	77.8	< 0.001	94.9
Arthralgia	6	17.8	7.3	37.1	292.8	< 0.001	98.3
Cough	6	17.6	8.1	34.3	263.9	< 0.001	98.1
Fever	5	16.8	7.0	35.3	202.3	< 0.001	98.0
Anosmia	6	15.7	6.5	33.0	399.5	< 0.001	98.7
Insomnia	4	15.6	11.7	20.6	10.9	< 0.001	72.5
Diarrhea	4	15.3	8.5	26.0	38.2	< 0.001	92.1
Headache	7	14.9	6.8	29.6	412.4	< 0.001	98.5
Chest pain	2	14.4	2.9	48.8	65.6	< 0.001	98.5
Ageusia	6	14.4	5.4	33.5	455.4	< 0.001	98.9
Cognitive impairment	3	13.7	7.5	23.7	23.0	< 0.001	91.3
Hypersomnia	2	13.4	9.7	18.1	0.2	0.6	0.0
Neuropathic pain	2	12.8	11.4	14.4	0.5	0.5	0.0
Abdominal pain	2	11.9	4.5	28.0	7.9	< 0.001	87.4
Dizziness	2	11.4	6.5	19.4	3.5	0.1	71.1
obsessive–compulsive disorder	2	9.2	2.6	27.6	15.8	< 0.001	93.7
Tinnitus	2	8.3	7.1	9.7	0.7	0.4	0.0
Sore throat	4	7.1	1.5	28.2	148.6	< 0.001	98.0
Vomiting or nausea	4	6.4	2.9	13.3	27.7	< 0.001	89.2
Skin rash	3	4.9	3.2	7.4	3.0	0.2	34.2
Tingling and numbness	2	3.9	2.6	5.7	0.7	0.4	0.0

be attributed to the capability of antibiotics to disrupt the microbiota, which has been suggested as a potential mechanism contributing to the development of PACS [9]. Notably, Abdelhafez et al. were the first to report the association between antibiotics and PACS. Worldwide, there are two other reports on the association between antibiotic treatment and PACS. One study reported the use of antibiotics as an independent risk factor for PACS [35]. The other study found patients treated with antibiotics had an increased risk of developing post-COVID-19 syndrome, but it was not statistically significant [36]. Therefore, additional research will help to provide a more comprehensive understanding of the potential impact of antibiotics on the development of PACS and clarify the significance of this association.

The findings of this meta-analysis have several implications for healthcare providers and policymakers in Egypt and other countries. The high prevalence of PACS highlights the need for ongoing monitoring of COVID-19 survivors and the provision of appropriate care and support to manage their symptoms. The identification of risk factors for PACS, such as female sex, severe COVID condition and comorbidities, suggests that targeted interventions may be necessary to reduce the risk of long-term complications in vulnerable populations.

To further enhance the quality of future research, we recommend the following: First, a comparative study with a COVID-negative control, a unified standard outcome, and a clear statement of the assessment time, hospitalization status, and patient sociodemographics Second, a minimum sample size of approximately 377 COVID-19 survivors would be needed for a study to estimate the prevalence of unresolved symptoms in COVID-19 survivors with a margin of error of 5% and a confidence level of 95% based on the highest sample size calculated from the lower limit of the 95% CI from this study, where the pooled prevalence was 78.3% (95% CI: 56.8 to 90.7).

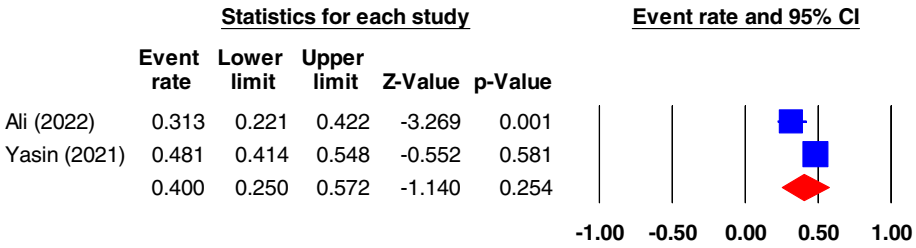

Fig. 5 The prevalence of post-COVID-19 pulmonary fibrosis (PCPF)

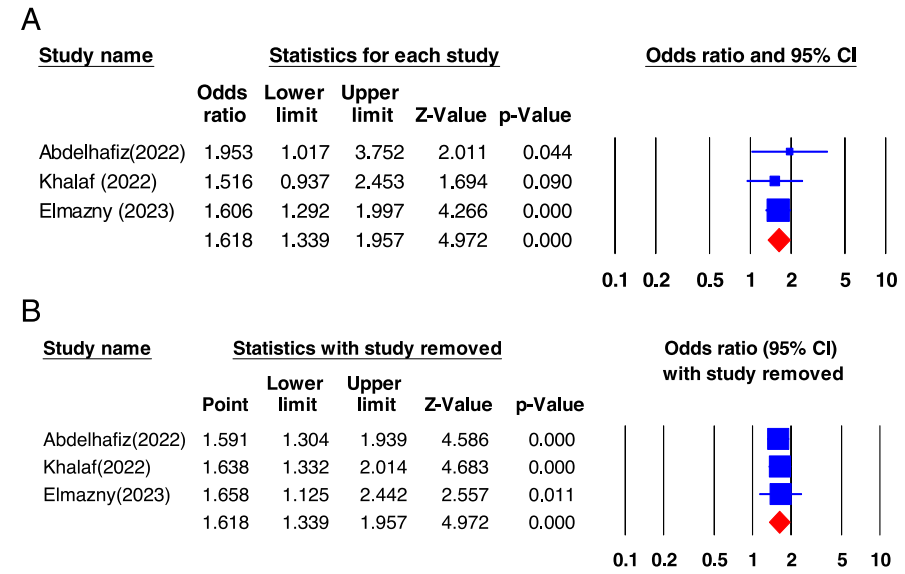

Fig. 6 Meta-analysis of the association between female sex compared to males and post-COVID syndrome. **A** Forest plot. **B** Sensitivity analysis using a leave-one-out approach

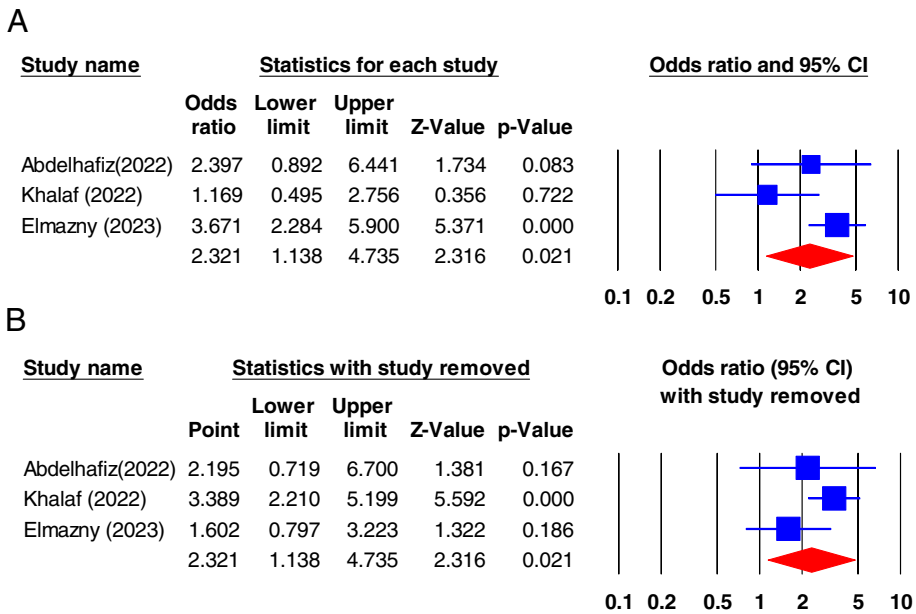

Fig. 7 Meta-analysis of the association between severe Covid cases compared to mild cases and post-COVID syndrome. **A** Forest plot. **B** Sensitivity analysis using a leave-one-out approach

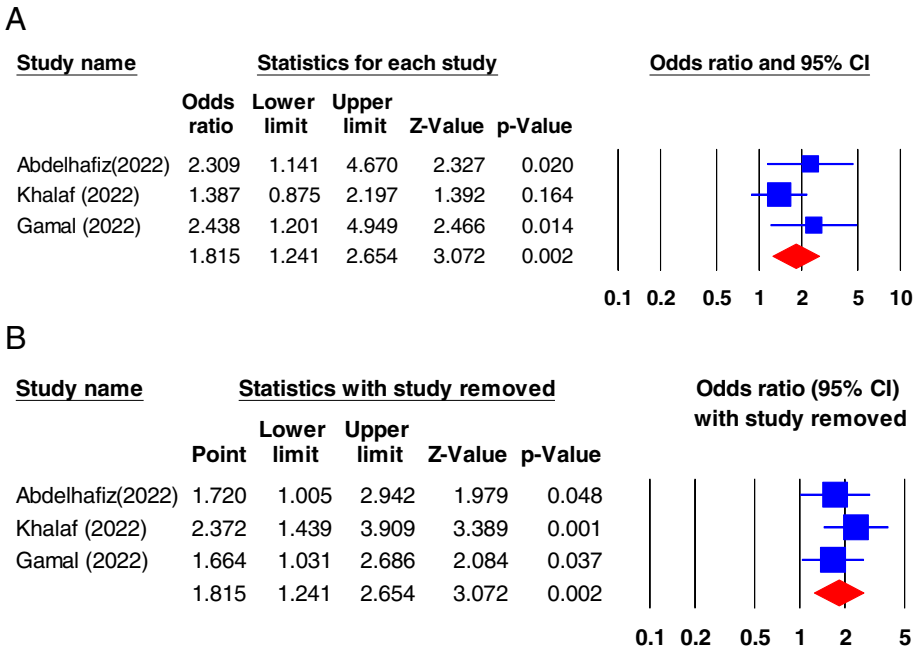

Fig. 8 Meta-analysis of the association between the presence of any comorbidity compared to non-comorbid post-COVID survivors and post-COVID syndrome. **A** Forest plot. **B** Sensitivity analysis using a leave-one-out approach

It is important to take into account certain limitations of this study. Specifically, the meta-analysis included studies with varying designs, sample sizes, and follow-up durations, which could have influenced the accuracy of the prevalence estimates due to heterogeneity.

Conclusion

In conclusion, this meta-analysis provides important insights into the prevalence and risk factors of PACS in Egypt. With the ongoing impact of the COVID-19 pandemic, further research is needed to confirm these findings and explore other potential risk factors and predictors of PACS. The identification of effective strategies to manage and prevent PACS will be critical for improving the long-term health outcomes of COVID-19 survivors.

Abbreviations

PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
COVID-19	Coronavirus disease 2019
PACS	Post-Acute Sequelae of COVID-19
CDC	Centers for Disease Control and Prevention
WHO	World Health Organization
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
ONS	Office for National Statistics
PCAS	Post-COVID-19 syndrome
PCC	Post-COVID-19 conditions
Cs	Cross sectional
PCPF	Post-COVID-19 Pulmonary Fibrosis
BMI	Body Mass Index
CI	Confidence interval

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43162-023-00252-x.

Additional file 1: Table S1. Checklist of items to include when reporting a systematic review or meta-analysis. **Table S2.** PubMed search strategy. **Table S3.** Quality assessment of the included studies. **Table S4.** Frequency of general Symptoms and nasopharyngeal Symptoms among Covid-survivors. **Table S5.** Frequency of Respiratory Symptoms among Covid-survivors. **Table S6.** Frequency of Psychological Symptoms among Covid-survivors. **Table S7.** Frequency of Musculoskeletal Symptoms among Covid-survivors. **Table S8.** Frequency of Gastrointestinal Symptoms among Covid-survivors. **Table S9.** Frequency of Neurological manifestation among Covid-survivors. **Table S10.** Frequency of dermatological symptoms among Covid-survivors. **Table S11.** Frequency of cardiac manifestation among Covid-survivors. **Table S12.** Frequency of other conditions among Covid-survivors.

Acknowledgements
None

Authors' contributions
Ahmed Azzam designed and planned this investigation. The retrieval and screening of studies were handled by Ahmed Azzam and cross-checked by Heba Khaled. Heba Khaled was in charge of the data collection and analysis, which was cross-checked by Ahmed Azzam. All authors contributed to the data interpretation and manuscript writing. The author read and approved the final version of the manuscript.

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Availability of data and materials
All data generated or analyzed during this study are included in this published article [and its supplementary information file].

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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