

DEMOGRAPHIC AND EPIDEMIOLOGICAL PROFILE OF LONG COVID-19: SCOPING REVIEW**PERFIL DEMOGRÁFICO Y EPIDEMIOLÓGICO DE LA COVID-19 PROLONGADA: REVISIÓN DE ALCANCE****PERFIL DEMOGRÁFICO E EPIDEMIOLÓGICO DA COVID-19 LONGA: REVISÃO DE ESCOPO**¹Ana Cristina Ribeiro²Júlia Hellen Ferreira de Sousa³Camilly Victória da Silva⁴Sílvia Carla da Silva André Uehara¹Universidade Federal de São Carlos,
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E-mail: a.crisrib@gmail.com**Submission:** 01-03-2025**Approval:** 22-08-2025**ABSTRACT**

Introduction: In 2023, the World Health Organization (WHO) declared the end of the global public health emergency of the novel coronavirus disease (COVID-19). However, a growing number of patients have reported prolonged symptoms after viral infection. **Objective:** To map the scientific evidence on long COVID symptoms, considering demographic and epidemiological profiles and vaccination status. **Methods:** This is a scoping review. Searches were conducted in LILACS, PubMed, SCOPUS, Web of Science, SCIELO, and LitCovid databases. **Results:** Twenty-seven articles were selected, showing the development of long COVID in different age groups, with a higher prevalence among females. The presence of comorbidities and hospitalization was associated with the development of long COVID, and vaccination against COVID-19 was considered a protective factor. The most frequently observed symptoms were fatigue, shortness of breath, sleep disturbances, changes in memory or concentration, and changes in smell or taste. **Conclusion:** This analysis revealed the most frequent symptoms of long COVID to be fatigue, shortness of breath, sleep disturbances, changes in memory or concentration, and changes in smell or taste, with variations observed across different age groups and among females. Furthermore, people with comorbidities and those who were not vaccinated were at greater risk of developing long COVID.

Keywords: Post-Acute COVID-19 Syndrome; Signs and Symptoms; Risk Factors.

RESUMEN

Introducción: en 2023, la Organización Mundial de la Salud (OMS) declaró el fin de la emergencia de salud pública mundial por la enfermedad del nuevo coronavirus (COVID-19); sin embargo, un número creciente de pacientes ha manifestado síntomas prolongados tras la infección viral. **Objetivo:** mapear la evidencia científica sobre los síntomas de la COVID prolongada, teniendo en cuenta el perfil demográfico, epidemiológico y la situación de vacunación. **Métodos:** se trata de una revisión de alcance, las búsquedas se realizaron en las bases LILACS, PubMed, SCOPUS, Web of Science, SCIELO y LitCovid. **Resultados:** se seleccionaron 27 artículos, que evidencian el desarrollo de la COVID prolongada en diferentes grupos de edad, con una mayor prevalencia entre las mujeres. La presencia de comorbilidades y la hospitalización se asociaron con el desarrollo de la COVID prolongada, y la vacunación contra la COVID-19 se consideró un factor protector. Los síntomas observados con mayor frecuencia fueron fatiga, dificultad para respirar, trastornos del sueño, alteraciones de la memoria o la concentración y alteraciones del olfato o el gusto. **Conclusión:** este análisis mostró que los síntomas más frecuentes de la COVID prolongada son fatiga, dificultad para respirar, trastornos del sueño, alteraciones de la memoria o la concentración y alteraciones del olfato o el gusto, además de una edad variada y ser mujer. Además, las personas con comorbilidades y no vacunadas presentaban un mayor riesgo de desarrollar COVID prolongada.

Palabras clave: Síndrome Posagudo de COVID-19; Signos y Síntomas; Factores de Riesgo.

RESUMO

Introdução: em 2023, a Organização Mundial de Saúde (OMS) declarou o término da emergência de saúde pública global da doença do novo coronavírus (COVID-19), no entanto, um número crescente de pacientes tem manifestado sintomas prolongados da após a infecção viral. **Objetivo:** mapear as evidências científicas sobre os sintomas de COVID longa, considerando o perfil demográfico, epidemiológico e situação vacinal. **Métodos:** trata-se de uma revisão de escopo, as buscas foram realizadas nas bases LILACS, PubMed, SCOPUS, Web of Science, SCIELO e LitCovid. **Resultados:** foram selecionados 27 artigos, evidenciando o desenvolvimento da COVID longa em diversas faixas etárias, uma maior prevalência entre o sexo feminino. A presença de comorbidades e hospitalização foram associados ao desenvolvimento da COVID longa e a vacinação contra a COVID-19 foi considerada um fator protetor. Os sintomas frequentemente observados foram a fadiga, falta de ar, distúrbios do sono, alterações na memória ou concentração e alterações no olfato ou paladar. **Conclusão:** esta análise mostrou os sintomas mais frequentes da COVID longa como fadiga, falta de ar, distúrbios do sono, alterações na memória ou concentração e alterações no olfato ou paladar, além de faixa etária variada e ser do sexo feminino. Ainda, pessoas com comorbidades e não vacinadas apresentaram maior risco de desenvolver a COVID longa.

Palavras-chave: Síndrome de COVID-19 Pós-Aguda; Sinais e Sintomas; Fatores de Risco.



INTRODUCTION

In 2023, the World Health Organization (WHO) declared the end of the global public health emergency of the novel coronavirus disease (COVID-19); however, viral infection still requires long-term disease control and management. It should be noted that this pandemic represented the most significant global health crisis in recent decades, of unprecedented severity. In addition, COVID-19 has been associated with long-term symptoms in a substantial proportion of infected patients. Thus, post-COVID conditions, also known as long COVID, have been defined as the persistence of symptoms or the onset of new symptoms without justification for at least 2 months after recovery from the acute phase of the disease⁽¹⁾.

Currently, a growing number of patients have reported prolonged symptoms of COVID-19, with people who required admission to the Intensive Care Unit (ICU) and ventilatory support having a higher chance of developing long COVID. However, the onset of prolonged symptoms has also been noted in patients with mild to moderate symptoms⁽²⁾.

The symptoms of long COVID can be indeterminate or recurring, affecting people's overall health and daily quality of life⁽¹⁾. Most of these individuals suffer from at least one symptom during the recovery period, and the dominant ongoing symptoms reported are psychosocial distress, joint pain, fatigue, memory and attention deficits, shortness of breath, chest pain, palpitations, loss of smell and taste, and hair loss⁽³⁾.

It should be noted that both the diagnosis and prognosis of long COVID are unclear and may depend on the severity of clinical symptoms, underlying comorbidities, and response to therapy. The WHO has estimated that 10 to 20% of people with COVID-19 experience ongoing symptoms months after the acute infection, recognizing that this condition is a public health concern due to its significant impact on society, ranging from increased healthcare costs to economic and productivity losses⁽²⁾.

Considering the growing number of people reporting prolonged symptoms of COVID-19, attention should be paid to the identification, documentation, and investigation of these long-term complications, as they contribute to a more profound understanding of the clinical characteristics and the development of treatments, in addition to diagnosis and care. The clinical characteristics of patients with long COVID are essential for providing appropriate treatment options and understanding the disease phenotypes that arise in different individuals^(2,4).

In this context, it is emphasized that knowledge about the symptoms of long COVID, considering differences in gender, age, presence of comorbidities, and vaccination status, contributes to identifying gaps in knowledge on the subject, highlighting the need for studies on specific topics related to this condition. Thus, this study aimed to map the scientific evidence on the symptoms of long COVID, considering the demographic and epidemiological profile, as well as vaccination status.

METHOD

Type of study

This is a scoping review based on the principles outlined by the Joanna Briggs Institute (JBI)⁽⁵⁾. The JBI proposal, represented by the acronym “PCC,” which stands for “P” Population, “C” Concept, and “C” Context, was applied to the search criteria for the review. The guiding question of the study was developed in line with the PCC method, with “P” (people with long COVID), “C” (demographic, epidemiological, and vaccination profile), and “C” (COVID-19 pandemic), defined as: What are the symptoms identified in people with long COVID, according to gender, age, presence of comorbidities, and vaccination status?

The inclusion criteria were defined as primary studies published in English, Portuguese, or Spanish, indexed in one of the databases above, and published between January 1, 2020, and June 30, 2024. As for exclusion criteria, articles that were duplicates, editorials,

protocols, systematic reviews, information from websites and other media, and studies that did not address the guiding question of the research were not eligible. The reference lists of all studies found were also examined.

The research was conducted between July and September 2024. Searches were performed in the Latin American and Caribbean Health Sciences Literature (LILACS), US National Library of Medicine National Institutes of Health (PubMed), SCOPUS, Web of Science, Scientific Electronic Library Online (SCIELO), and LitCovid databases.

These searches were conducted using descriptors and their synonyms listed in the Health Sciences Descriptor (DeCS) and Medical Subject Headings (MeSH), as shown in Table 1.

Table 1 - Search strategies used in databases. São Carlos, SP, Brazil, 2025.

DATABASE	SEARCH STRATEGIES
PubMed	(Vaccination OR "Active Immunization" OR Vaccinations OR Vacunación OR Inmunización Activa OR Vacinação OR Imunização Ativa) AND (Post-Acute COVID-19 Syndrome OR Síndrome Pós-Covid 19 Aguda OR COVID Longa OR COVID de Longo Curso OR transtornos post-COVID). (Demography OR Demographics OR Demografía OR Demografia OR Demográfico) AND (Post-Acute COVID-19 Syndrome OR Síndrome Pós-Covid 19 Aguda OR COVID Longa OR COVID de Longo Curso OR transtornos post-COVID). ("Health Profile") OR (Epidemiological Profile) OR (Epidemiological Profiles) AND (Post-Acute COVID-19 Syndrome OR Síndrome Pós-Covid 19 Aguda OR COVID Longa OR COVID de Longo Curso OR transtornos post-COVID).
LILACS	(vacinação) OR (imunização ativa) OR (vacunación) OR (inmunización)

	activa) OR (vaccination) OR (active immunization) AND (post-acute covid-19 syndrome) OR (síndrome post agudo de covid-19) OR (covid longa) AND (db:("LILACS")) (Demography OR Demographics OR Demografía OR Demográfico OR Demografia OR Demográfico OR "Impacto Demográfico") AND ("Post-Acute COVID-19 Syndrome" OR "COVID Longa" OR "COVID de Longo Curso") [Palavras]. (Perfil de Saúde OR Perfil Epidemiológico OR Perfil de Salud OR Health Profile OR Epidemiological Profile) AND ("Post-Acute COVID-19 Syndrome" OR "COVID Longa" OR "COVID de Longo Curso") [Palavras].
SCOPUS	TITLE-ABS-KEY ((vaccination OR "Active Immunization") AND ("Post-Acute COVID-19 Syndrome" OR "COVID Longa" OR "COVID de Longo Curso"))). TITLE-ABS-KEY (demografia OR demography OR demographics AND "Post-Acute COVID-19 Syndrome" OR "COVID Longa" OR "COVID de Longo Curso"). (ALL ("Health Profile") OR TITLE-ABS-KEY ("Epidemiological Profile") OR TITLE-ABS-KEY ("Perfil Epidemiológico") AND TITLE-ABS-KEY ("Epidemiological Profiles") OR TITLE-ABS-KEY ("Post-Acute COVID-19 Syndrome") OR TITLE-ABS-KEY ("COVID Longa") OR TITLE-ABS-KEY ("COVID de Longo Curso") OR TITLE-ABS-KEY ("post-covid") AND TITLE-ABS-KEY (conditions))
SCIELO	(Vacinação) OR (Imunização Ativa) OR (Vacunación) OR (Inmunización Activa) OR (Vaccination) OR (Active Immunization) AND (Post-Acute COVID-19 Syndrome) OR (Síndrome Post Agudo de COVID-19) OR (COVID Longa). (Demografia) AND (Demográfico) OR (Impacto Demográfico) OR (Demografía) OR (Demography) OR (Demographics) AND (Post-Acute COVID-19 Syndrome) OR (Síndrome Post Agudo de COVID-19) OR (COVID Longa). (Perfil de Saúde) AND (Perfil Epidemiológico) OR (Perfis Epidemiológicos) OR (Perfil de Salud) OR (Perfil Epidemiológico) OR (Perfiles Epidemiológicos) OR (Health Profile) OR (Epidemiological Profile) OR (Epidemiological Profiles) AND (Post-Acute COVID-19 Syndrome) OR (Síndrome Post Agudo de COVID-19) OR (COVID Longa).
Web of Science	(Vaccination OR "Active Immunization" OR Vaccinations OR Vacunación OR Inmunización Activa OR Vacinação OR Imunização Ativa) AND (Post-Acute COVID-19 Syndrome OR COVID Longa OR COVID de Longo Curso OR post-acute sequelae of SARS-CoV-2 infection OR post-COVID conditions) (Topic) and Article (Types of document). (Demography OR Demographics OR Demografía OR Demografia OR Demográfico) AND (Post-Acute COVID-19 Syndrome OR COVID Longa OR COVID de Longo Curso OR post-acute sequelae of SARS-CoV-2 infection OR post-COVID conditions) (Topic) and Article (Types of documents).

	(Perfil de Saúde OR Perfil Epidemiológico OR Perfil de Salud OR Health Profile OR Epidemiological Profile) AND (Post-Acute COVID-19 Syndrome OR COVID Longa OR COVID de Longo Curso OR post-acute sequelae of SARS-CoV-2 infection OR post-COVID conditions) (Topic) and Article (Types of documents).
Lit Covid	(Vaccination OR "Active Immunization") AND (Demography OR Demographics) AND ("Health Profile" OR "Epidemiological Profile") AND (Post-Acute COVID-19 Syndrome OR post-acute sequelae of SARS-CoV-2 infection OR post-COVID conditions OR LONG COVID) (LIMIT-TO TITLE). ("Health Profile" OR "Epidemiological Profile" OR "Epidemiological Profiles") AND ("Post-Acute COVID-19 Syndrome" OR "post-covid").

Source: The authors, 2024

After implementing the search strategy in each database, the identified references were imported into the State of the Art through Systematic Review (StArt) software⁽⁶⁾, where a two-stage selection process was performed. The first stage involved analyzing titles and abstracts, while the second stage entailed reading the articles in full. The studies eligible for this review were retrieved for full reading and evaluated by three researchers. We discussed disagreements until a consensus was reached for the final selection.

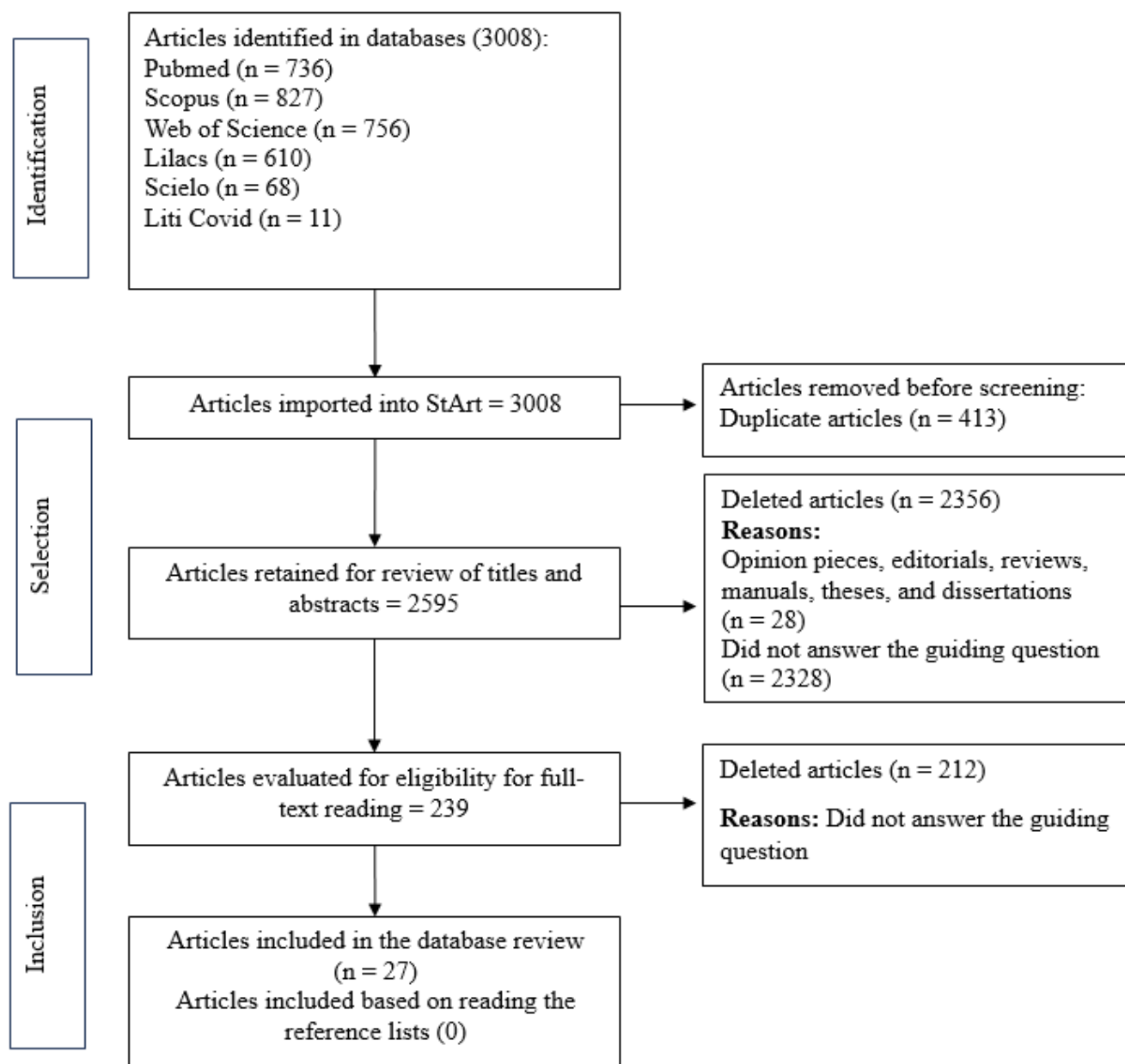
Data collection was performed following the guidelines of the *Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews* (PRISMA-ScR)⁽⁷⁾. Information regarding the article selection process is presented in a flowchart, and relevant data from each article were extracted and presented in a descriptive chart.

As this is a review study, approval by the Research Ethics Committee was not required.

RESULTS

In the initial search for studies, 3,008 articles were identified, of which 413 were excluded as duplicates. Subsequently, the titles and abstracts of 2,595 studies were analyzed, and 2,356 were excluded because they were editorials, protocols, systematic reviews, information from websites, and/or other media, as well as studies that did not address the research question. Thus, 239 articles were selected for full-text reading; 212 were excluded because they did not answer the research question and were not primary studies. Ultimately, 27 studies were selected (Figure 1).

Figure 1 - Flow chart of the article selection process, PRISMA-ScR. São Carlos, SP, Brazil, 2025.



It was found that all studies were published in English; 4 (14.8%) were conducted in the United States, 3 (11.1%) in Norway, 2 (7.4%) in the United Kingdom, 2 (7.4%) in Israel and India, Italy, Palestine, Japan, Switzerland, China, Hungary, Mexico, Malaysia, Korea,

Ethiopia, Iran, Austria, the Netherlands, and Jordan conducted 1 (3.70%) study, and 1 global study (3.70%). There were 22 (81.5%) cohort studies and 5 (18.52%) cross-sectional studies (Table 2).

Table 2 - Description of articles, according to author, year, location, objective, type of study, sample, and main results. São Carlos, SP, 2025.

Nº	AUTHOR, YEAR, AND LOCATION	TYPE OF STUDY AND SAMPLE (N)	MAIN RESULTS
1	Xie et al 2021 United States ⁽⁸⁾	Cohort study n = 181.384	The average age in the sample was 67 years, and approximately 92% of the participants were male. Chest pain, cough, headache, and tachycardia were slightly higher in black people, and smell problems were more frequent in white people. Shortness of breath, cough, chest pain, arrhythmia, headache, concerns about smell, hair loss, and rash were more prevalent in women. People with comorbidities and a history of hospitalization had more long COVID symptoms.
2	Arjun et al 2022 Índia ⁽⁹⁾	Cohort study n = 487	The average age was 39 years, and 40.9% of the participants were female. The most reported comorbidities were diabetes and hypertension, and the most common symptoms were fatigue, cough, shortness of breath, and chest pain. Pre-existing medical conditions and receiving two doses of COVID-19 vaccination were associated with long COVID.
3	Ayoubkhani et al 2022 United Kingdom ⁽¹⁰⁾	Cohort study n = 28.356	The average age was 46 years, 55.6% of the participants were women, and 13.6% reported having no health problems. After the first dose of the COVID-19 vaccine, there was a reduction in symptoms related to loss of smell, loss of taste, and difficulty sleeping.
4	Han et al 2022 United States ⁽¹¹⁾	Cohort study n = 397	The median age of participants was 45 years, and 141 (66%) were women. The most frequent and severe symptoms were fatigue, shortness of breath, difficulty concentrating, and loss of smell.
5	Peghin et al 2022 Italy ⁽¹²⁾	Cohort study n = 479	The average age was 53 years, with 52.6% of the participants being female. The most common comorbidities were hypertension, obesity, and diabetes. People who were not vaccinated against COVID-19 reported symptoms more frequently at 6 months compared to those who were vaccinated.
6	Abu Hamdh et al 2023 Palestine ⁽¹³⁾	Cohort study n = 669	The average age was 35.9 years, with 57% of the participants being female. Hypertension was the most common comorbidity. The most common symptoms were dyspnea, fatigue, headaches, loss of smell and taste, sleep disturbances, mental confusion, and cough. Women, people, and unvaccinated individuals were more likely to develop long COVID symptoms.
7	Brunvoll et al	Cohort study	The average age was 47 years, with 70% of the



	2023 Norway ⁽¹⁴⁾	n = 154.050	participants being female. There was a lower incidence of fatigue, memory problems, and concentration issues among those who received the vaccine than among those who did not.
8	Dennis et al 2023 United Kingdom ⁽¹⁵⁾	Cohort study n = 536	The average age was 45 years; 73% of the participants were female, and 89% were white. The most common comorbidities were asthma, hypertension, diabetes, and heart disease. The most common symptoms improved with follow-up, such as fatigue, myalgia, shortness of breath, headaches, chest and throat pain, cough, and fever.
9	Mizrahi et al 2023 Israel ⁽¹⁶⁾	Cohort study n = 299. 885	The average age was 25 years, with 50.6% of the participants being women. The most observed comorbidities were obesity, hypertension, and diabetes. Anosmia, dysgeusia, decreased concentration and memory, dyspnea, weakness, and dizziness were the most frequent symptoms. Women had a higher risk of hair loss, and vaccinated individuals had a lower risk of dyspnea.
10	Morioka et al 2023 Japan ⁽¹⁷⁾	Cohort study n = 502	The average age was 48 years, and 59.8% were female. The most frequent comorbidities were hypertension, asthma, dyslipidemia, and diabetes. Among the symptoms reported were fatigue, shortness of breath, cough, changes in smell, dysgeusia, hair loss, depressed mood, mental confusion, loss of concentration, and memory impairment. Persistent changes in smell, concentration, and hair loss were associated with the female gender.
11	Nehme et al 2023 Switzerland ⁽¹⁸⁾	Cohort study n = 3.507	The average age was 41.6 years, with 62.3% of the participants being women. Fatigue was present in 6.4% of vaccinated cases, compared to 11.9% of unvaccinated cases. Difficulty concentrating, headache, insomnia, loss or change in smell, loss or change in taste, dyspnea, cough, myalgia, arthralgia, paresthesia, chest pain, palpitations, digestive symptoms, and hair loss were less prevalent in vaccinated cases compared to unvaccinated cases.
12	Tene et al 2023 Israel ⁽¹⁹⁾	Cohort study n = 14.088	The average age was 40 years, with 52.4% of the participants being women. The most frequent comorbidities were obesity, hypertension, and diabetes. The most common symptoms were muscle pain and cough. Hospitalization during the acute phase was a risk factor for long COVID symptoms.
13	Wong et al 2023 China ⁽²⁰⁾	Cross-sectional study n = 2.712	Approximately 80.5% were aged between 25 and 44 years; 60% were female, and 12.3% reported having at least two comorbidities before COVID-19. The most prevalent symptoms were fatigue, cough, sore throat,

			difficulty concentrating, anxiety, myalgia, arthralgia, and difficulty falling asleep. Comorbidities and COVID-19 severity were associated with the development of long COVID. Previous vaccination against COVID-19 with at least two doses was a protective factor.
14	Aldahleh et al 2023 Jordan ⁽²¹⁾	Cohort study n = 366	The average age was 44.2 years, with 60.1% of the participants being women. The most common comorbidities were obesity and hypertension. Anxiety, fatigue, forgetfulness, difficulty concentrating, and depression were more prevalent in women.
15	Karuna et al 2023 Global ⁽²²⁾	Cohort study n = 759	The study comprised 53.8% women and 69.8% participants aged 18 to 55. The most common comorbidities were obesity, hypertension, and diabetes. Non-Hispanic blacks were 50% less likely to report persistent general symptoms and respiratory symptoms.
16	Reme el al 2023 Norway ⁽²³⁾	Cohort study n = 214.667	The average age was 44.6 years, with 50% of the participants being women. The most common long COVID symptom was fatigue.
17	Sahanic et al 2023 Austria ⁽²⁴⁾	Cohort study n = 145	The group consisted of 59% males, with an average age of 56 years. The most common comorbidities were metabolic and cardiovascular diseases. One year after the COVID-19 pandemic, two-thirds of patients still reported experiencing dyspnea and cough.
18	Van Zon et al 2023 The Netherlands ⁽²⁵⁾	Cohort study n = 3.465	59.5% of participants were aged 40 to 59, and 72.6% were women. The most common symptoms included muscle pain and fatigue. Being female, overweight or obese, having comorbidities, not having been vaccinated, and having been hospitalized increased the risk of developing long COVID.
19	Assadi-Pooya et al 2024 Iran ⁽²⁶⁾	Cohort study n = 4.681	The average age of participants was 52 years. It was observed that 15 of the 51 (29.4%) people who were not vaccinated and 528 of the 1,185 participants (44.6%) who received at least one dose of the vaccine had long COVID. The most common symptoms were fatigue, muscle weakness, shortness of breath, joint pain, and muscle pain.
20	Elias et al 2024 Ethiopia ⁽²⁷⁾	Cohort study n = 340	68.5% were male, with a mean age of 53.9 years. The most prevalent comorbidities were diabetes and hypertension. The most frequent symptoms included fatigue, cough, joint pain, headache, and shortness of breath. Factors associated with the development of long COVID included advanced age, female gender, presence of comorbidities, and hospitalization.
21	Erinoso et al 2024	Cross-sectional study	53.4% were female and 53% were over 45 years of age. The most common symptoms were fatigue and



	United States ⁽²⁸⁾	n = 121.379	breathing difficulties. Obese individuals or those with comorbidities had a higher prevalence of long COVID. People who received two or more doses of the COVID-19 vaccine showed a lower prevalence of long COVID.
22	Iversen et al 2024 Norway ⁽²⁹⁾	Cohort study n = 1.374	The average age was 39.8 years. It was also observed that four months after infection, patients with the Omicron variant reported dyspnea less frequently than patients with the Delta variant.
23	Kim et al 2024 Korea ⁽³⁰⁾	Cohort study n = 235	The group consisted of 59.5% women, with an average age of 52 years. The most common symptoms were fatigue, amnesia, difficulty concentrating, and insomnia.
24	Lim et al 2024 Malaysia ⁽³¹⁾	Cross-sectional study n = 609	The average age was 36 years, and 73.4% of the participants were female. The most common comorbidities were asthma, hypertension, and diabetes. The main symptoms of long COVID were fatigue, cough, and decreased physical strength.
25	Malden et al 2024 United States ⁽³²⁾	Cohort study n = 161.531	The average age was 37.1 years, with 54.5% of the participants being female. Most of the study population consisted of Hispanics and Whites. Gastrointestinal symptoms after vaccination during the Omicron period were lower compared to infections occurring during the pre-Omicron period.
26	Romero-Ibarguengoitia et al 2024 Mexico ⁽³³⁾	Cross-sectional study n = 807	A total of 477 women and 327 men participated, with a mean age of 41.5 years. The most common diseases were hypertension, diabetes, and autoimmune diseases. The most frequent symptoms of long COVID were fatigue, alopecia, dysgeusia, and cough. In the unvaccinated group, 25.1% of individuals reported experiencing long COVID, while 18.4% had received an incomplete vaccination.
27	Sárközi et al 2024 Hungary ⁽³⁴⁾	Cohort study n = 238	The average age of the patients was 55 years, with 54% being women. Almost half of the patients had cardiovascular disease, and one-fifth had some chronic respiratory disorders. The most common symptoms were respiratory discomfort, fatigue, and pain.

Source: Survey data, 2024.

Based on the analysis of the selected studies, shown in Figure 3, it was possible to identify that, in relation to age group, in 21 of the studies, the average age of the samples ranged from 35 to 55 years^(9-15,17,19,21,23-24,26-34), and long

COVID symptoms in the child and adolescent population were addressed in two studies^(19,29).

Of the 27 studies selected, 19 presented the highest percentage in their samples corresponding to females^(10-15,17-22,27-28,30-34), with 13 showing that females were associated with a

higher prevalence of symptoms in various systems, including dermatological symptoms such as hair loss, compared to males^(8,10-13,15-17,20-22,25,27). Furthermore, four studies have pointed out that being female is associated with a higher risk of developing long COVID^(13,15,20,27). It is noteworthy that two studies analyzed the distinction in long COVID symptoms between different races, indicating that black and white people may differ in the burden of specific symptoms^(8,22).

It is worth noting that only one study has shown that individuals over 50 and the elderly are at a greater risk of developing long COVID⁽¹³⁾. In addition, six studies have indicated that hospitalization due to COVID-19 infection increases the risk of developing long COVID^(8-9,13,19,25,27). Among the most frequent comorbidities were hypertension, diabetes, and obesity^(9,12-13,15-17,19,21-22,27,31), with four studies associating the presence of comorbidities with the development of long COVID^(8-9,15,20).

Furthermore, seven studies have pointed to the COVID-19 vaccine as a protective factor against the manifestation of long COVID^(9,12-14,16,18,20,26,28,32-33). The most frequent symptoms of long COVID include fatigue, shortness of breath, sleep disturbances, headache, changes in memory or concentration, cough, changes in smell or taste, hair loss, chest pain, myalgia, and arthralgia^(8-21,23,25,27-31,33-34).

DISCUSSION

This review showed that females accounted for the highest percentage of samples

in most of the studies conducted. Regarding the age group, most studies reported an average age between 35 and 55 years; however, no statistical analyses were presented to demonstrate any specific age group with a higher risk of developing long COVID. The presence of comorbidities and the severity of COVID-19 infection are risk factors, while vaccination against COVID-19 was identified as a protective factor. In addition, frequent symptoms such as fatigue, shortness of breath, sleep disturbances, changes in memory or concentration, and changes in smell or taste were identified.

Among the possible explanations for long COVID are the persistence of viral reservoirs in tissues, endothelial dysfunction, autonomic dysfunction, coagulopathy, SARS-CoV-2-induced tissue damage, chronic inflammation, and autoimmunity. Thus, the development of vascular clots, which lead to reduced pulmonary and cardiac perfusion, has been identified as responsible for persistent respiratory and cardiovascular symptoms, including shortness of breath, chest pain, palpitations, tachycardia, and arrhythmias⁽³⁵⁻³⁶⁾.

Regarding the manifestation of neurological and cognitive symptoms such as changes in memory and sleep, loss of taste and smell, and pain, these would be attributed to neuroinflammation, microclots, and endothelial dysfunction, leading to reduced cerebral perfusion and viral persistence in brain tissues that can result in persistent symptoms through direct viral cytopathic effects, dysregulated immune response leading to a prolonged state of



inflammation, and dysfunctional brainstem signaling⁽³⁵⁻³⁶⁾.

Regarding the approach to long COVID symptoms and the age group of individuals, records of the disease were found in all age groups. It is worth noting that only one study in this review highlighted that adults over 50 and the elderly are at a higher risk of developing long COVID⁽¹³⁾. Thus, there is insufficient data to determine an age group that is most susceptible to the highest risk of long COVID; however, there is scientific evidence that differences in symptom presentation may exist across different age groups⁽³⁷⁻³⁸⁾.

In this context, an analysis of children and adolescents in Portugal showed that this population group may present the same symptoms as other age groups affected by long COVID; however, behavioral changes such as anxiety and depressed mood were more frequent among adolescents. In addition, in the child and adolescent population, the presence of comorbidity increases the risk of developing long COVID threefold⁽³⁷⁾.

In addition to the differences in disease manifestation according to age group, gender asymmetry has also been noted in long COVID⁽²⁷⁻²⁸⁾. During the acute phase of COVID-19 infection, particularly at the onset of the pandemic, it was observed that the severity of the illness, as well as higher mortality rates from the disease, were more prevalent among males. In long COVID, it has been observed that females are more affected⁽³⁹⁻⁴⁰⁾.

Similar results were found in this review^(8,10-13,15-17,20) and in Brazil, where an analysis indicated that females were associated with a higher probability of presenting symptoms of long COVID⁽³⁹⁻⁴⁰⁾. In this scenario, the gender differences observed in long COVID may be related to the immune system, as women tend to develop faster and more robust innate and adaptive immune responses, which are essential in protecting against the severity of the acute phase of COVID-19. However, these exacerbated responses may contribute to a more prolonged illness and result in the chronicity of specific symptoms⁽⁴⁰⁻⁴²⁾. Furthermore, women may experience an overlap of long COVID symptoms with those of perimenopause and menopause, such as fatigue, muscle pain, palpitations, cognitive impairment, and sleep disorders, making diagnosis difficult⁽⁴³⁾.

The approach to the manifestation of long COVID and race, and/or ethnicity, was analyzed in only two studies^(8, 22). Thus, Black people had a slightly higher burden of symptoms related to chest pain, cough, headache, and tachycardia, while White people reported more symptoms related to changes in smell⁽⁸⁾. The other study did not identify differences in the presentation of long COVID symptoms between ethnic groups, comparing Black/Brown people versus White people and different ethnicities⁽⁴⁴⁾.

Among the risk factors associated with the development of long COVID are high blood pressure, obesity, and diabetes mellitus, diseases with a high prevalence in the population and previously identified as risk factors for the

worsening of COVID-19 in the acute phase, due to the dysfunctions they cause in the body⁽⁴⁵⁾.

The severity of COVID-19 has also been considered a risk factor, meaning that patients who require hospitalization during the acute phase of the disease are at a higher risk of developing long COVID⁽⁴⁵⁾. On the other hand, a person's vaccination status may influence the persistence or development of symptoms related to long COVID⁽⁴⁶⁻⁴⁷⁾. An analysis in Italy showed that although both vaccinated and unvaccinated individuals developed long COVID, symptoms were more prevalent in the unvaccinated individuals⁽¹²⁾.

However, there are still discrepancies in the literature regarding the relationship between the number of vaccine doses and protection against long COVID⁽⁴⁶⁻⁴⁸⁾. Furthermore, vaccination reduced the risk of developing long COVID in both individuals who were vaccinated before contracting COVID-19 and those who were immunized after experiencing an acute infection⁽⁴⁸⁾.

Given the findings in the literature, vaccination against the disease should be encouraged in all age groups to prevent severe forms of the disease and act as a protective effect, reducing the risk of long COVID, or at least minimizing persistent symptoms.

Limitations include the exclusion of articles that were available in complete and indexed databases not included in this research. However, this review presents robust results that contribute to the identification of the primary symptoms of long COVID, as manifested

according to demographic, epidemiological, and vaccination profiles.

CONCLUSION

This analysis revealed the most frequent symptoms of long COVID, including fatigue, shortness of breath, sleep disturbances, changes in memory or concentration, and changes in smell or taste, across varying age groups and among females. Furthermore, people with comorbidities and those who were not vaccinated were at greater risk of developing long COVID.

This study synthesizes the theoretical framework on long COVID to inform and contribute to a more accurate understanding of a current issue affecting the routine of healthcare professionals. These data can assist healthcare services in both diagnoses, by associating the presence of these symptoms with long COVID, and in encouraging vaccination against the disease.

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Authorship Criteria (Author Contributions)

Authors 1, 2, 3, and 4: 1. contributed substantially to the conception and/or planning of the study; 2. to the acquisition, analysis, and/or interpretation of the data; 3 and 4. as well as to the writing and/or critical review and final approval of the published version.

Conflict of Interest Statement

“Nothing to declare.”

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