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LONG COVID AND ASSOCIATED FACTORS IN INDIVIDUALS FROM SOUTHERN BRAZIL: A POPULATION-BASED STUDY SULCOVID-19

COVID LONGA E FATORES ASSOCIADOS EM INDIVÍDUOS DO SUL DO BRASIL: UM ESTUDO DE BASE POPULACIONAL SULCOVID-19

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ABSTRACT

The present study aimed to verify the prevalence and factors associated with COVID-19 and describe the main residual symptoms in individuals from the extreme south of Brazil. This is a cross-sectional study with 2,919 individuals older than 18 years diagnosed with COVID-19 in the period from December 2020 to March 2021 and who continued with symptoms after 6-9 months of infection. The prevalence of long COVID was 48.3% (95% CI 46.5; 50.1). The most prevalent residual symptoms were fatigue, memory loss, loss of attention, headache, loss of smell, muscle pain, and loss of taste. The groups most likely to develop long COVID were female, had anxiety, hypertension, heart problems, diabetes mellitus, musculoskeletal problems, respiratory problems, previous morbidities, and hospital admission. Physical activity and self-perception of good and very good health were protective factors for the outcome. When adjusted, female gender, anxiety, morbidities, and hospitalization remained associated with the outcome. This study showed that half of the individuals developed long COVID after 6-9 months of infection, highlighting female individuals and those with chronic conditions, demanding the creation of public policies that promote comprehensive and continued assistance to them.

Keywords: Long-COVID. Cross-Sectional Studies. Coronavirus Infections. Adult. Epidemiology.

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RESUMO

O objetivo do presente estudo foi verificar a prevalência e os fatores associados à COVID-19 e descrever os principais sintomas residuais em indivíduos do extremo sul do Brasil. Trata-se de um estudo transversal com 2.919 indivíduos maiores de 18 anos diagnosticados com COVID-19 no período de dezembro de 2020 a março de 2021 e que continuaram com sintomas após 6-9 meses de infecção. A prevalência de COVID longa foi de 48,3% (IC 95% 46,5; 50,1). Os sintomas residuais mais prevalentes foram fadiga, perda de memória, perda de atenção, dor de cabeça, perda do olfato, dor muscular e perda do paladar. Os grupos mais propensos a desenvolver COVID longa eram do sexo feminino, apresentavam ansiedade, hipertensão arterial, problemas cardíacos, diabetes mellitus, problemas musculoesqueléticos, problemas respiratórios, morbidades prévias e internação hospitalar. Atividade física e autopercepção de saúde boa e muito boa foram fatores de proteção para o desfecho. Quando ajustados, sexo feminino, ansiedade, morbidades e internação hospitalar permaneceram associados ao desfecho. Este estudo mostrou que metade dos indivíduos desenvolveu COVID longa após 6-9 meses de infeção, destacam-se os indivíduos do sexo feminino e os portadores de condições crônicas, demandando a criação de políticas públicas que promovam a assistência integral e continuada a eles.

Palavras-chave: COVID longa. Estudo Transversal. Infecção por Coronavírus. Adultos. Epidemiologia.

INTRODUCTION

COVID-19 is a disease caused by the SARS-CoV-2 virus that was discovered in China in December 2019 (OMS, 2021). Its infection affects multiple organs, mainly the respiratory system, and can range in severity from asymptomatic to very severe (ZAIM. CHONG; SANKARANARAYANAN; HARKY, 2020). In addition, some individuals may still present with persistent symptoms after the acute phase of infection, and this condition is called long COVID (MARTIMBIANCO et al, 2021).

The literature differentiates two types of long COVID namely, post-acute COVID-19 and chronic COVID-19. The former is described as having symptoms that extend between three and 11 weeks from the acute phase of the disease, while chronic COVID-19 is defined as having symptoms that remain beyond 12 weeks (MARTIMBIANCO et al, 2021; GREENHALGH et al, 2020).

According to research, the primary remaining symptoms are fatigue, headache, myalgia, cough, wheezing and chest pain, dyspnea, loss of concentration or memory, anxiety and depression, hair loss, ageusia, and anosmia (LUCCHETTA et al, 2020; AUGUSTIN et al, 2021; GAROUT et al, 2022). The factors that are associated with the development of long COVID are advanced age, female sex, presenting severe acute clinical picture (need for hospitalization, admission to intensive care units and intubation), and having a high number of comorbidities (CHEN CHEN et al, 2022; NGUYEN et al, 2020; BLIDDAL et al, 2021; WU et al, 2022). Additionally, studies show that the prevalence of this new syndrome can vary from 4.7% to 80.0%, which shows great variability in estimates (MARTIMBIANCO et al, 2021; KARAARSLAN; GÜNERI; KARDES; 2021).

Although some authors have shown evidence that these changes are reported mainly by individuals who had the severe form of the disease (LORENT et al, 2022; SCHERLINGER et al, 2021; FERNÁNDEZ-DE-LAS-PEÑAS et al, 2022), it is known that individuals affected by mild COVID-19 can also show persistent symptoms (PETERSEN et al, 2021; PRIETO; PRIETO; CASTRO, 2021). Thus, taking into account the significant growth of new cases considered mild, it becomes important to provide information for health managers to adapt services to new demands. In addition, studies with samples from the general population of infected patients are scarce, so these results can fill this gap in the literature (CHEN CHEN et al, 2022). Therefore, the present study aimed to verify the prevalence and factors associated with long COVID and to describe the main residual symptoms 6-10 months after infection in individuals from the extreme south of Brazil.

METHODS

This is a cross-sectional study conducted in Brazil in the city of Rio Grande in the extreme south of Rio Grande do Sul/RS, a port city that is 2,683 km², with a population of 191,900 inhabitants (IBGE, 2023). The city of Rio Grande during the pandemic had a death rate higher than the Brazilian rate, with approximately 202.4 deaths per 100,000 inhabitants in 2021, which placed it in eleventh position for deaths due to COVID-19 among the cities in the state. of Rio Grande do Sul. More information about the context of COVID-19 in Rio Grande do Sul and the city of Rio Grande can be accessed on the COVID-19 Monitoring Panel (SECRETARIA DE SAÚDE, 2021).

The sample included individuals aged 18 years or older residing in the municipality who had been diagnosed with COVID-19 through the RT–PCR test between December 2020 and March 2021, who were symptomatic, and who were diagnosed in the city of Rio Grande/RS. Individuals with functional limitations and/or advanced neurological diseases that made it impossible to answer the questionnaire were excluded. Those who were not reached after five attempts of telephone contact, one via WhatsApp and three home visits were excluded. In addition, to refusals, those who did not want to participate or answer the survey questionnaire were excluded.

First, adults and elderly individuals infected with SARS-CoV-2 were identified by epidemiological surveillance in the municipality of Rio Grande in the period investigated, creating a list with 4,014 individuals with positive RT–PCR and their respective data (name, address, telephone number, and presence of symptoms). From this list, eligible individuals were identified for the study, and telephone calls were made. Data collection was carried out by interviewers who went through a selection process and later underwent a total of 24 hours of training and qualification. In addition to telephone interviews, if preferred, the interviewees were offered face-to-face data collection through home visits.

Data collection occurred in the period from June to October 2021 through electronic tablets (Samsung Galaxy Table A) using the REDcap program and smartphones (Samsung Galaxy A01, 32 GB) for telephone calls. For the safety of the researcher and the interviewee, the call was recorded through a free mobile application (Callmarter) stored in an email account. Filling out the questionnaire lasted approximately 20 minutes.

Long COVID was determined from an affirmative response to at least one of the remaining 19 symptoms (WHO, 2021) investigated using the following questions: "Which of these symptoms did you experience after diagnosis of COVID-19 infection?" The symptoms investigated were headache, shortness of breath, dry cough, cough/sputum production, pain when breathing, altered taste, altered smell, change in sensation, fatigue/tiredness, sore throat, runny nose, nasal obstruction, diarrhea, nausea/vomiting, joint pain, muscle pain, memory loss, attention loss, and skin problems. Each of the symptoms was asked individually, with a dichotomous response option (yes/no). For each positive answer, the following question was applied: "Are you still experiencing this symptom at this moment? The long COVID outcome was obtained from the sum of all symptoms the individual said he or she continued to have at the time of the interview, ranging from zero to 19, and was operationalized dichotomously, with "no" being those with no remaining symptoms and "yes" being those with at least one.

The exposure variables were gender (female; male), age group (18-59; 60 years or older), skin color (white; black or brown), education (never studied; 0-8 years; 9-11 years; 12 years or older), marital status (married or living with partner; single, separated or widowed), economic class (A|B; C; D|E) (ABEP, 2021), physical activity practice (no/yes), smoking (no; yes or ex-smoker), sleep (very bad/bad; moderate; very good/good), body mass index (BMI) (underweight or eutrophic; overweight or obesity) (SISVAN, 2004), self-perception of health (very bad or bad; moderate; good; very good), hypertension (no; yes), anxiety (no; yes), depression (no; yes), heart problems (heart failure; cardiomegaly) (no; yes), diabetes (no; yes), musculoskeletal problems (arthritis, arthrosis, rheumatism or osteoporosis) (no; yes), respiratory problems (asthma, bronchitis, emphysema or chronic obstructive pulmonary disease - COPD) (no; yes), morbidities (0; 1 or 2; 3 or more) and hospitalization (ward or intensive care unit (ICU) admission) (no; yes).

First, a descriptive analysis of the sample was performed by estimating the absolute and relative frequencies. For long COVID, the prevalence and 95% confidence intervals (95% CIs) of the outcome according to exposures were calculated. For the crude and adjusted analyses, Poisson regression with

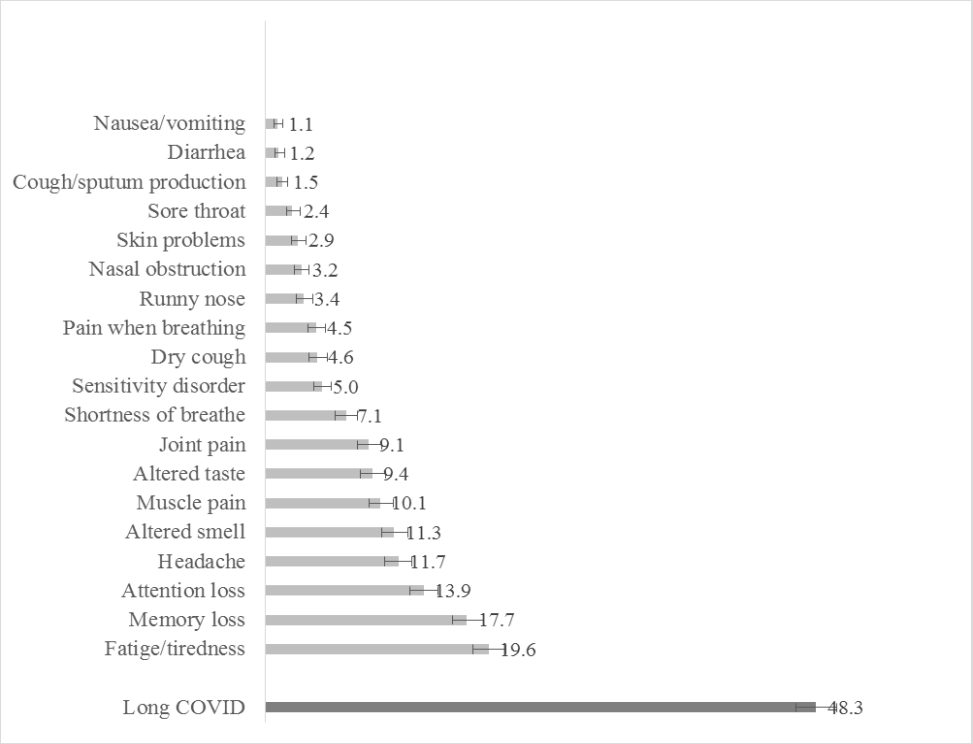
robust variance adjustment was used to calculate prevalence ratios (PRs) and their respective 95% CIs. After the crude analysis, variables with p values <0.20 remained in the model to control for possible confounding factors. The adjusted analysis was performed through a hierarchical model built into four levels, with the 1st level composed of gender, age, skin color, education, marital status, and economic class, and the 2nd level composed of physical activity practice, smoking, BMI, and self-perception of health. At the 3rd level the variables were hypertension, anxiety, depression, heart problems, diabetes, musculoskeletal problems, respiratory problems, and morbidities, and at the 4th level was the variable hospitalization. The significance level adopted was 5%. All analyses were performed using the statistical package Stata 16.1 (StataCorp LP, College Station, United States).

This study is linked to the Sul-COVID project and was approved by the Research Ethics Committee (CEP) of the Federal University of Rio Grande (Opinion: 4.375.697/CAAE: 39081120.0.0000.5324). The research respected the specific resolution of the National Health Council (466/2012) and the resolution of the National Health Council (510/2016), and the interviews were conducted after reading and agreeing to the Informed Consent Form (ICF).

RESULTS

A total of 3,822 participants testing positive for COVID-19 were eligible for the study; after losses (631) and refusals (272), 2,919 (76.4% of those eligible) were interviewed. Most of the sample was composed of women (59.6%), individuals between ages 18 and 59 (83.3%), white skin color (77.5%), and married or living with a partner (60.6%). Regarding education and economic class, 44.2% had a high school degree, and 54.8% were class C.

Figure 1 – Prevalence of long COVID and remaining symptoms



Source: The authors.

Approximately 60.0% were physically inactive, 24.4% smoked, 73.3% were overweight/obese, and 58.1% had a good self-perception of health. For the 43.1% who had at least one preexisting comorbidity, the most prevalent were anxiety (26.3%), hypertension (25.3%) and depression (19.4%). Among those investigated, only 3.7% needed to be hospitalized, putting the vast majority of the sample patients in the mild form of the infection (Table 1).

Table 1 – Sample description of individuals after COVID-19 infection from the municipality of Rio Grande, Rio Grande do Sul, 2021 (n=2919)

Variable	**N**	**%**
Gender		
Male	1.208	41.4
Female	1.711	59.6
Age group (years)		
18-59	2420	83.3
60 or older	482	16.7
Skin color		
White/Yellow	2.254	77.9
Black/ brown	640	22.1
Education		
Never studied	15	0.5
0-8 years	713	24.9
9-11 years	1264	44.2
12 years or older	871	30.4
Marital status		
Married/living with partner	1757	60.6
Single/separated/widowed	1144	39.4
Economic class		
A/B	809	30.1
C	1474	54.8
D/E	409	15.2
Physical activity practice		
No	1697	58.5
Yes	1205	41.5
Smoking		
No	2197	75.6
Yes/ex	708	24.4
BMI		
Low weight/eutrophic	757	26.7
Overweight/obese	2076	73.3
Self-perception of health		
Very Bad/Bad	107	3.8
Moderate	633	21.7
Good	1692	58.1
Very good	480	16.5
Hypertension		
No	2160	74.7
Yes	733	25.3
Anxiety		
No	2136	73.7
Yes	761	26.3

Depression		
No	2340	80.6
Yes	563	19.4
Heart problems [a]		
No	2630	91.0
Yes	260	9.0
Diabetes		
No	2605	89.9
Yes	292	10.1
Musculoskeletal problems [b]		
No	2489	86.7
Yes	383	13.3
Respiratory problems [c]		
No	2409	83.1
Yes	488	16.9
Morbidities		
0	1058	37.4
1 or 2	1219	43.1
3 or more	549	19.4
Hospitalization [d]		
No	2307	96.3
Yes	88	3.7

[a] heart failure, cardiomegaly; [b] Arthritis, arthrosis, rheumatism or osteoporosis; [c] Asthma, Bronchitis, Emphysema or COPD; [d] hospitalization in a ward or Intensive Care Unit (ICU).
Source: The authors.

The prevalence of long COVID was 48.3% (95%CI 46.5; 50.1). The most prevalent residual symptoms were fatigue 19.6% (95%CI 18.3; 21.2), memory loss 17.7% (95%CI 16.5; 19.3), attention loss 13.9% (95%CI 12.7; 15. 3), headache 11.7% (95%CI 10.5;12.9), altered smell 11.3% (95%CI 10.2;12.5), muscle pain 10.1% (95%CI 9.1;11.3) and altered taste 9.5% (95%CI 8.5;10.6) (Figure 1). The prevalence of long COVID ranged from 7.9% (95% CI) for those with no heart problems to 73.9% (95%CI) for those with very poor and poor self-perceived health (Table 2).

In the crude analysis, the groups most likely to develop long COVID were female sex (PR=1.77 95%CI 1.62; 1.94), hypertension (PR=1.22 95% CI 1.13; 1.32), presence of anxiety (PR=1.46 95%CI 1.36; 1.57) and depression (PR=1.39 95%CI 1.28; 1.50), heart problems (PR=1.15 95%CI 1.02; 1.29), diabetes (PR=1.13 95%CI 1.01; 1.27), musculoskeletal problems (PR=1.37 95%CI 1.25; 1.49), respiratory problems (PR=1.31 95%CI 1.20; 1.42), having 1 or 2 previous morbidities (PR=1.43 95%CI 1.30; 1.58), having 3 or more previous morbidities (PR=1.80 95%CI 1.62; 1.99) and having been hospitalized (PR=1.41 95%CI 1.19; 1.68). It was also found that physically activity (PR=0.91 95%CI 0.85; 0.99) and good (PR=0.60 95%CI 0.53; 0.68) and very good (PR=0.37 95%CI 0.31; 0.45) self-perceived health were protective factors for the outcome (Table 2).

After adjustments, the following remained associated with the outcome: female sex (PR=1.76 95%CI 1.61; 1.93), having anxiety (PR=1.11 95%CI 1.01; 1.20), 1 or 2 morbidities (PR=1.07 95%CI 1.20; 1.32) and 3 or more (PR=1.26 95%CI 1.10;1.45) and having been hospitalized (PR=1.26 95%CI 1.05; 1.45), while self-perception of good health (PR=0.68 95% CI 0.60; 0.77) and very good health (PR=0.44 95% CI 0.37; 0.54) were less likely (Table 2).

Table 2 **–** Analysis of crude and adjusted Poisson Regression and factors associated with long COVID in individuals from the municipality of Rio Grande, Rio Grande do Sul, 2021 (n=2919)

Variables	**Prevalence**	**Crude analysis**	**Adjusted analysis***
	%	**PR (95%CI)****	**PR (95%CI)****
Gender			
Male	33.3	1	1
Female	58.9	1.77 (1.62;1.94)	1.76 (1.61;1.93)
Age group (years)			
18-59	48.6	1	1
60 or more	46.7	0.96 (0.86;1.06)	0.97 (0.86;1.08)
Skin color			
White	48.4	1	1
Black/ brown	47.8	0.99 (0.90;1.08)	0.98 (0;90;1.09)
Education			
Never studied	42.9	1	1
0-8 years	48.6	1.13 (0.62;2.09)	1.20 (0.58;2.50)
9-11 years	47.1	1.10 (0.60.2.02)	1.19 (0.57;2.50)
12 years or older	49.7	1.16 (0.63;2.13)	1.20 (0.57;2.51)
Marital status			
Married/living with partner	48.4	1	1
Single/separated/widowed	48.0	0.99 (0.92;1.07)	0.95 (0.88;1.02)
Economic class			
A/B	51.2	1	1
C	47.7	0.93 (0.85;1.02)	0.98 (0.90;1.06)
D/E	46.2	0.90 (0.80;1.02)	0.97 (0.86;1.09)
Physical activity practice			
No	50.0	1	1
Yes	45.8	0.91 (0.85;0.99)	1.02 (0.95;1.01)
Smoking			
No	47.6	1	1
Yes/ex	50.6	1.06 (0.97;1.16)	1.04 (0.96;1.13)
BMI			
Low weight/eutrophic	46.2	1	1
Overweight/obese	49.1	1.06 (0.97;1.16)	1.04 (0.95;1.13)
Self-perceived health status			
Very Bad/Bad	73.9	1	1
Moderate	71.2	0.97 (0.85;1.10)	1.03 (0.91;1.17)
Good	44.2	0.60 (0.53;0.68)	0.68 (0.60;0.77)
Very good	27.5	0.37 (0.31;0.45)	0.44 (0.37;0.54)
Hypertension			
No	21.7	1	1
Yes	29.4	1.22 (1.13;1.32)	0.96 (0.87;1.06)
Anxiety			
No	18.7	1	1
Yes	34.0	1.46 (1.36;1.57)	1.11 (1.01;1.20)
Depression			
No	14.1	1	1
Yes	25.0	1.39 (1.28;1.50)	0.98 (0.90;1.09)
Heart problems			
No	7.9	1	1
Yes	10.2	1.15 (1.02;1.29)	0.92 (0.82; 1.05)
Diabetes			
No	47.6	1	1
Yes	53.8	1.13 (1.01;1.27)	0.89 (0.78;1.01)

Musculoskeletal problems			
No	45.8	1	1
Yes	62.6	1.37 (1.25;1.49)	1.02 (0.91;1.13)
Respiratory problems			
No	45.9	1	1
Yes	59.9	1.31 (1.20;1.42)	1.06 (0.97;1.17)
Morbidities			
0	35.5	1	1
1 or 2	51.0	1.43 (1.30;1.58)	1.07 (1.20;1.32)
3 or more	63.8	1.80 (1.62;1.99)	1.26 (1.10;1.45)
Hospitalization			
No	44.0	1	1
Yes	62.4	1.41 (1.19;1.68)	1.26 (1.05;1.53)

* Poisson regression with robust adjustment for variance. Those variables with p-values less than 0.20 after adjustments for possible confounding factors remained in the final model.
**RP: Prevalence Ratio; CI95%: Confidence Interval 95%.
Source: The authors.

DISCUSSION

The present study assessed the prevalence of long COVID and its associated factors 6-9 months after initial infection in adults and the elderly in southern Brazil. It was observed that almost half of the individuals developed long COVID. The most prevalent residual symptoms were fatigue, memory loss, loss of attention, headache, loss of smell, muscle pain, and loss of taste. Female individuals who had anxiety, previous morbidities, and who were admitted to a hospital were more likely to develop long COVID, while those with a good and very good self-perception of health were less likely to develop long COVID.

Internationally, studies find the prevalence of long COVID to be 26.0% and 38.2% after six months (SEANG et al, 2022; PÉREZ-GONZÁLEZ et al, 2022) and 12.8% (AUGUSTIN et al, 2021) after seven months of the acute phase of infection, with few studies investigating long COVID using a longer time frame in non-hospitalized individuals, both in the international and Brazilian literature. Regarding residual symptoms, the proportion of persistent symptoms among those infected with the mild form of acute infection may be as high as 50.0%, corroborating the data from our study (LOPEZ-LEON et al, 2021). Fatigue, memory loss, loss of attention, headache, loss of smell, myalgia, and loss of taste were not considered the most common symptoms presented in the literature (LOPEZ-LEON et al, 2021). Fatigue is one of the main persistent symptoms after six months of acute infection, and some authors suggest that this fact is related not only to the inflammatory response associated with acute SARS-CoV-2 infection, which may promote this prolonged convalescence but also to the possibility of posttraumatic stress disorder after COVID-19, which could contribute to a more prolonged experience of this type of symptom (MAHASE et al, 2020; OLIVEIRA et al, 2022).

Similar to the findings of this research, some authors suggest that memory and attention loss can also be experienced by individuals after COVID-19, showing prevalence rates of 11.0% and 13.0%, respectively (BLOMBERG et al, 2021), and another study showed a prevalence of 10.7% with symptoms evaluated as "concentration or memory deficit" (GAROUT et al, 2022). The cause of these sequelae can be explained by the affinity and ease of the virus replicating in neural cells (GAMA; CAVALCANTE, 2020), which can cause lesions in the hippocampus, and there is also a psychosomatic effect caused by the disease. Many people who have recovered from COVID-19 have reported that they do not feel like themselves: experiencing short-term memory loss, confusion, difficulty concentrating and just feeling different than before contracting the infection due to the traumatic event of contracting the virus (JUNIOR et al, 2021).

Olfactory and gustatory dysfunctions are described in the literature as the main acute symptoms of infection (LUCCHETTA et al, 2021); however, anosmia and ageusia are symptoms that remain for four to seven months after infection (AUGUSTIN et al, 2021). One of the theories for this could be that the targets of the virus may be nonneuronal cells and stem cells that express angiotensin-converting enzyme 2 (ACE2) receptors, while another theory is that there is the involvement of infection of the

sustaining cells and vascular pericytes of the olfactory epithelium and bulb (MAO et al, 2020; TONG, 2020).

Unlike the results of our study, headache as a neuropsychiatric symptom is a common persistent symptom after recovery from the acute phase of COVID-19 (44.0%) (LÓPEZ-LEON et al, 2021), but it is more commonly found in patients who have been hospitalized (MAHMOUD et al, 2021; KENNY et al, 2022). The etiology of this type of residual symptom is complex and multifactorial and may be related to the direct effect of infection, cerebrovascular disease (including hypercoagulation) (ROGERS et al., 2020), physiological impairment (hypoxia), side effects of medication and social aspects of having a potentially fatal disease (BALDINI et al., 2021).

The association between the female sex and long COVID has been previously discussed in the literature in non-hospitalized patients (BLIDDAL et al, 2021; PRIETO; PRIETO; CASTRO, 2021; SEANG et al, 2022; BALDINI, et al, 2021; KASHIF et al, 2021; SUDRE et al, 2021). Several hypotheses explain this association, including biological, immunological, and behavioral hypotheses. First, there are biological differences in the expression of angiotensin-converting enzyme 2 (ACE2) and transmembrane protease serine 2 (TMPRSS2) between women and men. Immunological differences, for example, lower production of proinflammatory interleukin-6 (IL-6) after viral infection in women, could explain the greater development of post-COVID symptoms (BWIRE, 2020; ANONYMOUS, 2020; MOHAMED-HUSSEIN et al, 2021; ORTONA et al, 2021).

The literature shows that factors such as higher psychological stress (depression and poor sleep quality) can play an important role in the development of long COVID symptoms, and in our study, the prevalence of depression and poor sleep quality (data not presented in the article) were higher in women, supporting this hypothesis (FERNÁNDEZ-DE-LAS-PEÑAS et al, 2022; SALARI et al, 2020).

Furthermore, female sex is associated with a higher occurrence of several autoimmune diseases, and the preponderance of these diseases in the long COVID may be a result of their similarity (BILLI; KAHLENBERG; GUDJONSSON, 2019). Additionally, women are more likely to report their symptoms to a physician (BARSKY; PEEKNA; BORUS, 2021). Finally, it is possible that pandemic-related factors of COVID-19, such as physical inactivity, isolation, and stress, may promote the triggering of this outcome (SALARI et al, 2022).

Our study showed that people with anxiety are more likely to develop long COVID. Other authors confirm this hypothesis by showing that anxiety is among the psychiatric disorders with the highest prevalence in people who have COVID-19, as well as being one of the symptoms that persist (GAROUT et al, 2022; BADENOCH et al, 2022), which shows that an increasing number of mental health problems, such as anxiety and depression, have been associated with the development of COVID-19 and consequently long COVID (PALMER, 2021). Another study conducted in the United States found that individuals with a diagnosis of a psychiatric disorder in the year before the COVID-19 pandemic had a 65% increased risk of developing the disease compared to a cohort matched for physical risk factors without a psychiatric diagnosis (TAQUET et al, 2021). The association between anxiety and the increased likelihood of developing COVID-19 and long COVID may be related to behavioral factors, symptomatology, comorbidities, the vulnerability of the anxious state and even be connected with other symptoms (WONG et al, 2020; SCHOU et al, 2021).

Individual-morbidity interactions are complex and interfere with the clinical management of patients with COVID-19 (TAVARES et al, 2020). A previous study showed that the greater the number of preexisting comorbidities, the greater the presence of long COVID (XIE et al, 2021), because healthy people, in general, have efficient innate immunity that, in addition to intact cellular and humoral immunity, limits the progression of infection and promotes recovery in a few weeks, unlike people with chronic diseases (UHLING et al, 2014). Both in individuals who were hospitalized and those who were not, the presence of previous morbidities seems to be an important determinant to be considered when evaluating long COVID (HUANG et al, 2021).

Our findings showed an association between hospitalizations in both wards and/or intensive care units and long COVID, which is consistent with several studies (PRIETO; PRIETO; CASTRO ,2021; MAHMOUD, et al, 2021; YAKSI; TEKER; IMRE, 2022) that observed impairments to health even after the cessation of symptoms. In a cohort by Rigoni et al., 2022 that evaluated 413 individuals who had

COVID-19 through remote and ambulatory monitoring, approximately 30% suffered from the persistence of at least two symptoms even after six months of infection. Tenforde et al., (2020) observed that the development of long COVID symptoms in hospitalized individuals was associated with the length of stay in the hospital, with the duration of symptoms among those who were not hospitalized being approximately four weeks, while for hospitalized individuals, the duration was at least eight weeks after discharge.

Having a good and very good self-perception of health was associated with a lower likelihood of developing long COVID in our study. Between the pre-pandemic period and the 1st quarter of 2022, an estimated 91.6% of Brazilians rated their health status as poor (COVITEL, 2022). Seeking health care due to COVID-19 symptoms during the pandemic was a major predictor of perceived poor health. Furthermore, negative individual feelings create a perception of poor health status even before the medical diagnosis of the disease. The worsening in overall health status is greater among those who have a self-perception of poor health than among those who rate their health as good or very good (SZWARCWALD et al, 2021). Infected people who negatively rate their general health status have a higher risk of developing long COVID and are strongly linked to residual symptoms (BECKER et al, 2021).

However, the results found in this study should be interpreted in the context of its limitations and strengths. Among the limitations, this design does not allow for inferring causality, as it is a cross-sectional study, but we tried to minimize this problem by including temporality in the questions. In addition, symptoms were self-reported, and our questions related to only 19 out of more than 200 symptoms reported in the literature; however, our questions addressed the most frequent symptoms (DAVIS et al, 2021). Survival bias should be considered, as only surviving individuals from COVID-19 were analyzed, which may have underestimated the occurrence of symptoms.

As a strength, our study provides information from a representative sample of individuals infected with SARS-CoV-2 regardless of disease severity, diagnosed with the gold standard test (RT–PCR), with a response rate above 75%. We also highlight that we interrogated the presence of symptoms, which decreases potential reporting bias. Moreover, this study reveals unpublished data on the characteristics of long COVID in the Brazilian population, which is especially important given that the literature on this subject is scarce. The few existing studies evaluated hospitalized patients and most evaluated small samples in developed countries, especially in Europe. In addition, the data presented in this study allows us to identify the profile with the greatest demand for complications related to long COVID for health services, which can be used to support the construction of public policies aimed at qualifying care for this population.

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